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The Chinese Consumers' Attitudes towards Their 'Willingness to Pay' for Renewable Electricity

An Analysis of Economic and Environmental Factors

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Abstract: China's economic development has not only led to enormous growth figures, but also to a severe degradation of the environment. Mass-consumption of fossil fuels like oil and coal in China contributed to reaching the level of the largest greenhouse gas emitter worldwide. For the Chinese government to react, it is crucial to take the electricity purchase decisions of households into account to successfully implement energy policies. Hereby, a Chinese social survey shall help to show the effects of economic and environmental factors on the consumers' willingness to pay for the adoption of green electricity: the results of both a *Linear Probability Model* and a *Probit* model indicate that environmental factors do not play a crucial role when it comes to the consumers' willingness to pay for higher prices/taxes in order to protect the environment – whereas the economic factor regarding the influence of price levels has a slightly more effective impact. Nonetheless, education and adequate information provision about the merits of green electricity seem to be a prerequisite in order to promote the purchase of renewable electricity.

Key words: China, green electricity, economic and environmental factors, purchase-decisions, Chinese General Social Survey

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List of abbreviations

CO_2	Carbon Dioxide
E.g.	Exempli gratia (latin for *for example*)
Etc.	Et cetera (latin for *and so forth*)
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gross National Income
GNP	Gross National Product
I.e.	Id est (latin for *that is*)
kWh	Kilowatt-hour
Mtoe	Million tons oil equivalent
NO_x	Nitrogen Oxides
OECD	Organization for Economic Co-operation and Development
RMB	Renminbi (Chinese currency)
R&D	Research & Development
SO_x	Sulfur Oxides
SWH	Solar Water Heater
UK	United Kingdom
USA	United States of America
USD	United States Dollar
WTP	Willingness to Pay

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1. Introduction

Even though China has become the world's largest environmental polluter in terms of greenhouse gas emissions, the country advanced at the same time to a leading investor in renewable energy amidst rapidly increasing energy consumption (The Economist, 2013; Christensen, 2015). In accordance with steadily rising economic growth figures, the energy demand in China has also increased (Hast et al., 2015). In order to sustain high economic growth rates, China's energy demand has been met through the exploitation and burning of conventional energy sources like coal, as the primary source of energy. The downsides of using predominantly fossil fuels, however, indicate that China's current carbon dioxide emissions are likely to double in the near future (Ma & Oxley, 2012).

Nonetheless, it is broadly pointed out that China's energy production and consumption in form of electricity will increase in terms of using renewable energy sources. In the end of 2012, China excelled to have the highest capacity of CO_2-free power worldwide with nearly 20 percent of China's electricity demand, of which solar energy accounted for approximately 0.6 percent and wind generated energy for 9.4 percent. The remaining 10 percent was met by other CO_2-free energy sources like nuclear and hydro power (Hast et al., 2015; IEA, 2016). However, renewable or green energy in China can be seen as an emergent, despite its increasing production rates, and the structuration of this new field is still continuing and open-ended (Christensen, 2015). The extensive development of green energy and the implementation of energy policies by the Chinese government can be explained by the country's growing concerns about the rapid aggravation of its own environment and overall climate change issues. Furthermore, the government's worries grow in terms of economic slowdowns which arise in parallel to worsening environmental conditions. Heavy air pollution, contamination of lakes and rivers, and the overall impurification coming mainly from the Chinese industrial sector play a crucial part in contributing to the concerns of not only the Chinese government, but also China's consumers that are greatly exposed to those problems stated (Yuan & Zuo, 2011; Stern, 2006).

In order for the Chinese government to implement large-scale renewable energy projects, social acceptance of consumers regarding the application of new systems seems to be a prerequisite. This issue needs to be addressed directly if certain policies are to be implemented successfully as it is stated by Yuan et al. (2011), Sardinaou and Genoudi (2013) and Wüstenhagen et al. (2007). Hence, with regards to the growing concerns mentioned, the aim of this paper is to focus on the Chinese consumers' side and to both identify and quantify factors that influence the consumers' attitudes towards green or renewable electricity in a national context. In order to conclude any potential relationships, an econometric approach will try to measure both economic and environmental effects on the consumers' willingness to pay for green electricity. A national-based social survey named the "Chinese General Social Survey" (CGSS) conducted by the *Renmin University of China* and institutes around China in the year 2010 will be used for reaching econometric results. The survey contains an environmental module comprising cross-sectional data with 25 different questions, including 3,672 observations used for this study.

The aim of this paper will focus on the following research question that will eventually lead to the econometric analysis:

What role do environmental and economic factors play for the Chinese consumers' willingness to pay for green electricity?

The contribution of this paper to the previous research is to measure the effect of both economic factors as e.g. income and government support on the one hand, and environmental factors as e.g. air pollution affecting a consumer's health condition on the other hand, on the consumers' willingness to pay (WTP) for green energy using micro-level data. The existing literature on China so far considers these factors as well, but does not explicitly explain causal effects that can be achieved to some extent by applying econometric regression models. In fact, the motivation behind this paper is to investigate these effects even though no complete causal inferences can be drawn as this remains the main issue within cross-section analyses. Nonetheless, the purpose of this thesis is to provide the reader with the best underlying explanations of consumers' behavior with a focus on renewable electricity in order to infer whether energy policies implemented by the government are able to bear fruit.

The remainder of this paper is structured as follows: at first, the issues at hand will be analyzed in a broader picture by providing an overview of China's current situation in terms of energy supply and consumption. This section is followed by an explanation of a shift from conventional towards renewable energy sources. The next part focusses on previous research done by other authors to see whether consumer behavior differs across economies. Following this, both economic and environmental factors regarding consumers' WTP will be considered. Next, reasonable hypotheses will be derived regarding the previous findings. The subsequent methodology part will introduce the econometric models that are applied. After that, the results will be presented, followed by a robustness check and the discussion section that will investigate the findings and their limitations. The paper will finish off with a conclusion by making recourse to the research aim and the research question in particular.

2. Previous Research

Within this chapter, already existing literature will be used in order to first provide information regarding the current energy situation in China and to further indicate which policy measures have been taken into account by the Chinese government. As the focus then lays on the consumers' side in terms of their WTP for green electricity, other countries besides China will be analyzed with particular regards to certain factors influencing their consumers' WTP. In order to provide some limits to the literature review, studies and articles that have been published in major energy journals such as *Sustainable Cities and Society* and *Energy Policy* will be used as those journals seem to cover most of China's renewable energy situation. Additionally, the latest *China Statistical Yearbook* and the *China Energy Statistical Yearbook* will be applied to provide certain statistics on energy consumption in China.

2.1 Overview of China's energy situation

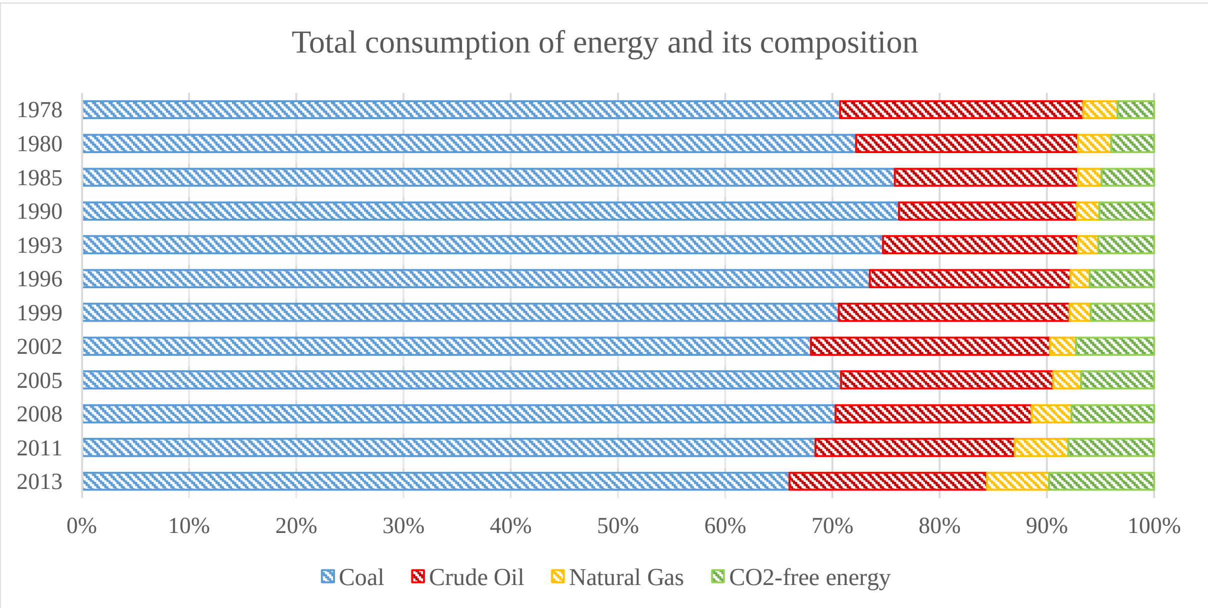
After China has initiated the so-called open door policy in 1978 which included several economic reforms, the country transformed from a rather closed to a capital-intensive and gradually more export-oriented economy. Those reforms undertaken by the Chinese government resulted in spectacular economic growth rates and declining numbers of people living in poverty (Tang et al., 2015). Today, China is the second largest energy consuming economy worldwide, right after the USA. In order to keep its GNP growth stable with an annual growth rate between 8 and 9 percent, China is more or less dependent on an enormous amount of energy for both the industrial and the household consumption. Additionally, it can be pointed out that primary energy consumption has increased by 8.1 percent in the OECD countries and by 24.6 percent for the whole world with regards to the last two decades. The rise for China, however, has been nearly 100 percent during the same period, which further indicates the tremendous impacts this vast energy consumption has had on both the economy and the environment on the national and worldwide scale. Eventually, this phenomenon made China into a target source of global political tensions (Ma et al., 2010).

Furthermore, China's situation in terms of energy production and consumption is heavily a coal-based one. Raw-coal energy production takes up for most of China's primary energy supply and not only industries', but also household consumers' consumption is mainly based on this type of fossil-fuel (Ma & Oxley, 2012). Interesting to note is that the consumption of coal differs unevenly across regions in China: even though this type of fossil fuel can be found everywhere throughout the country, the major deposits are located in the North (Shanxi and Inner Mongolia), Southwest (Guizhou and Yunnan) and Northwest (Shaanxi) of China (Ma & Oxley, 2012).

As can be taken from the diagram below, coal consumption in China has been pervasive throughout the last 35 years and took up 66 percent of China's total primary energy consumption in the year 2013. On top, coal production surpasses coal consumption and hence China faces a surplus of coal-generated energy (China Statistical Yearbook, 2014). As a surplus of coal seems to be rather difficult to export according to China's 'easy to import and difficult to export' policy, the excess will be stored in times of energy shortages. Hence, this appears to be a favorable measure in order to meet China's increasing energy demand (Liu & Wang, 2008).

China's share of CO_2-free energies, including nuclear power, hydro energy and wind energy, takes up only 55 percent of the world's average which comprised approximately 6.8 percent of the total energy consumption in 2007 in China (Ma et al., 2010). Nonetheless, the consumption regarding renewable energy is steadily increasing in the country and may presumably account for 11.4 percent in 2015 and 15 percent of total energy consumption by 2020 (Qi et al., 2013). The amount of renewable or green energy to the energy mix will hence increase continuously in China (Yuan & Zuo, 2011). First indicators can be taken from figure 1 in which the share of renewable energies from the beginning of the economic reforms starting in 1978 until today is displayed.

FIGURE 1: THE COMPOSITION OF CHINA'S ENERGY CONSUMPTION

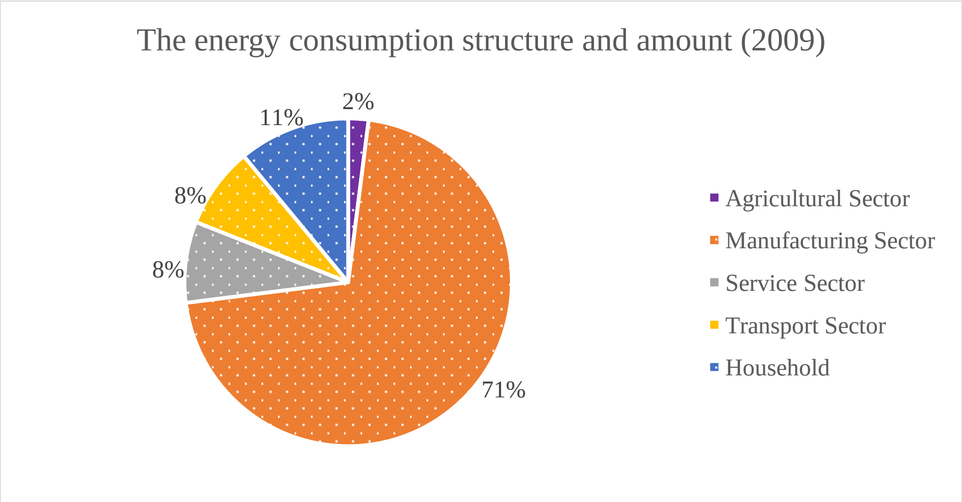


SOURCE: CHINA STATISTICAL YEARBOOK (2014A)

According to Midilli et al. (2006), green or renewable energy is defined as an energy source that has zero or minimum environmental impact and is hence rather sustainable to the environment. However, it is stated that renewable energy sources only take up less than 10 percent of the world's total energy consumption currently, even though its potential is vast due to its unlimited supply and also cleanliness in overall use (Chang et al., 2003). The sources used for green energy are mainly wind, hydropower, solar energy, geothermal power, wave power and biomass. However, due to the problems of deforestation that can come with the production of biomass, China's residents try a gradual reshaping of the pattern regarding energy consumption away from biomass to cleaner and more sustainable energy sources. This is the reason why energy produced from biomass is still at an early stage in China. Additionally, this is also due to the rather low preference and understanding of the Chinese population regarding this kind of energy's potentials and consequences (Ma & Oxley, 2012). Green generated electricity for consumption usage is based on the other named renewable energy sources and is marketed as being environmentally friendlier than conventional energy sources as, for instance, coal and oil (Salmela & Varho, 2006). Therefore, energy produced by using fossil fuels refers to conventional energy of unrenewable production which will eventually create harmful impacts on the overall environment (Hansla et al., 2008).

It is essential to point out that the majority of China's primary energy is consumed by its industries. As can be seen in figure 2, the manufacturing sector takes up the largest portion of China's entire energy consumption with 71 percent (Xiang et al., 2013). Chinese households seem to play a minor role in the distribution of energy consumption with a contribution of eleven percent, whereas in the EU-28 household consumption accounts for approximately 29 percent which is equivalent to approximately 304.09 Mtoe (Yuan et al. 2014; Hansla et al., 2008; Zografakis et al., 2010).

FIGURE 2: CHINA'S ENERGY CONSUMPTION STRUCTURE AND AMOUNT (2009)



SOURCE: XIANG ET AL. (2013)

However, the role of Chinese households and individuals will further gain importance regarding their use of energy. This can be explained by the prediction that the energy demand of Chinese households will increase between 3.0 and 3.5 percent in the year 2016 (Hill, 2016). The increase in energy demand can be described by the fact that China has advanced from a previously low middle income country in 2001 to an upper middle income country in 2010 and hence the overall GDP per capita has increased significantly. This indicates that more Chinese households and individuals are actually able to afford more goods, as for example household appliances, and therefore the usage of energy in form of electricity is generally increasing (Yuan et al., 2014; Wang et al., 2012). For instance, household air conditioners and microwave ovens have been trebled over the years 2003 to 2009, from 30 and 17 to 88 and 51 per hundred urban households, respectively (Ma & Oxley, 2012).

A greater usage of energy by not only Chinese consumers, but consumers on a worldwide level indicates that mankind is confronted with two major global climate issues as pointed out by Chang et al. (2003): these are firstly global warming or rather the greenhouse effect that is predominantly caused by the emissions of CO_2 in form of GHG discharges. Secondly, another climate issue comprises acid rain that is caused mainly by SO_x and NO_x. These two main problems are again caused by the over-usage of fossil fuels such as coal and oil which take the main proportion of China's primary energy consumption. Even though several authors (Chang et al., 2003; Zografakis et al., 2010; Hast et al., 2015) point out that fossil fuel energy sources will be drained in the future mainly due to government actions that will take place, it is important to involve the power of the Chinese consumers as well. This means that it has to be taken into account whether they perceive the usage of renewable energies as a mandatory measure in order to not only stabilize the Chinese economy, but also to protect the overall environment.

2.2 Government policies

China faces large barriers in order to successfully develop green electricity due to the competitive advantage of rather cheap and abundant coal production. In order to combat the issues resulting from the usage of fossil fuels like coal and oil to a large extent as stated above, the Chinese government has been eager to implement favorable policies and energy projects for the middle- and long-term development of renewable energy resources. This aims at both the security of energy supply and the protection of the Chinese environment (Chang et al., 2003). In the following, certain government implementations regarding the improvement of China’s energy situation will be worked out.

2.2.1 The renewable energy policy in China

Against the background of China being faced with a rather unfavorable energy situation in terms of heavy reliance on fossil fuels and the insubstantial amount of attention given by the Chinese government towards energy savings, the regulation and implementation of certain energy laws found an increasing importance throughout the last years in China (Ma & Oxley, 2012). For instance, the ‘Energy-Saving Law’ has been first drafted in 1997, has then been issued one year later, was revised in 2007 and has been finally reissued in 2008. The Chinese government succeeded to increase the energy intensity in terms of electricity consumption thanks to the implementation of certain laws, besides other factors like structural changes that emerged in China. Therefore, the electricity intensity ratio, that is the ratio between the gross inland energy consumption and the country’s GDP, improved from 0.66 in 1980 to 0.11 in 2012 (EEA, 2013; China Statistical Yearbook, 2014b). Even though China uses its energy resources more efficiently than in the past, there seems to be lots of room for improvements to make (Ma et al., 2010).

However, besides laws that aim to save up energy resources including conventional energies like coal and oil, the Chinese government tries to put more effort into the development of its own renewable energy sources. For this purpose, the Standing Committee of the National People’s Congress of China has implemented the *Renewable Energy Law* which came into effect in 2006 and has been revised in 2009 (Berrah et al., 2001; MOFCOM, 2013). The *Renewable Energy Law* is the leading legal basis regarding the use of renewable energy sources in China and has been mainly implemented to not only promote the development and utilization of renewable energy, but also to remove market barriers and to form markets for these renewable energy sources (Hast et al., 2015). The main intention behind the implementation is to legitimize the subsidization of renewable energy by the Chinese government for companies located in China in order to promote further sustainable development of energy usage (Christensen, 2015). Therefore, it seems that the law is mainly focused on the supply side, but less on the demand side, that is the end-users. For instance, the law fixes targets for grid companies to purchase all generated renewable electricity. Additionally, price authorities of the Chinese State Council set the on-grid electricity prices for renewables to promote the purchase of renewable energy for China's state power grid companies and petrol wholesale companies (Yu, 2011; Li, 2011).

Subsequently, in connection with the implementation of the *Renewable Energy Law*, the Chinese government published the *Medium and Long Term Renewable Energy Development Plan* in August 2007 (Lo, 2015). With focus on this renewable energy development plan, the Chinese government tries not only to set its focus on the supply side, but also aims to involve the Chinese consumer-side including environmental aspects as it is stated within its specific objectives section: "China will also aim to provide electricity to people in remote off-grid areas and resolve fuel scarcity problems in rural areas through the use of renewable energy, doing so according to local conditions and at the same time effectively protecting the ecological environment" (NDRC, 2007: 8).

Interesting to note is that the plan puts its focus mainly on rural energy consumption and hence strives for implementing pilot programs. Those aim to make full use of all forms of renewable energy sources including mainly solar power, wind energy and biomass. This seems to be a reasonable approach as the rural areas not only have the natural resources of solar and wind power that are rather rare in the urban areas, but they also have abundant land to set up solar and wind power plants and to promote the usage of biomass energy. In order to successfully implement those policies, the Chinese government is eager to apply favorable price policies and government investments to actually reach the target share of 15 percent of renewable energy within the primary energy consumption by 2020 (Tang et al., 2015; Qi et al., 2013).

2.2.2 The Green Electricity Scheme in Shanghai

It can be pointed out that both the *Renewable Energy Law* and the *Medium and Long Term Renewable Energy Development Plan* set the legal foundation upon which the municipality of Shanghai has been able to launch pilot programs with a focus on renewable electricity. Interestingly, Shanghai is the first city of a developing or rather emerging country that implements such a voluntary-based green electricity pilot project called the *Green Electricity Scheme* which started in 2006 (Yu, 2011). Within the first year, the incremental price premium was set for 0.53 RMB per kWh which will sum up to an end price of 1.14 RMB per kWh for green electricity. This will make the new electricity product called *Jade Electricity* approximately twice as expensive as ordinary electricity (0.61 RMB per kWh) and will lead to an additional price premium of approximately 29 RMB or 3.70 USD per month[1] (Li, 2011). As this renewable electricity product will only take up a small proportion in total electricity consumption ranging from 5 to 25 percent, depending on the consumers' annual electricity utilization, the overall increase in the price premium is rather low (Berrah et al., 2006). As the program already failed within the first year, no other prices have been set with regards to the upcoming time periods.

The Shanghai Municipal Government assured that the additional payments for green electricity would be used to develop further electricity for consumption usage. Remarkably, this scheme built the first arrangement in China to offer Chinese consumers the option to subscribe to electricity produced from renewable energy sources including mainly wind power and photovoltaic solar power generated in Shanghai (Berrah et al., 2001). Additionally, the scheme is exceptional as it on the one hand sets its focus on the consumer demand for the purchase of a renewable electricity product instead of concentrating on the supply side only. On the other hand, it also gives Chinese consumers the opportunity to actually freely choose its electricity provider which is normally fixed by the Chinese local governments (Hast et al., 2015). The target group is rather large as the product is not only available to non-household consumers, as industries, but also to household and commercial customers as well (Yu, 2011).

In order for consumers to buy this new electricity product, the Chinese government offered certain incentives for potential customers in order to subscribe. These incentive mechanisms comprise, for instance, the publication of a list including those people that signed up for the voluntary program and awarding them with honorary certificates, an emblem or even medals (Li, 2011). Despite these incentives, such methods proved to be rather ineffective and hence the

[1] Calculated based on China Statistical Yearbook, 2007; China Energy Statistical Yearbook, 2007; Chinability, n.d.

subscription rate remained somewhat low, that is below 1 percent of all residents and firms in Shanghai (Zhang et al., 2011). Therefore, the scheme has not been successful when regarding this case (Yu, 2011).

The question arises why this voluntary-based *Green Electricity Scheme* could not find enough customers in order to be a successful pilot program. According to Hast et al. (2015), the main barriers regarding the development of green electricity in the case of Shanghai have been the higher costs compared to conventional electricity and the overall lack of consumer awareness. When interviewing several Shanghai residents in April 2016[2], it can be pointed out that the assumption made by Hast et al. (2015) is partly in accordance regarding their statements. As an illustration, Yang Kai, a 36-year old Chinese resident living in Shanghai since he was born, stated that he had never been aware of the option to engage in the *Green Electricity Scheme*. He said, if "I would have been aware of the option to choose an environmental friendlier energy source, I would have definitely subscribed to this program. The additional costs involved would not be a hindrance in order to purchase green electricity as doing something good for the improvement of the people's environment is much more important than saving this money".

Li (2011) states that people in Shanghai do not automatically fully realize the environmental merits that come with adopting green electricity since the usage of it is still a new concept in China. Hence, as renewable electricity is more expensive than conventional electricity, consumers seem to be more reluctant to pay this additional cost. According to Guo Li, a 57-year old production worker who also has not been aware of the option in 2006 to purchase green electricity, he would not have subscribed to the program as "there are no visible benefits for me in the short run. Why should I spend more money on something that I will not benefit from directly? My income is just high enough to pay my current electricity bill. How can I afford more expensive renewable electricity then?"

As it is pointed out, the barriers for subscribing to a voluntary-based program differ across environmental and economic factors. They involve several problems that need to be addressed in order to successfully implement such a scheme. In the following, the focus will be laid on other countries, which shall display which cases seem to be successful in both developing green electricity and promoting the purchase of it to its potential consumers and which are also still struggling with implementing this renewable energy source.

[2] Semi-structured interviews have been conducted when having a field trip to Shanghai in April 2016. In total, eight Chinese residents have been interviewed face-to-face. The responses were given mainly in Chinese and have been translated into English accordingly. The questionnaire can be found in the appendix.

2.3 Evidence from other countries

Different from China, it can be seen that in liberalized energy markets the consumers can freely choose their own energy supplier according to their respective preferences. It has been studied in many countries which factors will have a certain impact on the decision-making for the consumers' WTP for green electricity (Hast et al., 2015). WTP can be defined in both relative and absolute terms as well as an increase in the amount of an electricity bill in the form of a premium payment (Zorić & Hrovatin, 2012). For this purpose, mainly Western and hence developed economies, which have already made large progress in the development of renewable energy sources, have been investigated in most of those studies (Liu et al., 2013). As it is stated by Wüstenhagen et al. (2007), social acceptance plays a crucial role when it comes to a successful implementation of certain energy policies in a country. For instance, in Germany with the largest number of installed wind turbines per capita on a worldwide level, the media reports on local resistance to new wind energy projects due to higher relative visible impacts those turbines create. But also countries that are only at the beginning of the diffusion curve in terms of renewable energies like the UK, Switzerland, the Netherlands and France face huge debates on local and sometimes national levels with regards to new energy projects. Hence, as social acceptance plays a determining part in order to successfully implement renewable or green electricity policies in certain countries, the issue of consumers' WTP needs to be urgently addressed throughout the world.

In several studies it is pointed out that certain constraints and push-factors exist when it comes to social acceptance and the WTP for green electricity. Those studies pick up on both the definition and analysis regarding constraints and barriers to WTP on the one hand, and the benefits and incentives for buying renewable electricity on the other. Investigations have been made throughout several countries, whereas the focus has been laid on how various demographic variables have affected the general public's WTP for a certain premium in order to obtain renewable electricity sources. For instance, Zarnikau (2003) describes in his paper how residential customers would be willing to pay a price premium on their monthly electricity bill in order to support the utility investment in renewable energy and energy efficiency projects in Texas, USA. Within this study, the author is controlling for both economic and demographic factors like a consumer's age, the gender, educational background and income. His findings are consistent with the so-called 'green consumer' profile indicating that an educated, affluent and under 55 year-old male is willing to pay the highest premium of 10 USD per month in order to support renewable and energy efficient investments. As it is stated by Borchers et al. (2006)

and Roe et al. (2001), there seems to be a real and increasing interest among several consumers for environmentally friendly energy production with focus on the USA, which creates optimal conditions for some consumers to pay a voluntary premium. Even though the results within those papers are statistically significant, the economic significance regarding the slightly increased marginal price premium appears to be rather limited.

However, in contrast to some of the US states and in accordance with China, the Japanese consumers cannot freely choose their respective electricity provider. Nonetheless, surveys conducted by Murakami et al. (2014) indicate that Japanese consumers are potentially more prone to buying renewable energy sources in the form of wind and solar power[3]. This seems to be mainly due to the increase in public interest after the Fukushima nuclear crisis in 2011.

Nonetheless, the case seems to be different for European countries where a certain product differentiation exists. As Salmela and Varho (2006) point out, the number of household customers consuming green electricity remains rather low. That is, in the year 2000 only 0.07 percent of the consumers in the UK had actually signed up for paying green electricity tariffs. The same holds for the majority of Finnish consumers who have not been willing to change their electricity supplier in order to obtain environmentally friendlier energy. This seems to be a surprising result given the fact that the Finnish electricity market has been liberalized in the 1990s and since 1998 all consumers have been able to buy green electricity. The study indicates that this consumer's choice is mainly based on the price-sensitivity regarding renewable energies and hence price seems to be a barrier for buying green electricity (Salmela & Varho, 2006; Mewton & Cacho, 2011; Hast et al. 2015).

Interesting to investigate is the case of Sweden, where the Swedish Parliament has passed a 'green electricity certificate' law in 2002 due to a desired switch from conventional to a more renewable energy usage by both the Swedish government and the consumers. The law obligates electricity suppliers and household consumers to buy a certain quota of green electricity from electricity producers, whereas the quota has been 7.4 percent in 2003. This measure introduced by the Swedish government seemed to bear fruit as by now almost two-thirds of the Swedish primary energy consumption come from renewable energy sources. The idea of quota-based obligations has also been imposed in other European countries as in Belgium, Poland and Italy with the same idea to more or less forcefully implement the usage of renewable energies (Hansla et al., 2008; Chang et al. 2003). Additionally, the Swedish government implemented further

[3] Approximately 80 percent of the people included in the survey.

policy measures such as investment subsidies and tax reliefs for both firms and consumers in order to primarily promote the generation of wind power and usage for consumers (Ek, 2005).

As it is stated by Zorić and Hrovatin (2012) in the case of Slovenia, the willingness to participate in green electricity programs depends heavily on the factors regarding education and environmental awareness. Nonetheless, the parameter of household income plays the major role when it comes to the WTP of Slovenian consumers to buy green electricity. However, both authors point out that the results in different papers stating the WTP for a certain product can differ heavily from each other as these studies cover different countries and time periods. Furthermore, the methods used and the setup of the questionnaires applied are different from one another and therefore the outcomes will not always be similar. This is important to acknowledge when analyzing the data and the outcome regarding the paper at hand.

Additionally, it seems to be crucial to make a differentiation between the willingness to pay for higher prices and the willingness to pay for higher taxes. The distinction has been made in order to measure the effect of the so-called *free-rider problem* that is explained by basic game theory: the benefits regarding the consumption of green electricity can be seen as a collective good problem as not only one specific person but rather all surrounding people receive marginal benefits from the adoption of renewable electricity as it has positive impacts e.g. on the environment. However, in the case where only certain individuals pay higher prices for the consumption of this renewable electricity source, some other people do not monetarily contribute to the consumption power. Hence, they profit from this public good while not paying for it. In the second case, however, all people have to pay higher taxes and therefore everybody is involved in the process of adopting green electricity, despite the high incentive and possibility to free-ride (Stern, 2006; Salmela & Varho, 2006; Zografakis et al., 2010).

2.4 Development of factors influencing WTP

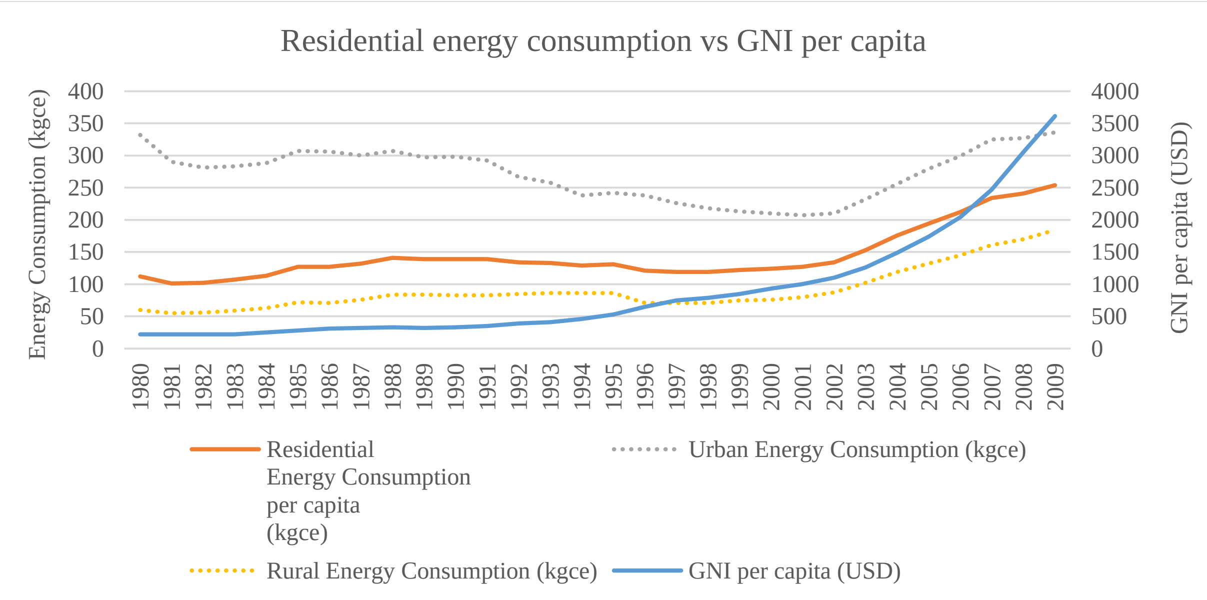
In the foregoing chapter, various factors have been mentioned that proved to have certain impacts on the consumer's WTP for renewable electricity. In the light of the present study, the most important factors will be further investigated, as they seem to be dominant for the consumption choice of green electricity. In order to answer the research question, the focus will be laid on the following economic and environmental parameters: income of Chinese residents, the influence of electricity price, government support policies in form of subsidies and tax reliefs with a focus on renewable energies and environmental factors including the effects of health conditions in China.

2.4.1 Income of Chinese residents

Since China's opening-up policy and the implementation of economic reforms in the late 1970s, the country has been able to increase its Gross Domestic Product (GDP) per capita which led to an overall surge in poverty reduction. As in 1978 when reforms began, the capita GDP of China has only reached a level of 155 USD, whereas only 23 years later in the year 2001 the GDP per capita has risen to 1,042 USD. These numbers indicate that China has entered into a low middle income level by the beginning of the new century. In the year 2010, China reached a GDP per capita of 4,000 USD and hence advanced to the upper middle income level (Yuan et al., 2014).

In terms of China's income development, it can be said that it seems to go hand-in-hand with the increase of the Chinese energy consumption. As can be drawn from figure 3 below, with an increase in Gross National Income (GNI) per capita for Chinese residents after the implementation of economic reforms until recently, the average annual residential energy consumption per capita has also increased over the years. When focusing on the split between urban and rural residents, it can be seen that the average consumption for people living in urban areas is still remarkably higher than for rural residents even though the gap has narrowed slightly over the years.

FIGURE 3: RESIDENTIAL ENERGY CONSUMPTION VS GNI PER CAPITA



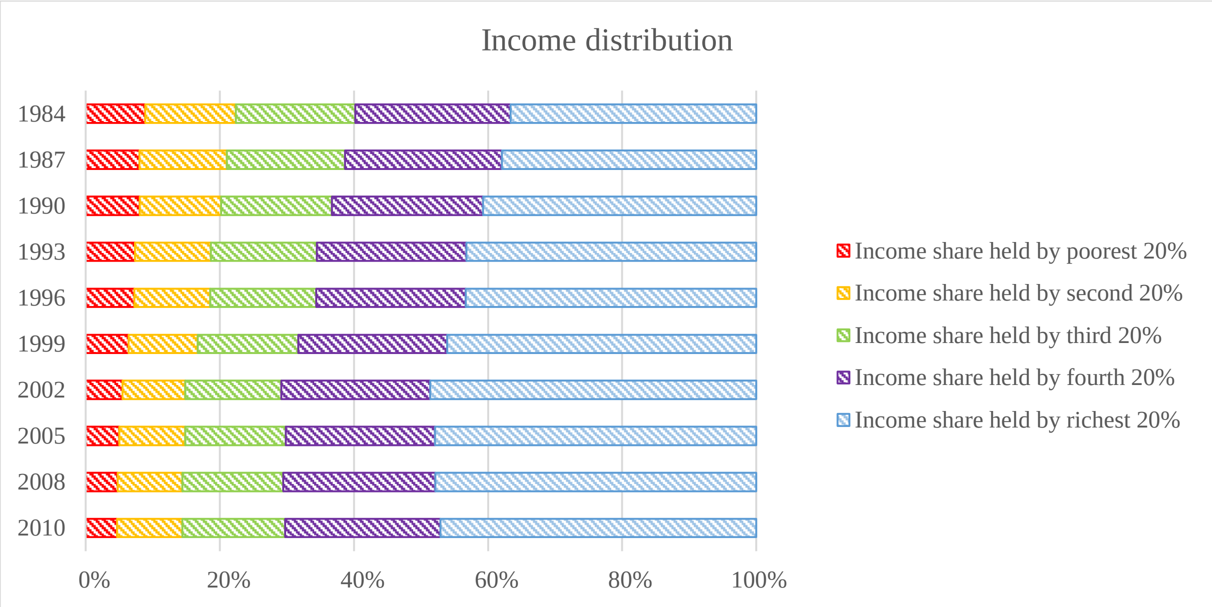
SOURCE: THE WORLD BANK (2016A); CHINA ENERGY STATISTICAL YEARBOOK (2010)

With regards to figure 3 it can be said that with an increase in income and the advancement of China to an upper middle income group, the consumption of energy will increase for both rural and urban residents as well. As it is stated by Hansla et al. (2008), a low income indicates living in a rather small apartment and therefore the electricity costs are in general low. When applying this point to the case of China, it can be stated the other way around: With a gradual increase in total income, Chinese residents are able to afford bigger apartments and houses. This leads to an increase in overall electricity consumption and electricity costs. Nonetheless, it has to be pointed out that China still has the status of a developing or emerging economy and hence the gradual increase of overall income is just at the beginning of keeping up with the developed countries. Hence, there seems to be lots of growth potential (The World Bank, 2016b).

As it is the case in many developed economies that the income is distributed rather unequally across its residents, also China shows to have developed such a trend over the last decades. With the economic reforms and especially with the labor retrenchment program in the mid-1990s, the Chinese government initiated the removal of employment guarantees for state-owned workers. The reason behind it is that the Chinese government wanted to create a shift from a previous planned labor allocation system to a well-functioning labor market (Appleton et al., 2005). Finally, this state-initiated approach has led to significant employment shifts both within and between sectors and resulted in rather high rates of unemployment and unequal distribution of income (Dong & Xiao, 2009).

As can be drawn from figure 4, the gap between the poorest and the richest people in China seems to widen in terms of income distribution. According to the Economist (2012), 57 percent of the national income has been earned by the upper 10 percent of Chinese residents in the year 2010. However, the numbers differ across studies as the World Bank (2016a) shows that almost half of the income is held by the richest 20 percent of China's population which can be seen in figure 4. As this share has been increasing over time, income inequality seems still to be an apparent occurrence in China.

FIGURE 4: CHINA'S INCOME DISTRIBUTION



SOURCE: THE WORLD BANK (2016A)

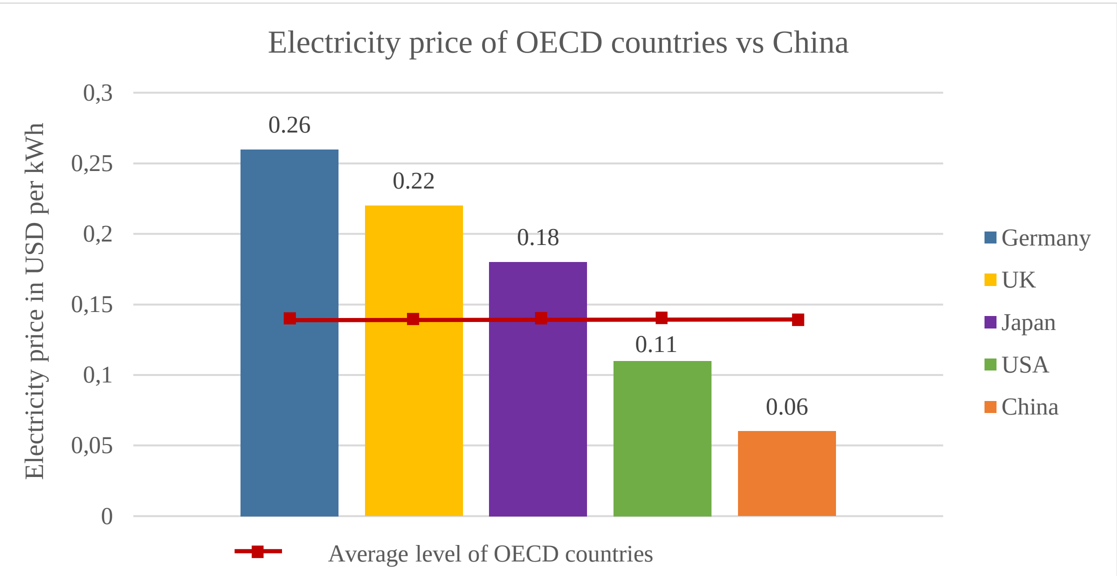
When comparing the income distribution between urban and rural residents, income disparities between those two groups are prevalent as well. As Xue and Gao (n.d.) point out, the income gap between rural and urban residents has been widening since the mid-1980s and seems now to be the highest in the world. According to the National Bureau of Statistics (2012), the net income of rural residents accounted for 6,799 RMB which seems rather little when compared to 23,979 RMB for urban residents in 2011. Even though the real income growth rate is 3 percentage points higher for rural residents (11.4 percent) than it is for urban residents (8.4 percent), the income disparity still seems to be significant and influences the electricity consumption behavior for both groups. Assumedly, rural residents just might not have the financial endowments to being able to afford green electricity.

2.4.2 The price of electricity

In China, it was not the electricity producing firms but the Chinese government set out both the legal framework and the policies to determine the development of conventional and renewable energy prices. The respective local governments of each province on the other hand have to assure that those policies and relevant provisions are correctly implemented. Hence, both the producers and the consumers have no say in setting any price decisions regarding the progress of electricity prices. In particular, the Chinese government wants to keep the electricity prices low in order to support the overall GDP growth. Even so, as also in many developed countries, the environmental externalities associated with the production and consumption of coal-fired energies have not been reflected in the rather low price of conventional electricity (Li, 2011).

As can be drawn from figure 5, the price of electricity with focus on the Chinese household sector is relatively low when compared to other OECD countries in the year 2007. For China, the household electricity price is only 0.06 USD per kWh, which is much less when compared to the prices for Germany (0.26 USD per kWh), the UK (0.22 USD per kWh), Japan (0.18 USD per kWh) and other OECD countries. Additionally, China lies far below the average electricity cost within the OECD countries of 0.14 USD per kWh.

FIGURE 5: ELECTRICITY PRICE OF OECD COUNTRIES VS CHINA



SOURCE: WANG ET AL. (2012)

Although China's price settings for overall electricity consumption seems to be rather low, it has to be taken a deeper look at the distribution of consumer classes within China: commercial and also industrial customers pay comparatively high prices, whereas the heavy industries, the agricultural sector as well as Chinese residents pay lower electricity prices which are heavily subsidized by the Chinese government. This approach is intended to support key industries and to maintain social stability in the Chinese society. However, this approach inherits problems that China still faces. Regarding the distribution side, the electricity prices that China's grid companies are permitted to charge their customers are not in accordance and in relation to their costs of buying and distributing electricity. This indicates that the conventional electricity prices are artificially kept low and are hence not transparent for the Chinese consumers. Therefore, there appears to be a deficiency of a robust link between the prices and costs that electricity production creates (Kahrl et al., 2011).

Additionally, the over-supply of coal and its generated energy let the overall electricity prices drop below market-prices. However, the prices for renewable electricity have been comparatively high. One decisive factor is the somewhat weak domestic manufacturing industry in China producing wind turbines, for instance. In particular, renewable energy technologies are an emergent within the power generating sector and do not benefit from economies of scale unlike conventional energy technologies. As in the wind industry, only a few Chinese owned manufacturers have been established which are rather limited in both their size and quality of the turbines they produce. These flaws force renewable energy developers to import rather expensive equipment from overseas which increases the cost of electricity from renewable energy sources. Simultaneously, this rather expensive import hinders the growth of the local manufacturing industry (Li, 2011). These problems need to be addressed in order to create more competitiveness regarding the price settings of renewable electricity.

Even though the central government in China controls the production and the prices of electricity for both the on-grid prices (i.e. between producers and grids) and the end prices (i.e. between grids and consumers), the investments to build energy capacities have been liberalized over the last years. This means that, although the majority of power supply capacity is owned and controlled by the state and competition remains mainly between the state-owned companies, the domestic private and international companies have been allowed to invest in the power generation sector and to make partial decisions in terms of price mechanisms (Hast et al., 2015).

For instance, in the year 2008 some Chinese solar companies including for example Suntech, Solarfun and Canadian Solar, which are all publicly listed firms, joined to agree on an industry pricing roadmap. This roadmap agreed upon to make a joint effort to decrease the on-grid solar power price between 0.729 and 0.991 RMB (0.11 USD and 0.15 USD respectively) per kWh by 2012. This has been decided to be the threshold for a large-scale commercialization of this specific energy source. Solar power was previously priced at approximately 4 RMB (0.59 USD) per kWh, which was calculated on the grounds of production costs and the amount of energy a solar module is able to produce over twenty years. Consequently, the new prices for solar power electricity have been successfully reduced from 4 RMB per kWh to less than 1 RMB per kWh within a rather short time period of only four years (Christensen, 2015; Zhang & He, 2013).

Nonetheless, even though the price for the consumption of solar power has been considerably reduced, it is still not competitive with non-renewable energy sources like coal-generated energy (Ma et al., 2010). Only when the incremental costs of renewable electricity will decrease in the future, that is the cost increase will decline and in the best case will reach zero, it will advance to the level of being financially competitive with conventional energy sources (Berrah et al., 2001). As pointed out by Li (2011), as long as the price for renewables is still higher than for other energy sources, many consumers are deterred to use it and hence the price becomes the largest barrier to the development of green electricity in China.

Additionally, there exist coal-fired and renewable price differences between rural and urban residential electricity use in China. According to Liu et al. (2013), electricity in rural areas is more expensive than in urban regions since the electricity needs to cover rather high maintenance fees for rural low voltage grid. For instance, in the provinces of Xinjiang, Liaoning and Inner Mongolia, which represent typical rural areas throughout China, the wind power prices more than double the ones generated from coal (Li, 2011). This implies that rural residents might be even more reluctant to invest in renewable energy when also taking their rather low income into account.

2.4.3 Government support policies

As already mentioned in chapter 2.2.1, the goal of the *Renewable Energy Law* is the legalization of subsidies by the Chinese government for companies focusing on the development and generation of renewable energies. As the price of green electricity seems to be a decisive factor for the end-users, some measures of the Chinese government have been implemented as possible incentives to promote the consumption of regenerative energy sources for residential consumers. As China is not benefiting from certain green electricity certificates like Sweden and Norway, which increase and promote the production of green electricity more cost-efficiently, the Chinese government needs to find other measures in order to successfully implement green electricity to a larger extent (Swedish Energy Agency, 2015). Those measures include preferential loans, direct subsidies to end-users and tax reductions or exemptions (Li, 2011). Interestingly, it is estimated by Sardianou and Genoudi (2013) that energy subsidies are more effective measures in encouraging the application of renewable energies with focus on the residential sector than tax deductions, as the effects are directly visible to the consumers. When people in Shanghai have been asked to describe the renewable energy policy with regards to their own city in China, subsidies for new electricity vehicles and energy saving appliances have often been mentioned. Also subsidies to solar power were stated by many respondents (Hast et al., 2015).

According to Liu et al. (2013), in China the higher cost of renewable electricity is to a large extent balanced by governmental subsidies. This is different from several developed economies, where households have to pay more if they want to consume green electricity instead of conventional electricity, without special subsidization provisions. For instance, the Chinese government encourages the application of solar photovoltaic power and other solar energy utilization systems like solar water heaters (SWH) in form of economic subsidies. Nonetheless, there is no identical standard subsidy regarding SWH installation: the amount of subsidies differs across Chinese cities. As in Yiwu County, located in Zhejiang Province, every family can receive a subsidy of 500 RMB when installing a SWH, whereas in Jiangshan County in the same province the subsidy is only 300 RMB. In other counties there is no subsidy at all. The thresholds have been stipulated by the respective local governments. However, problems are still present mainly for families in rural areas that cannot afford SWH systems, even when receiving certain subsidies (Han et al., 2010; Hast et al., 2015).

2.4.4 Environmental conditions

Besides economic factors that might influence the decision-making or WTP of Chinese consumers for buying renewable electricity, certain environmental factors may also play a decisive role for China’s end-users. This is especially the case for China, which is the largest GHG emitter after having overtaken the USA in 2007 with approximately 30 percent of the world’s total emissions (The Economist, 2013; Albert & Xu, 2016). Consequently, it is not surprising that the country contains sixteen of the top twenty most polluted cities in the world (Shen, 2016). Due to China’s economic rise, in which its GDP has grown on average 10 percent each year for longer than a decade, the country reached the level of large environment and public health degradation (Albert & Xu, 2016). The extreme high levels of pollution, deriving from heavy coal-utilization by China's industries and household consumers, affect not only China's air environment, which is clearly visible in form of smog in larger cities like Shanghai and Beijing, but also harms the water and land environment of the country (Yu, 2011). These pollutions can be so harmful that the life expectancy can possibly be reduced by approximately five and a half years, as a study by America's National Academy of Sciences found out (The Economist, 2013).

China's economic reforms accompanied by a large modernization process has lifted hundreds of millions of people out of poverty and has created a growing middle class. The country's journey of heavy industrialization does not come unexpectedly and resembles the courses of other modernizing nations such as the UK in the early nineteenth century (Albert & Xu, 2016). During this rapid industrialization process, coal has been the abundant energy source. Coal is still the main foundation of primary energy as depicted in figure 1 and it simultaneously causes severe negative environmental impacts (Ma et al., 2010). One of those environmental effects is the heavy air pollution in China which has mainly been caused by the consumption of both industries and households. Air pollution, which is mainly the consequence of coal combustion, contains approximately 90 percent of SO_x emissions, 70 percent of dust emissions and 67 percent of NO_x emissions (Tang et al., 2015). Consequently, it can be pointed out that the production and consumption of energy in form of conventional energy sources like coal have harmful effects on the environment as energy accounts for about two-thirds of overall emissions (Stern, 2006).

Along with the rapidly deteriorating environment in China, a growing number of residents become increasingly aware of the problems and their causes regarding the environmental status of their living area (Wang et al., 2012). After having followed three decades of economic growth and a rising demand of energy and electricity products, the Chinese population becomes more eager in terms of changing their consumption behavior in order to improve their environmental conditions (Ma & Oxley, 2012). The fact that green electricity is produced from renewable resources such as wind and solar power, the production of regenerative electricity generates little to no pollutants to air, water and land. Hence, it helps to reduce overall emissions in form of e.g. CO_2 and improves air quality in general (Li, 2011). Therefore, in the following it shall be worked out whether environmental factors play a crucial role in the Chinese consumers' WTP for green electricity and to what extent it might show a higher or lower probability when controlling for economic factors such as income, government subsidies and the influence of electricity pricing.

3. Hypotheses

With regards to the facts described in the previous chapters, the succeeding hypotheses shall provide some indications focusing on the impacts of economic and environmental factors on the Chinese consumers' WTP to protect the environment. Bringing to mind the research question, it shall be pointed out what role both economic and environmental factors play for the consumers' WTP and which factors might result in a higher or lower probability for customers to buy renewable electricity. Additional variables, which will find further explanations later on, will be included to control for their effect on the Chinese consumers' WTP.

The first hypothesis addresses the effect of income on the consumers' WTP as it is pointed out by many scholars (Zarnikau, 2003; Kotchen & Moore, 2007; Menges et al., 2005; Sardinaou & Genoudi, 2013; MacPherson & Lange, 2013; Zografakis et al., 2010), income plays a crucial and positive role when it comes to the adoption of renewable electricity sources. Only Hansla et al. (2008) in the case of Sweden and Roe et al. (2001) in the case of the USA point out that income does not have a positive effect on the WTP for consumers. Nonetheless, the following hypothesis shall clarify whether the impact of income will affect the probability of WTP as China has been able to advance to an upper middle income country and hence more and more people might have some extra-money they are able to spend on cleaner electricity. Therefore, the first hypothesis is as follows:

> **H1**: *Higher income groups are more likely to accept paying higher prices / taxes for the adoption of renewable electricity than lower income groups.*

As government support policies have been implemented in terms of subsidies and tax reliefs fixed within the *Renewable Energy Law* and the *Medium and Long Term Renewable Energy Development Plan* in order to support the consumption of renewable electricity, it is assumed that the Chinese consumers will positively respond to such policy measures. Hence, the second hypothesis is stated as follows:

> **H2:** *The influence of subsidies from the Chinese government to consumers will lead to a higher probability of people paying higher prices for the adoption of green electricity.*

Also the price of an electricity source seems to affect the consumers' choice as pointed out by Mewton and Cacho (2011), Salmela and Varho (2006) and Hast et al. (2015). As rural and urban residents still have a large income gap, their decision-making in terms of adopting green electricity might therefore be influenced by the price of the energy source. This assumption can be justified by the argument that rural residents' income is still not high enough in order to pay an extra price premium for the consumption of renewable electricity, whereas urban residents might be more able to do so. Additionally, as the infrastructure for implementing renewable energy is not as developed in rural areas and maintenance fees for installation are still somewhat high, the purchase of green electricity might not be affordable for rural residents (Liu et al., 2013; Li, 2011). Except for monetary reasons, those people residing in rural areas are still living rather remote and hence they want to grow equally in economic terms as their urban counterparts. This can mainly be achieved by using cheap and conventional energy sources. Therefore, even though rural residents might not be influenced by the price of a certain product, their WTP for paying higher prices / taxes might still be lower than for affluent urban residents who state that the purchase of a good is influenced by price. Therefore, the third hypothesis will be stated as follows:

> **H3**: *The likelihood of the WTP for higher prices is smaller for rural residents who are not influenced by the price level of certain products than for urban residents who are influenced by the price level.*

As not only the economic factors will be investigated, but also the environmental parameters, the effect of health impacts on the consumers' WTP will find further scrutiny. Due to the problems of heavy air pollutions that Chinese residents have been struggling with for several years and which result in rather bad health conditions for especially those people living in large and industrialized cities, it can be assumed that those people facing health problems might be more prone to invest in green electricity. Hence, the forth hypothesis will be stated as follows:

> **H4**: *The probability of paying higher prices / higher taxes for green electricity is higher for people that claim to be unhealthy than for healthy people.*

4. Methodology

The aim of this paper is to assess the effect of both economic and environmental factors on the consumption behavior of Chinese residents. With regards to previous research it has been pointed out that there are other factors besides income, government support policies, price and environmental conditions that might either promote or hinder the WTP of consumers. Those factors are namely the educational background, gender and the age of consumers, just to name a few. In the following it shall be tested whether those parameters have some sort of influence on the main economic and environmental factors by applying a national survey that has been conducted throughout 11,783 individuals in China. The following methodology will therefore be applied in order to investigate the assumptions made and to subsequently show the magnitude of their effects.

4.1 Methodology

It is attempted to model two dichotomous dependent variables in order to measure both the probability of a consumer's WTP for higher *prices* for the protection of the environment and the likelihood of a consumer willing to pay higher *taxes* in order to protect the environment as proxies for adopting green electricity. For this purpose, a *Linear Probability Model (LPM)* function shall be applied as it facilitates the measurement of probabilities by including a binary dependent variable when controlling for several other factors. Those other parameters will be described later on.

The relationship between both the dependent and the independent variables can be explained by the following linear function:

$$Y_i = \alpha + \beta_1 * \boldsymbol{X_1} + \beta_2 * \boldsymbol{X_2} + \beta_3 * \boldsymbol{X_3} + \cdots + \beta_i * X_i + \varepsilon_i$$

4.2 Data description

The dataset that will be used for the upcoming analysis is a national-based survey named the "Chinese General Social Survey" (CGSS). The survey has been conducted by the *Renmin University* in Beijing and several other institutes in China in the year 2010 and will be used for reaching the econometric results. The survey contains a general part including 11,783 observations and is then split into different modules that only certain subsamples of the entire sample size had answered. According to Leana Tang (email communication, 30 January 2016), the research assistant of the *Renmin University* focusing on the *Chinese General Social Surveys* throughout different time periods, the separation into different groups answering certain module questions has been executed due to time constraints as completing the full questionnaire would otherwise have taken up too much time. This might have resulted in negative effects on the quality of responses. Subsequently, the module of interest, that is the *Environmental Module L* within the survey containing 25 different questions, has been answered by 3,672 people. Nonetheless, this sample size still represents to some extent a sizeable amount of observations in order to infer conclusions on a national level.

The dataset at hand is cross-sectional and hence includes the answers of numerous observations at a certain point of time. The advantage of a cross-sectional dataset is the possible and simultaneous investigation of different aspects. In this case, it will be the investigation of several economic factors and one environmental factor on the probability of WTP for higher prices / taxes for the protection of the environment as proxies for the adoption of green electricity throughout China in the year 2010.

The entire dataset is separated into nine parts, which find another split into three times three groups. Each group of questions is answered by a certain subsample chosen by the interviewee's month of birth. That is, only answers are included in the environmental module that have been given by individuals born in the months February, September, November and December. This indicates that general questions like the amount of yearly income, the age and the educational background, for instance, have been answered by all interviewees included in the survey. However, the module of interest that followed after the split containing questions regarding the interviewees' willingness to pay for the protection of the environment or their willingness to pay higher taxes for the same reason, has only been answered by a fraction of the entire group. This provides therefore some, but not severe, sorts of limitations.

4.3 The econometric model

In order to test the aforementioned hypotheses, econometric models have been set up for the application of LPM regressions. A linear probability function allows to determine the probability of whether the dependent variable will result in one outcome or the other as the dependent variables used will be binary. However, it needs to be pointed out that the LPM methods inherits limitations as the regression is linear and can hence take on values outside the range 0 and 1. Therefore, the predicted yhat is free to vary between positive and negative infinity. Additionally, the assumption of normally distributed error terms cannot be satisfied as the residuals can only take on two potential values (Williams, 2015). Nonetheless, the LPM method seems to be the more appropriate option than running a *Probit* or *Logit* regression that serve as alternatives for the calculation of dichotomous outcome probabilities. In the case at hand, the modeled probabilities are not as extreme as completely being 0 or 1, which would be suitable for either *Probit* or *Logit*, but more moderate as the variables have been transformed from a Likert-type scale into dummy variables. Hence, the LPM will be favored for the ease of interpretation in an economic sense (Von Hippel, 2015).

The coefficients of the regressors will be used in their interpretation which indicate how much of the probability changes in percentage terms (when Y=1) for a one-unit change of the independent variables, *ceteris paribus*. Focusing on this investigation, a significance level of 10 percent will be taken as a threshold due to a rather large sample size. Hence, the chance to commit either a Type I or Type II error, that is either to reject a null hypothesis which is in reality true or to retain a null hypothesis when in reality false, is in this case 10 percent (Gujarati & Porter, 2009: 121-122).

On the basis of previous literature, the following models include several variables that serve as proxies. That is, as a proxy for the adoption of green electricity, the answers to the question will be used whether a person is either willing to pay higher prices or higher taxes for the protection of the environment, based on game theory regarding the *free-rider problem*. Those variables will be the two dependent variables in the regression model. Because the influences of both the price-level of renewable electricity and subsidies by the government will not affect the consumers' purchasing-decisions in terms of paying higher taxes, these two variables will be omitted in Model B.

Based on the research question, the models will be applied with the focus laid on the main independent variables, namely the economic and environmental parameters. Therefore, the model will look as follows:

$$\begin{aligned} Model\ A: Y_i = {} & \alpha + \beta_1 * \boldsymbol{income\ group}_i + \beta_2 * \boldsymbol{price_i} + \beta_3 * \boldsymbol{government\ support}_i + \beta_4 \\ & * \boldsymbol{health\ condition}_i + \beta_5 * price_i * residential\ status_i + \beta_6 (\ln) age_i + \beta_7 * \\ & * gender_i + \beta_8 * education_i + \beta_9 * (ln) hh\ expenditures_i + \beta_{10} \\ & * residential\ status_i + \varepsilon_i \end{aligned}$$

$$\begin{aligned} Model\ B: Y_i = {} & \alpha + \beta_1 * \boldsymbol{income\ group}_i + \beta_2 * \boldsymbol{health\ condition}_i + \beta_3 (\ln) age_i + \beta_4 * gender_i \\ & + \beta_5 * education_i + \beta_6 * (ln) hh\ expenditures_i + \beta_7 * residential\ status_i + \varepsilon_i \end{aligned}$$

For the respective models the following thresholds will be applied:

$$Model\ A: Y_i = \begin{cases} 1\ willing\ to\ pay\ higher\ prices\ in\ order\ to\ protect\ the\ environment \\ 0\ not\ willing\ to\ pay\ higher\ prices\ in\ order\ to\ protect\ the\ environment \end{cases}$$

$$Model\ B: Y_i = \begin{cases} 1\ willing\ to\ pay\ higher\ taxes\ in\ order\ to\ protect\ the\ environment \\ 0\ not\ willing\ to\ pay\ higher\ taxes\ in\ order\ to\ protect\ the\ environment \end{cases}$$

4.3.1 Dependent variables

As already mentioned above, two dependent variables will be used within the econometric regression models. The first one measures the extent to which an individual is "willing to pay higher prices in order to protect the environment"; the second variable measures the degree to which a person is "willing to pay higher taxes in order to protect the environment". The two effects are taken into account when running the different regressions.

The respondents answered the two questions using a five-point Likert-type scale (1 = strongly will, 2 = will, 3 = neither will nor not will, 4 = not will, 5 = strongly not will). As the dependent variables need to be binary ones in order to be able to apply a LPM regression, the answers have been comprised into two categories consisting of the two choices of either willing to pay higher prices / taxes or not with either *yes* or *no*. This means, the answers from 1 to 2 are included in the option *yes* (1 = willing to pay higher prices / taxes), whereas the answers from the option 3 to 5 are included in the option *no* (0 = not willing to pay higher prices / taxes).

4.3.2 Independent variables

As mentioned above, the main independent variables will be the economic parameters of income, the influence of government subsidies and the influence of price-levels. As for the continuous variable **income**, those observations that refused to provide an answer and those that stated they do not know will be excluded. Additionally, those individuals with an income above 100,000 RMB will be dropped as they are denoted as being outliers according to the income categorization of 2014 and hence might bias the regression outcome (Statista, 2014). Nonetheless, even when dropping those mentioned observations, 98.02 percent of all observations will be covered and the number of dropped ones is therefore very small. Furthermore, the variable will be grouped into low income group (0 – 11,000 RMB), lower middle income group (11,001 – 19,000 RMB), middle income group (19,001 – 26,000 RMB), upper middle income group (26,001 – 35,000 RMB) and high income group (above 35,000 RMB).

The second economic variable is the influence of **government subsidy**. As it is expected that subsidies on renewable electricity for consumers will have a positive effect on their WTP, I will include the variable whether "Government consumption support policies (subsidies and tax reliefs) have an influence when buying big-ticket items" as a proxy for the effects of subsidies on renewable electricity. For this purpose, the variable will be changed from a five-point Likert-type scale into a dummy variable, excluding those observations that refused to answer or did not know how to respond. The same split has been made as for the dependent variables.

The third economic parameter is the influence of **price** that might determine the WTP of consumers. Therefore, the variable will be included whether "the price will have an influence when buying big-ticket items". The construction of this variable will be the same as for the influence of government subsidy.

For the environmental variable, the **health condition** of an individual will be tested on the WTP. As it is expected that those people being currently unhealthy will reveal a higher probability of adopting green electricity, the effect of it shall be captured by including the question "what is your health condition now?". Also here the five-point Likert-type scale will be transformed into a dummy variable after having excluded those observations that refused to respond.

4.3.3 Control variables

As not solely the economic and environmental factors will have an effect on the consumers' WTP for green electricity, it seems necessary to further include other variables that will control and compensate for the actual effects the main independent variables might have on the outcome. Based on previous literature, the parameters of an individual's **age**, his or her **educational background**, the individual's **gender**, the **residential status** and the **household expenditures** have been added to the model in order to receive a higher explanatory power.

As for the variable age, it is assumed that with an increase in age of an individual, the awareness and hence the WTP for adopting renewable electricity will be higher than for younger individuals (Zarnikau, 2003). This variable will be logged in order to receive elastic terms. Furthermore, observations below the age of 17 have been dropped as those individuals are assumed to still live with their parents and hence do not get involved into paying electricity bills.

The variable of educational background will be clustered into eight different groups, ranging from having no education to graduate or higher. It is expected that a rather high education will also raise the awareness of the benefits that green electricity inherits and therefore it seems reasonable to include this parameter as a control measure (Hast et al., 2015; Stern, 2006; Yuan et al., 2011). Due to the assumption that the WTP differs within gender as for instance the 'green consumer' in the case of Texas is a male, it shall be controlled for this effect as well (Liu et al., 2013; Zarnikau, 2003).

Additionally, there are reasons to assume that the residential status might have influence on the adoption of renewable electricity. As urban residents live in larger and more developed cities, they might be more prone to consume more environmental-friendly energy than individuals living in the countryside as rural people are still in the starting phase of their city's development. Hence, their main goal is to industrially grow rather fast which can be accomplished by the consumption of mainly cheap conventional energy.

As for household expenditures, the question will be used how much of household expenditures have been made last year, that is in the year 2009. This variable will be logged in order to see the relative changes. It is assumed here that with an increase in household expenditures the likelihood of paying higher prices / taxes for green electricity will increase. This might be due to the assumption that with being able to pay more for the household expenditures, those people's income is also high enough to spend some extra-money on renewable electricity (Liu et al., 2013). Therefore, it is assumed that household expenditures slightly correlate with the variable of income and hence the effects shall be measured.

The inclusion of the dependent, independent and control variables seems to be the best possible fit in order to link previous research and the answers regarding the questions within the survey applied. Since some of the variables described are used as categorical or dummy variables, their regression result will be in comparison with their respective reference category:

TABLE 1: REFERENCE CATEGORIES

Variable	Reference category
WTP higher prices	0 = Not willing
WTP higher taxes	0 = Not willing
Health condition	0 = Unhealthy
Residential status	0 = Rural residents
Gender	0 = Male
Influence of price	0 = No influence
Influence of subsidies	0 = No influence
Income group	Low income group
Educational background	No education

4.3.4 Descriptive statistics

Table 2 shows the descriptive statistics for all dependent, independent and control variables used in the regression models. Interesting to see is that actually more people are willing to pay higher prices in order to protect the environment when compared to the number of people willing to pay higher taxes. This primarily indicates that apparently more people do not care or are just simply not aware of the free-rider problem mentioned. Hence, they rather pay a higher price for renewable electricity linked to the amount of their electricity consumption instead of paying a fixed amount of extra-money in form of taxes on a monthly basis.

Also the rather high number of individuals not having any educational degree (13.94 percent) when compared to those having a graduate degree or higher (0.77 percent) is worth mentioning. This phenomenon might have a biasing influence on the regression outcomes as those individuals having no educational background might take up most of the effects that otherwise people with higher education would take up.

Additionally, the number of those people stating that subsidies have no influence on their purchase-decisions when it comes to big-ticket items is also rather large (81.95 percent) compared to those that claim government support will influence those decisions (18.05 percent). Also when looking at the five different income groups, it becomes clear that the majority of people are within the low income group (55.99 percent), whereas the minority is located in the high income group (9.18 percent). Even though this might reflect the true nature of China's current society, these statistics might bias the variable of income in the way that most of the influence on the dependent variable is taken up by the lower income groups. These are limitations given due to the nature of the dataset that have to be taken into consideration.

TABLE 2: DESCRIPTIVE STATISTICS OF VARIABLES USED IN REGRESSION

Variable	*Observations*	*Percent*	*Mean*	*Std. Dev.*	*Min.*	*Max.*
WTP for higher prices						
Strongly will	312	8.55				
Will	1,238	33.93				
Neither will nor not will	995	27.27				
Not will	845	23.15				
Strongly not will	259	7.10				
Total	*3,649*	*100.00*				
WTP for higher taxes						
Strongly will	205	5.62				
Will	1,038	28.45				
Neither will nor not will	1,063	29.12				
Not will	1,023	28.04				
Strongly not will	320	8.77				
Total	*3,649*	*100.00*				
Income groups						
Low income	5,554	55.99				
Low middle income	1,465	14.77				
Middle income	1,370	13.81				
Upper middle income	620	6.25				
High income	911	9.18				
Total	*9,920*	*100.00*				
Influence of price						
Yes	7,447	63.77				
No	4,230	36.23				
Total	*11,677*	*100.00*				
Influence of subsidies						
Yes	2,093	18.05				
No	9,503	81.95				
Total	*11,596*	*100.00*				
Health condition						
Healthy	6,890	58.55				
Not healthy	4,878	41.45				
Total	*11,768*	*100.00*				
Educational level						
No education	1,640	13.94				
Primary school	2,600	22.09				
Junior high school	3,452	29.33				
High school	1,510	12.83				
Technical school	753	6.40				
College	933	7.93				
University	790	6.71				
Graduate and higher	90	0.77				
Total	*11.768*	*100.00*				
Residential status						
Urban	7,222	61.29				
Rural	4,561	38.71				
Total	*11,783*	*100.00*				
Gender						
Female	6,106	51.82				
Male	5,678	48.18				
Total	*11.784*	*100.00*				
Age	11,780		47.30	15.67	17	96
Housing expenditure	10,821		2,042.5	5,597.6	0	350,000

When referring to the bivariate statistics between the two dependent variables and the independent and control variables in table 3, it becomes clear that in both models the larger number of individuals is not engaging in paying higher prices or higher taxes when looking at different variables.

TABLE 3: BIVARIATE STATISTICS

	Model A **WTP for higher prices**			*Model B* **WTP for higher taxes**		
	Yes	No	*Total*	Yes	No	*Total*
Income groups						
Low income	626	1,047	*1,673*	522	1,153	*1,675*
Lower middle income	196	260	*456*	151	305	*456*
Middle income	213	226	*439*	173	265	*438*
Upper middle income	103	99	*202*	83	119	*202*
High income	158	135	*293*	127	166	*293*
Total	*1,296*	*1,767*	***3,063***	*1,056*	*2,008*	***3,064***
Influence of price						
Yes	841	1,467	*2,308*	651	1,661	*2,312*
No	704	607	*1,311*	585	724	*1,309*
Total	*1,545*	*2,074*	***3,619***	*1,236*	*2,385*	***3,621***
Influence of subsidies						
Yes	247	392	*639*	201	436	*637*
No	1,294	1,673	*2,967*	1,031	1,931	*2,962*
Total	*1,541*	*2,065*	***3,606***	*1,232*	*2,367*	***3,599***
Health condition						
Healthy	944	1,229	*2,173*	759	1,409	*2,168*
Not healthy	608	870	*1,478*	482	994	*1,476*
Total	*1,552*	*2,099*	***3,651***	*1,241*	*2,403*	***3,644***
Residential Status						
Urban	1,072	1,262	*2,334*	830	1,502	*2,332*
Rural	478	837	*1,315*	413	904	*1,317*
Total	*1,550*	*2,099*	***3,649***	*1,243*	*2,406*	***3,649***
Educational level						
No education	124	350	*474*	111	362	*473*
Primary school	275	490	*765*	234	524	*758*
Junior high school	474	596	*1,070*	364	705	*1,069*
High school	216	279	*495*	179	316	*495*
Technical School	127	113	*240*	97	143	*240*
College	169	148	*317*	125	192	*317*
University	146	112	*258*	112	146	*258*
Graduate or higher	19	11	*30*	12	18	*30*
Total	*1,550*	*2,099*	***3,649***	*1,234*	*2,406*	***3,640***
Gender						
Female	772	1,155	*1,927*	600	1,328	*1,928*
Male	778	994	*1,772*	643	1,078	*1,721*
Total	*1,550*	*2,149*	***3,699***	*1,243*	*2,406*	***3,649***

5. Model testing

In order to create a model with the best possible fit, it is necessary to see whether a certain degree of interconnectedness between the independent variables exists that would consequently influence the regression results. As can be seen from the multicollinearity table in the appendix, there seems to be no problem of variables being highly correlated as the threshold in all cases is below 0.5 and above -0.5. Additionally, the Variance-Inflating Factor (VIF) test has been applied and the results indicate no severe correlation between the X-variables. The results of the mean VIF are 1.91 and 1.63 for Model A and Model B, respectively. Those results are below the critical threshold of 5 and hence the model is not faced with multicollinearity issues.

As a test for the problem of heteroscedasticity, I ran the *White's test* in order to see whether the residuals of the models are either hetero- or homoscedastic. The test results indicate that the null hypothesis of homoscedasticity can be rejected (see appendix for test results). Therefore, the problem that the residuals in the model are heteroscedastic and the variables are no longer BLUE, which are the best linear unbiased estimators in a model, still exists. Nonetheless, within a LPM regression it seems impossible to receive homoscedastic or normally distributed residuals as the residuals can only take on two possible values (0, 1) as already mentioned. However, in order to redeem this problem at least to some degree, robust standard errors will be applied.

When running the omitted variable test that indicates whether certain variables have been omitted and should hence be included in order to create a better model-fit, the test results indicate that the null hypothesis cannot be rejected and hence the problem of omitted variables is not the case in the two models. Besides the tests for multicollinearity, the passing of this test seems to be a prerequisite for running the aforementioned regressions.

6. Results

Due to the nature of the variables, most of the independent parameters come up as dummy variables. Hence, the results have to be interpreted in relation to the previously mentioned reference categories. Additionally, a step-wise regression approach has been conducted in order to see the effect of the control variables. That is, first a specific model excluding the control variables will be applied. Afterwards, the effects of other explanatory variables will show whether they make up for the effect of the variables of interest or whether those variables or rather coefficients stay the same in terms of their sign and significance. The interpretation of the coefficients will be the change in the probability that Y=1 for a one-unit change of the independent variable of main interest with regards to the respective reference group, all else being equal. The output of the LPM regressions looks as follows:

TABLE 4: REGRESSION TEST RESULTS

	Model A				**Model B**			
	WTP for higher prices (1)		*WTP for higher prices (2)*		*WTP for higher taxes (3)*		*WTP for higher taxes (4)*	
Variables	*Coefficient*	*Std. Err.*	*Coefficient*	*Std. Err.*	*Coefficient*	*Std. Err.*	*Coefficient*	*Std. Err.*
Low middle income group	0.0330	0.0266	-0.129	0.0290	0.0192	0.0243	-0.0184	0.0281
Middle income group	0.0807***	0.0273	0.0101	0.0311	0.0815***	0.0265	0.0316	0.0307
Upper middle income group	0.0984***	0.0379	0.0306	0.0432	0.0985***	0.0362	0.0532	0.0430
High income group	0.1185***	0.0335	0.0153	0.0402	0.1226***	0.0314	0.0609	0.0401
Influence of price	-0.1959***	0.0308	-0.1759***	0.0323				
Urban	0.0088	0.0324	-0.0363	0.0355			-0.0285	0.0227
Price influence x urban	0.0522	0.0385	0.0468	0.0407				
Influence of subsidies	-0.0014	0.0234	0.0225	0.0247				
Health condition	0.0023	0.0181	-0.0223	0.0204	0.0035	0.0172	-0.0010	0.0199
Primary school			0.0563*	0.0333			0.0562*	0.0324
Junior high school			0.1011***	0.0346			0.0508	0.0335
High school			0.0801*	0.0410			0.0607	0.0403
Technical School			0.1623***	0.0488			0.1123**	0.0482
College			0.1757***	0.0492			0.0793	0.0486
University			0.2595***	0.0579			0.0711	0.0562
Graduate and higher			0.2095	0.1650			0.1496	0.1735
(ln)Age			-0.0250	0.0325			-0.0080	0.0318
Female			-0.0449**	0.0198			-0.0518***	0.0196
(ln) Household expenditures			0.0420**	0.0099			0.0370***	0.0097
_cons	0.4921	0.0284	-0.3303	0.6964	0.3097	0.0144	0.5063	0.9670
R-Squared	0.1154		0.1021		0.1275		0.1256	
Observations	3,018		2,648		3,059		2,671	
Method	LPM, robust S.E.		LPM, robust S.E.		LPM, robust S.E.		LPM, robust S.E.	

*Note: *p<0.10, **p<0.05 and ***p<0.0*

The regression outcomes show interesting findings that need to be described in a next step. First of all, it has to be pointed out that some of the economic variables show significant results with regards to the baseline models (models without control variables). With focus on the variable income it can be said that the higher the income group level, the more likely those people within the respective groups are willing to pay both higher prices and taxes for the protection of the environment. Only the lowest income group shows insignificant test results.

When including the control variables, it can be stated that income apparently does not play a role when it comes to both the WTP for higher prices and higher taxes. This finding is in accordance with the ones of Hast et al. (2015) in the case of Shanghai. Even though some of the signs coincide with the *á priori* expectations stated before, the coefficients are not statistically significant and hence the first hypothesis can be rejected. However, it is noteworthy that the inclusion of the parameter educational level shows significant test results. This might indicate that in the baseline model the effects of different educational levels are captured within the income variable. After including the control variable of education, the income groups turn out not to be significant, while educational levels are. These results indicate that education takes up the effects of the income groups and hence plays a crucial role when it comes to the WTP. Additionally, the coefficients of education grow in scale as the educational level increases.

When looking at the variable regarding the influence of subsidies, it becomes clear that this parameter is statistically insignificant and hence does not affect the WTP for higher prices. The second hypothesis can therefore not be verified either. Even if the effect would have been significant, the economic impacts would be marginal with a 2.25 percent increase in the probability of the WTP for those people that are influenced in their purchase-decisions by government support mechanisms.

When it comes to the influence of price, it can be concluded that indeed this variable has a negative influence on the probability regarding the WTP for higher prices of 17.59 percent with a significance level of 1 percent. Interesting to see is that urban residents show a negative effect on the WTP. Hence, the probability is 3.63 percent less when compared to rural residents. But also here the result is statistically insignificant. The interaction effect (see appendix for calculation) shows that urban residents who are influenced by the price level of a product are 16.47 percent less likely to pay higher prices / taxes when compared to rural residents who are not influenced by the price level. Obviously, this is not in accordance with the assumptions made in the third hypothesis.

With regards to the environmental factor it can be pointed out that also here the results are statistically insignificant and have therefore no effect on the consumers' WTP for higher prices / taxes when it comes to the protection of the environment. Therefore, no inference can be made when looking at those people that claim to be either healthy or unhealthy in terms of their WTP for renewable electricity even when controlling for several factors. The forth hypothesis cannot be verified as well.

Even though most of the main independent variables do not show any effect on the consumers' WTP, some of the control variables do so: for instance, the educational level plays a crucial role as higher educational levels raise the probability of WTP when compared to those people having no education, with statistical significance at different levels. With regards to household expenditures it can be pointed out that an increase for example of 10 percent raises the likelihood of investing in the protection of the environment ranging from 42.0 percent to 37.0 percent taking the two models into account. These results are significant at a 1 percent level and in accordance with the *á priori* expectations.

Noteworthy and interesting are also the significant results for the gender variable: women are less likely to pay more for the protection of the environment when compared to men with probabilities of 4.49 and 5.18 percent, respectively. These are significant and interesting results that need to be discussed further.

7. Robustness check

A robustness check shall test for the stability of the models presented, that is, whether the coefficients of interest remain stable when changing for instance the type and nature of the models. As a *Linear Probability Model* has been applied in order to see both the economic and environmental effects on the Chinese consumers' WTP, another probability model, namely a *Probit* model, shall display whether the models created are stable in terms of their covariates. As the *Probit* model can only be applied when having a dichotomous outcome variable, this method is a good fit for the robustness check of the two different models at hand. Even so, as the coefficients of the *Probit* model cannot be interpreted *per se*, the average marginal effects will provide a more useful application in terms of interpreting the test results.

As can be drawn from the outcomes regarding the economic and the environmental parameters, the coefficients and their respective p-values show the same direction when compared to the

LPM regressions. Therefore, even when taking the average marginal effects of the variables of interest and the control variables into account, the two models stay robust.

TABLE 5: RESULTS FOR ROBUSTNESS CHECK

	Model A		**Model B**	
	WTP for higher prices (5)		*WTP for higher taxes (6)*	
Variables	*dy/dx*	*Std. Err.*	*dy/dx*	*Std. Err.*
Low middle income group	-0.0120	0.0284	-0.0178	0.0283
Middle income group	0.0096	0.0302	0.0302	0.0295
Upper middle income group	0.0297	0.0418	0.0494	0.0404
High income group	0.0135	0.0388	0.0556	0.0375
Influence of price	-0.1742***	0.0315		
Urban	-0.0361	0.0342	-0.0271	0.0228
Price influence x urban	0.0498	0.0396		
Influence of subsidies	-0.0233	0.0250		
Health condition	-0.0226	0.0204	-0.0050	0.0200
Primary school	0.0616	0.0356	0.0585	0.0343
Junior high school	0.1053*	0.0361	0.0518	0.0350
High school	0.0842**	0.0421	0.0614	0.0410
Technical School	0.1632***	0.0487	0.1122**	0.0477
College	0.1764***	0.0494	0.0798*	0.0485
University	0.1595***	0.0570	0.0729	0.0552
Graduate and higher	0.2059	0.1621	0.1145	0.0158
(ln)Age	-0.0352	0.0343	0.0053	0.0313
Female	-0.0457**	0.0197	-0.0525***	0.0192
(ln) Household expenditures	0.0421***	0.0100	0.0372***	0.0097
Observations	2,648		2,675	
Method	Probit, robust S.E.		Probit, robust S.E.	

*Note: *p<0.10, **p<0.05 and ***p<0.0*

8. Discussion

The results presented show relatively clear and interesting findings as well as indications of what influences the Chinese consumers' WTP for higher prices / taxes when it comes to the protection of the environment as a proxy for the adoption of green electricity. Even though some of the identified factors show statistical significance, certain limitations need to be clarified.

As it is pointed out within several papers (Zorić & Hrovatin , 2012; Sardianou & Genoudi, 2013; Kotchen & Moore, 2007; Mewton & Cacho, 2011), it has strongly to be taken account for the fact that the survey and the involved test results are based on intentions to protect the environment rather than on actual payments. Therefore, there might be a strong indication that the answers given within the survey are only grounded in good-will and not in the full conviction of actually taking action. Another interesting point is stated by Salmela and Varho (2006) which implies that the purchase of an electricity commodity is a rather rare situation and thereby an electricity contract normally has to be renewed only when moving into a new house or apartment. Hence, it is not a question of changing routines or daily life habits, but instead one has to take real action for something that is not actually thought about intentionally. This point also indicates that the purpose of changing habits might be stronger and more visible throughout electricity consumers than the actual action of adopting a new electricity source. Therefore, this argument consequently implies that the hypothetical WTP might overestimate the actual WTP and hence these biases of the obtained regression results need to be taken into account.

Another limitation that is pointed out in the paper of Zhang et al. (2011) is the so-called *bandwagon effect*. This effect indicates that certain consumption behavior is not established on the utility of a commodity, as it is in this case green electricity, but decisions are rather made on the basis of social pressure. This pressure comes from the absolute number of consumers who actually accepted the specific commodity and is transferred to the surrounding people. The potential *bandwagon effect* that can be inherited within the survey at hand might therefore imply that the Chinese consumers' are affected by the consumer choices of other people. Hence, some sort of social pressure can push certain people to subscribe to a commodity that they might not have chosen in the case of absence regarding the influence of other people. Therefore, the actual WTP to subscribe to green electricity can be limited due to the effect stated.

Careful attention also needs to be taken when looking at the variables of different income groups, the household expenditures and their effects on WTP. The official definition of income groups is considered as being relatively problematic since not only the income differs across rural and urban areas, but also the costs of living are different between the diverse levels of income (Wang, 2010). Therefore, the grouping into the five income groups used in the regression models might be somewhat inaccurate due to the problem stated. For this reason the outcome regarding the economic factor of income might be slightly biased since more than half of the observations included belong to the low income group. This bias can lead to the results that the higher income groups show insignificant results and hence have no impact on the consumers' WTP as the low income group takes all of the effect.

Another disadvantaging point is that it cannot be concluded how large the actual price premium might be in order to pay higher prices or higher taxes for the application of green electricity. That is, no payment threshold can be applied within the regression models which is due to the limited nature of the dataset used.

Nonetheless, in the following section conclusions shall be drawn with regards to the regression outcomes. The displayed limitations are due to the nature of the applied dataset, but still have to be taken into account when inferring conclusions.

9. Conclusion

Coming back to the before-mentioned research question what role environmental and economic factors play for the Chinese consumers' willingness to pay for green electricity, the answer might be somewhat identical for both parameters. With regards to the regression outcomes it can be pointed out that environmental factors apparently do not play a crucial role. This outcome seems to be rather surprising as it has been already worked out that the degradation of the environment in China has led to heavy air pollutions not only in major cities, but gradually throughout the entire country. People are more and more suffering from these severe environmental conditions, but still it seems that their WTP for higher prices or taxes in order to protect the environment is somewhat limited. This might be explained by the lack of information with focus on the benefits green electricity inherits for both the Chinese residents and the overall environment. When interviewing several female and male students from *Fudan University* in Shanghai, they stated that there is still a deficiency of information regarding the benefits of renewable energies in the Chinese population. Hence, in order to raise green electricity awareness, sufficient information from the Chinese government and other organizations need to be provided to the Chinese consumers in order to being able to implement successful measures.

When it comes to economic factors, it can be pointed out that their role with regards to the protection of the environment is also somewhat limited. Government subsidies do not influence the decision-making of Chinese consumers at all. This might find explanation by the fact that even though the higher price of green electricity requires subsidies for household electricity utilization, the large amounts of high electricity usage are rather attributed to high-income consumers (Wang et al., 2012). Since the majority of people belong to the low income group that might just not benefit from certain government subsidies, the profits are not visible and hence the effect of subsidies on the consumers' WTP seems to be limited.

Also in the case of income it can be said that this parameter does not affect the WTP of Chinese consumers. One possible explanation for the lacking effects might be that Chinese residents reached the upper-middle income level just few years back and hence the additional amount of income they now have is spent on more luxury goods instead on electricity products. Or put it differently, Chinese people might rather tend to spend this extra amount for their own good and status in society. It can only be assumed that China will overcome this phase and finally reaches a level when the awareness of environmental issues becomes more visible throughout the public. This is why it seems also important to provide additional information about energy in general at an early stage as it seems that education takes up most of the effects with regards to income. This assumption needs to be considered by the Chinese policy makers in order to promote the merits of green electricity and to successfully implement policy measures.

The price level of electricity, on the other hand, plays a more important role in the consumers' adoption of renewable electricity. Hence, it might be said that even though subsidies do not affect the purchase intentions, other measures need to be found in order to make green electricity less expensive and hence more affordable to the Chinese consumers. As renewable energy technologies are still an emergent in China as described before, the renewable electricity price is hence rather high. However, this situation may change in the future due to the assumption that the learning curve with regards to renewable energy generation will be extended by increasingly incorporating e.g. R&D measures in technology firms by the central government (Jamash & Köhler, 2007). This might eventually reduce the overall price of renewable electricity and makes it more affordable to Chinese residents.

Consequently, economic factors apparently still play a slightly more important role when compared to environmental factors. Nonetheless, ongoing debates and studies in the existing developing context should be encouraged since they will contribute to a better understanding of the merits green electricity inherits. Therefore, as also pointed out by Zografakis et al. (2010), raising the awareness of energy and the provision of useful information will not only contribute to the promotion of social acceptance regarding the application of renewable electricity, but also to the conversion of passive consumers to more responsible and active consumers. Those will play an important part in influencing energy utilization and environmental impacts both in the present and in the future. However, the real impacts of information-provision and the general increase in the awareness on the Chinese consumers' WTP still need further research.

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Appendix

TABLE 6: CORRELATION TABLE OF INDEPENDENT VARIABLES

	Income	Price	Subsidies	Health condition	Residential Status	No education	Primary school	Junior High	High school	Tech. School	College	University	Graduate	Age	Gender	HH exp.
Income	1.000															
Price	-0.1477	1.000														
Subsidies	-0.0543	0.1660	1.000													
Health condition	0.1212	-0.0462	-0.0436	1.000												
Residential Status	0.2873	0.1016	-0.1094	0.0544	1.000											
No education	-0.1900	0.0766	0.0370	-0.1717	-0.2175	1.000										
Primary school	-0.1828	0.0545	0.0439	-0.0799	-0.2459	-0.2150	1.000									
Junior High	-0.0570	-0.0146	-0.0078	0.0510	-0.0237	-0.2606	-0.2150	1.000								
High school	0.0419	-0.0202	-0.0163	0.0582	0.1434	-0.1482	-0.2606	-0.2498	1.000							
Tech. School	0.0741	-0.0509	-0.0389	0.0228	0.1501	-0.1053	-0.1464	-0.1774	-0.1009	1.000						
College	0.1739	-0.0385	-0.0120	0.0872	0.2016	-0.1123	-0.1561	-0.1892	-0.1076	-0.0765	1.000					
University	0.3171	-0.0525	-0.0316	0.0734	0.1937	-0.0973	-0.1354	-0.1641	-0.0933	-0.0663	-0.0707	1.000				
Graduate	0.1986	-0-0060	-0.0231	0.0455	0.0663	-0.0312	-0.0434	-0.0526	-0.0299	-0.0213	-0.0227	-0.0197	1.000			
Age	-0.1278	-0.0041	-0.0010	-0.3250	-0.0481	-0.3307	0.1326	-0.1226	-0.0718	-0.0420	-0.1447	-0.01439	-0.0768	1.000		
Gender	-0.1804	0.0317	0.0115	-0.0723	0.0232	0.1677	0.0046	-0.0642	-0.0402	-0.0053	-0.0212	-0.0394	-0.0014	-0.0500	1.000	
HH expenditures	0.1810	-0.0554	-0.0088	0.0243	0.1476	-0.0694	-0.0683	-0.0065	0.0260	0.0266	0.0699	0.0783	0.0438	-0.0268	0.0141	1.000

TABLE 7: RESULTS FOR *WHITE'S* TEST

		chi2	df	p-value
Model A = WTP for higher prices	Heteroscedasticity	173.15	112	0.0021
	Skewness	238.21	16	0.0022
	Kurtosis	1081.61	1	0.0024
	Total	*1492.96*	*129*	*0.0022*
Model B = WTP for higher taxes	Heteroscedasticity	190.86	129	0.0023
	Skewness	330.86	17	0.0021
	Kurtosis	687.23	1	0.0020
	Total	*1208.95*	*147*	*0.0021*

TABLE 8: RESULT FOR INTERACTION EFFECT

	WTP for higher prices	
	Price Influence (0=no)	*Price Influence (1=yes)*
Rural resident	(-0.1771*0)+(-0.0365*0)+(0.04894*0)=0	(-0.1771*1)+(-0.0365*0)+(0.04894*0)= -0.1771
Urban resident	(-0.1771*0)+(-0.0365*1)+(0.04894*0)= -0.0365	(-0.1771*1)+(-0.0365*1)+(0.04894*1)= **-0.1647**

Semi-structured questionnaire for interviews in Shanghai, April 2016

A.1. General Questions

- What is your age?
- What educational background do you have?
- How long did you live / work in Shanghai already?
- Do you know about your current supplier of electricity?

A.2. General Perception and environmental impact of your own electricity consumption

- Do you personally face any health problems which can be derived from air pollution?
- Which environmental problems caused by the production of electricity are you worried about?
- If you had the power to decide, how would you try to reduce environmental problems caused by electricity production?
- Do you think consumers have the power to influence the issues related to electricity production?

A.3. Perception about Renewable Energy

- How would you define "renewable energy"?
- How do you think it is different from conventional or "ordinary" electricity?
- Do you think RE is more environmental friendly than conventional energy sources? If so, why?

A.4. Potential Purchase of green electricity – barriers and incentives

- Have you ever heard about the possibility to buy green electricity in form of the 'Shanghai Green Electricity Scheme' conducted in 2006? If so, how did you respond?
- Would you personally be interested in buying green electricity?
- Do you think there is a lack of information in order to get engaged into buying green electricity?
- What could motivate/hinder you to buy green electricity?
- Would you buy your own solar panels? Do you know someone who has?