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# Regional One Child Policies and Economic Development in China from 1997 to 2010

Austin Hayes

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The University of Southern Mississippi

Regional One Child Policies and Economic Development in China from 1997 to 2010

by

Austin Hayes

A Thesis  
Submitted to the Honors College of  
The University of Southern Mississippi  
in Partial Fulfillment  
of the Requirements for a Degree of  
Bachelor of Arts  
in the Department of Economics

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## Abstract

The one child policy enacted by the Chinese government in 1979 has restricted the sizes of Chinese families and led to an abnormal male-dominated sex ratio. Abnormal sex ratios can have a variety of economic consequences that could work together to reduce the general welfare of the regions they exist in. This study aims to evaluate the effect of sex ratios on GRP (gross regional product) and GRP per capita through a series of linear regression models. Data used in this study was collected from the National Bureau of Statistics in China, a Chinese government organization in charge of collecting and logging data from a wide variety of fields.

While male dominant regions did tend to exhibit lower GRP and GRP per capita, changes in sex ratio within regions showed no statistically significant effect. In models that were run without using year and regional dummies, sex ratio did have a negative effect that was statistically significant on GRP and GRP per capita, though once the dummies were included to isolate the effect of sex ratio on output, this statistical significance no longer existed. However, it should be noted these abnormal sex ratios may still be influencing other economic factors which could indirectly affect output, which would have been missed in the models run for this study.

Key Words: sex ratio, GRP, GRP per capita, dummies, statistically significant

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## List of Abbreviations

USM: The University of Southern Mississippi

GRP: Gross Regional Product

Sq: square

GDP: Gross Domestic Product

CPI: Consumer Price Index

Km: kilometers

## Chapter 1: Introduction

In 1979, the People's Republic of China launched a Malthusian-esque policy to attempt to drastically reduce population growth in a short period of time. The one child policy (or variations of it) was enacted throughout all of China. This policy has met a wide range of praise and criticism, both for its effectiveness in reducing population growth and its often harsh methods in doing so, respectively. The policy was drawn back in 2015 to be replaced by a two-child policy for all of China, in an effort to raise fertility rates.

While the one-child policy was effective in its goal of drastically reducing population growth, it may carry severe consequences for the future. Such broad-sweeping policies are often short-sighted. The Chinese government has estimated that the one-child policy prevented up to 400 million births, the majority of which were female.<sup>1</sup> This has resulted in both an aging population and a wildly skewed sex ratio. These kinds of rapid changes in the demographics of a population can carry severe economic consequences. The rapid reduction of the young population has led to an aging population that will put strains on the youth as they struggle to support a growing retired community. In China, sons typically provide for their parents in their old age, which helps explain the skewing of sex ratios.<sup>2</sup> If a couple is only allowed one child, they naturally prefer a son because he is the key to their future. To many Chinese people, this is a matter of self-preservation. A small and economically strained youth population that is overwhelmingly male will be the future for China.

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<sup>1</sup> Banister, J. (2004)

<sup>2</sup> *One Child*, Mei Fong

This study aims to find whether there is a significant correlation between sex ratios and GRP and GRP per capita between the years 1996-2005 at a regional level. Relationships with other economic factors are also explored, these include: population density, total population, natural growth rate, and illiteracy rate. These factors were included in the models run because they are intertwined with GRP and GRP per capita.

## Chapter 2: Review of the Literature

### The One Child Policy, a Brief History

Limiting population growth to foster economic development was not always supported by the Chinese government. The original communist government under Mao Zedong believed that rapid population expansion was a means to economic growth. As a result, rapid increases in population took place, leaving China with a population of almost 1 billion people in the late 1970s.<sup>3</sup> These increases worried government officials, as they were concerned China would not be able to obtain the resources necessary to support such a large population. The government introduced a mild propaganda campaign in the 1970s to promote the idea that fewer children was better for both the individual and the future of the nation to combat the rising population.<sup>4</sup>

The one-child policy was officially enacted in 1979 as a way to curb China's population growth. China saw that other countries exhibited a trend in which decreasing fertility rates correlated with greater economic prosperity. It was believed by the government that a strict policy limiting fertility rates would be the most effective way to slow this population growth and help achieve their economic goals.<sup>5</sup>

It is a common misconception that this policy was inclusive of all China. Studies have shown that the policy is actually heavily adapted at a local level.<sup>6</sup> Some areas of China have been allowed to have two children throughout the entire duration of the one-child policy. Also, ethnic minorities are excluded from the stipulations of the policy.<sup>7</sup> The strictness of the legal definition

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<sup>3</sup> *Rapid Population Change in China*, Ansley J. Coale

<sup>4</sup> *One Child*, Mei Fong

<sup>5</sup> Coale (1981)

<sup>6</sup> Short and Zhai, 1998

<sup>7</sup> Bulte, Heerink, and Zhang (2010)

of the policy and its enforcement varies greatly from region to region. Punishment for breaking the policy can include fines, forced abortions, sterilization, insertion of birth control technologies, and physical repercussions (the Chinese government often denies some of these claims, yet evidence presented by multiple papers and Congressional hearings suggests these types of human rights violations do take place).<sup>8</sup>

To add to the complexity of the one-child policy, local policies are often changed every few years. Policies are frequently adapted to local needs, and change depending on the developmental goals of the Chinese government and the conditions of the area. An area that may have allowed a second child in some scenarios may choose to enforce a strict one child policy just a few years later. The Family Planning Commission (the government agency that has authority over one child laws) is an enormous bureaucratic entity that is as complex as it is expansive. Accurate data on policy effectiveness and a realistic picture of the punishments given for violation of policy may be difficult to obtain<sup>9</sup>, as the allowance for local adaptation gives local Family Planning officials a great deal of autonomy in both enforcement and reporting. The Chinese legal system makes it difficult for individual citizens to dispute punishments, and the local governments often operate outside legal parameters with little supervision or consequence from the national government.<sup>10</sup> (*One Child*, Mei Fong). In addition to these barriers, communication is limited online<sup>11</sup>, and known dissenters are often handled with harsh repercussions. These practices of population control are outlined in a paper called Document 9, an official release from the Chinese government.

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<sup>8</sup> Subcommittee on Africa, Global Health, and Human Rights, 2011

<sup>9</sup> Hesketh and Xing (2006)

<sup>10</sup> *One Child*, Mei Fong

<sup>11</sup> Xiao (2011)

The one-child policy continued at a national level for over 35 years, longer than its originally intended timespan. It was replaced on January 1st, 2016 with a two-child policy. The Chinese government is beginning to understand the possible effects of such a wide-sweeping policy, and it is drawing it back to attempt to lessen those effects. However, 35 continuous years of the policy means that while changes can be made now, consequences from the original policy are still inevitable.

### Effects on Sex Ratios and Their Implications

Given the existence of son-preference in Chinese culture, it is logical that a one-child policy would skew sex ratios in favor of males. It is widely accepted that the one-child policy isn't fully responsible for the shift in the sex ratios because several other countries in the Eastern Hemisphere have experienced a similar shift (i.e. India). Son preference is typically cited as the culprit, as males typically have greater economic prospects and therefore a greater ability to care for their family.<sup>12</sup> The one child policy in China exacerbated the natural effects of son preference on sex ratios by constraining the size of the family.

In some parts of China, sex ratios have climbed as high as 114 (according to the National Bureau of Statistics of China), and Mei Fong even reported numbers as high as 130 in her book *One Child* (that would equate to 130 males to every 100 females). Given that the natural sex ratio hovers around 95 (males are more susceptible to dying young, so there is a naturally higher rate of females in most countries), these are staggering numbers. Son preference combined with the

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<sup>12</sup> Hesketh and Xing (2006)

one-child policy have created a population that is overwhelmingly male in many regions. This imbalance in gender dispersion has brought a number of problems.

First, the low availability of females for marriage has increased human trafficking as young females from surrounding nations are brought in to be married off to these excess males. In Mei Fong's book *One Child*, she outlines the cultural tendency of the Chinese to look negatively on males who cannot find a wife. This cultural attribute increases the pressure on these excess males, driving them and their families to extreme measures to find a female partner.

This shortage of females brings with it a second problem: in rural areas where a dowry is common, asking prices of a girl's family for the daughter's hand in marriage have soared, putting even greater economic strains on rural males and their families.<sup>13</sup> The males that have the hardest time finding mates are often the poorest and least educated, as the better suitors are able to capture the attention of the small pool of females. This has led (and will continue to lead) to a sizable population of poor, uneducated males who will be unable to find a wife. Studies have shown that males without a partner are far more prone to crime and other risky activities.<sup>14</sup> This has led to a growing concern in China over how to handle this restless male population; some people fear that China may enter a foreign conflict in order to accomplish a territorial goal and reduce the poor male population simultaneously.<sup>15</sup>

Finally, the shortage of females in comparison to males presents the problem of population stagnation or decline. If restrictions are tightened and females are not brought in or allowed in from surrounding countries, there will be a huge shortage of babies in the next

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<sup>13</sup> *One Child*, Mei Fong

<sup>14</sup> Edlund, Li, Yi, and Zhang (2013)

<sup>15</sup> *One Child*, Mei Fong

generation. The poor, uneducated men will be unable to find a partner and start a family. With the two child policy still in place, the births lost from the unbalanced sex ratios will not be replaced by Chinese couples. This further aggravates the problems the Chinese will have to deal with in the near future. If the next generation is smaller than the current one, strains on social systems will be exacerbated. Whatever China decides to do, it will have to find some way to cope with these imbalanced ratios and their possible effects.

### Potential Economic Effects

The economic implications of the one-child policy appear harsh at the moment. Many countries around the world are experiencing a rapid aging of their population (such as Japan and much of Europe).<sup>16</sup> This increase in proportion of retirees to workers puts greater strain on the working population to support their elders.<sup>17</sup> Many Chinese are currently finding themselves struggling to support small children and their aging parents at the same time. Considering that the Chinese population is one of the largest consumer bases in the world, a reduction in the disposable incomes of the Chinese population may directly impact China's trading partners. According to income theory, as the population's disposable income decreases, their consumption should decrease as well. This means the demand for imports will fall under these conditions, reducing the volume of global trade.

Other economic implications of the policy include the previously mentioned stark rise in dowry (especially in rural areas). Because of these increases in dowry cost, many unwed rural males eventually migrate to urban areas in search of a wife. This influx of population in urban

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<sup>16</sup> Fougere and Merrette (1999)

<sup>17</sup> Bos and Weizsacker (1989)

areas will drive housing prices up, affecting both new and original residents.<sup>18</sup> Also, a rapid influx of eligible laborers may alter the urban labor markets, potentially reducing wages as cheap labor becomes increasingly available. However, if consumption and investment decrease as a result of a small working population supporting a growing number of retirees, these workers may not be able to find employment even in urban areas. A sizable, unemployed, unwed male population with little future prospects may become quite disgruntled, increasing crime and social unrest and further hindering China's economic progress.<sup>19</sup>

Some researchers disagree that China faces a difficult economic future, often citing China's current growth rates as evidence for their continued success.<sup>20</sup> However, they are not considering the long term impact of the policy. It has now become culturally ingrained in Chinese society that less children is better. Years of government propaganda have done much to shape the Chinese view of fertility. Capping the fertility rate at two children (the new policy was introduced at the start of 2016) per woman does not mean that all women will have two children. It simply means they are allowed to if they so choose. Since the Chinese people have been told for years that less is better, and waiting to have children increases your economic prospects, it will be difficult to get the people to detach themselves from these ideas and start having two children. Therefore, the effects of the one-child policy will continue in the coming years, as fertility rates will remain lower than the replacement rate. This means the problem of a small working population supporting a growing elderly population will not be alleviated anytime soon, and the ratio of workers to retirees will continue to decrease. Economic strains on the workers will rise as the ratio falls. Assuming that China's growth will continue just because the numbers

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<sup>18</sup> *One Child*, Mei Fong

<sup>19</sup> *Bare Branches*, Valerie Hudson and Andrea den Boer

<sup>20</sup> *China's "One Child": Policy, Population, Pollution, Protest*, Ted Pohlman

are high now is foolish. The first generation that was affected by the one-child policy is now of working age, and they are now attempting to support the generation that was excessively large as a result of Mao's promotion of population growth. If fertility rates do not increase, this problem will be exacerbated with each successive generation's retirement. A rapid expansion in population followed shortly by a forced contraction creates a huge disparity in age distribution. Capping the allowance at two children per family is hindering the restoration of the fertility rates, making China's road to recovery even more difficult. In order to provide a stable future for the country, fertility rates must rise so that each generation replaces the next. Without this, the potential problems listed above may become realities.

## Chapter 3: Methodology

### Proposed Study

This study will attempt to provide an examination of the effects of sex ratios on GRP and GRP (gross regional product) per capita to see if any relationship between them exists. These wildly skewed sex ratios may have a variety of adverse economic effects.<sup>21</sup> Areas that are heavily male dominant typically experience higher crime rates, have high unemployment, and have lower levels of education in comparison to more gender-balanced areas.<sup>22</sup> Areas that have a disproportionate share of males may also experience large emigrations as these males move to urban areas to try to find jobs. All of these negative factors would likely work together to reduce the general earning capacity of a region.

Based on this information, I hypothesize that a negative relationship exists between sex ratios and GRP/GRP per capita. It is also important to remember that there are a wide variety of factors that could play a role in shaping each region's GRP; therefore, policy restrictions and the resulting sex ratios are not the only possible explanation for changes in GRP. Also, policies are adapted to a local level, so they change rapidly, making it difficult to draw certain conclusions from any trends.<sup>23</sup> This study simply aims to see if a correlation between sex ratios and GRP/GRP per capita exists.

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<sup>21</sup> Hesketh and Xing (2006)

<sup>22</sup> Subcommittee on Africa, Global Health, and Human Rights, 2011

<sup>23</sup> Short and Zhai (1998)

## Data Selection

All of the data used in this study comes from the National Bureau of Statistics of China. I am going to be looking at years 1997-2010. Data is collected on an annual basis. Several data tables have been pulled for each of the above years; these include: GRP, GRP per capita, sex ratio, total population, birth rate, death rate, and natural growth rate. I will be focusing on the variables GRP by region, GRP per capita by region, and sex ratio.

The database used in this study, the National Bureau of Statistics of China, is missing several values for the selected variables in various years. Data for all variables is missing for the year 2003, as all the links to the 2003 data tables on their site are broken. To counter this, all data from 2003 was constructed by averaging the sum of the data from 2002 and 2004. This should be noted when analyzing trends around this year, as all variables will show either a constant increase or decrease for these years. The variable “illiteracy rate” is not tracked until after 1999. The variable “natural growth rate” is only missing for the year 2000, and is also calculated by averaging the previous year and next year’s rates. The variable “GRP per capita” was also missing only one year (1998). Since the data for total population and GRP for each region is readily available in 1998, we can calculate GRP per capita instead of just estimating it by the averages of the two adjacent years. No explanation for these missing variables is given, and variables are frequently added and removed on an annual basis to each data set that was explored.

## Explanation of Variables

The variable “Sex Ratio” refers to the ratio of males to females in a given region. Sex ratios vary widely across China, some regions are male dominant and some are female dominant. The national average was male dominant in every year studied. The natural number for sex ratios is generally 95, since males are more predisposed to die young.

The variable “Natural Growth Rate” refers to the natural growth rate of each region (birth rate-death rate). This is what the growth rate of the population would be if immigration wasn’t a factor.

The variable “Total Population” refers to the total population in each region. This is measured in units of 10,000 people, and is based off of totals at the end of the year.

The variable “Illiteracy Rate” refers to the number of people over the age of 15 who are illiterate. The National Bureau of Statistics of China pulled this data from Population Sample Surveys which are collected annually.

The variable “Population Density” refers to the population density in urban areas, measured in persons per sq. kilometer.

The variable “GRP” refers to the gross regional product of each region. This amounts to the total of each region’s economic output, measured with the same inputs as GDP (gross domestic product, the same measurement just at national level). GRP is measured in units of 100,000,000 yuan, and was adjusted by the 2004 CPI (consumer price index) to represent real GRP and not gross GRP.

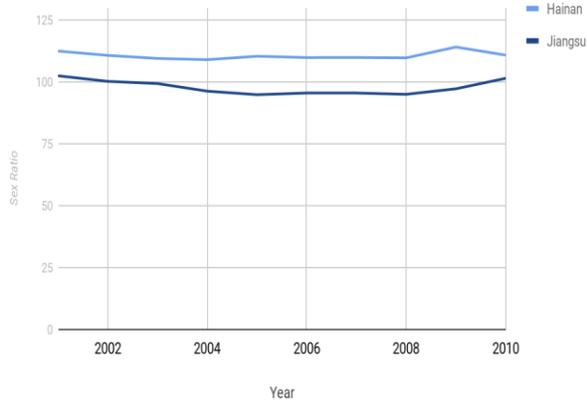
The variable “GRP per capita” refers to the gross regional product divided by the total number of people within that region. This variable was also adjusted by the 2004 CPI to represent real values. GRP per capita is measured in units of yuan.

Shown below is a table of the descriptive statistics of the dataset, as well as a series of graphs that show track the sex ratio, GRP, and GRP per capita of the Hainan and Jiangsu provinces. These provinces were chosen because they have some of the highest and lowest sex ratios in China, respectively.

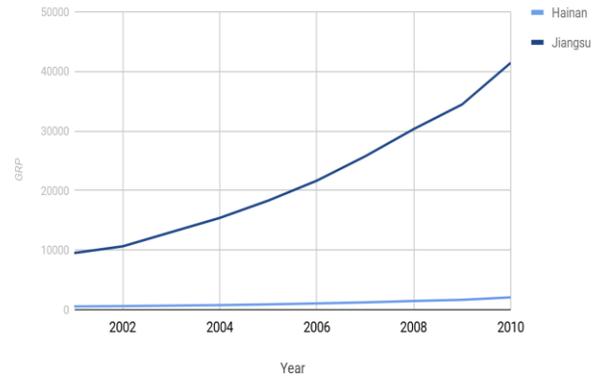
Table 1: Descriptive Statistics

Variable Name	Description	Mean 1997	Mean 2010
Sex Ratio	Ratio of males to females x 100	103.47	105.66
Illiteracy Rate	Percent of the adult population (15+) that is not literate	n/a	4.87%
GRP	Gross regional product, which is the total annual output within a region’s borders	2389.29	13568.95
GRP per capita	GRP divided by total population within a region	6598.65	32180.82
Total Population	Estimated total population of each region (measured in units of 10,000 people)	3945.87	4302.77
Population Density	Population density per sq km in urban areas	1060.26	2707.03
Natural Growth	Birth rate-death rate	8.46	5.46

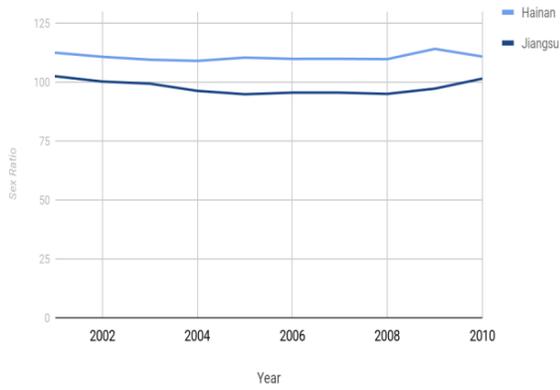
Hainan and Jiangsu Sex Ratios 2001-2010



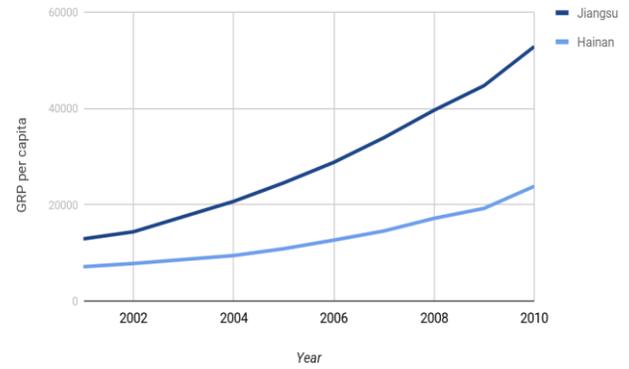
Hainan and Jiangsu GRP 2001-2010



Hainan and Jiangsu Sex Ratios 2001-2010



Hainan and Jiangsu GRP per capita 2001-2010



(Sex ratio is repeated for comparative viewing)

## Methods

I will be analyzing data for the eight variables listed in table 1 (pictured above) from each of the 31 different regions provided by the National Bureau of Statistics of China from the years 1997-2010. All data analysis and models will be run in R studio.

I will be running a total of four linear regression models. The first model will be run on GRP using all of the independent variables but excluding the year and region dummies. The second model will also be run on GRP, but will include the year and region dummies as well as the other independent variables. The third and fourth models will be structured the exact same way, but will be run to predict GRP per capita. Inclusion of year and region dummies should help isolate the effect of sex ratios on GRP and GRP per capita by controlling for events effecting the whole nation (policy changes, war, etc.) and regional differences that are unrelated to differences in sex ratios. Tables 2-5 show the effects of the independent variables in these models, with each table representing a separate model. Sex ratio is in bold because it is the most important independent variable in this study.

## Chapter 4: Results

### GRP, no dummies (Model 1)

Variable	Estimate	Std. Error	T value	P value
Illiterate rate	-283.767	47.643	-5.956	0***
Nat growth rate	145.407	110.615	1.315	.190
Population Density	.442	.201	2.199	.027*
<b>Sex Ratio</b>	<b>-642.079</b>	<b>89.126</b>	<b>-7.204</b>	<b>0***</b>
Total pop	1.514	.106	14.329	0***

### GRP, year and region dummies (Model 2)

Variable	Estimate	Std. Error	T value	P value
Illiterate rate	138.000	83.230	1.658	.098
Nat growth rate	757.600	163.700	4.628	0***
Population Density	-.168	.159	-1.059	.291
<b>Sex Ratio</b>	<b>-68.280</b>	<b>72.220</b>	<b>-.945</b>	<b>.345</b>
Total pop	8.619	.718	12.012	0***

As you can see, sex ratio is statistically significant in models that are not controlled for year or region with dummy variables (models 1 and 3). In model 1 and model 3, sex ratio has a fairly large effect size. In model 1 (GRP with no dummies), each unit represents 100 million yuan, so the negative estimate of -642.079 yuan actually represents a little over 64.2 billion yuan. This means for each additional unit of sex ratio (each additional male to 100 females) leads to a

reduction of GRP by 642 million yuan. In model 3, units represent individual yuan, so the estimate of -1,276 represents a loss of 1,276 yuan per additional unit of sex ratio. Considering the national average for GRP per capita in 2010 was 32,180.82 yuan, a loss of 1,276 is a pretty sizeable reduction. Average GRP in 2010 stood around 1.36 trillion yuan, so an average loss of 642 million yuan per additional unit of sex ratio is also a steep drop. However, once dummy variables were included, the results changed significantly.

GRP per capita, no dummies  
(Model 3)

Variable	Estimate	Std. Error	T value	P value
Illiterate rate	-852.800	126.000	-6.770	0***
Nat growth rate	-672.400	295.500	-2.299	.022*
Population Density	1.060	.531	1.996	.047*
<b>Sex Ratio</b>	<b>-1276.000</b>	<b>235.700</b>	<b>-5.414</b>	<b>0***</b>
Total pop	-1.211	.280	-4.334	0***

GRP per capita, year and region dummies  
(Model 4)

Variable	Estimate	Std. Error	T value	P value
Illiterate rate	109.600	254.700	.430	.667
Nat growth rate	2822.000	500.900	5.633	0***
Population Density	-.939	.485	-1.935	.054
<b>Sex Ratio</b>	<b>156.400</b>	<b>221.000</b>	<b>.708</b>	<b>.480</b>
Total pop	7.250	2.196	3.302	.001**

The inclusion of the dummy variables helps isolate the effect of sex ratio and the other independent variables on GRP and GRP per capita. These dummies work to reduce the impact of region and time on the models run. With these factors accounted for, it does not appear that sex ratio alone is affecting GRP or GRP per capita. However, it is important to remember that these models still aren't accounting for everything. By isolating the effect of sex ratio on GRP and GRP per capita, we look solely at the relationship between the numbers themselves, and lose the input from the underlying consequences of the real life events that are influencing them. While sex ratio may not be directly affecting GRP and GRP per capita, policies that cause the imbalanced sex ratios influence other economic factors such as unemployment rates or investment spending may still be contributing to lower levels of output and income per capita.

Total population and natural growth rate were found to have a positive effect that was statistically significant in both of the models that included dummy variables (Models 2 and 4). These were the only variables in those models that had any statistically significant effect on GRP or GRP per capita. Total population likely correlates positively with GRP and GRP per capita because total population is higher in regions with large urban areas, and urban areas tend to generate more output and have more economic opportunity than more rural regions. Natural growth rate is also higher in urban regions, which would explain its positive correlation with sex ratio as well. Also, in regions with high natural growth rates, the population is not as old, so there are more young people earning income per old people who aren't in these regions.

## Chapter 5: Discussion

### Research Question and Hypothesis

The research question behind this study was “What effect do sex ratios have on GRP and GRP per capita?” The hypothesis created in attempt to answer this was that imbalanced male-dominant sex ratios have an adverse effect on GRP and GRP per capita. This seemed like it would be the case, as the literature used in this study showed that excess males led to increased male singlehood, which was shown to lead to increasing crime rates. Also, too many males in one region could overflow male dominated employment sectors, driving many men out of work and leading to unemployment and migration to find jobs. A disproportionately male population also stands in danger of failing to replace itself, especially with the current two child policy still in place. Because there are too many males, there will be less couples, and as a result less children. If each couple can already only have two children, and there are a reduced number of couples, there will not be enough children born to replace the current generation. A region in which there is a growing elderly population supported by a shrinking young population will be poorer than if his wasn’t the case.

The hypothesis in this study was shown to hold true when models were run without regional and year dummies, but not when they were included. Though no effect is found when region is controlled for, regions with higher GRP and GRP per capita tend to have lower sex ratios. However, changes in sex ratio within regions do not seem to have an effect on either GRP or GRP per capita. This means that the two may still be linked, but that changes in sex ratio within a region do not directly affect either statistic.

Another possible explanation is that there may be a large number of undocumented women in regions with male-dominant sex ratios that are balancing out the population without showing up in the official statistics. It's common for illegal additional children to be forced to go undocumented as punishment for breaking the policy in place. That way, they are not allowed to attend public schools and use public benefits that are otherwise available to all. They also do not get counted in most censuses and would likely not appear in any of the data found from the National Bureau of Statistics. This means that the imbalanced sex ratios may not exist at all; they may simply be a misrepresentation of the data.

Another possible explanation for why the hypothesis was not supported by the models could be that the effect of sex ratio on GRP isn't a direct effect. What this means is that sex ratios do not directly affect GRP or GRP per capita, but rather other economic factors, which may then affect GRP and GRP per capita under the right conditions.

### Limitations and Directions for Future Research

There are several limitations to this study that should be mentioned to put the results in perspective. The data used in this study comes from the National Bureau of Statistics of China, a Chinese government organization. Many of the organizations who are collecting the data to submit to the National Bureau of Statistics (i.e. the Family Planning Commission mentioned earlier in this study) have incentives to under or over report certain statistics. Often times, bonuses and funding are hinged upon success of policies and programs, and since local government agencies have a great deal of autonomy in their operations and reporting, some of

these statistics may be altered so that they represent a more positive situation than what actually exists.

Another limitation of this study is that there are other economic factors that are not accounted for in the models run. Illiteracy rate was one of the few education related statistics that was relevant and tracked throughout most of the years studied. Other variables that gave more specific ideas of the education levels present in the regions studied were not usable because of the infrequency with which they were tracked. Originally, there were variables set up to show percentage of the population with varying education levels completed (high school, university, etc), however these variables were dropped from the data tables in the database with no explanation a few years in.

Future research using sex ratios to try to predict economic outcomes could try to link sex ratios to unemployment rather than GRP and GRP per capita. Statistics could be collected for what employment sectors are most popular in each region and what percentage of those sectors are male and female. A future study could then run regressions to see if male dominated regions experience higher levels of unemployment in male dominated sectors, and then see what the effects of those higher unemployment levels are.

## Chapter 6: Conclusion

For this study, there is not a certain conclusion. The results from the regression models run on GRP and GRP per capita were statistically insignificant, so our hypothesis can neither be confirmed nor rejected. It is likely that there are other variables affecting GRP and GRP per capita that were not accounted for in the models. This study has many limitations that should be considered. Better results may come from studies that take different variables into account, or that study the effect of sex ratios on a more specific economic measurement, such as the unemployment rate.

We can be sure, however, that China has an interesting road ahead of them in the coming century. While the exact effects of the one-child policy are unclear, it is obvious that this policy carries serious implications for the future. China started to backpedal in 2015, as they expanded the previous one child policy to a two child policy. The one-child policy definitely accomplished its goal of slowing population growth, but it may have done so too well. It will be difficult for the Chinese economy to continue experiencing growth at the rate it has in years past with a rapidly aging population. Other concerns have been raised about national security, as the population is skewed heavily in favor of males. It is uncertain at this point whether all of the concerns raised about China's future are as serious as some believe, but there are definitely some impending problems the Chinese government will have to find a way to deal with in the near future.

## References

- Banister, J. (2004). Shortage of girls in China today. *Journal of Population Research*, 21, 19–45.
- Bos, Dieter, and Robert K. Von Weizsacker. “Economic Consequences of an Aging Population.” *European Economic Review*, vol. 33, no. 2-3, 1989, pp. 345–354., doi:10.1016/0014-2921(89)90112-8.
- Bulte, Erwin, et al. “China's One-Child Policy and the Mystery of Missing Women: Ethnic Minorities and Male-Biased Sex Ratios\*.” *Oxford Bulletin of Economics and Statistics*, vol. 73, no. 1, 2010, pp. 21–39., doi:10.1111/j.1468-0084.2010.00601.x.
- Coale, Ansley J. “Population Trends, Population Policy, and Population Studies in China.” *Population and Development Review*, vol. 7, no. 1, 1981, p. 85., doi:10.2307/1972766.
- Coale, Ansley J. *Rapid Population Change in China: 1952-1982*. University Microfilms International, 1984.
- Committee of Foreign Affairs. *China's One-Child Policy: the Government's Massive Crime against Women and Unborn Babies. Hearing before the Subcommittee on Africa, Global Health and Human Rights of the Committee on Foreign Affairs House of Representatives One Hundred Twelfth Congress First Session September 22, 2011*. House of Representatives - Committee on Foreign Affairs, 2011.
- Edlund, Lena, et al. “Sex Ratios and Crime: Evidence from China.” *Review of Economics and Statistics*, vol. 95, no. 5, 2013, pp. 1520–1534., doi:10.1162/rest\_a\_00356.
- Fong, Mei. *One Child: the Story of China's Most Radical Experiment*. Houghton Mifflin Harcourt, 2016.
- Fougere, Maxime, and Marcel Merrette. “Population Ageing and Economic Growth in Seven OECD Countries.” *Economic Modelling*, vol. 16, no. 3, 3 Aug. 1999, pp. 411–427.
- Hesketh, T., and Z. W. Xing. “Abnormal Sex Ratios in Human Populations: Causes and Consequences.” *Proceedings of the National Academy of Sciences*, vol. 103, no. 36, 2006, pp. 13271–13275., doi:10.1073/pnas.0602203103.
- Hudson, Valerie M., and Andrea M. den. Boer. *Bare Branches: the Security Implications of Asia's Surplus Male Population*. The MIT Press, 2005.
- Pohlman, Ted. *China's "One Child": Policy, Population, Pollution, Protest*. Planet Ethics Press, 2013.
- Short, Susan E., and Zhai, Fengying. “Looking Locally at China's One-Child Policy.” *Studies in Family Planning*, vol. 29, no. 4, 1998, p. 373., doi:10.2307/172250.
- Xiao, Qiang. “The Battle for the Chinese Internet.” *Journal of Democracy*, vol. 22, no. 2, 2011, pp. 47–61., doi:10.1353/jod.2011.0020.