‘The Chinese Miracle(?)’

Measuring China’s development in terms of well-being between 1970 and 2010.

RMA thesis

Author

T.J. ten Berge

t.j.tenberge@uu.nl

Supervisor

Prof. dr. B.J.P. van Bavel

Second evaluator

Prof. dr. J.L. van Zanden

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Universiteit Utrecht

Abstract

This research has studied to which extent the spectacular growth in GDP per capita China experienced between 1970 and 2010 – 'the Chinese miracle' – has been experienced in a similar fashion in well-being. On the basis of OECD standards a definition for well-being is drawn. Seven components for well-being have been identified: income and jobs, housing, health, education, political institutions, environmental quality and personal security. The indicators representing these components have been compiled into one indicator for well-being through an equal-weighting method where all components are acknowledged to contribute equally to well-being. Using this compiled indicator, this research has found a divergent development of well-being in comparison with GDP per capita's growth path. In contrast to the dominant stance in the literature advocating that growth in GDP took root only from 1978 onwards, this research suggests that well-being already made strong improvements since 1970. Also, after improvement in a first phase between 1970 and 1986, this research finds a decline in well-being during a second phase from 1986 to 1994 which has not been experienced similarly in GDP per capita. Growing income inequality, a flattening in the decrease of infant mortality rates, worsening political institutions, deteriorating environmental quality and rising homicide rates are responsible for this decline in well-being. In a third phase (1994-2010) well-being increased in an identical pace as GDP per capita. Over all four decades, income, housing, health and education have consequently made improvements. The discrepancy in the development of well-being and GDP can partially be attributed to the fact that well-being incorporates important aspects of welfare that GDP fails to take into account.

Preface

On a Sunday in December 2018 a highspeed bullet train leaves the former British colony Hong Kong and quickly approaches an almost astronomic speed of 306 kilometres an hour as it drives into the Mainland of China. Passing by megacities like Shenzhen, Dongguan and Guangzhou, for more than an hour I only see building blocks seemingly touching the sky and cobwebs of roads, bridges and railways. The sun is unfortunately invisible as it is masked by a thick layer of smog produced by the world-famous 'Made in China' production plants. Along the way the train gets filled up with Chinese, young and old, carrying glistering new suitcases ready to visit their families in the rural inlands. A lot has changed at the mouth of the Pearl River Delta. After the miserable years under chairman Mao, the new pragmatic leader Deng Xiaoping (1904-1997) spoke the famous words "Let some get rich first" in 1978. Forty years after these famous words were spoken the Guangdong province has emerged into one of richest and most innovative provinces of the most populous nation in the world. The People's Republic of China is now on the verge of becoming the world's biggest economy; it is likely to surpass the size of the American economy soon. Current president Xi Jinping has openly unleashed his ideas of the 'Chinese dream' and his ambition to make China the most important nation in the world; superior in material, technological and military terms.

It has been forty years since China opened itself up to the rest of the world and in 2018 I had the unique opportunity to study in Hong Kong for one semester. It was there where I had the chance to get to know this fascinating 'Mainland China' from the other side of the border in the Special Administrative Region of China as Hong Kong is at the moment. At the Chinese University of Hong Kong, I became fascinated by the biggest country in the world with its 1,4 billion people, megacities, massive infrastructure and its distinctive culture that I would argue is incomparable with any other culture around the world. It is unbelievable how such a huge country has been able to work itself out of poverty and reach unprecedented levels of wealth on a national scale; all with a paradoxical mix of marketization and political autocracy of the Chinese Communist Party with the legacy of chairman Mao Zedong (1893-1976). All this motivated me to research this intriguing development to understand how China has manifested itself into the country it is today.

I am thankful for the good supervision of Bas van Bavel who helped me work out this thesis in a structural and satisfying manner the past five months. Also, Auke Rijpma and Ruben Ros were invaluable in helping me muddle through the quantitative parts and working with R-programming. Finally, I would like to express my gratitude to my family, girlfriend and friends for their continuous support during the writing of this thesis.

Contents

1. Introduction

China has experienced spectacular economic growth since the 1970s. Almost forty years after the initiation of a first series of far-reaching economic reforms striving to help the country out of poverty, China has become the second biggest economy in the world in terms of Gross Domestic Product (GDP). Its GDP is likely to surpass the United States' GDP in the near future, making China the country with the highest GDP in the world. This 'Chinese miracle' has however also caused tremendous environmental problems threatening environmental sustainability and the liveability for its inhabitants. The unequal division of GDP among the members of its society has produced large economic and social inequality. The construction of the GDP statistic by the Chinese government has furthermore come under scrutiny ever since the discovery of falsifications and exaggerations. Did China's economic growth in GDP then really represent a similar improvement in the lives of the ordinary Chinese?

In recent years, the use of GDP to measure the well-being of a society has become heatedly debated. In 2008 the OECD, the Organisation for Economic Cooperation and Development, urged the need for a new measurement of well-being and opened a 'beyond GDP' debate. This report stipulated a shift from measuring production to measuring well-being as there seems to be a disparity between the information contained in aggregate GDP data and what counts for common people's well-being.[1] By looking at various aspects of well-being, this thesis strives to understand whether China's GDP growth between 1970 and 2010 also implied a similar improvement in well-being.

First, this introduction will provide some more detail on the use of GDP and the construction of the statistic in China. Secondly, the flaws of GDP to measure well-being mentioned in the 'beyond GDP debate' are discussed. Thirdly, the alternatives attempting to capture Chinese well-being more adequately that sprung off this debate are explored. Then it makes sense to provide some historical background on China's economic history. Following the historiographical debate and the historical background of the subject, the research question of this thesis is presented. After this, the method and theories are considered, and the used sources to answer the research question will be explained. Finally, a brief note is made on the contribution of this thesis and the build-up of this thesis is presented.

[1] Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi. 'The measurement of economic performance and social progress revisited.' *Commission on the Measurement of Economic Performance and Social Progress* (Paris, 2009) 12.

1.1 Why move beyond GDP?

1.1.a Gross Domestic Product (GDP)

An understanding of GDP is necessary prior to delving into its potential shortfalls. First measured by Simon Kuznets in 1934 for a US Congress report, GNP and GDP have become the most common measurements for national income.[2] National income is known as the conventional method to measure the well-being of a society. The New Palgrave Dictionary of Economics defines it as the income that accrues due to a nation's productivity.[3] As the Gross National Product measures the productivity of all normal residents of a nation, it also includes residents who earn their money outside the borders of the nation. Gross Domestic Product only includes the economic production within the borders of the nation. Since the 1990s, GDP has become a more common measurement to capture economic productivity. An important reason for this is that GDP includes the parts of income produced by a multinational within the national boundaries, instead of only adding the productivity of a multinational in case its headquarter is located within the national borders.[4] As GDP is a statistic to calculate the performance of a nation's economy and is calculated on a national level, the gathering of data and the measurement of GDP is done by the government. For international comparison after World War II, a first system of National Accounts has been established in 1953. This United Nations System of National Accounts has standardized the way in which GDP is reported internationally and has forced national governments to conform to these international standards; the Chinese government conforms to this standard.

However, the collection of the Chinese GDP statistic has come under scrutiny after a series of data falsifications and embellishments in 1998.[5] It turned out various falsifications were made in the calculation of statistics of GDP. The gathering of the GDP statistic is politically sensitive and question marks can be made about the objectivity of the collection of the statistic. China's GDP on a national and local level is namely provided by the National Bureau of Statistics (NBS) of China. This NBS is not completely independent from the political power in China, the Chinese Communist Party.[6]

For a long time, GDP has been acknowledged to be the method to measure the well-being of members of a society and to indicate the level of performance of a country; an increase

[2] See: Simon Kuznets, 'National Income, 1929-1932.' *NBER, National Bureau of Economic Research*, (1934):1–12.
[3] Wilfred Beckerman, 'National Income', In: John Eatwell et al. (eds.), The new Palgrave: a dictionary of 3 economics, volume 3 (London 1998) 590-592.
[4] Philipp Lepenies, The Power of a Single Number: A Political History of GDP (New York 2016) 3.
[5] See: Thomas G. Rawski, 'What is happening to China's GDP statistics?' *China Economic Review*, *12* (2001) 4: 347-354; Carsten A. Holz, 'The quality of China's GDP statistics', *China Economic Review*, 30 (2014) 309-338.
[6] National Bureau of Statistics (accessed on 11-06-2019), retrieved from: http://data.stats.gov.cn/english/.

in GDP means an increase in the output of goods and services which often means an increased ability for individuals to buy these goods and services. Besides more goods and services, an increase in GDP would mean more spending ability for non-material aspects of well-being such as education and health.[7]

1.1.b Why does GDP fail to measure well-being?

The use of GDP to measure societies members' well-being has however received criticism in recent years. The debate on the setbacks of GDP to measure well-being was opened by a report of the OECD in 2008 by renowned economists Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi.[8] This report resulted in the OECD initiative in 2011 called "How's Life?" to gather internationally comparable statistics to measure well-being. In 2014, Van Zanden et al. added a historical account of this attempt named "How was Life?" to provide international comparable statistics on well-being from 1820 until 2010.[9] This literature criticises the use of GDP for the measurement of well-being on the following points.

The first important limitation is that GDP only includes goods and services produced within the market. It does not include the services produced within the domain of the household and voluntary work.[10] When China was a communist planned economy a lot of transactions were probably done outside of the market to avoid the collectivist system.[11] This implies that a lot of production has remained out of the scope of the GDP statistic before China started to implement market principles in (some areas) of the economy since 1978. Above all, there may still be a substantial amount of economic productivity within the household – think of childcare or elderly care – in the Chinese society where family values are deemed to be very important.[12]

Next, there is the problem of measuring publicly produced goods and services. China has a huge public sector as strategic industries such as telecommunication and energy, the state has until today retained a monopoly via state-owned enterprises.[13] The power of these State-Owned

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[7] Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Conal Smith, and Marcel Timmer. *How was life?: Global well-being since 1820*. (OECD Publishing, 2014) 58.
[8] Stiglitz, 'The measurement of economic performance and social progress revisited.' *Commission on the Measurement of Economic Performance and Social Progress* (Paris, 2009).
[9] Van Zanden et al., *How was life?* (2014).
[10] Van Zanden et al., *How was life,* 61. Stiglitz et al., 'The measurement of economic performance', 17-20.
[11] See: Frank Dikötter, 'The Silent Revolution: Decollectivization from Below during the Cultural Revolution', In: Thornton, Sun and Berry eds, *Red Shadows: Memories and Legacies of the Chinese Cultural Revolution* (Cambridge University Press, 2016) 198-213.
[12] See: Xiaomei Pei & Pillai, V. K., 'Old age support in China: The role of the state and the family.' *The International Journal of Aging and Human Development*, 49 (1999) 3: 197-212; Heying Jenny Zhan, Feng, Z., Chen, Z., & Feng, X, 'The role of the family in institutional long-term care: cultural management of filial piety in China.' *International Journal of Social Welfare*, 20 (2011) S121-S134.
[13] See: Naughton, Barry, *The Chinese economy: Transitions and growth* (London, 2007).

Enterprises (SOEs) even seems to have increased in recent years.[14] Normally, publicly produced goods and services are calculated by measuring the input in the form of government expenditure, which assumes that inputs are equal to the output and that productivity in the public sector is the same as productivity in the private sector. Both these assumptions do not entirely hold.[15]

A second point of critique claims GDP does not correctly represent societal welfare and development. China's economic growth has not been equally distributed among society, as some regions, especially the urban coastal areas, developed in a much higher pace than the mainly rural inland regions. Within cities the disparities are also huge. Inequality of income and the resulting social inequality and its deficits for well-being cannot be explained by GDP per capita.[16] The income inequality as well as wealth inequality in China are high.[17]

Third, GDP only measures monetary value and assumes that all kinds of monetary value created adds to well-being.[18] Certain aspects of well-being that are not directly reflected in the monetary value have dramatically improved in China since the market-oriented economic reforms of the 1970s. Education and healthcare, for example, were the engines of China's economic growth and made big improvements.[19] Education grew dramatically due to large investments by the Chinese government but also because parents invested heavily into the education of their child's education due to the introduction of the one child policy in 1979.[20] Furthermore, not all created monetary value adds to well-being as GDP also includes monetary value created out of commodities and services that are not beneficial to society. Illegal activities as for example drugs dealing and prostitution are also included into GDP.[21]

Fourth, externalities caused by the process to produce goods and services are not included into the measurement of GDP. The enormous economic GDP growth in China has at cost huge environmental pollution and resource depletion in China; negative externalities which are not accounted for in the measurement of China's GDP.[22] Furthermore, GDP counts

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[14] See: Kjeld Erik Brødsgaard, 'Politics and Business Group Formation in China: The Party in Control?' *The China Quarterly*, 211 (September 2012) 624-648.
[15] Stiglitz et al., 'The measurement of economic performance', 31,32.
[16] Stiglitz et al., 'The measurement of economic performance', 21-26.
[17] H.T. Li, Shang, R.B. and Zhai, Q., 'The calculation and application of the GINI coefficient based on the Lorentz Curve', *Journal of Gansu Science,* 15 (2003) 1: 89-94; World Inequality Database (accessed on 11-06-2019), retrieved from: https://wid.world/country/china/.
[18] Auke Rijpma, Van Zanden, J. L., & d'Ercole, M. M., 'A long-term perspective on the development experience of emerging and industrialised economies' *OECD Statistical Working Papers* (2018) 26.
[19] See: Amartya Sen, *Development as Freedom* (Oxford, 1999).
[20] Rijpma et al., 'A long-term perspective', 26.
[21] Stiglitz et al., 'The measurement of economic performance', 34-51.
[22] World Bank, *Cost of Pollution in China: Economic Estimates of Physical Damages* (Washington, D.C., 2003); James Roumasset, Kimberley Burnett, and Hua Wang, 'Environmental Resources and Economic growth,' chapter 8 in Brandt and Rawski, China's Great Economic Transformation (Cambridge, 2008); Thomas G. Rawski, 'Urban Air Quality in China: Historical and Comparative Perspectives' in Nazrul Islam (ed.), Resurgent China: Issues for the

pollution as a double gain to economic growth: the economic gains of the polluting oil industry are counted plus the economic gains from companies trying to resolve the environmental problems caused by the oil industry.[23]

A fifth drawback is that GDP is not capable of properly taking into account technological innovation. This means that besides the depletion of natural recourses there is the depreciation of capital stock. Within the period 1970-2015, China transformed from an agrarian society to a manufacturing economy and is transforming to a technological economy. In an economy that has just started to industrialize, a manufacturing economy, depreciation is the result of machines wearing out while in an economy that has started to rely on modern innovation, a modern innovation economy, machines become obsolete because technological change has produced substitutes. In the manufacturing economy the rate of depreciation is lower than in an innovation economy; in the later stages depreciation is higher than before.[24]

1.2 Historiography: alternatives beyond GDP

To account for the mentioned flaws of China's GDP, a series of alternatives has been launched that attempt to capture well-being in China more adequately. The literature can be ordered into three different categories: alternatives amending GDP, alternatives using surveys to create subjective well-being indicators and alternatives compiling different indicators into one indicator for well-being.[25]

1.2.a Amending GDP

To start, there is the alternative to amend the GDP statistic by trying to overcome its shortcomings and correct it accordingly. An example is the research by Charles I. Jones and Peter J. Klenow that proposed a summary statistic that amends GDP by incorporating consumption, leisure, mortality and inequality using the standard economics of expected utility to measure welfare. According to this research, China's growth in welfare is lower than the GDP per capita growth would suggest due to low life expectancy and high income inequality.[26] The advantage of the construction of amendments correcting GDP is that the calculation method is comparable with that of calculating GDP. The disadvantage of this method is that it may be difficult to express qualitative data necessary to express well-being in monetary values.[27]

Future (Houndmills: Palgrave Macmillan, 2009), 353–369; Ligang Song and Wing Thye Woo (eds.), China's Dilemma: Economic Growth, the Environment, and Climate Change (Canberra, Washington, D.C., Beijing, 2008).
[23] Stiglitz et al., 'The measurement of economic performance', 52-62.
[24] Stiglitz et al., 'The measurement of economic performance', 20.
[25] Bas Van Bavel, *De Bredere Welvaartsindicator* (Utrecht, 2017) 7.
[26] Charles I. Jones & Klenow, P. J., 'Beyond GDP? Welfare across countries and time.' *American Economic Review*, 106 (2016) 9: 2426-57.
[27] Van Bavel, *De Bredere Welvaartsindicator*, 7.

1.2.b Measuring subjective well-being

To capture subjective well-being, alternatives have been launched that are based on surveys answered by respondents. An example is the Gross National Happiness Index after the example of the government of Bhutan who took this index as the basis for government policy.[28] As a result, a World Happiness report is annually published by the United Nations Sustainable Development Solutions Network edited by Western economists John F. Helliwel, Richard Layard and Jeffrey Sachs based on the Gallup World Poll.[29] China scores a 86th place on this happiness index in 2018. The ranking is based on six factors: GDP per capita, social support, healthy life expectancy, the freedom to make life choices, generosity and perception of corruption. GDP per capita and social support are the biggest contributor to happiness for China, followed by healthy life expectancy and the freedom to make life choices. The proportion these factors contribute to happiness in China is comparable to the United States, which is ranked 18th. Over the period 2008-2010 to 2015-2017, China is the 20th biggest gainer in happiness.[30] The first World Happiness report was published in 2011 which makes the use of these reports unsuitable for historical research. In general, the big drawback of such a subjective well-being indicator relying on the use of surveys is that the questions in the surveys can be interpreted differently by comparable groups, which can lead to conflicting views of the welfare of comparable groups.[31] Furthermore, different cultures may value well-being differently.[32]

1.2.c Compiled indicators

The third group of alternatives to measure well-being strive to compile different indicators for well-being into one indicator. The most prominent examples of this method are the Human Development Index of the United Nations[33], the Genuine Progress Indicator[34] and indices for well-being set up by the Better Life Index initiative of the OECD[35]. The advantage of these compiled indicators is that different aspects of well-being, objective as well as subjective, can be

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[28] See: Winston Bates, 'Gross National Happiness.' Asian-Pacific Economic Literature 23 (2009) 2:1–16.
[29] Helliwell, J., Layard, R., & Sachs, J., World Happiness Report 2018, *New York: Sustainable Development Solutions Network* (2018).
[30] John Helliwell, Layard, R., & Sachs, J. (2018). World Happiness Report 2018, New York: Sustainable Development Solutions Network 20, 21, 25.
[31] Daniel Kahneman and A.B. Krueger, 'Developments in the measurement of subjective well-being.' *Journal of Economic Perspectives*, 20 (2006) 1: 3-24; Amartya Sen, 'Health: perception versus observation – self reported morbidity has severe limitations and can be extremely misleading.' *BMJ: British Medical Journal*, 324 (2002) 7342: 860.
[32] William Tov & Ed Diener. 'Culture and subjective well-being.' In *Culture and well-being* (Dordrecht, 2009) 9-41.
[33] UNDP, 'Human Development Report 1990: Concept and Measurement of Human Development.' *New York: United Nations Development Programme* (1990).
[34] Ida Kubiszewski, Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., & Aylmer, C., 'Beyond GDP: Measuring and achieving global genuine progress.' *Ecological Economics*, *93* (2013) 57-68; Zongguo Wen, Yang, Y., & Lawn, P. A., 'From GDP to GPI: quantifying thirty-five years of development in China.' In: Lawn, P. A., & Clarke, M. (Eds.). *Sustainable welfare in the Asia-Pacific: studies using the genuine progress indicator.* (Cheltenham, 2008).
[35] Organisation for Economic Co-operation and Development, *How's life?: measuring well-being.* (Paris, 2011); Van Zanden et al., *How was life?*.

merged into one indicator. The process of attributing weights to the different aspects of well-being to construct one final indicator is however a troubling process.[36]

The Human Development Index

In 1990 the Pakkistani economist Mahbub ul Haq together with the Indian economist Amartya Sen created the Human Development Index (HDI) that would not only measure the economic growth of a country to determine its development but should also incorporate the people and their capabilities as a criterion to access a nation's development.[37] Besides Gross National Income, education and health are incorporated and over the years new indices have been included to better capture other dimensions of human development such as poverty, inequality, gender empowerment, environmental sustainability and socioeconomic sustainability.[38] Due to an improvement in health, education and the standard of living, human development in China has been steadily rising over the last decades while inequality and gender empowerment suppress this human development.[39] The general drawback of HDI is that the composition of the Human Development Index is made attaching weights to the different indices which include an arbitrary trade-off. The HDI may show an increase in the end, while certain important aspects of human development may have become less, simply because a strong improvement of one component overshadows the possible worsening of others.[40] Furthermore, as the HDI indices are gathered from 1990 onwards only, they do not allow to assess historical trends further back in time.

The Genuine Progress Indicator

A compiled well-being indicator that is calculated for a longer period in time is the Genuine Progress Indicator (GPI). Genuine Progress Indicators were designed following the initiative of the Index of Sustainable Economic Welfare (IESW) which was first proposed in 1989[41]. Two major attempts have been made to construct a GPI for China covering the period 1970-2010. The first GPI for China was constructed by the Chinese scholar Zongguo Wen. The Genuine Progress Indicator for China constructed by Wen et al. includes eighteen variables. The major attempt of the GPI is to correct GDP for economic activity that reduces welfare, welfare enhancing activities that fall outside of the market transactions and the unequal distribution of

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[36] Martin Ravallion, 'Troubling tradeoffs in the human development index', *Journal of Development Economics*, 99(2012) 2: 201-209.
[37] UNDP, 'Human Development Report 1990: Concept and Measurement of Human Development'.
[38] United Nations Development Programme, 'Human Development Indices and Indicators: 2018 Statistical Update', *United Nations Development Programme* (New York, 2018).
[39] United Nations Development Programme, Human Development Reports (accessed on 04-02-2019), retrieved from: http://hdr.undp.org/en/countries/profiles/CHN.
[40] Ravallion, M., 'Troubling tradeoffs in the human development index.' *Journal of Development Economics*, 99(2012) 2: 201-209.
[41] Herman E. Daly, Cobb Jr., J.B., *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future.* (Boston, 1989).

income among individuals. Economic activity that has a negative contribution to welfare are the cost of unemployment, the cost of crime, the cost of family breakdown. Activities that fall outside of the market transactions such as the value of non-paid household labour and the value of volunteer labour add to welfare. The same can be said for variables consumption expenditure, service from consumer durables and welfare from publicly-provided infrastructure; all add to welfare. The deterioration of China's distribution index that accesses the income Gini coefficient however overshadows the increased weighted consumer index. Variables incorporating the environmental costs such as the cost of non-renewable recourses depletion, excessive water use, timber depletion and air pollution all have a negative contribution to welfare.[42] This GPI merely takes into account the monetary value of subjective well-being aspects and therefore actually falls more within the category of alternatives amending GDP.

A second GPI is constructed by Ida Kubiszewki and Robert Constansa from Western universities (US, UK and Australia) building on the GPI of Wen et al.[43] Kubiszewski et al. included more subjective, not necessarily monetarized aspects of well-being such as the ecological footprint, the biodiversity, the Human Development Index, Life Satisfaction and the GINI coefficient, and compiled a GPI for seventeen countries. Both GPI's show different results when comparing the development of GPI with that of GDP. GPI was in both cases around 1970 at a higher level than GDP but had in 2000 been surpassed by GDP. Where Wen et al. on the one hand point to the beginning of the 1980s as the pivotal moment in which GDP surpassed GPI[44], Kubiszewki et al. on the other hand, argue that GDP per capita overtook GPI per capita only in 1990.[45]

According to Wen et al. on the hand, GPI per capita started in 1970 at a much higher level than GDP per capita but was overtaken by GDP in in 1981. Wen et al. point to the pivotal moment in China's economic development when the transformation from an agrarian society to an economy with an industrial base between 1970 and 1981. In order to fuel this industrial process, a massive rise in non-renewable resource depletion took place. The industrialisation gave rise to an exponential grow in GDP, but the environmental costs of this industrial resource depletion lowered the growth in GPI leading to a takeover by GDP per capita which was never restored.[46] Kubiszewki et al. on the other hand, argue that GDP per capita overtook GPI per capita only in 1990. Besides the phenomenal growth rate of GDP per capita from the opening up

[42] Wen et al., 'From GDP to GPI', 228-259; Zongguo Wen, Zhang, K., Du, B., Li, Y., & Li, W., 'Case study on the use of genuine progress indicator to measure urban economic welfare in China.' *Ecological Economics*, *63* (2007) 2-3: 463-475.
[43] Kubiszewski et al., 'Beyond GDP', 57-68.
[44] Wen et al., 'From GDP to GPI', 250-256.
[45] Kubiszewski et al., 'Beyond GDP', 61-62.
[46] Wen et al., 'From GDP to GPI', 250-256.

under Deng Xiaoping from 1978 onwards, GPI per capita also steadily grew due to the gradual increase of HDI over the period 1980 and 2010. During the period between 1990 and 1997, the growth rate of GDP per capita and GPI per capita even equalled. However, due to worsening income distribution, increasing crime, family breakdown, air and water pollution, and non-renewable resource depletion, a divergence between GDP and GPI growth took root.[47] The inclusion of non-monetary well-being indicators such as HDI by Kubiszewksi to the composition of GPI thus seems to give a different picture.

The GPI however remains to take GDP as the vocal point. GDP is still the point of departure from which inabilities of the GDP statistic to measure well-being are attempted to be overcome by adding additional objective and subjective aspects of well-being. Just like GDP, the GPI looks at economic activity and tries to calculate to which extent economic activity adds to welfare.[48] It does not take well-being as the starting point.

The OECD Better Life Index

The first alternative of GDP that moves away from GDP and puts well-being as point of departure is the Better Life initiative of the OECD. The How's Life report of the OECD brings together a large set of internationally comparable well-being indicators.[49] It focusses on four points. Firstly, it puts the emphasis on households and individuals rather than the aggregate condition of a nation's economy as there may be a discrepancy between the economy-wide economic situation and the well-being of households. Secondly, it concentrates on well-being outcomes instead of well-being drivers measured by input or output indicators. Thirdly, it looks at the distribution of well-being across individuals by incorporating disparities in age, groups, gender, income and socio-economic background. Fourthly, it considers both objective and subjective aspects of well-being as also the evaluation and feelings of people's living conditions and quality of life are important to understand psychological aspects of people's life and to understand the relationship between objective and subjective components of well-being.[50] How's Life report however lacks an overview of environmental sustainability over time[51] and is limited to well-being of the present day as the data is mainly available from 2009 onwards.

Followed up by How's Life, the publication of economic historian Jan Luiten van Zanden and colleagues named "How was Life" has strived to historically understand the development of global well-being since 1820.[52] This research makes it possible to assess whether the current well-

[47] Kubiszewski et al., 'Beyond GDP', 61-62.
[48] Ibidem, 58.
[49] Van Zanden et al., *How was life?,* 1-273.
[50] Ibidem, 18-19.
[51] Ibidem, 19-20.
[52] Ibidem, 1-273.

being can be sustained in the future by looking back at the composition of well-being in history. It draws on an extensive database created in the so-called Clio Infra project[53] that has gathered worldwide data on social, economic and institutional indicators. Until now, the only research with this new data on well-being in China has been a publication making a macro-comparison with developing countries.[54] Thus, the data in How was Life has not been used yet to analyse well-being specifically in China.

1.3 Historical background: China's economic development between 1970 and 2010

Before specifying the exact contribution of this thesis to the historiography, some historical background of the case study has to be sketched. China has experienced a remarkable economic growth over the last decades. How has it achieved such a spectacular growth?

After a tense struggle between nationalists and communists, the People's Republic of China (PRC) was established in 1949. The PRC would be governed by the Chinese Communist Party (CCP) led by chairman Mao Zedong. Under his reign, a socialist class struggle was unleashed, and China transformed into a communist, planned economy. In the countryside property rights were abolished and rural communes in which farmers worked together on communal grounds were established. Industries were nationalized. Following the example of the Soviet Union, five-year plans were constructed. Arguably the biggest five-year plan, the so-called 'Great Leap Forward', ended catastrophically with millions of people starving to death between 1957 and 1960. In reaction to preserve his socialist project, Mao unleashed a Cultural Revolution (1965-1971) to get rid of revisionist forces and to gain absolute power by establishing a cult around himself. This revolution pushed back economic development even further and isolated China even more from the rest of the world. China was poor; GDP per capita in 1970 was 113 USD.[55]

When Mao Zedong passed away in 1976 a new generation was determined to follow a different path.[56] Pragmatic leader Deng Xiaoping took over in 1978 and changed the politics regarding economics dramatically. In a gradual process of implementing market forces and opening up to the rest of the world, the ideological socialist project was in an economic sense partially abandoned. The command economy was slowly transformed into an economy with market influences.[57] Instead of radical privatization, which had occurred in most other former

[53] Clio Infra project (accessed on 11-06-2019), retrieved from: https://clio-infra.eu/.
[54] Rijpma et al., 'A long-term perspective', 25-28.
[55] National Bureau of Statistics (accessed on 11-06-2019), retrieved from: http://data.stats.gov.cn/english/.
[56] Alan Lawrance, *China under communism* (London, New York, 1998) 1-6, 8, 12, 33-35, 57-63, 66-77.
[57] Naughton, 'A political economy', 106-107; Alvin Y. So & Yin-wah Chu. 'The transition from neoliberalism to state neoliberalism in China at the turn of the twenty-first century.' *Developmental politics in transition.* (Palgrave Macmillan, London, 2012) 8.

communist countries, the former command economy was slowly exposed to market forces. The literature mainly divides reform into two periods of transition. During the first period of transition between 1978 and 1993, certain regions were assigned as so-called Special Economic Zones where market experiments could be performed; once the experimentation proved to work, they could be expanded to other regions.[58] These regions, especially the coastal Guangdong and Shanghai regions, were allowed to grow harder than others.[59] In the rural areas, formerly communal assets were given to the farmers to produce for themselves and the emphasis shifted to industrialization in the urban regions.[60] The second period of transition between roughly 1993 and 2003 was characterized by a process of recentralization and fostering economic institutions in the developing market economy such as the establishment of a central bank and a restructuring of the tax system.[61] In the 1990s the market became a more and more dominant economic institution in China and this achievement was crowned with the accession to the World Trade Organization in 2001.[62]

At the same time, the introduction of market forces into the economy has always strictly been guided by the rule of the Chinese Communist Party (CCP). The pragmatic shift allowing market forces into the economy has been paralleled by the retainment of power by the CCP which legitimizes its political authority by the commitment to economic growth.[63] Some have coined this coexistence of market principles and rule of the CCP as 'state capitalism'[64] or 'state-neoliberalism'[65]. The government has always kept tight control over which parties are allowed to enter the internal market in which fashion[66], the government has retained control in important sectors[67], the importance of State Owned Enterprises (SOEs) has in recent decades earlier increased than diminished and SOEs are seen as a major contributor to China's economic growth.[68]

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[58] For more information about the functioning of Special Economic Zones see: L. Moberg, 'The political economy of special economic zones', *Journal of institutional economics*, 11(2015) 1: 167-190.
[59] Naughton, 'A political economy', 91-97; So & Chu, 'The transition from Neoliberalism', 8.
[60] So & Chu, 'The transition from Neoliberalism', 6-9.
[61] Naughton, 'A political economy', 101; Justin Yifu Lin, Fang Cai & Zhou Li, *The China Miracle: Development Strategy and Economic Reform* (Hong Kong, 1996).
[62] Barry Naughton, *The Chinese Economy: Transitions and Growth* (Massachusetts, 2006).
[63] Naughton, Barry. 'A political economy of China's economic transition.' *China's great economic transformation* (2008) 91-135.
[64] Barry Buzan and George Lawson, 'Capitalism and the emergent world order', *International Affairs* 90 (2014) 1: 82; Chang-Tai Hsieh, & Song, Z. M. 'Grasp the large, let go of the small: the transformation of the state sector in China' *National Bureau of Economic Research*, w21006 (2015) 1.
[65] So & Chu, 'The transition from Neoliberalism', 1-30.
[66] Paul W. Beamish, 'The characteristics of joint ventures in the People's Republic of China.' *Journal of International marketing*, 1 (1993) 2: 29-48; Arrighi, Giovanni., *Adam Smith in Beijing: Lineages of the twenty-first century*. (London, 2007).
[67] So & Chu, 'A transition from Neoliberalism', 13; Barry Naughton, *The Chinese Economy: Transitions and Growth* (Massachusetts, 2006) 119.
[68] Hsieh & Song, 'Grasp the large', 1-27.

The economic reforms starting in 1978, have always been marked as the origins of economic growth in China.[69] From 1978 onwards, China experienced unprecedented per capita GDP growth. Between 1978 and 2005, the GDP per capita growth was on average at least 7% per year which is one of the most extraordinary growths in GDP per capita in human history.[70] Although the GDP growth seems to start levelling off slightly in the last decade, it still experiences growth rates of around 6% per year compared to 2% growth per year in the US and Western European countries. China's GDP per capita was in 2010 8031,95 USD.[71] The implicit conclusion has always been that the economic growth in GDP per capita represents a reasonable proxy for the development of welfare and well-being in China. Regarding the drawbacks that surround the GDP statistic mentioned in paragraph 1.2, it is yet not straightforward whether well-being has experienced the same development as the GDP growth rates suggest.

1.4 Research question

The data published in How was Life offers a unique opportunity to assess well-being in China more comprehensively than all listed alternatives have previously been able to. It offers a more complete set of variables relevant for well-being over the historical time period 1970-2010 in which China experienced its spectacular GDP growth. Therefore, this research can compare GDP and broader welfare to understand whether China's economic growth in GDP was experienced in a similar fashion in well-being. The research question that this thesis strives to answer is: to which extent was the growth of GDP per capita in China between 1970 and 2010 also a growth in well-being? The approach to answer this question can be split into three components. First, a definition for well-being has to be made. Second, data sources that confines the definition of well-being and allows the construction of a well-being indicator, have to be determined. Thirdly, to measure and understand the development of well-being, a compiled indicator for well-being will be constructed.

Theory: a definition of well-being

In contrary to previous efforts in the beyond GDP debate, this thesis uses well-being as point of departure. The standards for well-being set up by the OECD are used for the definition of well-being. Well-being of an individual according to the OECD includes the material living condition, the quality of life dimension and sustainability. Material living is determined by i) Income and wealth; ii) Income and jobs; and iii) Housing. Quality of life is deemed to include vi) Health

[69] Naughton, *The Chinese Economy,* 140; Lin et al., 'The China Miracle', 1-340; Lin, *Demystifying the Chinese economy*. (Cambridge, 2011).
[70] Barry Naughton, *The Chinese Economy: Transitions and Growth*, 139-159.
[71] National Bureau of Statistics (accessed on 11-06-2019), retrieved from: http://data.stats.gov.cn/english/.

status; v) Work and life balance; vi) Education and skills; vii) Civic engagement and governance; viii) Social connections; ix) Environmental quality; x) Personal security; and xi) Subjective well-being.[72] These eleven aspects of well-being form the basic definition of well-being for this research.

Data

The compiled well-being indicator that will be constructed in this thesis will attempt to capture the eleven mentioned well-being aspects as adequately as possible for China between 1970 and 2010. The OECD data gathered in How was Life provides most of the mentioned aspects of well-being. How was Life included education, life expectancy, human height, personal security, political institutions, environmental quality and income inequality.[73] Some aspects of well-being will be supplemented by additional sources. Real average wages are retrieved from the International Labour Organisation (ILO)[74] and disposable income and household consumption from the Chinese Statistical Yearbooks. This last source is also used to gather data on the average amount of squares of living space which serves as indicator for housing.[75]Another important source is the World Bank that provides among others information on infant mortality rates (to supplement health) and homicide rates (to supplement personal security). Environmental quality will – besides SO2 and CO2 emission and Biodiversity[76] – be supplemented by data on the economic costs of pollution collected by Wen et al.[77] Historically it will however remain impossible to capture certain aspects such as work and life balance, and social connections. An extensive overview of all used indicators and their sources can be found in chapter 3.

Method

Several alternatives of GDP per capita to measure well-being have been discussed. Amendments of GDP only correct GDP by adding monetary values of well-being that are deemed to be relevant for well-being. These only incorporate material aspects that can be expressed in a monetary value and fail to account for nonmaterial aspects of well-being. Alternatives measuring subjective well-being have the methodological problem of the usage of surveys and do not account for the objective aspects of well-being; one can try to be happy with whatever he or she has in life, but a minimal material condition is necessary to live. Compiled indicators combining

[72] OECD, *How's life?,* 19-20.
[73] Van Zanden et al., *How was life?*, 1-273.
[74] International Labour Organisation, Monthly average wage (accessed on 11-06-2019), retrieved from: https://www.ilo.org/ilostat/faces/ilostat-home/download?_adf.ctrl-state=m2bn44de_78&_afrLoop=4243661509694882#!.
[75] Chinese Statistical Yearbook, various years (accessed on 11-06-2019), retrieved from: http://www.stats.gov.cn/english/Statisticaldata/AnnualData/.
[76] Van Zanden, et al., *How was life?*. 182-183.
[77] Wen et al., 'From GDP to GPI', 228-259.

objective as well as subjective thus seem the most suitable to measure well-being.[78] A compiled indicator of well-being will be constructed incorporating the stated aspects of well-being. In the process of compiling one indicator for well-being two methods have been explored, namely the factor analysis and the equal-weighting method; both are thoroughly specified in chapter 4.

1.5 Contribution

The added value to existing academic research is threefold. In the first place, this thesis will historically help to understand China's economic development of the last decades; what did growth in GDP do to the well-being of the Chinese people? The different Genuine Progress Indicators (GPI's) of Wen et al. and Kubiszewksi et al. show a different development in genuine progress and GDP per capita in China between 1970 and 2000. There is thus a discrepancy between Gross Domestic Product development and the development in Genuine Progress.[79] The different GPI's constructed however disagree on the exact development of progress as both use different variables to measure genuine progress. The collection of data on broader welfare by the How was Life publication provides a new opportunity to give a more comprehensive indication of the development of actual well-being in China for the period 1970-2010.

Secondly, this research's methodology challenges conventional economic theory which heavily relies on GDP as an indicator for welfare. It adds to the ongoing debate on defining methods beyond GDP to measure well-being; various methods have been proposed in this debate, but all have their deficits.[80] Although the most complete method in the historiography, the genuine progress indicator, is a better proxy of well-being than GDP per capita, the GPI's do not strictly measure well-being. This thesis strives to strictly measure well-being by constructing a compiled indicator for well-being. China seems to possess large discrepancies between the growth in GDP per capita and actual welfare. Therefore, the case of China is an excellent case to exemplify the disparity between the information contained in GDP per capita and actual well-being. This thus urges the importance of the use of broader welfare measures as an alternative to GDP per capita to capture well-being.

Thirdly, this thesis will contribute to the Better Life Initiative of the OECD. It takes the OECD definition for well-being as starting point and provides a historical dimension of this well-being. By adding a long-term perspective on the development of well-being, a more comprehensive understanding of the sustainability of today's well-being evolves; in this case the sustainability of China's well-being. The degree to which today's well-being will be the same as

[78] Van Zanden et al., *How was life?*, 1-273.
[79] Wen, et al., 'From GDP to GPI', 228-259; Kubiszewski et al., 'Beyond GDP', 57-68.
[80] See my discussion on the various methods in the beyond GDP debate in paragraph 1.2.

tomorrow's well-being after all depends on the historical roots of well-being.[81] By developing a better understanding of well-being, policy designated to improve lives can be designed more effectively.

1.6 Build-up

Previous paragraph 1.1 reflected on the drawbacks of *what* GDP actually measures, the proceeding chapter two will focus on *how* the GDP statistic in China is measured and what problems have arisen in this process of measurement in the past. Chapter three will decompose the concept of well-being into separate dimensions that are represented by measurable indicators and will specify the sources from where the data for the various indicators is retrieved from. In the first part of chapter four the trends of these indicators will then be presented. The second part of the fourth chapter will execute both a factor analysis as well as an equal-weighting method to compile all separate indicators into one indicator for well-being. Once the compiled indicator for well-being is constructed, the development of well-being between 1970 and 2010 is compared with the development of GDP per capita. Chapter 5 will analyze the discrepancy between both, will confront the findings of this research with existing literature and does some suggestions for future research on how to explain the discrepancy between both. A discussion of the chosen indicators and methods will follow in chapter 6 before the contribution of this research is specified in a conclusion that recapitulates the set-up and findings of this research and strives to answer the research question as a whole.

[81] OECD, *How's life?*, 19-20. Van Zanden et al., *How was Life?*, 24-26.

2. China's GDP statistic

This chapter provides some more explanation of the construction of China's GDP statistic. The general limitations of what GDP actually measures have been thoroughly discussed in the introduction. This chapter reflects on how the GDP statistic is measured in China and what problems have arisen. It must be stressed that certain doubts on the reliability of the Chinese GDP statistic are not the main rationale for this thesis on well-being in China. The driver of this research is namely the worldwide consensus that the GDP statistic is an imperfect method to adequately capture well-being in a nation. The economic history of China serves as a good case study to exemplify possible big discrepancies that exist between well-being and GDP. The fact that the construction of the Chinese GDP statistic is subject to various concerns may support the motive to explore an alternative measurement of welfare for China but is not the main drive. As GDP thus does serve as the point of departure for this thesis, some background for reference is necessary. An extensive explanation of the exact collection of the official GDP statistic in China asks research that overshoots the scope of this thesis. This chapter therefore proceeds with a brief explanation of how the GDP statistic is measured in China and what problems have been encountered in the literature.

2.1 The measurement of China's GDP statistic

In general, GDP can be measured in three different ways. The first way is by measuring output: it measures gross sales of goods and services minus intermediate sales of these goods and services. By subtracting intermediate sales, the residual value that every actor adds is retrieved and duplications are avoided. Secondly, GDP can be measured by aggregating all forms of income. This income method includes all sources of income, namely: labour income, rents, profits, taxes on production and import, interest and depreciation (which is the consumption of capital). Thirdly, there is the final expenditures approach to calculate GDP. This adds up all types of spending such as consumption of final goods and services by households, government expenditures, private investment and exports minus imports. To indicate the average income within a nation, the aggregate GDP of a nation is divided by the total population to get a nation's GDP per capita.[82]

The eventual measurement of GDP depends on the availability of data by the government. Where for instance the US reports its GDP data via aggregate expenditures, China focusses on the production approach. According to the website of the Chinese National Bureau of Statistics (NBS), GDP calculations are made in accordance with the United Nations system of

[82] Steven J. Landefeld, Eugene P. Seskin and Barbara M. Fraumeni, 'Taking Pulse of the economy: 6 Measuring the Economy', Journal of Economic Perspectives, 22-2 (2008) 197.

National Income in 1985. The data is retrieved from three different sources: national survey data, financial statistics of administrative departments and administrative records of administrative departments. The NBS complements the production approach with the income approach because of the availability of data. According to their website, the added value of 94 industries is estimated. In those industries with 'sufficient basic information' the output and value added is directly calculated while in industries with 'insufficient basic information' the value added is calculated by using a number of indicators reflecting the development of the industry and based on the output and the value-added of the industry in benchmark i.e. the census year and adopting internationally accepted principles'.[83]

Measuring the state of the economy is an ever-present problem as there is no single statistic that perfectly gauges this. To come to an estimation, taking some type of weighted average of various imperfectly measured statistics is often acknowledged to be the most sensible method. This problem is the same everywhere in the world; for China as well as, for instance, the United States.[84]

2.2 Problems encountered

The problem of measurement on a national scale is apparent for China in particular as one can imagine the difficulty to measure the economic performance of a nation consisting of more than one billion people. Since the end of the 1990s the measurement of China's GDP has come under scrutiny when researchers detected various falsifications in the calculation of the statistics of GDP; the so-called "wind of embellishment and falsification". Thomas Rawski, a renowned economist who conducted various research on China's GDP construction, reconstructed an own version of the Chinese national income and found that real national income growth was 5,7 % versus an officially stated GDP growth rate of 7,8 %.[85] Another economist renowned for his research on China's GDP, Carsten Holz, claims that of total GDP in 2000, only 45 % the measurement is reliable, 11 % is somewhat reliable while 44 % is of poor quality.[86] There has been a substantial amount of different efforts to reconstruct China's GDP and detect the scale of falsification.[87] The exact scale of exaggeration remains impossible to measure, but the scrutiny

[83] National Bureau of Statistics (accessed on 11-06-2019), retrieved from: http://www.stats.gov.cn/english/StatisticalStudio/201010/t20101025_72353.html.
[84] Dennis J. Fixler & Nalewaik, J., 'News, Noise, and Estimates of the" true" Unobserved State of the Economy.' *Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board* (2007) 2.
[85] Rawski, 'What is happening to China's GDP statistics?', 347-354.
[86] Holz, ' The quality of China's GDP statistics', 19.
[87] See: Gerard F. Adams & Chen, Y., 'Skepticism about Chinese GDP growth — The Chinese GDP elasticity of energy consumption.', *Journal of Economic and Social Measurement*, 22 (1996) 4: 231–240; Rawski, T. G., 'On the reliability of Chinese economic data: Discussion', *Journal of Development Studies*, 12(1976) 4: 438–441; Carsten A. Holz, 'Fast, clear and accurate: How reliable are Chinese output and economic growth statistics?', *The China Quarterly*, 173 (2003): 122–163; Carsten A. Holz,, 'Deconstructing China's GDP statistics.', *China Economic Review*, 15 (2004) 2: 164–

can generally be attributed to two main factors: organizational problems in the collection of data and political dependence of collecting units.

Organisationally, the rapid transition of the economic has made it difficult for the NBS to gather comprehensive statistics. Certain sectors that were outside of the traditional reporting system of the planned economic system in the 1970s rapidly began to grow. Also, the NBS has adopted novel statistical concepts and variables over the years. Benchmarks to measure the value added of certain sectors have been adjusted various times during the 1990s, leading to revisions in the GDP statistic. Because data of only some industries is reported directly and some data is moreover attained by estimations and surveys, it is not completely reliable. The NBS does not collect all data itself but has authorized other institutions to gather data for them. This contains over one hundred other institutions such as the People's Bank of China for financial sector data, the Finance Ministry for fiscal sector data and Customs General Administration for foreign trade data. The choice, quality and coverage of the data collection of these departments is determined by the needs of these departments and the NBS just has to rely on these statistics. On a local level the NBS is dependent on provincial statistics bureaus. Here the NBS only has its surveys teams at the provincial bureaus and does not have any authority over the functioning of the provincial bureaus.[88]

Next, there is a considerable amount of activity that falls outside of the official statistics in every country. Every country has a shadow economy that is unreported in official GDP. Countries such as the U.S. and Japan have an estimated 8 to 10% GDP in the shadow economy unreported, while countries such as Greece, Italy and Spain have between an estimated 24 and 30% of their actual GDP unreported in official GDP.[89] Rough indications for China vary between 20 to 25% GDP in the underground economy for China in 1990 against below 10% in the late 1990s. What kind of economic activities this shadow economy entails also varies and as the estimations are made with strong assumptions, it is not immediately clear how these large variations in the 'underground economy' are caused.[90] Organisationally, it always thus remains a hard task to produce reliable statistics on a national scale.

202; Carsten A. Holz, 'China's reform period economic growth: How reliable are Angus Maddison's estimates?', *Review of Income and Wealth*, 52 (2006a) 1: 85–119; Carsten A. Holz, 'China's reform period economic growth: How reliable are Angus Maddison's estimates? Response to Angus Maddison's reply.', *Review of Income and Wealth* 52(2006b) 3: 471–475; Carsten A. Holz, 'Chinese statistics: Classification systems and data sources' *Stanford Center for International Development Working Paper* 471 (2013a) 532-571; Carsten A. Holz, 'Chinese statistics: Output data.' *Stanford Center for International Development Working Paper* 473 (2013b) 1-112. Carsten Holz, 'Measuring productivity growth in China, 1952–2011.', *Mimeo, Stanford Center for International Development* (2013c); Carsten Holz & Lin, Y., 'Pitfalls of China's industrial statistics: Inconsistencies and specification problems.', *The China Review* 1 (2001) 1: 29–71.

[88] Holz, 'The quality of China's GDP statistics', 310-321.

[89] Friedrich Schneider & Enste, D. H., 'Shadow economies: Size, causes, and consequences.', *Journal of Economic Literature*, 38 (2000) 1: 77–114.

[90] Holz, 'The quality of China's GDP statistics', 323.

Furthermore, the reliability of China's official statistics is a rather unique case because of the institutional arrangements for the collection of official data. The NBS is not independent. It is under direct control of the State Council of the People's Republic of China, which is the administrative authority of the People's Republic of China. The State Council is formally responsible to the national legislature of the People's Republic of China, the National People's Congress (NPC) and its Standing Committee. The National People's Congress consists of members of the Chinese Communist Party (CCP), China's political authority, and thereby the CCP controls the actions of the NPC. Thus, the National Bureau of Statistics eventually operates under control of the Chinese Communist Party. Furthermore, Carsten Holz showed that within the NBS in 2006 the commissioner of the NBS was also the Party Secretary of the NBS, while the first deputy secretary of the NBS had the same function in the Party. The head of the Party Disciplinary Commission within the NBS is one of the five regular Party cell members, while three of the other members were deputy-commissioners within this disciplinary commission. Personnel of the provincial bureaus on which the NBS relies, was also appointed by the provincial Party Committee and government.[91] Bureaucracy of the NBS has thus been neatly interwoven with politics.

This may trigger falsification. On a national level, it can be argued that the legitimacy of the ruling CCP since the pragmatic economic reforms from 1978 onwards is based on the economic growth of the nation.[92] The government thus has a vast interest in producing convincing growth rates. The final construction of the official nominal GDP statistic is secret as it is only known by a select number of individuals within the NBS.[93] This means theoretically that statistics are reported only after political review.[94] At the local level, the evaluation of local cadre who were responsible for reporting data on economic performance to statistical agencies depended on their economic performance. This may have provided incentives to deflate or distort data otherwise when reporting to higher ranks.[95]

Summary

It is clear that the collection of the official GDP statistic for China is a troubling process. Besides organizational problems encountered, China's stand out because of the interrelatedness of the NBS and other organisations gathering statistics and politics. It is therefore highly sensitive to falsifications and exaggeration. It is however impossible to completely reconstruct the official

[91] Holz, 'The quality of China's GDP statistics.', 321.
[92] Yuchao Zhu, "'Performance legitimacy" and China's political adaptation strategy.', *Journal of Chinese Political Science*, 16 (2011) 2: 123-140.
[93] Holz, 'The quality of China's GDP statistics.', 322.
[94] Ibidem, 336.
[95] Ibidem, 310; Barry Naughton, *The Chinese Economy,* 142.

GDP statistic and comprehensively prove possible falsifications. The collection of statistics to estimate the performance of an economy on a national scale eventually always remains a complex process prone to possible errors. The possibility of falsification therefore does not serve as the main reason to access well-being in China but does provide an extra encouragement to experiment with an alternative method to measure well-being.

3. Theory and indicators for well-being

The previous chapter has explained into detail how GDP in China is measured and what problems have arisen in this process. The suspicion surrounding the Chinese GDP statistic serves as an additional impulse to define an alternative method that measures well-being besides the flaws of GDP mentioned in the introduction. This thesis thus strives to measure actual well-being in China. In this chapter, the concept of well-being will first be decomposed into different components that are acknowledged to contribute to well-being according to the literature. Following up, different indicators are made to measure the different components of well-being. Explained will be what indicators will be used and where exactly the data is retrieved from.

3.1 Theory: decomposing the concept of well-being

It is a challenging task to define what well-being is as every individual has its own preferences and own perception of what "well-being" connotes. This thesis does therefore not claim to give a rigid, single definition of what well-being entails for all individuals in China. But, most experts and ordinary people do agree that there is a common base of various factors for every individual that facilitates a certain amount of well-being. This research draws on a comprehensive framework of well-being established by the Better Life Initiative of the OECD that has been conducted by influential researchers from around the world. This framework relies on a large number of dimensions that are agreed to interrelatedly shape people's everyday lives, are conceptually sound and are able to be expressed into gatherable data on a national scale. These can be organised into components relating to the material condition of well-being such as household income and wealth, income and jobs, housing and components relating to the quality of life such as health, work-life balance, education and skills, social connections, civic engagement and governance, personal security, environmental quality and subjective well-being. The theoretical relation between the different components of well-being according to the OECD Better Life Initiative is the following.

Household income and wealth are essential components of well-being. Income serves as a resource to satisfy people's basic needs and pursue other goals in life while wealth helps to sustain this over time. On an individual level they broaden people's choices in life, enable people to have more freedom to make choices and enable people to protect themselves against economic and personal risks. On a national level, it may not be the only component to determine welfare, but it is vital for a countries general development as it allows countries to invest in aspects such as education, health and security.[96] Via these investments on a national level,

[96] OECD, *How's life?*, 37-38.

individual well-being can indirectly be improved.

Income and jobs increase people's command over recourses, provide people an opportunity to pursue their ambitions, improve skills and ability, help to feel useful in society and build self-esteem.[97] Research has shown that unemployment has a negative effect on physical and mental health and on subjective well-being.[98]

Housing is a crucial element of material living. It provides the basic need of shelter, a place to sleep and rest and offers some sense of personal security, privacy and personal space. Also, it is important for personal health and for child development. Having a "home" is intrinsically valuable to people.[99]

Health is one of the most valuable aspects of a human life. The length of life and being free of illness and disability enables individuals to have a job, engage in social activities and pursue one's goals in life. In OECD countries, health is, together with having a job, acknowledged to be the most important valued aspect of human life.[100]

Work life balance, the ability to combine work with family and personal life, is important for personal well-being and for the well-being of the whole household. The capacity of parents to combine their work with spending time with their children strongly effects the well-being of their children. Society benefits from a balanced division between work and social, because people participate in community life and socialise.[101]

Education and skills strongly improve well-being as it opens opportunities and benefits society. The benefits of education in the literature are numerous. The fulfilment of the basic need to learn is intrinsically valuable. By learning how to understand the world around them, people become capable of understanding the opportunities they have and become increasingly capable to master their lives.[102] Directly, education has a strong positive effect on the material living conditions of people. Also, higher education leads to higher income and a better position in the job market.[103] Moreover, education is linked to a better health status as education leads to a healthier lifestyle and an increased chance of doing a job in a healthy and safe working

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[97] OECD, *How's life?*, 58.
[98] Samuel Wilson & G.M. Walker, 'Unemployment and Health: A Review', *Public Health*, 107 (1993): 153-162; Andrew E. Clark & A.J. Oswald, 'Subjective well-being and unemployment', *Economic Journal*, 104 (1994): 648–659.
[99] OECD, *How's life?*, 81-82.
[100] Ibidem, 103-104.
[101] Ibidem, 123-124.
[102] Ibidem, 145-146.
[103] OECD, 'Education at a Glance 2010', *OECD Publishing*, (2010b); Romina Boarini & E. Luedemann, 'The Role of Teacher Compensation and Selected Accountability Policies for Learning Outcomes: An Empirical Analysis for OECD Countries', *OECD Journal of Economic Studies*, (2009); Barbara Sianesi & Van Reenen, 'The Returns to Education: Macroeconomics', *Journal of Economic Surveys*, 17 (2003) 2: 157-199.

environment.[104] Furthermore, education increases civic awareness and political participation.[105] On a societal level, education raises productivity and enhances economic growth[106]. It also improves macro-economic and political stability, lowers criminality and fosters better social cohesion[107]. Education also empowers the capacity to cope with structural changes in society and creates a big innovation potential for the future.[108] By investing in education, governments and families can improve various economic and social goals at the same time.[109]

Social connections have an intrinsic pleasure for people and also have positive spill-overs for individuals and societal well-being.[110] Research has shown that people enjoy spending time with others and experience more pleasure from activities with others.[111]

Civic engagement and governance refers to the actions people can undertake to express their opinion and to contribute to the political functioning of society. Amartya Sen has argued that having a political voice is one of the basic aspects of human freedom and rights.[112] Also, research has shown that if people feel a decision is fair, people are more likely to endorse it.[113] Therefore, public policy becomes more effective with higher civic engagement.[114] Furthermore, civic engagement increases peoples sense of personal efficacy and control over one's own life.[115] Lastly, civic engagement gives a sense of belonging to a community, improves trust in others and enhances social inclusion.[116]

Environmental quality strongly influences the healthiness of people's life; quality of life is strongly affected by a healthy physical environment.[117] Research has shown that 80% of major

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[104] Koji Miyamoto & A. Chevalier, 'Education and health', In: Improving Health and Social Cohesion through Education (Paris, 2010); Gaetan La Fortune & Looper, M., 'Measuring Disparities in Health Status and in Access and Use of Health Care in OECD Countries', *OECD Health Working Paper*, 43 (2009) 1-56.
[105] OECD, *Improving Health and Social Cohesion through Education* (Paris, 2010b); Francesca Borgonovi & K. Miyamoto, 'Education and civic and social engagement', In: Improving Health and Social Cohesion through Education, (Paris, 2010).
[106] Eric A. Hanushek & L. Woessmann, 'The High Cost of Low Educational Performance. The Long Run Impact of Improving PISA Outcomes', *OECD Publishing* (2010): 1-56; Sianesi B. & Van Reenen, 'The Returns to Education: Macroeconomics', 157-199.
[107] Michael Grossman, M., 'Education and Nonmarket Outcomes', In: E. Hanushek and F. Welch, eds, Handbook of the Economics of Education, (Amsterdam, 2010a).
[108] OECD, *Education at a Glance 2010* (Paris, 2010);
[109] OECD, *How's life?*, 146.
[110] Ibidem, 170.
[111] Daniel Kahneman & A. Krueger, 'Developments in the Measurement of Subjective Well-Being', *Journal of Economic Perspectives*, 20 (2006) 1: 3-24.
[112] Amartya Sen, *Development as Freedom* (Oxford, 1999).
[113] Bruno S. Frey & A. Stutzer, 'Political Participation and Procedural Utility: An Empirical Study'. *European Journal of Political Research*, Vol. 45 (2006) 3: 391-418.
[114] Knack, S., 'Social capital and the quality of government: Evidence from the States', *American Journal of Political Science*, 46 (2006): 772-785.
[115] Benjamin R. Barber, *Strong Democracy: Participatory Politics for a New Age*, (California, 1984).
[116] Knack, S., 'Civic Norms, Social Sanctions, and Voter Turnout.', *Rationality and Society*, 4 (1992): 133-156.
[117] OECD, *How's life?*, 212; Mathew E. Kahn, 'Demographic change and the demand for environmental regulation', *Journal of Policy Analysis and Management*, 21 (2002) 1: 45–62; Mirya Holman & T. G. Coan, 'Voting Green', *Social Science Quarterly*, 89 (2008) 1121–1135.

diseases and one fourth of diseases and overall deaths are caused by poor environmental conditions.[118] Intrinsically, people enjoy the beauty of their environment and care about the loss of natural allure and the degradation of the planet.[119] Long-term structural changes in climate and biodiversity will effect human health.[120]

Personal security and the ability to live a safe life has a big contribution to well-being. A broad range of factors contribute to personal security of which most notably international and national violent conflicts and crime. The existence as well as the feeling of insecurity limit the possibilities and functioning of daily life.[121]

Subjective well-being expresses how people experience circumstances. The perception of a circumstance might be as important as the circumstance itself. It is a notion of what matters for the "Goodlife". The literature divides it into life satisfaction, positive effects and negative effects.[122]

Together these dimensions offer a comprehensive framework to decompose the concept of well-being into widely acknowledged components that contribute to a basic level of well-being. An important part of the selection criteria of the different components is based on the availability of data that can accurately measure the different components. As this research strives to measure well-being in a historical timespan, the amount of data available is limited. Certain components therefore became increasingly difficult to measure, while a few unfortunately even became impossible to measure back in time.

3.2 Indicators to measure well-being

The publication of How was Life and the underlying gathering of data by the Clio Infra project have yielded an incredibly rich amount of source material to assess components of well-being back in time. Following the listed components in the How's Life publication of the OECD, How was Life has partially been able to cover the income and wealth, income and jobs, health, education, civic engagement and governance, environmental quality and personal security dimensions. In the database of How was Life – Clio Infra database – data focussed on the historical development of well-being over 200 years. Because this research concentrates on a more recent timespan and specifically focuses on one country, some data for China between 1970 and 2010 could be augmented. Most notably, data on income and jobs could be supplemented, as

[118] Annette Prüss-Üstün & C. Corvalán, *Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease.* (Geneva, 2006).
[119] OECD, *How's life?*, 211; Carlotta Balestra & D. Dottori, 'Ageing Society, Health and the Environment', *Journal of Population Economics* 25 (2011) 3: 1045-1076.
[120] OECD, *How's life?*, 212.
[121] Ibidem, 239-240.
[122] Ibidem, 265-266.

well as data on living space to capture housing, homicide rates to complement personal security and costs of pollution to extend environmental quality. Admittedly a lot of research has been done on subjective well-being[123], but this literature is unfortunately limited to surveys conducted in the 1990s at the latest and no research has inquired well-being in China in the 1970s and 1980s. Data on work and life balance and on social connections also remains historically unavailable.

If possible, data from international independent organisations is used. But, for some indicators this is unfortunately not possible. A large proportion of the data is eventually retrieved from government statistics; either indirectly, as some data from the Clio-Infra database has been retrieved from the NBS or by directly retrieving supplementary data from for instance the Statistical Yearbooks. Although this may seem to flaw the reliability of designing a method that is besides more capable to capture well-being also more reliable than a GDP statistic that is collected by the government, this can be nuanced. For most, it remains impossible to surpass the government to gather statistics on a national level; the government is mostly the only authority capable of gathering aggregate data, especially in a state-controlled country as China. Fact is that most data on which this research will rely to measure well-being, presumably has less political sensitiveness. Certain data on key economic drivers besides GDP such as the unemployment rate has also received some criticism on its reliability and political sensitiveness.[124] But, data on for instance housing, education and crime are expected to be less prone to political pressures. Furthermore, a large proportion of the data such as life expectancy, human height and environmental quality are gathered by international researchers and the same applies to the calculation of indicators such as political institutions and personal security. Above all, this research measures well-being via a broad-diversified set of indicators coming from a vast set of different data sets collected by a large number of different researchers. Some uncertainty on the quality of the data can unfortunately never be ruled out, but the inability to cancel out every possible flaw does not mean that we are unable to grasp the development of well-being in China in the first place. In the end, this research will still be able to gauge a better account of the development of well-being than GDP has ever been able to since it actually measures well-being and deploys all available sources contributing to well-being.

In what follows, the different indicators that this research considers (overview in figure 3.1) to research well-being in China between 1970 and 2010 are explained. Clarified is how the indicators capture the various components of well-being as specified by the theory in the

[123] For an overview see: Gareth Davey & Rato, R., 'Subjective well-being in China: A review.' *Journal of Happiness Studies* 13 (2002) 2: 333-346.
[124] See: John Giles, Albert, P., & Zhang, J., 'What is China's true unemployment rate?' *China Economic Review* 16 (2005) 2: 149-170.

previous paragraph, what data is available to measure these components and how this data is retrieved.

Figure 3.1: Indicators used to cover the different components of well-being with their sources.

Component	Indicator	Source
Income and jobs	Real wage	International Labour Organisation
	Annual disposable income	Chinese Statistical Yearbook
	Household final consumption	Chinese Statistical Yearbook
	Income inequality	Clio Infra & World Bank
	Total employment	Chinese Statistical Yearbook
	Unemployment rates	World Bank
Housing	Living space	Chinese Statistical Yearbook
Health	Life expectancy at birth	Clio Infra
	Infant mortality rate	World Bank
	Human height	NCD-RisC database
Education	Illiteracy rates	Chinese Statistical Yearbook
	Average years of education	Clio Infra
Political institutions	Polity2 Index	Clio Infra
	Index of Democracy	Clio Infra
Environmental quality	SO2 (Sulphate Dioxide) emission	Clio Infra
	Biodiversity	HYDE database
	CO2 (Carbon Dioxide) emission	Carbon Dioxide Information and Analysis Centre
	Loss of Natural Capital Services (LNCS)	Wen et al.
Personal security	Homicide rates	Chinese Statistical Yearbook
	Armed internal conflicts	Clio Infra
	Armed external conflicts	Clio Infra

Income and jobs

The first component of well-being can be grouped into the category income and jobs and is captured by the indicators real wages, disposable income, household consumption, income inequality, employment and unemployment. The literature on well-being separates income and wealth and income and jobs in two categories. The former category focusses on income while the latter on how much can be earned by jobs and what the quality of these jobs is. For income, the OECD Better Life Initiative uses indicators such as household net adjusted disposable income, household net financial wealth, household final consumption and measures for inequality. Annual disposable income, household final consumption and income inequality are the measures which are available for China. The disposable income represents the possibilities individuals possess to fulfil their material needs, while the final consumption informs the material condition effectively

realized.[125] Per capita annual disposable income of households and total household consumption are available between 1978 and 2010 from the Chinese Statistical Yearbook 2018; both are expressed in the value of yuan in 2018.

The average material well-being these two indicators reflect, contains nothing about the distribution among the population, therefore income inequality is supplemented as indicator. The GINI coefficient is used as a summary measure of income dispersion in the population.[126] The GINI coefficient is the proportional area between the line indicating perfect inequality and the Lorenz curve – a curve that plots the cumulative percentage of income that is held by the cumulative proportion of the reference population. A GINI of zero means perfect equality while a GINI of one indicates perfect inequality.[127] An income GINI for the years 1970, 1980, 1990 and 2000 is retrieved from How was Life. This is supplemented by an income GINI for the years 2008 and 2012 by the World Bank.[128]

Jobs are the most important way to provide income to people. Ideally jobs are measured quantitatively and qualitatively. Quantitatively signifies the number of jobs available.[129] Employment and unemployment rates are retrieved from the Chinese Statistical Yearbook. The total number of employed in all sectors is directly retrieved from the Chinese Statistical Yearbook 2018. The unemployment rate between 1978 and 2010 is indirectly retrieved from Chinese Statistical Yearbooks via the Word Bank[130]. Both indicators are available from 1978 onwards.

Theoretically quality of jobs mainly entails the safety of the working conditions of the jobs, the earnings of the jobs, the employment security and social protection.[131] Earnings from jobs is the only available indicator for the whole time period in China. Real wages are chosen as measurement for earnings on wages. Real wages are eventually calculated in the following way. From the International Labour Organisation (ILO) the average monthly earnings of employees are obtained. This ILO has conducted an annual survey since 1924, called the October Inquiry, in which national statistical agencies worldwide are asked to share the available information on wages and prices.[132] This research has used the average nominal monthly wages for all sectors; between 1970 and 1985 the agricultural sector is excluded and for 1970-1978 only wages from the

[125] OECD, *How's life?*, 39, 40.
[126] Ibidem, 41.
[127] Ibidem, 201.
[128] World Bank, GINI Index (accessed on 11-06-2019), retrieved from: https://data.worldbank.org/indicator/SI.POV.GINI?locations=CN&view=chart.
[129] How's Life, 59.
[130] World Bank, GINI Index (accessed on 11-06-2019), retrieved from: https://data.worldbank.org/indicator/SI.POV.GINI?locations=CN&view=chart.
[131] How's Life, 59.
[132] International Labour Organisation, Monthly average wage (accessed on 11-06-2019), retrieved from: https://www.ilo.org/ilostat/faces/ilostat-home/download?_adf.ctrl-state=m2bn44de_78&_afrLoop=4243661509694882#!.

public sector is available. These average wages are corrected by the Consumer Price Index (CPI). This CPI is retrieved from the Chinese Statistical Yearbook 2011. Between 1985 and 2010 this CPI is yearly available, before 1985 only data for a few years is available.

Housing

As an indicator for the housing conditions, living space is used as a proxy. This serves as a basic proxy to gauge the housing situation, although it obviously does not include the quality of the square meters of living space in terms of where the house is situated (to which extend is it exposed to pollution) or quality of the house itself (such as sanitary facilities, availability of electricity and the quality of the building materials).[133] Per capita living floor space of residential building is retrieved both for urban and rural areas. The Chinese statistical yearbooks 1999, 2005 and 2011 are the sources for living space between 1978 and 2010.

Health

Life expectancy and human height serve as indicators for health. As health concerns different dimensions such as the length of a life, the presence and severity of chronic conditions, and many aspects of physical morbidity and mental health, it is difficult to capture into one indicator.[134] Health can be studied via morbidity (illness and injury) and mortality (death). Because mortality is clearer cut than measuring morbidity – death is easier definable than a huge range of different illnesses that exist – the literature relies on mortality as an indicator of health.[135] Life expectancy at birth available from the Clio Infra database is a summary measure of mortality on average of all age groups.

It is important to keep in mind that high infant mortality rates can heavily influence the life expectancy at birth as these drive the average life expectancy down.[136] Life expectancy is based on the average life expectancy of all age groups at one period of time and if mortality rates are high this drives the life expectancy unproportionable down. Therefore, infant mortality rates, or the mortality rate under 5 years of age per 1000 births, derived from the World Bank are added as a second indicator to compensate for this flaw.

Human height is a third indicator for human health. The link between health and human height is not straight forward as other components of well-being such as environmental quality and the quality of housing also contribute to human height. Much evidence confirms the relationship between health and height: the main rationale is that the growth of a human body is

[133] OECD, *How's life?*, 82.
[134] OECD, *How's life?*, 103.
[135] Van Zanden et al., *How was Life*, 102.
[136] Ibidem, 103.

dependent on the nutrition it receives.[137] Height thus reflects the nutritiousness of the diet. Although nutrition focusses on the amount of proteins, the amount of proteins alone do not give a balanced diet which should also include grains, vegetables and fruits. Historical research has however suggested that large amounts of protein are necessary to generate antibodies that fight infectious disease.[138] Data on human height for China between 1970 and 1996 is retrieved from the NCD-RisC database. This database has reanalysed 1472 population-based studies for 200 different countries.[139] It reports average wages for females and for males. For simplicity reasons for calculation, one average height of males and females is calculated using the gender ratio reported by the Clio-Infra project.[140] Caused by the fact that the measurement of heights is done only for adults and that adults born in the second half of the 1990s have not reached their final adultery stature yet, 1996 is the last year of measurement for human height.

Education

Education is measured by literacy and the average years of education. Literacy is measured by illiterate rates that indicate the amount of people illiterate as a percentage of the total population. Statistics on illiteracy between 1964 and 2010, for every 10 years are retrieved from the National Population Census in 1954, 1982, 1990, 2000 and 2010 are available in the Chinese Statistical Yearbook 2011. In the literature, literacy is not considered to be a comprehensive indicator for education in the 20th century as technological change required a level of knowledge that exceeded merely the ability to read. [141] Where literacy rates have reached almost 100% in most countries in the 20th century, this was not the case for China at the beginning of the 1970s. This may have something to do with the fact that the Chinese language does not have an alphabet but consists of a vast amount of characters which could arguably be harder to learn. Furthermore, different minorities speak different types of Chinese and learning Mandarin Chinese may be hard for particularly elderly people.[142] Because illiteracy rates were still high at the beginning of the examined time period, it still seems a valuable indicator for education in China.

Average years of education is a common used method to measure education in the literature. Even more common is the use of educational attainment, but where educational

[137] Van Zanden et al., *How was Life*, 118-120.
[138] David Grigg, 'The Pattern of World Protein Consumption', *Geoforum* 26 (1995) 1: 1-17; Hans de Beer, 'Dairy products and physical stature: A systematic review and meta-analysis of controlled trials', *Economics and Human Biology*, 10 (2012) 3: 299-309.
[139] Majid Ezzati et al., 'A century of trends in adult human height', *eLife* (2016); NCD-RisC database, Human height (accessed on 11-06-2019), retrieved from: http://ncdrisc.org/.
[140] Van Zanden et al., *How was Life*, 217-249.
[141] Ibidem, 88-89.
[142] Minglang Zhou, 'Legislating literacy for linguistic and ethnic minorities in contemporary China', *Current Issues in Language Planning* 6 (2005) 2: 102-121.

attainment only reveals that an individual has received certain education[143], average years of education captures the amount of years of education that an individual above 15 years has enjoyed. Data on the average years of education is available from the Clio Infra Project for every 10 years since 1970.

Political institutions

The degree of freedom people enjoy and their capacity to shape their political and social environment is for a significant part dependent on the political institutions. Evidence has been found on the effect of political institutions on social life such as democracy and happiness.[144] Political institutions are difficult to measure as it includes the rule of the law, the amount of corruption experienced in everyday life, the quality of governments, the extent of democracy, the nature of elections, the stability and duration of political regimes and the characteristics of elections.[145]

The Polity2 index is the first measurement to historically measure political institutions. It is designed to capture the political regime of every country. Every country is assigned a score between +10 (fully democratic) and -10 (fully autocratic). This composite index is based on six component variables; i) the regulation of chief executive recruitment; ii) the competitiveness of executive recruitment; iii) the openness of executive recruitment; iv) executive constraints; v) the regulation of participation; and vi) the competitiveness of participation. These six components are combined to compute a "autocracy and democracy index", which ranges between 0 and 10.[146]

The Index of Democracy is a composite score of political score and political participation. Political score is calculated by one minus the share of votes by the winning party, while political participation is the percentage of the adult population who cast a ballot in the election. A lack of participation or competition results in a score of zero. Participation depends on the enfranchisement of the population and the voter turnout during elections, while competition reflects the dominance of a single opinion within the parliament. A significant majority of seats within the parliament may on the one hand maintain stability but may on the other hand suppress the expression of other alternative views and the probability of change in the future government.[147] The overall theory both methods apply to is the "minimalist approach"

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143 Van Zanden et al., *How was Life*, 89.
144 Bruno Frey & A. Stutzer, *Happiness and Economics* (Princeton, 2010); Adam Przeworski et al., *Democracy and Development. Political Institutions and Well-being in the World, 1950-1990* (Cambridge, 2000).
145 Van Zanden et al., *How was Life*, 160-161.
146 Ibidem, 162. A full explanation of the polity2 index can be found in Marshall, M.G.K. Jaggers & T.R. Gurr, 'POLITY IV project Political Regime Characteristics and Transitions, 1800-2010' *Dataset Users' Manual* (2011). www.systemicpeace.org/inscr/p4manualv2010.pdf.
147 Van Zanden et al., *How was Life*, 162. A full explanation of the Index of Democracy can be found in Tatu Vanhanen, *Democratization: A Comparative Analysis of 170 Countries* (London, 2003).

towards democracy; this covers the basic attributes of democracy (the "thin" approach) and does not cover the "thick" approach which makes the variables a very general proxy of democracy.[148] Both the Polity2 Index and the Index of Democracy are retrieved from the Clio Infra dataset. In the dataset the "Latent Democracy Variable" captures both the Polity2Index and the Index of Democracy.

Environmental quality

The literature differentiates between three important dimensions of environmental quality: pollution, the loss of biodiversity and climate change. The first indicator for environmental quality, SO2 (Sulphate Dioxide) emission, serves as a proxy for pollution. Health, and thereby human well-being, are negatively affected by pollution. Increased emission of the toxic sulphate gas as a result of fossil burning, harms aquatic animals and forestry due the so-called acid rain which decomposes the increased concentration of sulphate.[149] SO2 is measured by aggregating the emission of SO2 by the oil, coal and natural gas combustion, land-use and ocean bunker fuels which together contribute for 90% of SO2 emissions.[150]

The second indicator for environmental quality is biodiversity loss. A well-functioning ecosystem contributes to human well-being by providing nutrients cycling, the natural processing of carbon emissions and fresh water and air. The functioning of this ecosystem depends on the diversity of animals, plants and micro-organisms at genetic, species and ecosystem levels; the biodiversity. A loss or gain of biodiversity will thus affect well-being. The variable loss of biodiversity therefore indicates the quality of the ecosystem by examining the said loss. Retrieved from the Clio Infra Project, biodiversity loss is measured by the so-called Mean Species Abundance (MSA) that measures the intactness of biodiversity. It measures the amount of different species remaining as a proportion of the amount of different species originally available in pristine vegetation, assumed that this vegetation has been untouched by human activity for a prolonged period. A MSA of 100% would thus indicate that all species originally apparent in a certain vegetation are still apparent after a prolonged, untouched period and that there is no loss in biodiversity. An overall MSA was calculated by subtracting the total land available by the land made into use serving as cropland, grazeland (pasture) or urban (build-up) land.[151] Necessary historical estimates for this calculation such as the amount of cropland, pasture and build-up area

[148] The destinction between thin and thick approaches of democracy is made by Michael Coppedge, 'Defining and measuring democracy', *International Political Science Association working paper* (2005) 1-57.
[149] Van Zanden et al., *How was Life*, 180-182.
[150] Ibidem, 182.
[151] Ibidem, 182-183.

are initially retrieved from the HYDE database.[152] It must be stressed that this is an imperfect method of measuring the quality of an ecosystem and that complementary indicators should be added to fully capture the complex concept of biodiversity.[153] But, for grasping the development of biodiversity for this historical research, it is acknowledged to be a sufficient method as it is widely used for assessments of biodiversity in the United Nations Environment Programme Environmental Outlook and the OECD's Environmental Outlook.[154]

Thirdly, CO2 (Carbon Dioxide) emission is used as an indicator for climate change. Carbon emission in the form of carbon dioxide (CO2) and methane (CH4) has increased due to the burning of fossil fuels. Both carbons absorb and retain heat in the atmosphere and contribute to a greenhouse effect. This has disturbed the earth's natural balance of carbon and has caused changes in temperature. Change in climate as a result of this global warming will affect the well-being of future generations. Because data on carbon dioxide is widely available in the Carbon Dioxide Information and Analysis Centre (CDIAC), CO2 is chosen as the indicator for climate change.[155]

Additionally, data on environmental quality of the Clio Infra dataset is supplemented by data on the costs of natural resource depletion calculated by Wen et al.[156] One of the big drawbacks of GDP mentioned in chapter 1.1b, is that GDP not only fails to incorporate the costs of environmental damage but furthermore counts environmental damage double; the productivity gained at the cost of the environment as well as the productivity retrieved from the effort to resolve environmental damage are incorporated in the GDP statistic. Wen et al. has calculated the cost of lost natural capital services (LNCS) which captures a broad range of environmental costs. The environmental costs consist of the cost of non-renewable resource depletion, the cost of land degradation, the cost of timber depletion, the cost of urban waste-water pollution, the cost of air pollution and the cost of long-term environmental damage.[157] It would make more sense to incorporate the actual data on resource and timber land depletion et cetera, but the data of the individual environmental depletion is only published to the public in terms of resource depletion explicated in money; the LNCS. As these environmental resource depletions are an important part of environmental quality in China and are not covered in the

[152] Klein Goldewijk et al., 'The HYDE 3.1 spatially explicit database of human induced land use change over the past 12 000 years', *Global Ecology and Biogeography*, 20 (2011): 73-86.
[153] Van Zanden et al., *How was Life*, 182-183.
[154] UNEP (United Nations Environmental Programme) *GEO 5 – Fifth Global Environmental Outlook* (Paris, 2012); OECD, *OECD Environmental Outlook to 2050: The Consequences of Inaction* (Paris, 2012).
[155] Van Zanden et al., *How was Life*, 183.
[156] Wen et al., 'From GDP to GPI', 228-259.
[157] For full explanation of the exact calculation these variables, see: Wen, Z., Yang, Y., & Lawn, P. A., 'From GDP to GPI: quantifying thirty-five years of development in China.' In: Lawn, P. A., & Clarke, M. (Eds.). *Sustainable welfare in the Asia-Pacific: studies using the genuine progress indicator.* (Cheltenham, 2008).

other indicators, this research has chosen to incorporate the LNCS calculated by Wen et al. as such.

Personal security

The most important indicator for personal security is crime. Violent conflicts and crime affect the personal security of people. The vocal indicator for crime in the literature is homicide (murder). It is one of the most serious crimes and effects people well-being not only heavily via the effect on the environment of the victim of the homicide, but also indirectly by contributing to a feeling of unsafety when it receives a lot of media coverage. Homicide furthermore tends to be correlated with other violent crimes in OECD countries, making it a reasonable proxy for crime.[158] The number of homicides per 100.000 people (the homicide rate) data is retrieved indirectly from the statistical yearbooks for the period 1978-1999 via a publication by Liu[159]; from 2000 to 2010 the intentional homicide rate published by the World Bank is used.[160]

The second indicator for personal security is the amount of armed conflicts: internal conflicts such as revolutions, rebellions, civil wars, and unrest and ethnic cleansings and external wars including wars between countries and interventions.[161] Data on conflicts leading to more than 32 deaths are gathered in the Conflict Catalogue.[162] This is a very broad indicator of personal security that only incorporates officially reported large scale violent events.

158 Van Zanden et al., *How was Life*, 140.
159 Jianhong Liu, 'Crime patterns during the market transition in China.', *British Journal of Criminology* 45 (2005) 5: 613-633.
160 World Bank, homicide rate (accessed on 11-06-2019), retrieved from: https://data.worldbank.org/country/china?view=chart.
161 Van Zanden et al., *How was Life*, 141.
162 Peter Brecke, 'Violent Conflicts 1400 A.D. to the Present in Different Regions of the World', Paper prepared for the 1999 Meeting of the *Peace Science Society* (1999): 1-30.

4. Results

This chapter presents the results of this research. The previous chapter laid out the theoretical framework for well-being and explained where the data to understand well-being in China between 1970 and 2010 is retrieved from. In the first paragraph of this chapter the results of this gathered data are presented. On the basis of the development of the various indicators that together constitute the underlying concept of well-being a first gauge of the development of well-being is provided. The second paragraph then applies to different methods to capture all separate indicators into one compiled indicator for well-being. First, the rationale for the chosen methods is explained, then the exact execution of the methods is specified. Eventually, the result is a compiled well-being indicator which allows a comparison between the development of well-being with the development of GDP per capita for China between 1970 and 2010 in chapter 5.

4.1 Well-being: trend per indicator

Below the output of the gathered data as reported in previous chapter 3 is presented. Per component of well-being the results are presented in two ways. First, per component the results of all indicators are separately shown in their initial unit of measurement. This allows us to understand the development of every individual indicator that constitutes a component of well-being. Secondly, the indicators that together constitute a certain component of well-being are displayed in one graph. In order to be able to compare all indicators together, the well-being indicators are standardized. Standardizing is a widely acknowledged way to compare variables that are expressed on different scales.[163] All indicators are measured on different scales and use different units of measurement. Standardizing all indicators allows us to compare all different indicators on a comparable scale. Standardization is done by computing the Z-score of every variable. The Z-score (Z) is simply computed by subtracting the observation (x) by the mean of the indicator over time (μ) and dividing by its the standard deviation (σ). This is expressed in the following function: $Z = (x - \mu) / \sigma$

Once all indicators are standardized, the development of a component of well-being can be displayed in one graph and enables us to understand its trend. This brings us to the following results.

[163] Morris D. Morris, 'The Physical Quality of Life Index (PQLI)', *Development Digest* 18 (1990) 95-109; Human Development Report 2010, *The Real Wealth of Nations: Pathways to Human Development* (New York, 2010); Romania Boarini & M. Mira D'Ercole, 'Going Beyond GDP: An OECD Perspective' *Fiscal Studies* 34 (2013): 289-314; Michela Nardo et al., 'Handbook on Constructing Composite Indicators: Methodology and User Guide', *OECD Statistics Working Papers* 03 (2005): 1-162.

Income and jobs

The trends of the individual indicators that constitute to jobs and earnings are displayed in figure 4.1. Disposable income and consumption both show a gradual increasing trend. In 1978 disposable income was 171,2 Yuan per capita and household consumption was 184 Yuan. This dramatically increased to a level of 12.519,5 Yuan of disposable income and 10.919 Yuan household consumption in 2010. Both thus seem to display an almost similar trend. This correlation is however not surprising as an increase in the amount of disposable income theoretically means more room for consumption.

A similar trend is shown for real wages. In 1970 the average monthly real wage was 51 Yuan. Recall that the real wages between 1970 and 1978 were only real wages for the public sector and excluded agriculture. At the end of the 1970s, real wage was still only 59 Yuan in 1979. From then on it started to almost exponentially grow: in 1985 the average real wage was 92 Yuan, in 1990 178 Yuan, in 2000 781 Yuan and in 2008 it was a vast amount of 2436 Yuan. This is thus a staggering increase of average monthly real wages. Keep in mind that this is the monthly wage; so, where disposable income was 12.519,5 Yuan and consumption was 10.919 Yuan, real wage was approximately (2436 per month times twelve months) 29.232 Yuan in 2010. Also, it is expressed in Yuan: in 2010 1 US dollar was worth 6,83 Yuan which means that the average real wage was 4.279,94 US dollar a year.[164]

The unemployment rate was 5,4 percent in 1980 and in four years' time decreased substantially to 1,8 percent in 1985. From 1985 onwards, the unemployment started to steadily increase and was at about 4 percent in 2010. The total number of employments shows a steady increase over the whole period 1970-2010 with a remarkable increase over the year 1989 to 1990. The overall increase in the number of employments can be logically be linked to the constant population growth over the time period (green line figure 4.1 middle right).

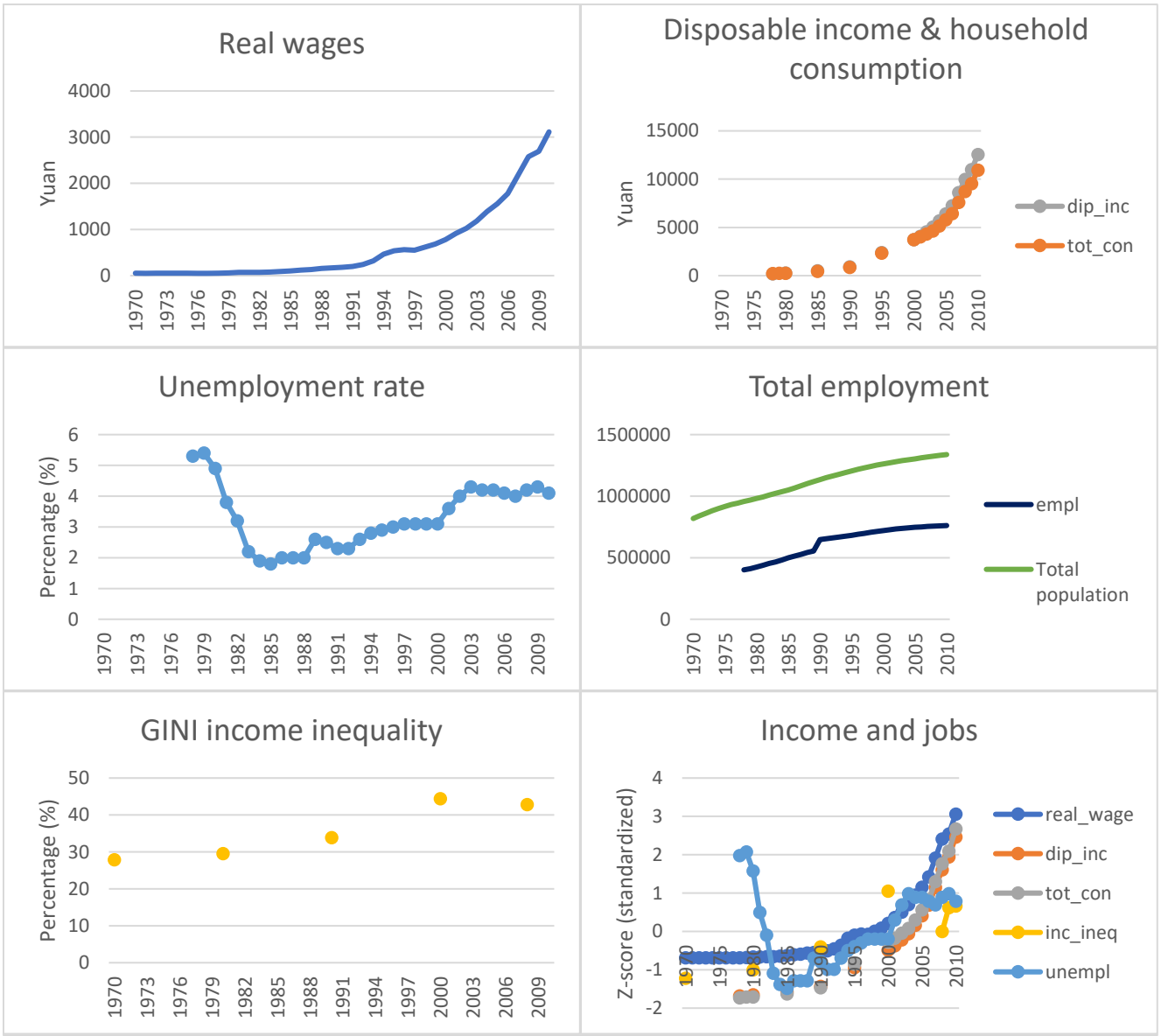
Income inequality increases with a GINI coefficient of 27,9 in 1970 to 44,43 in 2000, which indicates a strong increase of income inequality between 1970 and 2000. After 2000 the GINI coefficient levels off to around 42 in 2010. Although there is no common agreement on how to interpret the GINI coefficient exactly - hypothetically a GINI of 0,5 would indicate that 50% own all income but this is practically not feasible as the poorest need at least some income to live[165] - a GINI between 44 and 42 is acknowledged to be quite high given that it used to be 27,9 in 1970. Compared to other countries around the world the absolute level of income

[164] Macro trends, dollar yuan exchange rate (accessed on 11-06-2019), retrieved from: https://www.macrotrends.net/2575/us-dollar-yuan-exchange-rate-historical-chart.
[165] Inequality.org, U.S. inequality: just how unequal?', (version 12-02-2012) retrieved from: https://inequality.org/research/unequal-americas-income-distribution/ (Accessed on 11-06-2019).

inequality is higher than most European countries, on the same level as other Asian countries, slightly lower than African and Middle Eastern countries and comparable with the United States. The development of income inequality has in any case worsened between 1970 and 2010.

In figure 4.1 bottom right all five indicators that together theoretically contribute to income and jobs are displayed in one graph. The amount of disposable income, consumption and the real wages have increased strongly. The flip side of the coin is that the increased amount of disposable income earned has been unequally divided as the income distribution has worsened; the unemployment rate has also worsened slightly between 1985 and 2010. Both the worsening of the income inequality and the unemployment did stabilize during the last decade.

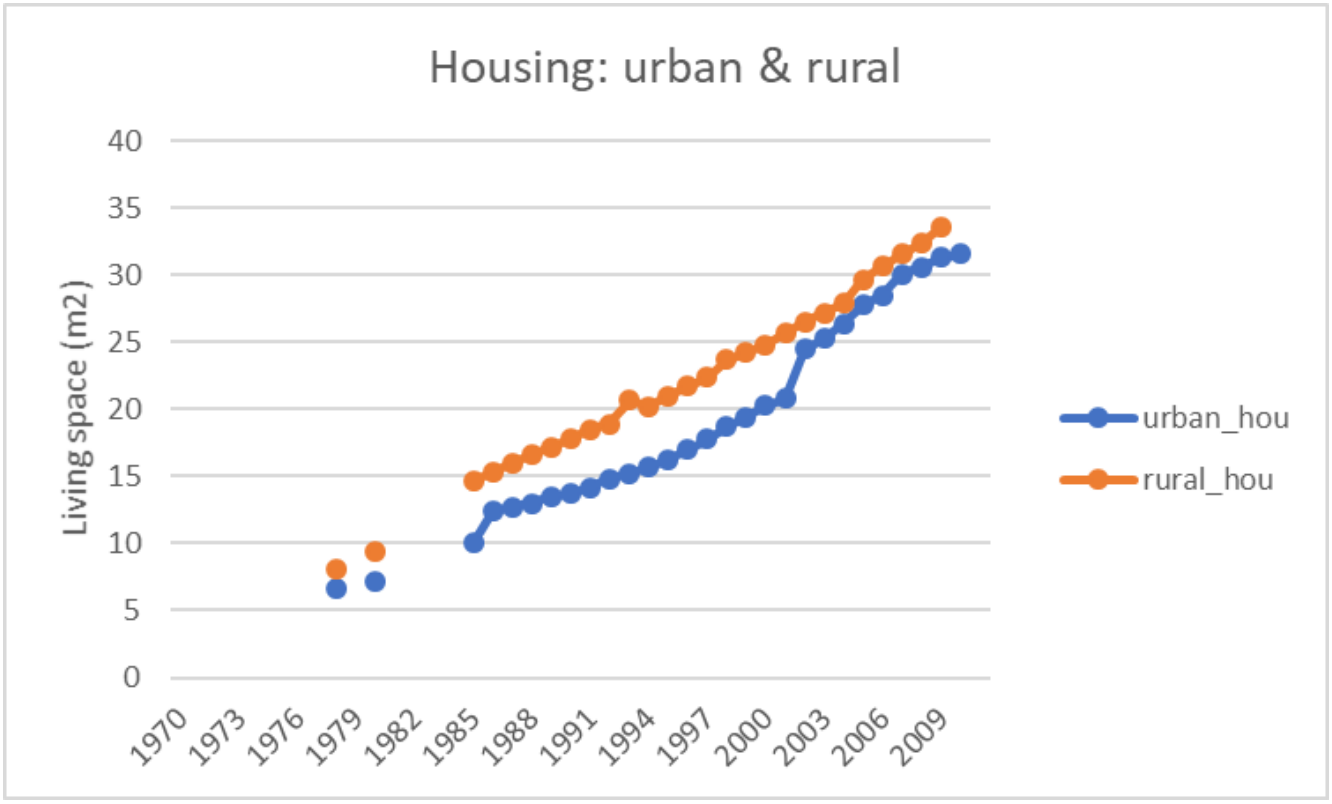
Figure 4.1: Income and jobs



Housing

As shown in graph 4.2, the average amount of square metres of living space has steadily increased in both urban and rural areas between 1978 and 2010. In 1970 the average amount of square metres on which people lived was 6,7 square metres for houses in urban areas and 8,1 square metres in rural areas. The living space in rural areas continued to be slightly bigger than in urban areas but both urban and rural housing improved at more or less the same pace and in 2001 the amount of living space in urban areas catches up with the living space in rural areas. In 2009 the average living space was 31,3 and 33,6 square metres for urban and rural housing respectively. Housing conditions in terms of living space have thus steadily improved in China between 1970 and 2010.

Figure 4.2: Urban and rural housing

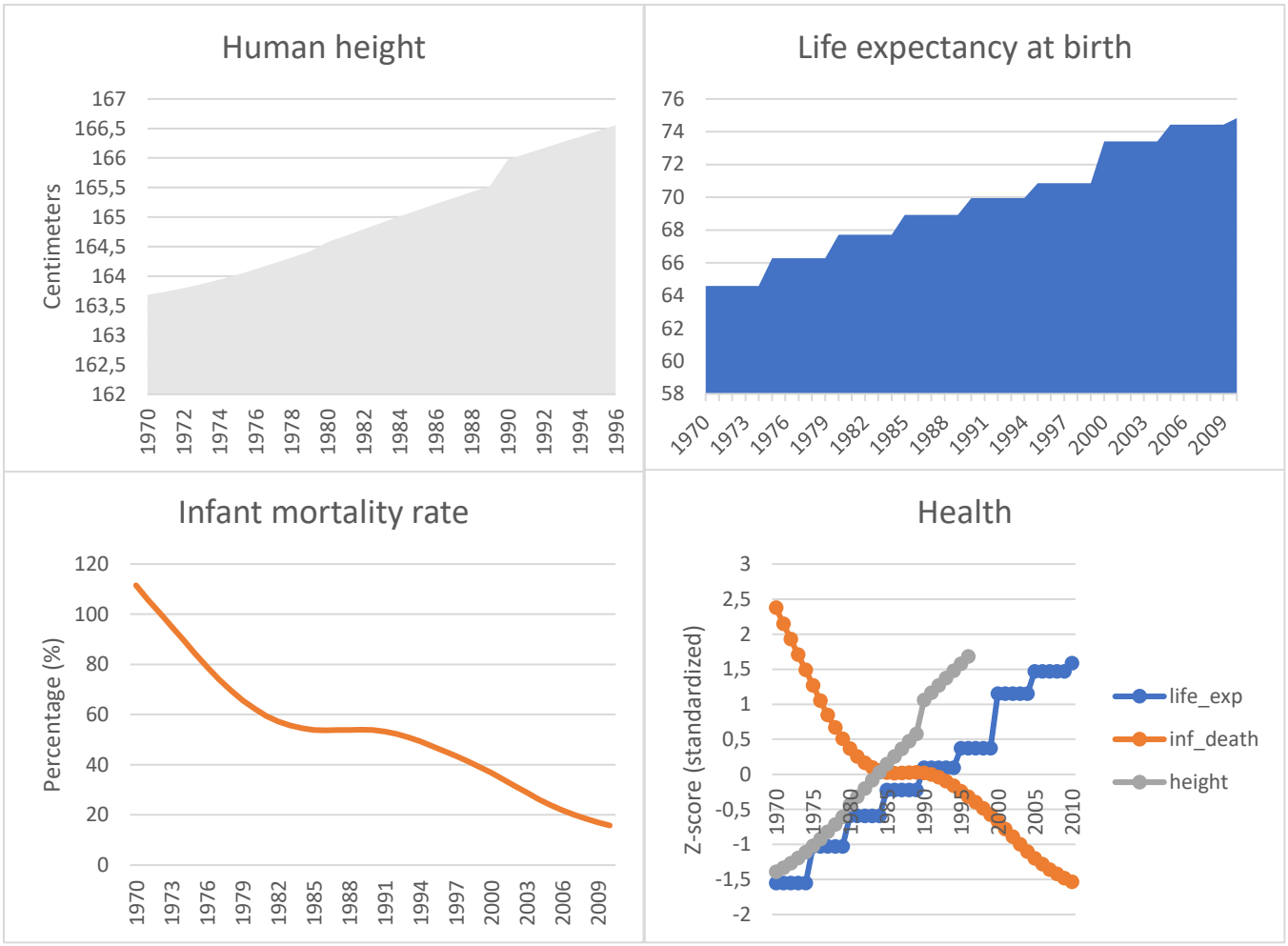


Health

Figure 4.3 displays the trends of the separate indicators of health. Human height steadily increased; where in 1970 the average height was 163,68 centimetres, it was 166,6 centimetres in 1996 (the birth year of the latest full-grown young adults). Also, the life expectancy steadily increased (life expectancy was only available for every five years which explains the shape of the curve) from a life expectancy of 64,58 years for individuals born in 1970 to a life expectancy 74,83 for individuals born in 2010. This entails that in 40 years' time, life expectancy increased with 10 years which is substantial. Increased life expectancy is also reflected in the decreasing

infant mortality rates. Over the whole period the mortality rate under 5 years of age per 1000 births decreased. Between 1980 and 1988 the mortality rate stabilized but after 1988 it decreased further ending with an infant mortality rate reaching 15,8% meaning that per 1000 births 15% of all children under 5 years of age died while this used to be 111,5 % in 1970.

Figure 4.3: Health



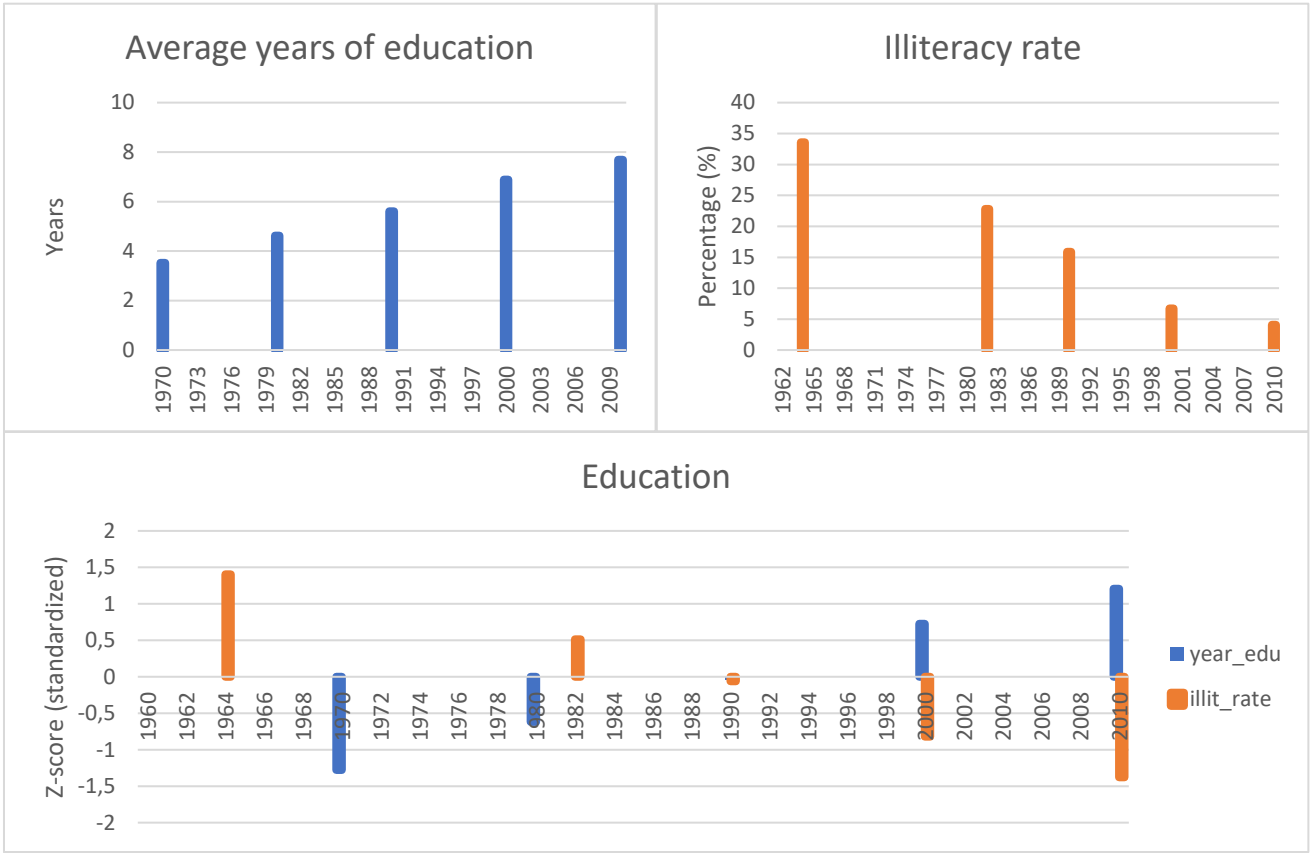
As confirmed in figure 4.3 bottom right, health has improved in China between 1970 and 2015. Height and life expectancy made huge improvements while the infant mortality rates dramatically decreased. The average Chinese born in 2010 thus lived ten years longer, grew 3 centimetres taller and was much more likely to survive the first five years after birth than the average Chinese born in 1970.

Education

The indicators for education (figure 4.4) show a constant improvement between 1970 and 2010. In 1970 the average years of education in China for a person older than 15 years was 3,5 years; every ten years the average years of education enjoyed an increase at slightly more than one year and rose to 7,7 years in 2010. Over the period between 1964 – which is the starting point as only

the national census of 1964 gave data on illiteracy between 1964 and 1982 – and 2010 the illiteracy rate decreased at a constant rate. In 1964 the illiteracy rate was very high with 33,58 of the population being illiterate; in 1982 this had decreased to 22,81 percent, in 1990 to 15,88 percent and in 2010 it was only 4,08 percent. Recall that a decrease in the illiteracy rate implies an improvement as it is the inverse of the literacy rate. Education measured in terms of the average years of education and the illiteracy rate thus improved between 1970 and 2010 as can be seen in figure 4.4 bottom.

Figure 4.4: Education

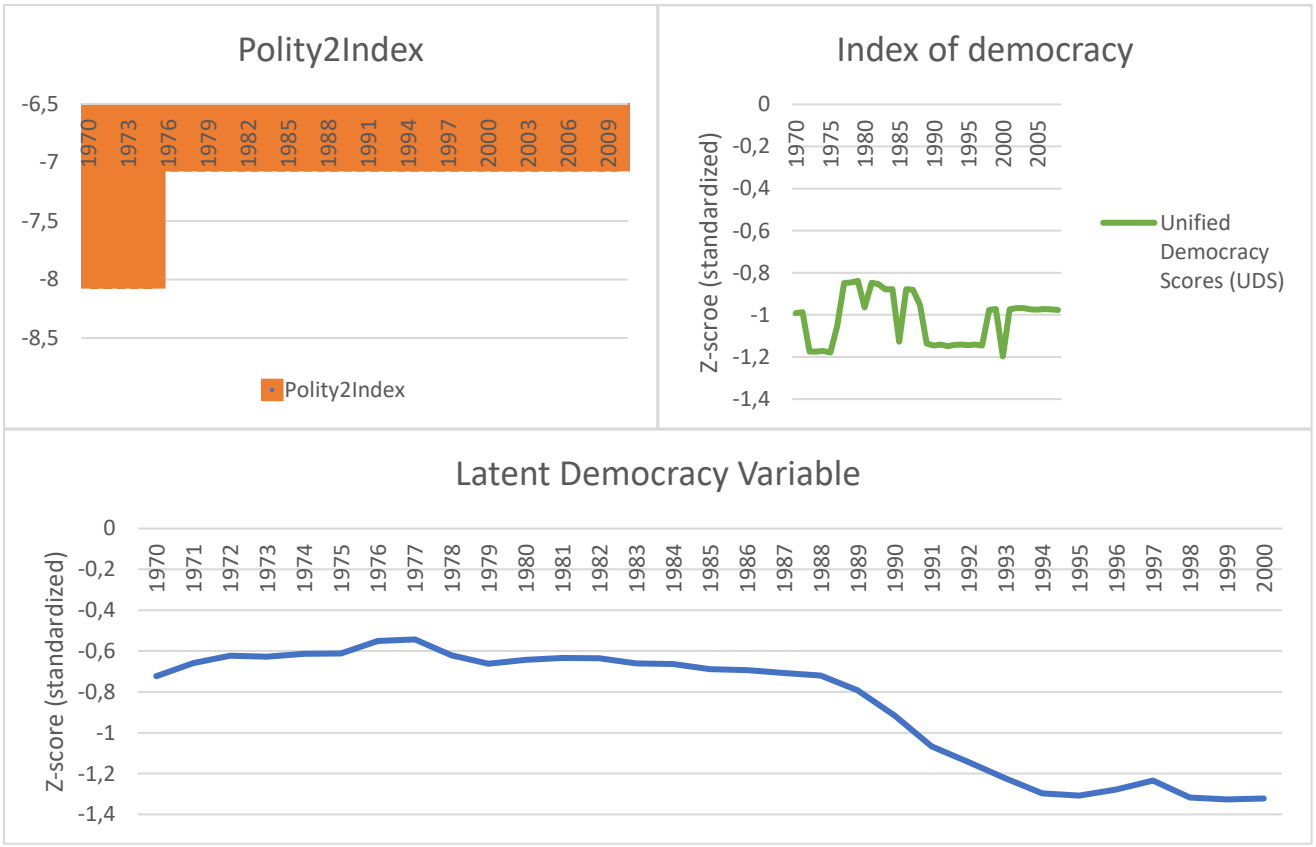


Political institutions

The Latent Democracy Variable that is designed to represent the quality of the political institutions remains at a more or less constant level between 1970 and 2001 (Figure 4.5). In the 1990s it almost doubles negatively and stays at this level going into the new millennium. Recall that the Latent Democracy Variable represents the underlying development of both the Polity2 index and the Index of Democracy. The Polity2 index is the equivalent of the "autocracy and democracy index" and assigns a score to every country between +10 for fully democratic and -10 for fully autocratic. As figure 4.5 shows, China had a score of -8 between 1970 and 1976 which slightly improved to -7 in 1976 but remained at this level until 2010. With a score of between -8 and -7 over the time period 1970-2010 it can be considered to be fairly autocratic.

The Index for Democracy (figure 4.5 bottom) neither becomes positive over the whole period 1970-2010 nor shows any signs of improvement. This democracy index measured the political participation and competition, and both can thus considered to be low for China. On the basis of the scores in the Polity2 index as well as the scores in the Democracy Index, China scores poorly on the basic attributes of democracy and has shown more signals of deterioration than improvement of its political institutions between 1970 and 2010.

Figure 4.5: Political institutions

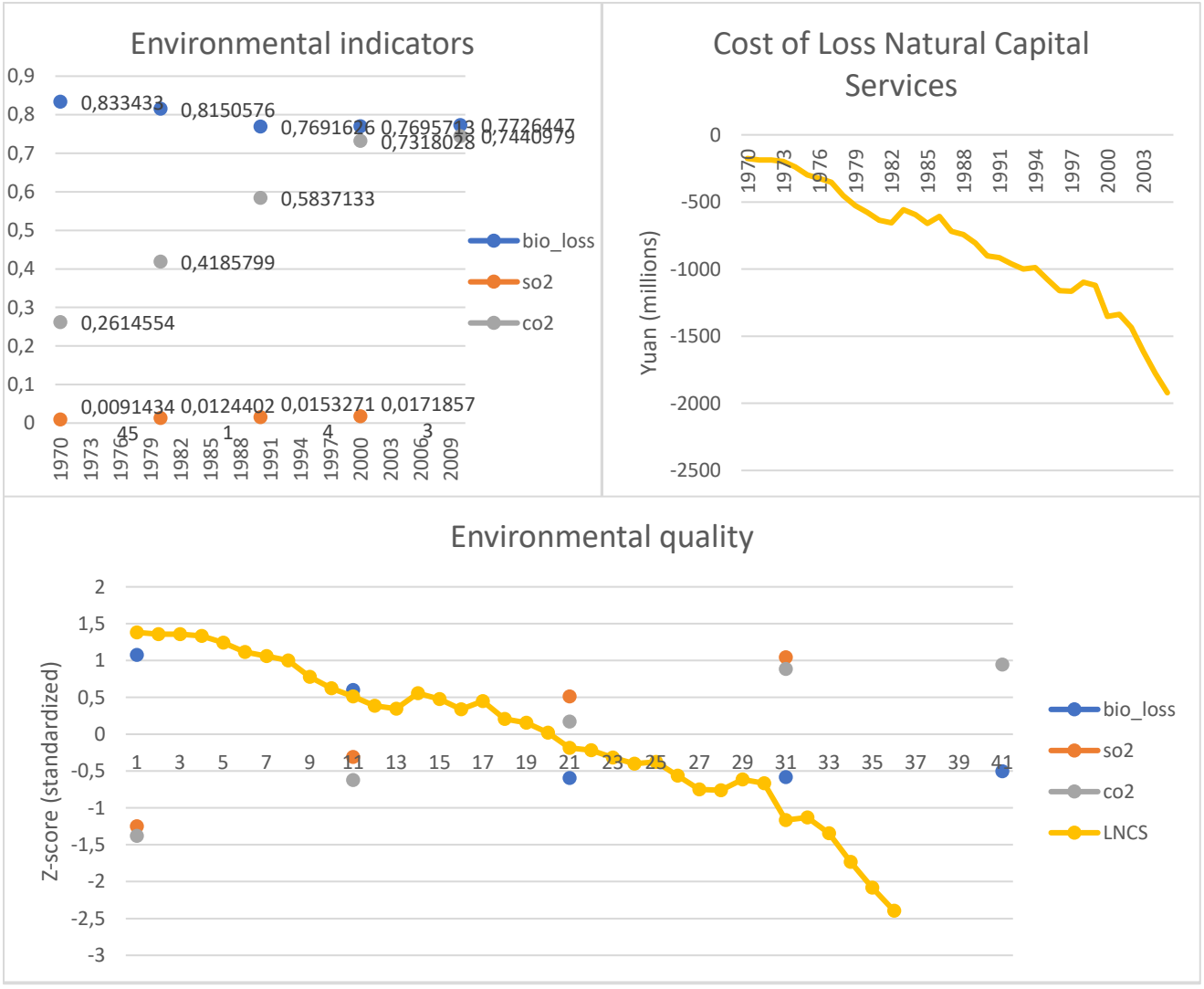


Environmental quality

The indicators for environmental quality show the following trend (figure 4.6). Firstly, both SO2 and CO2 per capita emission show an increasing trend. Sulphate Dioxide (SO2) may seem to increase less than CO2 when using the initial units of measurement for both, but SO2 simply has a lower value, since a concentration of SO2 is much more toxic than the same concentration of CO2 is. Once the values are standardized in figure 4.11 it becomes apparent that both SO2 and CO2 per capita emission follow more or less the same trend. Secondly, biodiversity loss and the LNCS show an overall decreasing trend. Recall that the measurement for the loss of biodiversity is the Mean Species Abundance. This variable measures the intactness of biodiversity; a value of 100% would indicate that the biosystem is intact and that the biodiversity is at full strength. A decrease in the variable thus means that the percentage of species abundant increases, and that

biodiversity is lost. The biggest loss of biodiversity was between 1980 and 1990: in 1970 the Mean Species Abundance was 83,3%, in 1980 this was 81,5% and in 1990 it had dropped to 76,9%. In 2000 it was at the same value as in 1990 but in 2010 it decreased again to 77%. A similar explanation applies to the cost of lost natural capital services (LNCS). The downward trend of LNCS indicates that the costs as a result of a broad set of categories of environmental damage have increased over the period 1970-2005. In 1970 the cost of loss of natural recourses was 743 billion yuan (in value of 2005 yuan). This rapidly increased during the entire period with a few minor upsurges in which the costs stabilized in notably 1983 and between 1996 and 1998. Between 1998 and 2005 the costs increased with 799 billion yuan, from 1,122 billion yuan in 1998 to 1,921 billion yuan in 2004. The quality of the environment has thus undoubtably deteriorated in China between 1970 and 2010; pollution has increased, climate change intensified, the biodiversity reduced, and the resource depletion enlarged, which is represented by the rising SO2 and CO2 emission, declining MSA and expanded LNCS respectively.

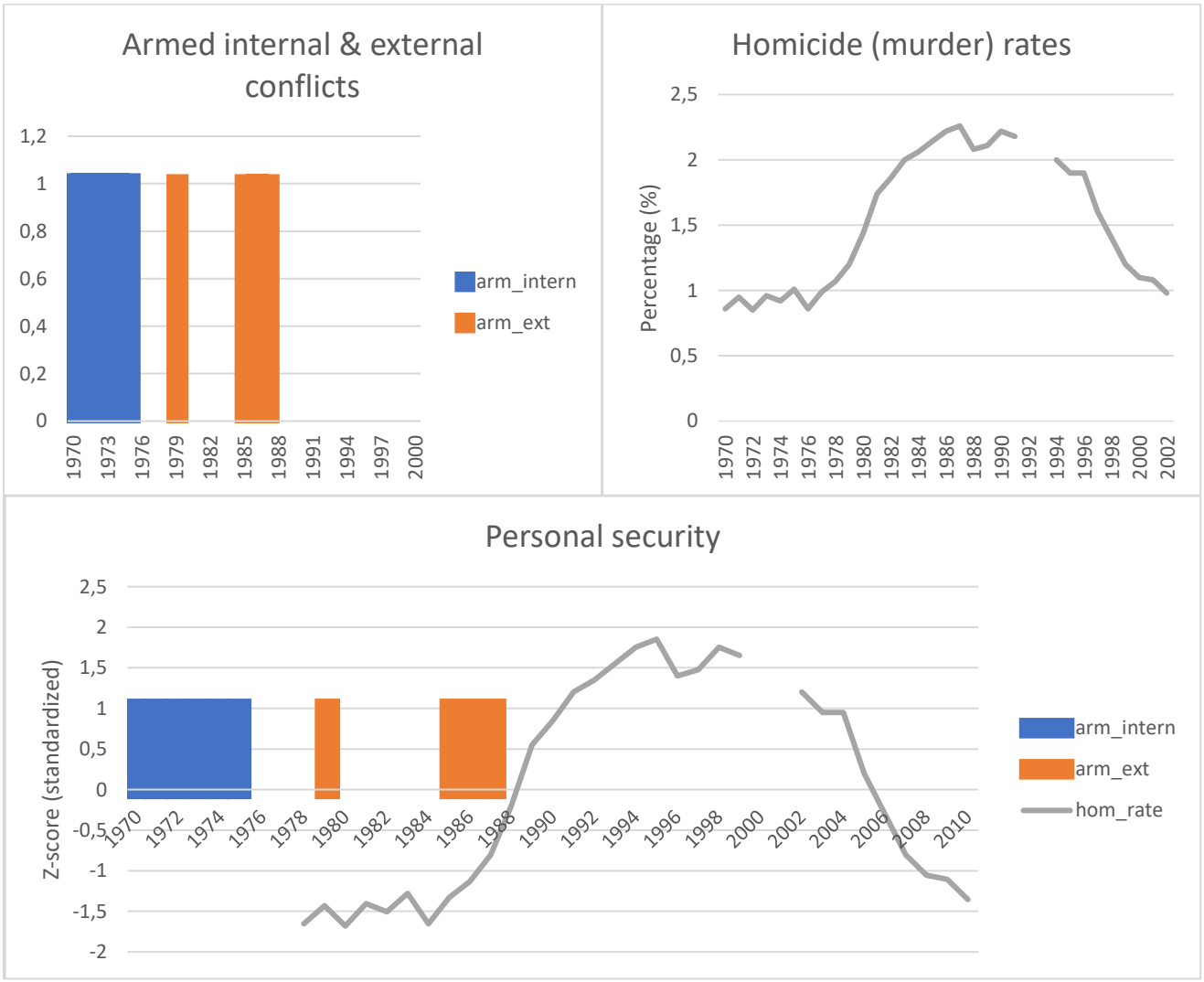
Figure 4.6: Environmental quality



Personal security

A clear gauge of the general development of personal security is difficult. The homicide rate, which represents the number of murders per 100.000 people, rapidly increased from 0,84 percent in 1984 to 2,26 percent in 1994 (figure 4.7). After 1994 homicide rates started to decline and in 2010 returned to the level it was at during the 1978-1984 period. Categorized in a dummy variable figure 4.12 (right) it has shown that between 1970 and 1976 there were reported internal conflicts with at least 32 casualties. Considering international conflicts, there were conflicts in 1979 and between 1995 and 1997 in which there were more than 32 deadly victims. From 1997 onwards, there were no reported internal or international conflicts anymore. Based on these indicators together (figure 4.7 below), personal security seemingly improved in the 2000s with declining homicide rates and no large-scale violent conflicts.

Figure 4.7: Personal security



Summary

Overall, the following results can be summarized. On the basis of our data, three components of well-being have undoubtably improved in China over the time period 1970 and 2010. First, the housing conditions in terms of the square meters on which people lived in urban as well as rural residential areas have improved. Second, health has made big advancements: the life expectancy and the average human height have constantly risen and the infant mortality has decreased. Third, education has made progress: the average Chinese has enjoyed more years of education and the illiteracy rate has dropped significantly.

Also, personal security and income and jobs give a prevailing positive picture. Only in a few time periods, in respectively the 1970s and the 1990s, there have been large-scale internal and international violent conflicts in a few years. The homicide rates were relatively high in the 1990s compared to around 1980 but restored to the level of around 1980 in 2010. For income and jobs, the per capita disposable income, consumption and real wages have improved substantially. The number of employments increased, while the unemployment rate has fluctuated but never reached a high level. Only income inequality has endured a negative development and has deteriorated over the time period.

The quality of the environment and the political institutions have definitely deteriorated between 1970 and 2010. In these years the per capita SO2 and CO2 emission expanded, the biodiversity shrunk and the costs for the environmental damage enlarged. The quality of political institutions was low in the 1970s and 1980s and further worsened in the 1990s and 2000s.

Housing conditions, health and education have thus definitely improved in China between 1970 and 2010, personal security and income and jobs more or less also improved while the quality of the environment and the political institutions clearly worsened. How the separate development of the various components of well-being and the development of the various indicators of these components have contributed to well-being in general is difficult to understand. Therefore, the next paragraph will attempt to bring all indicators together in order to understand the development of well-being in general.

4.2 Compiling one well-being indicator

This paragraph attempts to compile all indicators for well-being into one composite indicator that represents the development of well-being in general. Two methods have eventually been applied to compile a composite indicator for well-being: the factor model analysis and the equal-weighting method. Both methods will be elaborated in the first section. In the second section the exact execution of the factor model analysis including all considerations for modifications and adjustments of the model are specified, whereas the third section specifies the execution of the equal-weighting method. In the last section, both resulting compiled indicators for well-being are compared.

4.2.a Two different methods

The aim is to compile one indicator for well-being that captures all separate indicators which together are acknowledged to theoretically constitute well-being. In the literature two methods are common to compile a certain indicator. The first method is the equal-weighting approach. The indicators are standardized and for every indicator the arithmetic average is calculated. All dimensions get an equal weight in their contribution to well-being.[166] This method did on first sight however not seem suitable for this research for two reasons. In the first place, the equal-weighting method requires an observation for every indicator in every period of time. The data for China over the period 1970-2010 however contains a considerable amount of missing observations which makes the equal-weighting method unsuitable. Secondly, the equal-weighting method would ideally require data of all indicators not only for China but for a whole set of countries that should serve as a reference group to standardize China's well-being indicators. Although a vast amount of data used in this research on well-being in China is retrieved from the Clio Infra Database, which possesses comparable indicators for all countries over the world, the amount of data that should be added to be able to serve as reference group is considerable. This research has added indicators, has completed missing data over the period 1970-2010 and has extended most data from the year 2000 to 2010. Executing this for a broad set of other countries exceeds the scope of this master thesis.

The second method used in the literature is a so-called factor model analysis, or latent variable model analysis, which proved to be a more suitable method for this research. In a latent variable model, an unobserved dependent variable is estimated on the basis of a set of observed independent variables. For a latent variable there are two possibilities. An exploratory latent variable model on the one hand explores a number of latent variables underlying the observed

[166] Van Zanden et al., *How was Life*, 256.

variables. This is useful when the latent variable underlying the data is unknown. In this research a profound theoretical model has already been established in which the observed variables – the different indicators – are believed to constitute to well-being as the underlying latent variable. Therefore, the confirmatory latent variable model on the other hand is used. This method strives to confirm the theoretically established model. The latent variable underlying all the indicators is then well-being.[167]

Initially, the factor model seemed to be the most suitable model. Firstly, the factor model is perfectly equipped to deal with missing observations as it interpolates missing observations in its calculation by using the covariance between the indicators. If data on one variable is missing, such as for instance education, it then estimates the missing variables based on the linear trend between two known data points or other highly correlated variables. It would then use the covariance with for instance an indicator such as illiterate rates that probably highly correlates with education to compute education's imputations. The uncertainty caused by these imputations is eventually reflected in the composite indicator. The advantage of the factor method is in the second place that it does not require comparable data for other countries as a reference group. This research only focusses on China and has thus not gathered data for a set of other countries. Furthermore, the outcome of the latent variable model method is similar to the outcome of the arithmetic mean method in the literature. The How was Life publication was able to perform both methods and concluded that the results were qualitatively similar as the weights retrieved from the latent variable method turned out to be similar to the equal weighting method. This backs the biggest flaw of the latent variable model, namely; there is no guarantee that the latent variable model captured actually represents well-being. This is caused by the paradox that well-being is primarily an individual-level concept, while most data on well-being is gathered on the nation-wide level.[168]

However, it turned out that the transparency of the factor model was the biggest pitfall in the execution. The model is data driven and attaches weights to the various indicators based on correlations with the other indicators and the underlying latent variable. In the How was Life publication, some indicators were given a factor weighting counter intuitive to the theoretical link of the indicator with well-being.[169] Eventually, this research experienced the same drawback. Certain indicators had to be omitted from the factor analysis and that resulted in the drawn composite indicator for well-being by the factor analysis unfortunately to not include all

[167] SPSS tutorial, Factor analysis (accessed on 11-06-2019), retrieved from: https://www.spss-tutorials.com/spss-factor-analysis-tutorial/.
[168] Van Zanden et al., *How was Life*, 256.
[169] Ibidem, 261.

components of well-being. Therefore, this research eventually has applied a simple equal-weighting method. During the process of the execution of the factor model, the biggest pitfall of performing an equal-weighting method had been overcome, namely; that interpolation and extrapolation had produced a complete dataset with observations for every indicator in every single year. Using the complete dataset that resulted, a simple equal-weighting method could be applied in which all dimensions simply received an equal weighting. This simple equal-weighting method is basic in its execution but does give a more complete picture of all dimensions that contribute to well-being.

4.2.b Factor model analysis

A confirmatory latent variable model analysis or "factor analysis" has been performed. The factor analysis was then executed in the statistical programme R-programming. In the first attempt, the data was prepared in the statistical programme SPSS and the estimation of the model was done in the designated extension of SPSS for performing a confirmatory factor analysis: the programme called AMOS. Various attempts computing a latent variable model in AMOS led to unsolvable computational errors. Before performing the factor analysis in R a few actions had to be undertaken.

In our analysis a few modifications of our indicators are performed. First, the total number of employments is omitted from the analysis. It is omitted because it is presented in total numbers while most other indicators are reported in other units such as percentage of total population and the total number does not correct for working age population growth. This flaws the model. Moreover, employment is no more than the inverse of the unemployment rate which is also already included in the model.

Second, to avoid computational errors caused by high correlation effects between the selected variables, certain variables are omitted for the calculation of the composite well-being indicator. The correlations are graphed in figure 4.8. Household consumption is omitted because it is highly correlated with disposable income; both are theoretically similar variables. CO2 is omitted because it is highly correlated with SO2. This choice is theoretically justified by the fact that high levels of CO2 emission per capita have a less strong effect on well-being than SO2 per capita emissions have, as SO2 is far more toxic than CO2 is. Also, LNCS has been omitted. Theoretically there was already doubt whether to incorporate this variable into the model of well-being as it measures merely the monetary value of environmental damage plus it is highly correlated with loss of biodiversity. For the sake of the factor analysis it is thus omitted. Finally, internal conflicts and international conflicts are omitted. Both variables are dummy variables and do not have a lot of significant observations to represent a gauge for actual well-being: only in the

1970s a few internal conflicts in China occurred in which more than 30 people were killed and internationally there are, only in the mid-1980s, a few international conflicts in which a substantial amount of people were killed due to large scale violence. These variables thus turn out to not give a fully comprehensive impression of personal security in China over the time period. The homicide rate is still included and in the absence of a significant amount of violent conflicts may therefore give a better impression of personal security. Therefore, in the process of eliminating variables we have chosen to also omit internal and international conflicts. Finally, the variables urban housing and rural housing are combined into one variable that takes the mean of both and is called "housing".

Figure 4.8: Correlations

	real_wage	dip_inc	tot_con	inc_ineq	unempl	housing	life_exp	inf_death	year_edu	height	illit_rate	LDV	bio_loss	so2	co2	LNCS	hom_rate	arm_interr	arm_ext
real_wage	1	0,66761	0,66433	0,6414	0,3955	-0,2191	0,21925	-0,0828	0,622558	-0,091	-0,52678	-0,2342	0,60048	-0,643329	-0,617675	-0,1213	-0,0909	NA	-0,051124
dip_inc	0,66761	1	0,99791	0,979757	0,44936	-0,057	0,00337	-0,0474	0,940886	-0,2204	-0,82104	-0,23	0,90525	-0,982304	-0,932945	-0,0635	-0,1611	NA	-0,037122
tot_con	0,66433	0,99791	1	0,97974	0,45696	-0,0536	-0,0184	-0,0524	0,938133	-0,2303	-0,81993	-0,2394	0,90198	-0,982178	-0,930062	-0,064	-0,1474	NA	0,010971
inc_ineq	0,6414	0,97976	0,97974	1	0,36055	0,01852	-0,0154	-0,0151	0,890715	-0,2443	-0,78522	-0,18	0,84114	-0,999837	-0,879281	-0,0313	-0,1898	NA	-5,04E-16
unempl	0,3955	0,44936	0,45696	0,360546	1	-0,0921	-0,0238	0,34642	0,371301	-0,0802	-0,13827	-0,2372	0,36294	-0,362478	-0,369577	-0,2068	0,22274	NA	0,137205
housing	-0,2191	-0,057	-0,0536	0,018521	-0,0921	1	-0,0764	0,0311	-0,10571	-0,2003	0,083632	0,18632	-0,1298	-0,013669	0,111767	0,27842	-0,097	NA	0,133445
life_exp	0,21925	0,00337	-0,0184	-0,015418	-0,0238	-0,0764	1	-0,1944	0,079623	0,32817	-0,04582	0,13487	0,0981	0,011711	-0,084264	-0,6549	-0,2356	NA	-0,035713
inf_death	-0,0828	-0,0474	-0,0524	-0,015118	0,34642	0,0311	-0,1944	1	-0,340151	0,17193	0,5548	-0,3749	-0,4014	0,028078	0,355603	0,08063	0,52235	NA	-0,125469
year_edu	0,62256	0,94089	0,93813	0,890715	0,3713	-0,1057	0,07962	-0,3402	1	-0,2574	-0,92299	-0,1369	0,99505	-0,898769	-0,999698	-0,0887	-0,3088	NA	-1,35E-15
height	-0,091	-0,2204	-0,2303	-0,24433	-0,0802	-0,2003	0,32817	0,17193	-0,257392	1	0,289086	-0,3773	-0,2528	0,245868	0,2565	-0,1945	0,04994	NA	-0,073207
illit_rate	-0,5268	-0,821	-0,8199	-0,785218	-0,1383	0,08363	-0,0458	0,5548	-0,922993	0,28909	1	0,03425	-0,9265	0,793962	0,924708	0,10234	0,3744	NA	8,60E-14
LDV	-0,2342	-0,23	-0,2394	-0,179997	-0,2372	0,18632	0,13487	-0,3749	-0,136886	-0,3773	0,034248	1	-0,1235	0,179037	0,133706	-0,1435	-0,5163	NA	-0,158617
bio_loss	0,60048	0,90525	0,90198	0,841136	0,36294	-0,1298	0,0981	-0,4014	0,99505	-0,2528	-0,92649	-0,1235	1	-0,850754	-0,997191	-0,0987	-0,326	NA	0
so2	-0,6433	-0,9823	-0,9822	-0,999837	-0,3625	-0,0137	0,01171	0,02808	-0,898769	0,24587	0,793962	0,17904	-0,8508	1	0,887729	0,03366	0,19528	NA	-1,12E-15
co2	-0,6177	-0,9329	-0,9301	-0,879281	-0,3696	0,11177	-0,0843	0,3556	-0,999698	0,2565	0,924708	0,13371	-0,9972	0,887729	1	0,09128	0,31336	NA	-7,56E-15
LNCS	-0,1213	-0,0635	-0,064	-0,031254	-0,2068	0,27842	-0,6549	0,08063	-0,08873	-0,1945	0,102337	-0,1435	-0,0987	0,033665	0,091285	1	0,19174	NA	-0,096866
hom_rate	-0,0909	-0,1611	-0,1474	-0,18976	0,22274	-0,097	-0,2356	0,52235	-0,308839	0,04994	0,374395	-0,5163	-0,326	0,195277	0,313357	0,19174	1	NA	0,075507
arm_interr	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA
arm_ext	-0,0511	-0,0371	0,01097	-5,04E-16	0,13721	0,13345	-0,0357	-0,1255	-1,35E-15	-0,0732	8,60E-14	-0,1586	0	-1,12E-15	-7,56E-15	-0,0969	0,07551	NA	1

Third, all missing observations are interpolated: for all variables with missing observations between two different points in time a linear estimation is made for these missing observations. In practise this means for instance for the variable "urban housing" lacking observations between 1980 and 1985, a linear estimation is made for the years 1981, 1982, 1983, 1984 on the basis of the assumed linear trend between known datapoints in 1980 and 1985. All variables are interpolated using known datapoints between 1970 and 2010; only for the illiteracy the data of 1964 is used to interpolate data between 1970 and the next datapoint 1982.

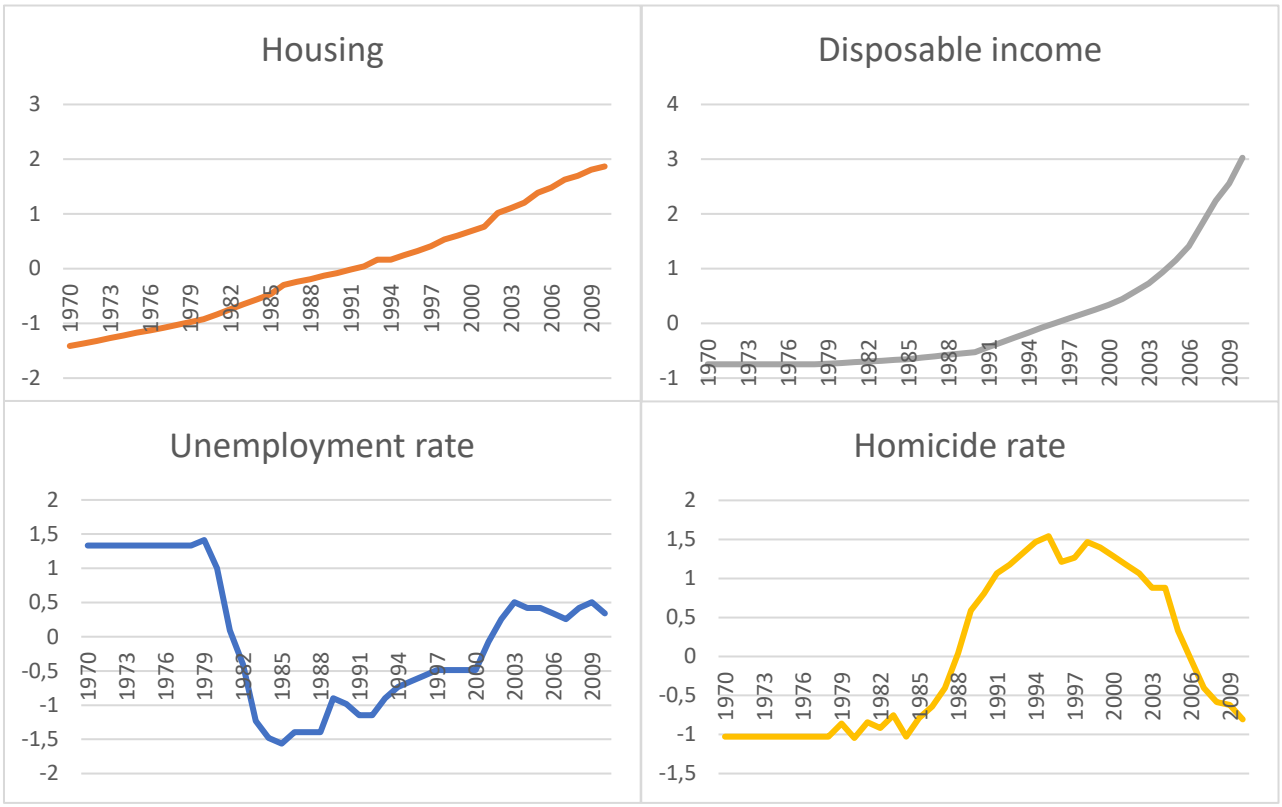
Fourth, for missing observations in our timeframe in which there are no two known

datapoints on two sides, extrapolation is done. The variables height, illiteracy rate, LDV, per capita consumption and SO2 are extrapolated to limit the number of missing variables. Two types of extrapolation are used. One way to extrapolate is by using the last known variable. This means that for the period between 1970 and 1978 all missing observations get the value of the year 1978. Another way is to use linear extrapolation or even loglinear extrapolation. A function is calculated for the variable on the basis of the known variables and this function is then used to estimate the missing datapoints. This is a complex process as the results of the different extrapolations sometimes yield impossible results. Especially backward extrapolation to estimate the missing values for the years 1970 and 1978 for the variables disposable income, unemployment, housing and the homicide rate was challenging. Eventually the choice has been made to linearly extrapolate housing while using extrapolation of the last known data point – the year 1978 – for the variables disposable income, unemployment and the homicide rate.

For the variable housing this means that the last known datapoint is in 1978 while we want to know the value between 1970 and 1978. Using linear extrapolation, the increasing trend housing displayed is expanded backwards providing a logical continuation of the ongoing trend. The result is then the trend in figure 4.9 (top left) where the trendline of housing is extrapolated backwards. This seems a reasonable estimation for the value of square metres of living space in the 1970s. In 1978 the average amount of living space was 7,4; the extrapolation suggests that it should be around 4 square metres in 1970 which seems plausible regarding the trend and reality (4 square metres living space is small but could possibly fit reality).

The other variables are extrapolated by simply copying the last known datapoint in 1978 to other years; the assumption is then that the value of the indicator in 1978 is the same in the period 1970 and 1978. The variables display such a volatile trend in the years with known datapoints that alternative extrapolations, notably the linear and the loglinear extrapolation, produced such ambiguous results which did not seem plausible at all. Therefore, this simple extrapolation is applied with the trends in graph 4.18 as a result. Especially this kind of extrapolation for disposable income seems plausible as the trend displayed a flattening trend towards the last datapoint for 1978. For the unemployment rate and the homicide rate this kind of extrapolation may seem less convincing. On the other hand, the volatile development of both in the known datapoints from the year 1978 onwards makes it impossible to estimate the data between 1970 and 1978. Also recall that the extrapolation only serves to allow the computational programme to calculate factor loadings for the composite indicator for well-being. When analysing the eventual composite indicator, we should bear in mind that the period 1970-1978 possessed the least reliable data and conclusions for this period should be drawn with caution.

Figure 4.9: Extrapolation of variables.



Fifth, a principal component factor analysis is performed in which R estimates what the factors are in which every variable in our model contributes to our latent variable well-being. This method is data driven and constructs a composite indicator by giving all indicators a weight on the basis of the shared information between the different indicators and the latent variable.[170] In practise, higher correlated indicators get higher weights as this increases the robustness of the model.[171] A Bayesian variant is used to estimate the model.[172]

After the modifications of our model as specified were made, our eventual model on which a factor analysis has been performed contains fourteen variables listed in figure 4.10. In the factor analysis real wage, disposable income, income inequality and the unemployment rate represent the jobs and earning component; urban and rural housing combined represent housing; life expectancy, the infant mortality and human height represent health; the average years of education and the illiteracy rate represent education; the latent democracy variable represent the

[170] Van Zanden et al., *How was Life*, 285.
[171] James E. Foster, M. McGillivray and S. Seth, 'Composite Indices: Rank Robustness, Statistical Association, and Redundancy', *Econometric Reviews* 32 (2013) 35-56.
[172] Simon Jackman, *Bayesian Analysis for the Social Sciences*, (Hoboken, 2009); Edgar Merkle, 'A Comparison of Imputation Methods for Bayesian Factor Analysis Models', *Journal of Educational and Behavioral Statistics* 36 (2011) 257-267; Sik-Yim Lee, *Structural Equation Modeling: A Bayesian Approach*, (Hoboken, 2007).

quality of political institutions; the loss of biodiversity and the per capita SO2 emission represent the environmental quality and the homicide rate represents personal security.

Figure 4.10: variables in factor model

Variable names	Variable	Component
real_wage	Real wage	Income and jobs
dip_inc	Disposable income	Income and jobs
inc_ineq	Income inequality	Income and jobs
Unempl	Unemployment rate	Income and jobs
Housing	Rural and urban housing	Housing
life_exp	Life expectancy at birth	Health
inf_death	Infant mortatility rate	Health
Height	Human height	Health
year_edu	Average years of education	Education
illit_rate	Illiteracy rate	Education
LDV	Latent Democracy Variable	Political institutions
Bio	Biodiversity	Environmental quality
so2	SO2 per capita emission	Environmental quality
hom_rate	Homicide rate	Personal security

The first factor analysis using the variables specified in figure 4.10 gave the following factor loadings to the latent variable. In the right column the factor loading per variable is given. For example, disposable income has a factor loading of 0,833 for the factor that theoretically is identified to be well-being. Most factor loadings seem to be plausible, but a few variables however show an unfeasible outcome. Income inequality, SO2 and the homicide rate show a positive contribution to well-being, while the Latent Democracy Variable and the biodiversity show a negative contribution to well-being. This is counterintuitive to the theoretical contribution. Rising income inequality, SO2 emission and homicide rates would on the one hand negatively influence well-being, while an improving Latent Democracy Variable and biodiversity would enhance well-being. This was thus a problem to be solved.

Figure 4.11: factor loadings per indicator.

	Factor analysis 1
real_wage	0,813
dip_inc	0,844
inc_ineq	0,916
unempl	-0,330
housing	0,988
life_exp	0,982
inf_death	-0,951
year_edu	0,994
height	0,993
illit_rate	-0,989
LDV	-0,941
bio	-0,898
so2	0,991
hom_rate	0,612

The following approach attempted to solve this problem. A potential problem seemed to be that the computational programme cannot recognise how an indicator theoretically relates to the latent variable we theoretically assign to well-being: it only sees the trends in the data and therefore assumes that all increasing values positively contribute to the latent variable while this is negatively influenced by the decreasing values. However, a few variables in the dataset (written in red in figure 4.11) have an increasing trend while this has a negative effect on well-being and vice versa. An increasing Gini-coefficient for income inequality for example indicates more income inequality which theoretically harms well-being. The factor analysis has however given a positive sign to income inequality producing the counterintuitive finding that an increased Gini-coefficient for income inequality would benefit well-being. The same holds for a decreasing biodiversity which theoretically leads to less well-being, while the factor loading assigned is negative indicating that less biodiversity would improve well-being. In order to make the programme understand this difference some variables are modified to clarify this difference.

For all variables that have a trend counter to their contribution to well-being – cases in which a decreasing trend of the variable has a positive effect on well-being – an inverse variable is created. All variables in the model with an increasing trend then theoretically also have a positive effect on well-being whereas all variables with a decreasing trend theoretically negatively influence well-being. For the variables income inequality, the unemployment rate, the infant mortality rate, the illiteracy rate, SO2 emission, biodiversity and the homicide rate an inverse is calculated. Most variables are already on a 100 percent scale which makes the inverse simple. The income inequality (formerly inc_ineq) becomes variable inc_ineq2 in which a rising value indicates a

positive effect for well-being. Then, the inverse of the unemployment rate (unempl) is logically the employment rate (employ), the infant mortality rate (inf_death) becomes the infant live rate (inf_live), the illiteracy rate (illit_rate) is substituted by the literacy rate (lit_rate), the biodiversity (bio_loss) is replaced by the biodiversity loss (bio) and the homicide rate (hom_rate) is replaced by the non-homicide rate (nonhom_rate). Only SO2 emission is not expressed on a 100 percent scale. Therefore, an inverse is created for the variable so2 by using max (x) -x to create the new inverse variable SO2. The result should be straightforward: an increase in the value of these variables then theoretically indicates an increase in well-being.

This approach did not work. Using inverses simply turned the sign in front of the factor loading around. This confirmed that the factor analysis is mainly done using the correlations between the indicators and this correlation does not change after using the inverse (only the sign flips). Executing a factor analysis with the inverses results in the factor loadings exhibited by the first column in figure 4.12 below. Some signs of the factor loading thus remain counterintuitive. The inverse of the income inequality (inc_ineq2) would theoretically receive a positive sign as an increase in this inverse variable would signal decreasing level of inequality in income and would suggest improvements for well-being. It nevertheless remained receiving a negative loading suggesting that the declining income inequality benefits the latent variable well-being. Further, the latent democracy variable still has a negative loading. Biodiversity goes from a negative value for the variable that indicated the biodiversity (bio) to a positive value for the new variables that reflects the biodiversity loss which would suggest that more loss in biodiversity is good for well-being. The same problem holds for SO2 emission as well as for the homicide rate.

Figure 4.12: factor loadings per indicator using inverse of certain variables.

	Factor analysis 2
real_wage	0,821
dip_inc	0,851
inc_ineq2	-0,959
employ	0,320
housing	0,990
life_exp	0,983
inf_live	0,948
year_edu	0,994
height	0,994
lit_rate	0,989
LDV	-0,943
bio	0,894
SO2	-0,962
nonhom_rate	-0,389

A working solution to solve the problem for the latent democracy variable was to replace it for the Polity2 index indicator. Political institutions were represented by both the Polity2 index and the Unified Democracy Variable. It has thus not worked to include both through the Latent Democracy Variable. This proved to be a solution as the Polity2 index did receive a theoretically logical factor loading: an increase in the Polity2 index, which means an improvement in political institutions and indeed receives a positive loading in the factor model. As can be seen in figure 4.13 in the second column (factor analysis 3).

Figure 4.13: factor loadings per indicator in final factor analysis.

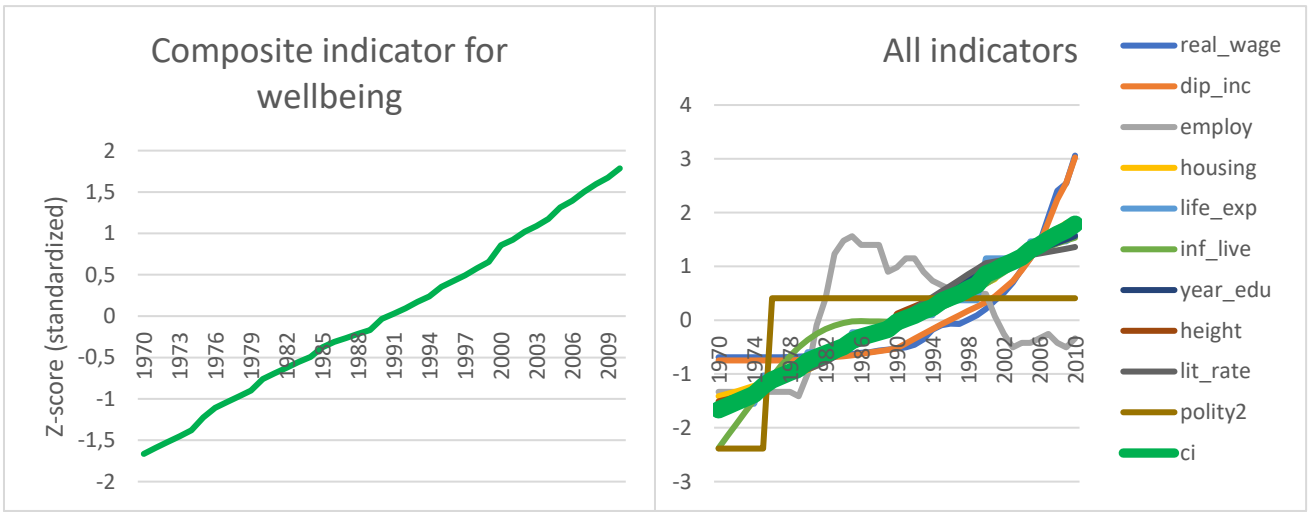
	Factor analysis 3	Factor analysis 4
real_wage	0,813	0,845
dip_inc	0,843	0,872
inc_ineq2	-0,952	X
employ	0,339	0,293
housing	0,990	0,986
life_exp	0,984	0,984
inf_live	0,957	0,956
year_edu	0,993	0,988
height	0,991	0,989
lit_rate	0,987	0,979
polity2	0,625	0,608
bio	0,899	X
SO2	-0,966	X
nonhom_rate	-0,384	X

The variables income inequality, biodiversity, SO2 emission and the homicide rate had to be omitted. The resulting factor loadings are shown in the third column of figure 4.22 (factor analysis 4). Real wages and disposable income with a factor contribution of 0,8 and housing, life expectancy, infant live, average years of education, height, literacy rate with 0,9 all have a relatively strong contribution to the latent variable well-being. Meanwhile, employment and Polity2 have a relatively weaker contribution to well-being in this model, with factor loadings of respectively 0,3 and 0,6. Factor analysis 5 produces the composite indicator for well-being, which is shown in figure 4.23 below.

On the basis of the indicators of the model, the latent variable well-being shows a steadily increasing trend of well-being between 1970 and 2010. A test to check the reliability of the model, the so-called "Cronbach Alpha" test proves that the formation of the latent variable that we defined as well-being in this model is reliable (for full output of the test see appendix C). Recall that the indicators that constitute this composite indicator of well-being (see figure 4.14)

only cover the income and jobs, housing, health, education and political institutions dimension of well-being. No indicators for environmental quality or personal security are included as its indicators biodiversity, SO2 emission and the homicide rates were dropped during the process. Well-being drawn without these two dimensions of well-being may thus indicate a steady increase, but the results in chapter 4.1 however signalled that environmental quality definitely worsened between 1970 and 2010. A composite indicator for well-being without the dimensions of environmental quality and personal security thus gives a very limited view of the development of well-being. As seen in figure 4.14 (right), the calculated composite indicator is the logical consequence of a model in which most included indicators show a steadily increasing trend over the time period; the resulting composite indicator perfectly represents this ongoing trend. This nonetheless does not present the full picture of the development of well-being.

Figure 4.14: Composite indicator for well-being using the factor analysis.



4.2.c Equal-weighting method

To compile an indicator for well-being that does contain all seven identified components of well-being the equal-weighting method is eventually applied. In this method all indicators are standardized using the Z-score with all means zero and standard deviation 1 – which has already been done in paragraph 4.1. All dimensions then receive an equal weight.[173] This means that with components that contain multiple indicators the weight of one is divided over the number of indicators. In practise, (see figure 4.16) income and jobs is represented by real wages, disposable income, income inequality and the unemployment rate; housing is represented by the combined indicator of urban and rural housing, health by life expectancy, infant live rates and height; education by the average years of education and the literacy rate, political institutions by the Latent Democracy Variable; environmental quality by the biodiversity , SO2 emission and CO2 emission and personal security is represented by the homicide rates. CO2 is included again as it was only omitted due to high correlation executing the factor analysis but does serve as an important indicator for environmental quality as being an indicator for climate change. All seven components receive an equal weight (one seventh) and the weight of every indicators is received by devidence over the number of indicators per component.

No indicators are given a negative sign as the inverse variables created in paragraph 4.2.b are used. For CO2 an inverse is calculated in the same fashion as was done for the calculation of the inverse for SO2; using max (x) -x. Also, the interpolation and extrapolation performed in this paragraph 4.2.b is adopted. This completes the dataset and enables the equal-weighting method to be executed. In addition, this method is then able to not only cover all seven components – contrary to the factor analysis it includes the environmental quality and personal security – but furthermore includes more indicators per component rather than using a few that should represent the others.

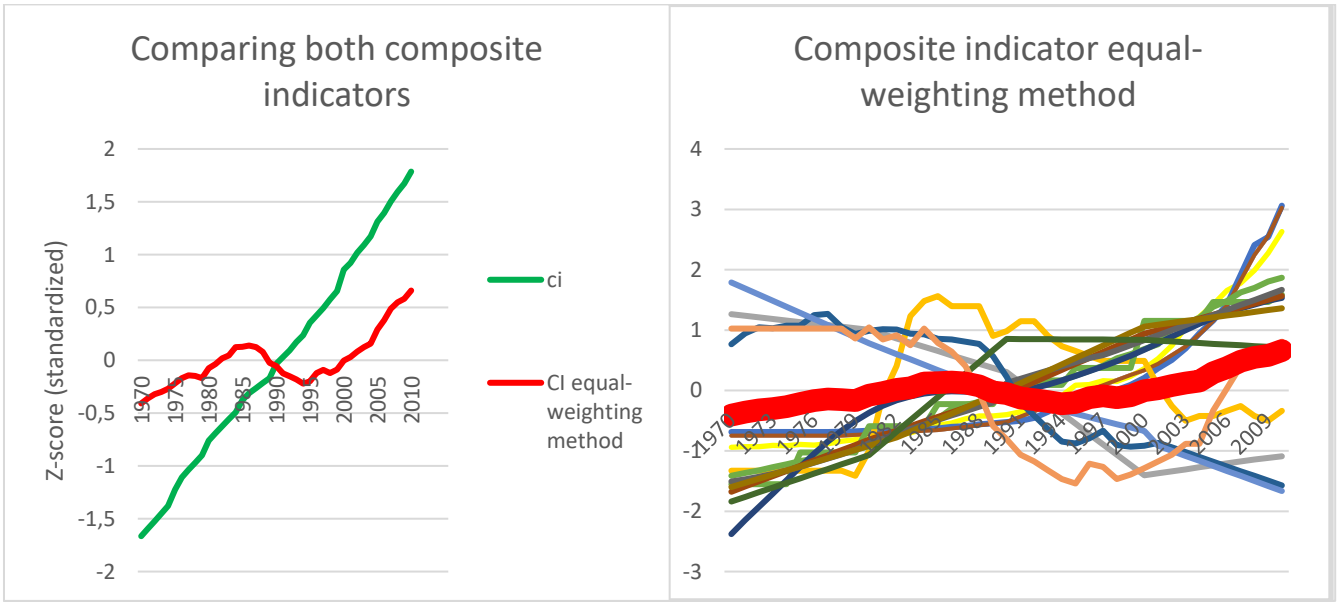
The result is a more nuanced trend of well-being than the factor analysis proposed. Figure 4.17 shows that the composite indicator, following up the equal-weighting method (red line), also shows an increasing trend between 1970 and 2010. But, this trend is much less steep than the improvement of well-being suggested after applying the factor analysis. Both the compiled indicators for well-being resulting from the factor analysis and from the equal-weighting method are compared in figure 4.18. The factor analysis produced a composite indicator that possesses a much higher gradient than the composite indicator generated by the equal-weighting method.

[173] Van Zanden et al., *How was Life*, 257.

Figure 4.16: Indicators used in the equal-weighting method.

Variable names	Variable	Component
real_wage	Real wage	Income and jobs
dip_inc	Disposable income	Income and jobs
inc_ineq	Income inequality	Income and jobs
unempl	Unemployment rate	Income and jobs
housing	Rural and urban housing	Housing
life_exp	Life expectancy at birth	Health
inf_death	Infant moratility rate	Health
height	Human height	Health
year_edu	Average years of education	Education
illit_rate	Illiteracy rate	Education
LDV	Latent Democracy Variable	Political institutions
bio_loss	Loss of biodiversity	Environmental quality
SO2	SO2 per capita emission	Environmental quality
CO2	CO2 per capita emission	Environmental quality
hom_rate	Homicide rate	Personal security

Figure 4.17: Comparing both the composite indicator from the factor analysis (green) and from the equal-weighting method (red) & the composite indicator for well-being using the equal-weighting method versus well-being indicators (right).



It is rather logical that the factor analysis produced a trend for well-being that suggests a stronger increase than the equal-weighting computed. Recall that the factor analysis only included real wage, disposable income, employment, housing, life expectancy, infant live rates, height, average years of education, literacy rates and the Polity2index; most of variables more or less showed an increasing trend as seen in paragraph 4.1. This thus gave a highly flawed image of the development of only certain aspects of well-being. The equal-weighting method took a much wider view of well-being into consideration by including at least one indicator for every component of well-being in its model. By including indicators that had shown a worsening over the time period in paragraph 4.1, such as income inequality, the LDV, biodiversity, SO2 emission and the homicide rate a much more complete view of well-being is presented which logically displays less progress in well-being than the factor model did. The compiled indicator generated by the equal-weighting method therefore is acknowledged to be a better indication of welfare and will form the basis for analysis in the following of this research.

The equal-weighting method does however have the arbitrary trade off of weights. In the literature two broad ways of weighting are possible: subjective or objective.[174] The choice has been made to give objective weights and give all components of well-being the same weight. In our theory presented in paragraph 3.1, all aspects were presented as being all a certain aspect of well-being. No insinuations have been made about what aspects are more important than others. One may value income and their housing conditions most while another finds environmental and personal security more important. This remains a highly subjective and delicate trade off of subjective preferences. A solution would be to let subjective determinants of well-being such as life satisfaction and happiness determine what the weights of all components of well-being would be.[175] In recent years, a lot of studies on well-being have appeared, also for China.[176] However, historical public opinion for later than the 1990s is not available. Applying the available surveys of subjective well-being of recent years to the whole time period 1970-2010 fails to do justice to the historical context of a time period. For these reasons the choice has been made to give all components of well-being an equal contribution to well-being.

Because the indicators are standardized using a Z-score and are thus standardized using their own scale, the results only are allowed to be relatively compared and not in absolute terms.[177] It is thus not possible to conclude on the basis of the figure below that well-being was at

[174] Matteo Mazziotta, & Pareto, A., 'Methods for constructing composite indices: One for all or all for one.', *Rivista Italiana di Economia Demografia e Statistica*, 67 (2013) 2: 67-80.
[175] Van Zanden et al., *How was Life*, 255.
[176] See: Davey & Rato, 'Subjective well-being in China', 333-346; Cheng, Mishra, V., Nielsen, I. et al., 'Well-being in China', *Social Indicators Research* 132 (2017) 1: 1-10.
[177] Mazziotta, & Pareto, 'Methods for constructing composite indices', 67-80; Matteo Mazziotta & Pareto, A., 'A well-being index based on the weighted product method.' In *Topics in Theoretical and Applied Statistics* (2016): 253-259.

a higher level than GDP per capita was; it is only possible to compare the trends of both. This would only have been possible if comparable data for a wide range of countries was collected and the data for China could have been benchmarked. On the other side, this is not deemed to be a very large problem as the aim of this research was to understand the trend in well-being and not the level of well-being. Furthermore, well-being does not have a unit of measurement which would make absolute comparisons with for instance GDP peculiar.

4.2.d Summary

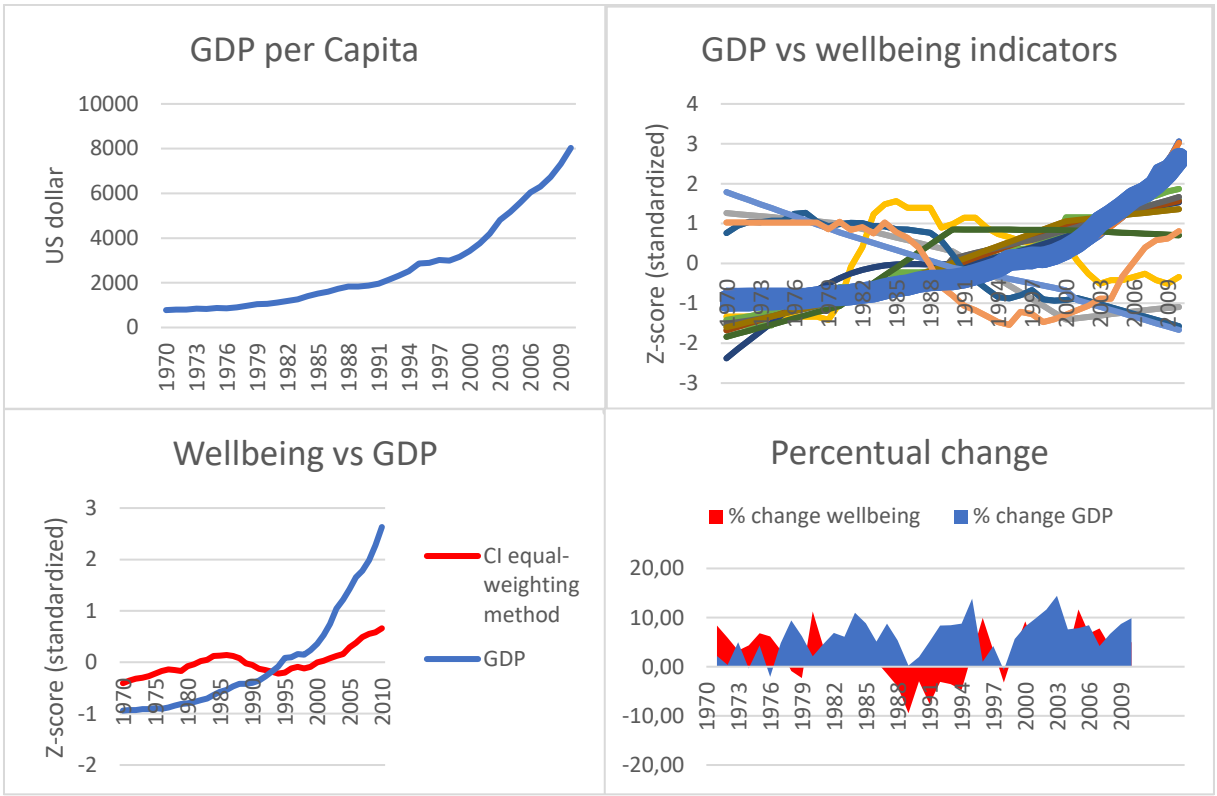
This research thus started with the conviction that the factor model would be the most suitable method to compile one indicator for well-being in China between 1970 and 2010 that would combine all components of well-being as theorized in chapter 3. It seemed more suitable to deal with missing data and would leave the arbitrary trade off of weights to a data driven computational programme. Our presumption did however not hold. It turned out that the computational programme was not able to produce intuitively logic factor loadings. As a solution, indicators had to be omitted from the model and the resulting composite indicator only gave a limited view of certain components of well-being. Using this composite indicator would result in a flawed positive view of the development of well-being. Moreover, it would not actually represent well-being at all as it would neglect a wide set of important aspects of well-being. Therefore, this research eventually recurred to the equal-weighting method. This method did take into account all indicators identified to be relevant for well-being and gave them all an equal weight. Although it hereby assumes that all indicators equally contribute to well-being, it is acknowledged to give the most complete gauge of the development of well-being in China between 1970 and 2010 and forms the basis for further analysis in this thesis.

5. Analysis

5.1 Development of GDP per capita vs well-being in China

Now a compiled indicator for well-being has been generated, a comparison with the trend of GDP is possible. As can be seen in figure 2, China has enjoyed a staggering rise in GDP per capita between 1970 and 2010. It set off at 778 US dollar per person per year in 1970 and had been more than decupled in 2010 with a GDP per capita of 8031 US dollar. Data on GDP has been retrieved from the Clio-infra database and the World Bank has standardized the GDP statistic into an internationally comparable statistic by adjusting it by the nation's price level. Originally, the GDP statistic is measured by the national statistical agency: the Chinese National Bureau of Statistics (NBS).

Figure 5.1. Top left: China's GDP statistic, retrieved from: Clio-Infra database; Top right: China's GDP statistic vs all separate well-being indicators; Bottom left: Comparison of the development of GDP per capita and well-being; Bottom right: Percentual change in GDP per capita and well-being.



Standardized and compared with all separate well-being indicators in figure 5.1, GDP per capita and well-being in China have clearly experienced a different development between 1970 and 2010. Where GDP per capita has shown a constant, exponential growth, the development of well-being shows a different picture. The development of well-being in China has experienced three different phases. In a first phase between 1970 and 1986 well-being experiences consequent

improvement. This growth flattens during the mid-1980s and sets off a period of decline of well-being between 1986 and 1994; a second phase. In 1994, well-being is on par with the level of well-being experienced two decades before in 1975. From 1994 onwards a third phase (1994-2010) preludes in which well-being improves between 1994 and 2010. In 2003 the highest level of well-being enjoyed until then (in 1985) is surpassed and steadily increases further towards 2010.

The results are hence surprising. The first phase (1970-1986) has thus shown a steady improvement of well-being. Recollect that the period 1970-1978 includes considerable gaps in the data and necessarily includes a number of estimations through extrapolation to fill in the missing datapoints; the development of well-being in this period should thus be analysed with caution. By looking at the development of the separate indicators the improvement of well-being can be explained by the fact that most indicators positively improved. Even an indicator such as the political institutions – that later deteriorated – improved, whereas indicators that negatively influenced well-being over the whole period did not strongly worsen. The increase in well-being is paralleled by a similar rising GDP per capita rate.

Although GDP per capita also endures stagnation in the second phase (1986-1994), well-being even declines. GDP per capita on the one hand drops from 5,3 % growth to 0,22 % growth in 1989 but recovers to growth rates of 8,77% in 1996. The decrease in GDP between 1986 and 1989 may have been sharp but it never reached negative levels, recovered quickly and even reached higher levels of growth than before in consequent years. Well-being on the other hand decreases during eight consecutive years in the second phase (1986-1994) with a nadir of 9,47% decrease in 1989. Decline of well-being in the second phase can be attributed to the strong increase in income inequality, a flattening of the decrease of infant mortality rates, worsening political institutions, fierce losses in biodiversity and natural resources, major increases in SO2 and CO2 emission and exacerbating homicide rates. All these developments together caused decreasing well-being in this period despite steady increases in earnings, housing, health and education. This decline in well-being was not experienced at all in GDP per capita development, which – albeit minimal growth in 1989 – continued to show high percentages of growth.

In the third phase (1994-2010), well-being recovers. Some indicators that reduced the growth of well-being in the previous phase recovered: the homicide rate rapidly declined, the income inequality decreased slightly and the biodiversity remained stable. Other indicators such as real wages, disposable income, household consumption and housing that increased in all four decades experienced their most intense growth in the last period; a growth which can be paralleled with the GDP per capita growth in these years. Underlying the fluctuating indicators

mentioned, was the constant improvement of the indicators for earnings, housing, health and education during all three phases.

5.2 Intervening in the debate

China thus experienced a major discrepancy between the development of well-being and GDP per capita. In the literature (elaborated in the historical background in paragraph 1.4) the year 1978 is always seen as the start of China's economic growth and prosperity. In this year the successor of Mao Zedong, Deng Xiaoping, unleashed a vast set of economic reforms that opened up the economy to the rest of the world. From 1978 onwards, GDP per capita started to grow and reached unprecedented growth levels between 1978 and 2010. The assumption has always been that this growth of GDP per capita has been illustrative for the development of well-being in China. This research however suggests that well-being encountered a totally different development. Our findings counter existing literature on two points.

Firstly, this research contrasts the dominant view in the literature that most growth in welfare was encountered from 1978 onwards,[178] whilst well-being already endured considerable growth from 1970 onwards. A reason for this contrariety could be that data was widely available from 1978 onwards but thinly reported before; this research also encountered that a lot of data was only moderately or not reported for the period 1970-1978. This presumably has to do with the fact that, parallel with the reforms starting in 1978, the administrative reports improved, and it became easier to gather data. Previous research may not have been able to conclude that the start of economic growth and welfare already commenced before 1978 because data before 1978 was lacking. This may flaw the over-eminent conclusion that economic growth took root from 1978 onwards. On the other hand, it should be kept in mind that the conclusion of this thesis suggests that it was well-being that improved, while most literature looked at GDP per capita as a measure for (economic) well-being – and GDP surely started to rise from 1978 onwards. It may be that well-being improved so much in the 1970s because the level of well-being was so low that improvements were easily made. The historiography of China shows that the 1950s and 1960s were marked by turmoil with fundamental societal shocks such as the Great Leap Forward resulting in millions of casualties due to starvation and the Cultural Revolution severely disturbing daily life. It may be therefore that the level of well-being was at such a low level before the 1970s that improvements in well-being were easily achieved. In any case, between 1970 and 1978 improvements were made in, most notably, average years of education, literacy rates, human height, life expectancy and infant mortality rates.

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[178] Naughton, *The Chinese Economy,* 140; Lin et al., 'The China Miracle', 340; Lin, J. Y. (2011). *Demystifying the Chinese economy*. Cambridge University Press.

Secondly, this research suggests a decline in well-being between 1986 and 1994. GDP per capita also endured stagnation but not the shrinkage that well-being experienced. This decline in well-being has not clearly been noticed in the literature. The literature does mark the year 1989 as a year of crisis symbolized by the Tiananmen square protests after a period of economic slowdown and political dissatisfaction.[179] Previous research proposing alternatives to GDP, most notably the Genuine Progress Indicator, did already notice stagnations in genuine progress that were not experienced in a similar fashion in GDP. Wen et al. signalled the detrimental effects of the fossil-energy use on genuine progress in 1980s.[180] An alternative GPI by Kubiszewski et al. pointed to worsening income distribution, increasing crime and family breakdown, air and water pollution and non-renewable resource depletion between 1990 and 1997.[181] This research confirms notably the worsening of income inequality, environmental quality and personal security that together with a deterioration of political institutions contributed to a decline in well-being between 1986 and 1994.

5.3 Suggestions for understanding the discrepancy

The discrepancy between well-being and GDP can partially be explained by the disparity in the information contained by both. The individual indicators responsible for the discrepancy are exactly those factors which are inadequately incorporated by GDP: income inequality where GDP failed to account for distribution of income, environmental damage for the negative externalities caused by (some) economic production and personal insecurity where GDP sometimes sees crime as a contributor to overall economic activity.[182] Also, important contributors such as health and education are directly reflected by well-being whereas the translation from a higher national income to more investments in health care or the educational system is not straightforward. Moreover, immaterial aspects of well-being like health and political institutions, which undoubtably played a role in well-being, were formerly excluded with the use of merely GDP per capita. Also, by measuring the well-being of the average inhabitant in China, there may thus be discrepancy between the well-being of individuals and households and the aggregate condition of nation's economy. China's economy may have been growing on a national

[179] Hui Wang & Karl, R. E., 'The year 1989 and the historical roots of neoliberalism in China.' *positions: east asia cultures critique* 12 (2004) 1:7-70.
[180] Wen, Z., Yang, Y., & Lawn, P. A., 'From GDP to GPI: quantifying thirty-five years of development in China.' In: Lawn, P. A., & Clarke, M. (Eds.). *Sustainable welfare in the Asia-Pacific: studies using the genuine progress indicator*. (Cheltenham, 2008) 250-256.
[181] Kubiszewski et al., 'Beyond GDP', 61-62.
[182] Meant is here that criminal activities such as for example prostitution and drugs dealing, when within the formal economy, or in the form of money laundering, generate income which is not beneficial to well-being but adds to national income; for more information see: Ida Kubiszewksi & Costanza, Robert, 'Measuring Genuine Social Progress', In *The Sustainability Practitioner's Guide to Social Analysis and Assessment,* Common Ground Publishing (2015) 45.

level, but on the individual level this may have been different in some time periods. Another part may be explained by the difference in mode of measurement. As noted in chapter 2, the calculation of the GDP statistic has encountered difficulties in measuring overall economic welfare due to organizational problems and possibly because of political independency issues. This thesis has relied on a broader range of data and sources and has presented a more complete view of the development of societal well-being.

Besides this, a causal explanation of the discrepancy in development between GDP and well-being cannot be given on the basis of this research. It would be tempting to parallel executed policy in the various areas that affect well-being with the development of well-being. But causal links between policy inputs and well-being outputs cannot be established on the basis of the material used in this research. Well-being is such a wide phenomenon that encounters so many different aspects; the understanding of the development of an indicator as for instance education not only requires the amount of investment in education by the Chinese government but also the type of investment, the school system, the attitude towards education and so forth. One would form theoretical links between in- and outputs that empirically are difficult to establish.

For future research, some suggestions could be made to explain the discrepancy more comprehensively and thoroughly. A suggestion could be to link the development of the market in China with the implications this had for well-being. There seems to be discrepancy between the evolution of the market and how this increased national income translated into well-being. Over the considered time period, the Chinese economy under the rule of the Chinese Communist Party transformed its economy from a planned economy to an economy with controlled market forces. National income or GDP has thus increased but it is unclear how and to which extend the increased means to improve well-being have led to actual improvement of well-being. In the discussion on the evolution of market influences in the Chinese economy, the Chinese authors So and Chu mention how the transformation of the collectivist system posed challenges on how to access services such as medical care and education. Also, workers had enjoyed life-long employment and job security under the collectivist system but flexibilization of the labour market had commodified these services and left the distribution to the market.[183] Similar trends can be seen in the accession of housing where inhabitants had to acquire housing via the private housing market.[184] Xinping Guan points to this trend as "increasing individual responsibility for social security and well-being".[185] The question is whether an increasing market influence and a

[183] So & Chu, 'A transition from Neoliberalism', 7, 11-12; Guan Xinping, 'China's Social Policy: Reform and Development in the Context of Marketization and Globalization.', *Social Policy and Administration* 34 (2000) 115-130.
[184] Jie Chen, Jing, J., Man, Y., & Yang, Z., 'Public Housing in Mainland China: History, Ongoing Trends, and Future Perspectives.' In *The Future of Public Housing* (Heidelberg, 2013) 15-16.
[185] Xinping. 'China's Social Policy', 115.

growing market produced more opportunities for people to pursue a higher level of well-being. To analyse the relation between economic growth and well-being, the underlying mechanisms that caused this growth and translation into well-being could be studied. How economic earnings have been distributed is determined by the political and economic agreements made over time. An appealing framework for analysis is the recent popular New Institutional Economics (NIE) school which sees institutions as the basis of long-term economic development and growth. Through an interplay of political and economic institutions the economic growth and distribution is studied.[186] This economic growth is analysed in terms of market production (in GDP). Future research could use this framework to study the translation of market growth into actual well-being. Some research on the interplay between political and economic institutional change and economic growth has already been done. Research by Justin Yifu Lin has been the most notable.[187] This research is limited to the institutional causes of growth in terms of GDP per capita until now. In the future, research should take the institutional causes of the development of well-being as its core.

[186] Douglas C. North, *Institutions, Institutional Change and Economic Performance* (Cambridge, 1990); Daron Acemoglu, Simon Johnson en James A. Robinson, 'Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution', *The Quarterly Journal of Economics* 117 (2002) 4, 1231-1269; Daron Acemoglu, Simon Johnson, en James A. Robinson, 'Institutions as a fundamental cause of long-run growth', *Handbook of economic growth* 1 (2005): 385-472.

[187] Justin Yifu Lin, Fang Cai, and Zhou Li, 'The lessons of China's transition to a market economy.', *Cato Journal* 16 (1996) 201-231; Lin, Justin Yifu, and Yingyi Tsai, 'Reform and development in China: A new institutional economics perspective.', *Seoul Journal of Economics* (2004) 335-381; Justin Yifu Lin, & Jeffrey B. Nugent, 'Institutions and economic development.', *Handbook of development economics* 3 (1995): 2301-2370.

6. Discussion

6.1 GDP vs well-being: what they measure

The introduction discloses a list of flaws using GDP per capita as a measurement of well-being. Measuring well-being directly following the approach of this thesis solves a certain amount of drawbacks the use of GDP per capita encountered. Firstly, where GDP per capita only incorporates goods and services produced within the market and thereby neglects household and voluntary work, the direct measurement of well-being is not dependent on the production within a market. It does not focus on the pure monetary input within the market that could theoretically lead to outputs attributing to a higher level of well-being but directly looks at the effect on well-being. The same argument holds for the difficulty to measure publicly produced goods and services and the translation of monetary value produced within markets to aspects attributing to welfare such as healthcare and education. By measuring well-being in terms of well-being outcomes, the market does not play a direct role and well-being can directly be measured by looking at, for instance, the performance of health and education indicators. Health and education constantly improved between 1970 and 2010 while the spending on healthcare and schooling may have been more volatile. Furthermore, an indicator such as homicide rates correctly incorporates the detrimental effects of crime which is using the measurement of GDP per capita seen as an economic activity that contributes to overall economic activity. Partly due to exacerbating homicide rates, well-being decreased between 1986 and 1994 whereas GDP growth slowed down but sustained during this period. Direct measurement of well-being thus circumvents the limitation of GDP per capita that its value is dependent on the usage of monetary value accruing from market production.

Secondly, well-being is more able to represent societal welfare and development by controlling for unequal distributions of economic growth. Whereas GDP per capita only represents average earnings and tells nothing about societal disparities in income and wealth, well-being incorporates inequality in income to display the disparity in earnings. This research has thus shown that although GDP per capita – just as real average wages, disposable income and household consumption – painted a positive picture with constantly increasing values, the Gini-coefficient for income inequality grew as well signalling an increasing unequal distribution of earnings which tempered the growth of well-being.

Thirdly, well-being incorporates the externalities GDP per capita fails to correctly represent in its measurement. The measurement of well-being encompasses indicators such as the intactness of biodiversity and SO2 and CO2 emission to cover the detrimental effects pollution and resource depletion have on the quality of the environment in China. By adding the cost of

this resource depletion via the LNCS, the deficits for well-being resulting from pollution and depletion are correctly incorporated, contrary to the loophole of GDP where pollution and the resulting economic activity tends to be counted as a double gain to economic growth; externalities are not included while the economic activity that strives to resolve pollution is also added to GDP. The severe loss of biodiversity, large emissions of SO2 and CO2 and substantial costs of resource depletion in China have substantially hampered the development of well-being.

6.2 GDP vs well-being: how they are measured

Besides *what* GDP per capita measures, *how* it is measured also posed considerable doubts which have been elaborated in chapter 2. The measurement of well-being surely relies on a much more diversified set of sources than solely the National Bureau of Statistics (NBS) of which the process of measurement as well as its independency have been questioned. Ultimately, this measurement of well-being has had to rely on certain indicators retrieved from the NBS as well. The data for the indicators such as disposable income, household consumption, unemployment, living space, illiteracy rates and homicide rates are derived from the Chinese Statistical Yearbook published by the NBS. A second prominent data source is the data provided by the Clio Infra project. Data available on this platform also partially originates from government statistics. But, this is for most a much more diversified set of data of a large variety of different subjects. In the end it is unavoidable to surpass the government in obtaining data of phenomena on a national scale from a wide range of topics; the government has the capacity as well as the authority to collect such specific data. Besides that, this research has, when available, deployed a large number of sources outside the government and this has fruited a large amount of data from a well-diversified set of independent agencies. Data has most notably also been derived from the World Bank (infant mortality rates), International Labour Organisation (real wages), Carbon Dioxide Information and Analysis Centre (CO2 emission), the HYDE database for global environment (Biodiversity), the Polity index (political institutions), NCD-RisC database (human height) and the Conflict Catalogue (internal and external conflicts). This research' measurement of well-being thus relies on a much more diverse set of indicators retrieved from a lot more data sources that overcomes the problems of how to measure and how to independently measure societal welfare and well-being.

6.3 Discussion of indicators

Although this measurement of well-being prevails in the described ways over GDP per capita, progress can be made to measure well-being even more adequately. This research has focussed on rather tangible and measurable aspects of well-being and has used an internationally agreed concept of well-being by relying on the guidelines set out by the Organisation of Economic

Cooperation and Development (OECD). The focus has therefore been on objective indicators of well-being; aspects that are believed to add to the well-being of every individual. The concept of well-being remains an utterly precarious subjective subject which all people perceive slightly differently. The perception of what a 'good life' is, will always remain a subjective matter where every individual has his or her own preferences. Subjective data on well-being was limited to the last two decades and was unfortunately not available for China over the whole examined period 1970 to 2010. A solution could have been to assume that the subjective well-being in the last two decades was representative for the previous two decades, but this would not do justice to the historical reality. In the examined forty years the numerous economic and societal reforms have changed the possibilities in societies and must have changed the perceptions and preferences accordingly.

This research therefore focussed on objective and also the quantitative sides of well-being. The indicators used in this research in the end are unfortunately merely numbers that try to capture a particular facet of well-being into one number that represents an average for all individuals together; in the case of China this means one number for more than 1,3 billion people. Despite including measures of distribution, this undoubtably falls short to represent the well-being of all Chinese. Earnings may have increased substantially between 1970 and 2010 but this does not mean all Chinese have experienced this in a same way; some may have become extremely rich while others remained extremely poor. Besides, adding inequality measures – what this research has done – remains extremely difficult to capture the well-being of all into a few numbers. But, this is the always occurring limitation of quantitative research.

Something that can be accounted for in future research, is to account for regional disparities. As it overshot the scope of this master thesis, the data and analysis focussed on national data and did not come to an analysis of regional differences. There may be huge differences between regions in China such as for instance coastal and urban regions Shanghai, Guangdong, Tianjin and Beijing versus inland and rural regions such as Yunnan, Guizhou and Tibet. Another aspect that was missing in the set of indicators was an indication of the enforcement of human right laws. Concerns about the worship of human rights in China have always been expressed in the past as well as in the present.[188] Human right protection improves people's well-being and is even argued to be related to health.[189] An indicator for human rights

[188] See for instance: Roberta Cohen, 'People's Republic of China: the human rights exception.', *Human Rights Quarterly* 9 (1987) 447; Zhao, S., 'Xi Jinping's Maoist Revival', *Journal of Democracy*, *27* (2016) 3: 83-97.
[189] Jonathan M. Mann, 'Health and human rights.' *British Medical Journal* 312 (1996) 7036: 924-925.

could be included in future research; for example, the Universal Human Rights Index of the United Nations.[190]

6.4 Discussion of methods

Besides the discussion on what indicators for well-being to choose, there is the discussion of the method: how and to which the degree do separate indicators contribute to well-being and how should these be combined? All separate indicators do not immediately give a comprehensive understanding of how well-being has developed. To avoid the difficult discussion on the contribution of every single indicator to well-being, the execution of a factor analysis or principal component analysis seemed the most suitable method to compile indicators into one indicator for well-being, since the method assigns data-driven weights to the indicators in the model. A posteriori, the factor model analysis does not seem to be a sufficient method to compile one indicator for well-being. It turned out to be incapable of processing theoretically sound weightings to the indicators as some indicators received counter intuitive weights. In this research the income inequality and the indicators for environmental quality and personal security did not receive plausible weightings. The same pitfall had in the past been experienced in the compilation of an indicator for well-being in the How was Life publication where the Biodiversity failed to receive a theoretically correct contribution to well-being.[191] Although the factor analysis is repeatedly offered as a considerable option to create a compiled indicator for well-being[192], on grounds of past as well as our own experience it can be concluded that this method should be executed with high caution. If not stronger, it may not be a suitable method to compile an indicator for well-being as the data driven method derived from the natural sciences does not seem adequate to capture a societal phenomenon such as well-being.

The equal-weighting method therefore seems a more reliable method. The results of the factor analysis are similar to the equal-weighting method, which diminishes its importance even more. Furthermore, the equal-weighting method assures that the latent variable computed is actually well-being – which is unsure using the factor analysis. Ideally the equal-weighting method requires datapoints for every indicator at every point in time and a set of data of comparable countries. The first can be easily achieved by interpolation and extrapolation which is also executed in the preparation of the factor analysis – it does require certain caution to use the logic type of inter- or extrapolation given the existing data trends. The latter is more difficult to acquire as it requires data not only for one case, but for a whole set of cases. Having comparable data for

[190] See: United Nations, Universal Human Rights Index (accessed on 11-06-2019), retrieved from: https://uhri.ohchr.org/en/.
[191] Van Zanden et al., *How was Life*, 261.
[192] Mazziotta & Pareto, 'Methods for constructing composite indices', 72.

other countries allows comparisons on the level of well-being between different countries as well-being indicators can then be benchmarked. For instance, the development of education can then be benchmarked on an international scale: it is then possible to assess how education has improved compared to other countries. When merely standardizing the indicators on their own scale, the results may be somewhat flawed as the height of a positive trend may show an inaccurate picture of improvement. An indicator that comes from an extremely low point and improves, is in this research seen as entirely positive. However, it may be that the indicator was at such an extreme low level that improvements were easily enjoyed while this tells nothing about the level of well-being of this indicator. Take for instance the illiteracy rate. In 1964 this was around 33,5%, which is extremely high compared with other countries around the world. Over the years this improved to 4% in 2010. The improvement of literacy and thereby education may then be stronger than in other countries, but this is caused by the fact that it came from far – around one third of the population was illiterate – and improvements were then easily made. This is not fully incorporated in the indicator merely standardized on its own scale.

It is nonetheless not entirely necessary to perform this step. Ultimately it remains extremely difficult to compare well-being between different countries as no scale for well-being exists; well-being cannot be grasped in one unit of measurement. Given this, it then does not matter if an alternative is applied in which the indicators are standardized on their own scale. The result is that only relative comparisons can be made in which the trend of the compiled indicator can be compared with for instance the trend GDP ("well-being grew harder than GDP") but no absolute comparisons can be made ("well-being was at a lower level than GDP"). This does thus not seem to be a big problem as absolute comparisons with well-being do in any way not make sense as there is no unit of measurement.

With the choice of an equal-weighting method, one eventually faces the difficult discussion on the degree to which every indicator contributes to well-being. Attaching equal weights to all components of wellbeing may be unrealistic, but it is debatable how more realistic weights could be attributed. An option could be to let people themselves determine what component of well-being they value more than others. The measurement of subjective well-being nonetheless also has its own challenges especially when comparing different cultures.[193] In terms of material well-being, all people around the world perceive certain aspects of well-being similarly: all people value a certain number of square meters living space, enough earnings to buy essentials such as food and clothing and a sense of safety and security. When it however comes to for instance the level of earnings or the quality of political institutions to live 'the good life' there

[193] Van Zanden et al., *How was Life,* 255.

may be substantial variances in culture and time. Withal, certain measures for China historically lack for pre-1990.[194]

[194] Richard A. Easterlin, Morgan, R., Switek, M., Wang F., 'China's life satisfaction, 1990-2010.', *Proceedings of the National Academy of Sciences,* 109 (2012) 25: 9775-9780.

7. Conclusion

This research has strived to measure the development of well-being in China between 1970 and 2010. During these decades China has experienced an unprecedented increase of Gross Domestic Product. Per capita GDP rose from 778 USD in 1970 to 8031 USD in 2010. The expectation was that this 'Chinese miracle' would have been experienced in a similar fashion in well-being. The use and measurement of GDP to represent well-being has received criticism in recent years. With the publication of an OECD report by renown economists Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi a 'beyond GDP' debate was opened to inquire alternatives to GDP to measure well-being. GDP per capita would be imperfectly capable to cover activities that fall outside of the market, to account for unequal development within society and to differentiate between market activities adding to well-being such as health and education and those harming, like criminal activities and negative externalities as for instance environmental damage. Its measurement is complicated and since the end of the 1990s falsifications have been discovered. Organizationally, report systems and statistical concepts have changed which has complicated the process of gathering and calculation of the GDP statistic by the Chinese National Bureau of Statistics (NBS). The NBS is thereby not acknowledged to be politically independent as politics and bureaucracy are interwoven at different levels. On the basis of these points, the conviction was that a disparity existed between the development of GDP per capita and well-being.

The definition for well-being set up by the OECD report 'How's Life' formed the basis for our definition for well-being. Using the follow-up of 'How's Life', the publication 'How was Life' that historically measured well-being worldwide between 1820 and 2000, different indicators were selected. The underlying data project of 'How was Life', the so-called Clio infra project, formed the basis. To select data for a wider range of indicators to measure well-being in China between 1970 and 2010, additional data was retrieved from Chinese Statistical Yearbooks published by the NBS but also from independent agencies such as the World Bank, the International Labour Organisation, the NCD-RisC database and the Carbon Dioxide Information and Analysis Centre. Well-being is represented by seven different components measured by various indicators. First, the component 'income and jobs' is measured by the indicators real wages, annual disposable incomes, household final consumption, income inequality and unemployment. Second, the component 'housing' is measured by the average amount of square meters living space. Third, 'health' is represented by life expectancy at birth, infant mortality rates and human height. Fourth, 'education' is measured by the average years of education and the literacy rate. Fifth, the 'quality of political institutions' is measured by the Polity2 index and the Unified Democracy Score. Sixth, 'environmental quality' is measured by

Sulphate Dioxide (SO2) and Carbon Dioxide (CO2) emission, intactness of the biodiversity and costs of resource depletion. Seventh, 'personal security' is measured by homicide rates and the number of national and international armed conflicts.

All these separate indicators have been merged into one composite indicator for well-being that represents an overall development of well-being. Two methods have been performed. The first method, the factor analysis, seemed to be the most appropriate method as this method is data-driven and circumvents the arbitrary trade-off of attributing weights according to the contribution of every single indicator to well-being. The weights produced by this method were unfortunately counterintuitive and not consistent with the theoretical contribution of the indicators to well-being; indicators such as income inequality, biodiversity and homicide rates all received a positive weight which oddly suggested that deteriorating income inequality, declining biodiversity and higher homicide rates would benefit well-being. As exact the same problems have been experienced in previous research (including the How was Life publication), this method does not seem to be an adequate method to measure a societal phenomenon such as well-being. An equal-weighting method, the second method, proved to be sufficient. All components were standardized using the Z-score and per component simply received an equal weight.

Using this equal-weighting method, this research concludes that well-being in China has experienced a more distinctive development than GDP per capita between 1970 and 2010. Three phases in the development of well-being have been identified. Contrary to popular opinion highlighting the start of the economic reforms by Deng Xiaoping in 1978 as the start of economic growth, this research suggests an improvement of well-being in a first phase between 1970 and 1986. This conclusion must be made with caution as certain data unavailability forced estimations for certain indicators. In any case, between 1970 and 1978 improvements in most notably average years of education, literacy rates, human height, life expectancy and infant mortality rates were made. During a second phase (1986-1994), well-being declined whereas GDP growth hampered around 1989 but never diminished. This decline in well-being can be attributed to worsening income inequality, a flattening in the decrease of infant mortality rates, worsening political institutions, deteriorating environmental quality and high homicide rates. Despite enhancements of income (real wages, disposable income and household consumption), housing, health and education, well-being decreased. Wen et al. and Kubiszewski et al. already noticed certain relapse in genuine progress which was unanticipated in GDP per capita evolution. A decrease in well-being between 1986 and 1994 has however not been mentioned before. The third phase between 1994 and 2010 shows an improvement in well-being that is more consistent

with the GDP growth. Income inequality, pollution (SO2 and CO2 emission) and climate change (loss of biodiversity) were still persistent, but levelled off while infant mortality and homicide rates decreased. The continuous growth of income, housing conditions, health and education – which have all improved consequently between 1970 and 2010 – proceeded. Only political institutions have shown no sign of improvement.

This disparity between well-being and GDP per capita can partially be explained by the difference between what both measure. GDP only measures market production whereas well-being directly measures aspects that contribute to the well-being of people. Well-being directly incorporates the outcome of education and health and circumvents the translation of what share of national income is spent on healthcare and the educational system. Also, it correctly deducts activities detrimental to well-being such as crime and sufficiently adjusts the negative externalities such as pollution and climate change accruing from some economic production. Furthermore, well-being entails qualitative factors like health and political institutions that are not monetary measurable. The discrepancy may also partially be attributed to the difference in how GDP per capita and well-being are measured. A further explanation on the basis of this research cannot be provided.

Further research could focus on the development of the market in China and its relation to well-being. As the Chinese Communist Party implemented market forces in its formerly planned economy, the character of the providence of social services as for instance healthcare, education and housing changed while the market expanded. The dynamics of the interplay between the evolution of the market and that of well-being could clarify the discrepant development even further. Considering the measurement of well-being, further research could pay more attention to the perception of well-being in China. Well-being is a subjective matter, sensitive to cultural context. Attributing an equal-weight to every aspect of well-being was pragmatic but may not completely represent the well-being inhabitants really experienced in China in the last decades. Therefore, future research could carefully experiment with giving different weights to the various indicators. The factor model analysis is discouraged following the explained problems. Further research on composite indicators for well-being should hence focus on the equal-weighting method in which the indicators are benchmarked using comparable data for a range of different countries. This method is time consuming but does allow a more absolute comparison of levels of well-being rather than a relative comparison that could only be drawn in this research because the indicators were merely standardised on the basis of their own Z-score instead of on international scales for well-being indicators. Nevertheless, it will remain arbitrary to compare levels of well-being as a phenomenon as well-being lacks a unit of measurement that

enables proper comparisons.

The contribution of this thesis is threefold. Firstly, it contributes to a better understanding of the Chinese economic history of the last four decades. A more comprehensive picture of the 'Chinese miracle' arises in which not only the spectacular growth of market production is highlighted but also detrimental effects such as deteriorating income inequality, pollution, climate change and weak political institutions are taken into account. By adding these aspects of well-being, this thesis secondly advocates the necessity of deploying alternatives to GDP to measure well-being; also, outside of the context of China. A large discrepancy in the development of well-being and GDP has been unravelled which is to a certain extent caused by the flaws of GDP to measure broader welfare and well-being. Previous alternatives to GDP already signalled discrepancies; neither however included such a diversified set of indicators as this research, nor did they signal such a strong disparity. Furthermore, this thesis is the first to step away completely from GDP per capita as measurement and directly measured well-being in China. By that, it thirdly contributes to the Better Life Index of the OECD and provides a historical dimension to the well-being experienced today in China. The historical development of well-being shapes today's well-being as well as the sustainability for tomorrow. Due to the 'Chinese miracle' the average Chinese in 2010 probably earned more income, was more likely to have a job, lived in better living conditions, enjoyed more years of education and the children born were more likely to survive there first years, were more likely to grow taller and grew older than his or her grandfather or -mother who lived in 1970. But, for the average Chinese the distribution of the higher incomes has become more unequal leaving a few richer while more others are poorer than average, breathe air with a higher concentration of Sulphate Dioxide and Carbon Dioxide and face changes in climate due to lower biodiversity while politically no significant improvements have been made. China's development of well-being then slightly disturbs of what is ought to be the 'Chinese miracle'.

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Appendix

Appendix 1a Script correlation indicators

```
library("readxl")

library("zoo")

library('data.table')

# read data

setwd("//Client/C$/Users/tjten/Documents/RMA_thesis/Compiled_indicator/Data/Well-being")

standardized = read_excel("Well-being_total.xlsx", sheet = "Standardized")

standardized = data.table(standardized)

standardized

# ensure that data is numeric

standardized[, names(standardized) := lapply(.SD, as.numeric)]

# interpolate data

standardized[, names(standardized) := lapply(.SD, function(x) na.approx(x, na.rm = F))]

# subset dataset to contain only relevant years and variables

dat = standardized[Year <= 2010, list(

  real_wage,

  dip_inc,

  tot_con,

  inc_ineq,

  unempl,

  housing = urban_hou + rural_hou,

  life_exp,

  inf_death,

  year_edu,

  height,

  illit_rate,

  LDV,

  bio_loss,

  so2,

  co2,

  LNCS,

  hom_rate,

  arm_intern,

  arm_ext)]
```

```
# look at correlations
print(cor(dat), digits = 2)
# calculate dataset of first differences
datfd = dat[, lapply(.SD, function(x) x - data.table::shift(x))]
print(cor(datfd[complete.cases(datfd)]), digits = 2)
cor_df = as.data.frame(cor(datfd[complete.cases(datfd)]))
write.table(cor_df, "Correlation.csv")
```

Appendix 1b: Script factor analysis

```
library("readxl")
library("zoo")
library('data.table')
# 1.
# read data
## set working directory
setwd("//Client/C$/Users/tjten/Documents/RMA_thesis/Compiled_indicator/Data/Well-being")
standardized = read_excel("Well-being_backup2.xlsx", sheet = "R")
standardized = data.table(standardized)
standardized
# ensure that data is numeric
standardized[, names(standardized) := lapply(.SD, as.numeric)]
# interpolate data
standardized[, names(standardized) := lapply(.SD, function(x) na.approx(x, na.rm = F))]
# subset dataset to contain only relevant years and variables
dat = standardized[Year <= 2010, list(
  dip_inc,
  inc_ineq2,
  employ,
  housing,
  life_exp,
  inf_live,
  year_edu,
  height,
  lit_rate,
  polity2,
  bio_loss,
  SO2,
  nonhom_rate)]
#####
#Extrapolatie
library(zoo)
library(dplyr)
## Make subset from dat
subset = as.data.frame(dat$housing)
subset$year = c(1970:2010)
```

```
colnames(subset)[1] = "housing"
## Use Dplyr to fill in gaps
test.frame = subset
output = test.frame %>%
  do(lm(housing ~ year , data = .) %>%
       predict(., data.frame(year = 1970:1977)) %>%
       data_frame(year = 1970:1977, value = .)) %>%
  bind_rows(test.frame)
subset$housing[1:8] = output$value[1:8]
dat$housing[1:8] = subset$housing[1:8]
#keep complete cases only
dat = dat[complete.cases(dat)]
#2.
# actual factor analysis
# alternative is scores = "lm", difference is small
fa = factanal(dat[, c(1:13)], factors = 1, lower = 0.1, scores = "Bartlett")
fa
fa$scores # these are the scores for the latent variable
# assign them to dataset
dat$ci = fa$scores
# very quick plot of all data and the fa scores
matplot(dat, type = 'b')
dat
#data back to excel
write.csv(dat, file = "final_composite.csv")
```

Appendix 1c: Output Alpha Cronbach test

Reliability analysis

Call: alpha(x = dat)

raw_alpha	std.alpha	G6(smc)	average_r	S/N	ase	mean	sd	median_r
0.94	0.97	1	0.74	32	0.0067	-0.16	1.1	0.85

lower	alpha	upper	95% confidence boundaries
0.93	0.94	0.95	

Reliability if an item is dropped:

	raw_alpha	std.alpha	G6(smc)	average_r	S/N	alpha se	var.r	med.r
real_wage	0.93	0.97	1.00	0.76	31	0.0076	0.079	0.87
dip_inc	0.93	0.97	1.00	0.75	30	0.0077	0.080	0.84
employ	0.95	0.98	1.00	0.85	57	0.0036	0.031	0.88
housing	0.95	0.96	1.00	0.72	26	0.0108	0.088	0.83
life_exp	0.93	0.96	0.99	0.72	26	0.0081	0.089	0.83
inf_live	0.93	0.96	1.00	0.72	26	0.0079	0.093	0.84
year_edu	0.93	0.96	1.00	0.72	26	0.0078	0.088	0.83
height	0.92	0.96	1.00	0.72	26	0.0088	0.088	0.83
lit_rate	0.93	0.96	1.00	0.72	26	0.0077	0.090	0.84
polity2	0.94	0.97	1.00	0.79	37	0.0059	0.088	0.88
ci	0.93	0.96	0.99	0.72	26	0.0081	0.088	0.83

Item statistics

	n	raw.r	std.r	r.cor	r.drop	mean	sd
real_wage	41	0.83	0.82	0.82	0.80	2.1e-16	1.00
dip_inc	41	0.85	0.85	0.85	0.82	-8.6e-01	1.10
employ	41	0.38	0.38	0.38	0.29	-3.9e-01	1.20
housing	41	0.99	0.99	0.99	0.99	-1.5e+00	3.05
life_exp	41	0.98	0.98	0.98	0.98	8.2e-15	1.00
inf_live	41	0.98	0.98	0.98	0.97	3.5e-16	1.00
year_edu	41	0.99	0.99	0.99	0.99	7.8e-03	0.77
height	41	0.99	0.99	0.99	0.98	8.8e-01	1.50
lit_rate	41	0.98	0.98	0.98	0.97	5.2e-02	0.73
polity2	41	0.67	0.68	0.68	0.62	1.2e-15	1.00
ci	41	1.00	0.99	0.99	0.99	-1.4e-17	1.01