

Quality of China's Official Statistics: A Brief Review of Academic Perspectives

DMITRIY PLEKHANOV

Abstract

Following the rise of the Chinese economy, interest in the official statistics coming from China is intensifying. Official data on GDP, industrial production and other economic indicators attracts a lot of attention all over the world. This positive development represents a challenge for the Chinese official statistics system, as official data is now under greater scrutiny. As the Chinese economy is undergoing the process of transformation and rebalancing, the need for reliable and accurate statistical data becomes even more imperative. This article presents a brief review of English-language publications on the topic and provides key points of criticism of the Chinese official statistics. The review shows that the majority of studies present a rather critical view of the Chinese statistical system. However, from an academic point of view, it is almost impossible to provide concrete evidence that the Chinese official data is deliberately manipulated or falsified. The limitations of publicly available data do not allow researchers to double-check the accuracy of the official statistics. Alternative estimates of Chinese economic indicators are not free from criticism either. Nevertheless, research in this area is an important contribution to the understanding of the China's official statistics, and hence the Chinese economy and society in general.

Keywords: China, official statistics, statistical system, economic indicators

Introduction

Maintaining quality of data and user confidence in data quality is fundamental to official statistics. Official statistics from developed and developing countries usually attract significant public attention and undergo intensive scrutiny from the expert community. Even in countries with long and stable histories of compiling official statistics the quality of official data is constantly debated. The main aim of any statistical system is to gain insights into ever-changing social and economic developments, and there is always a question about whether the current statistical systems are sufficiently fit for purpose. Take, for example, the famous Boskin Commission report which, in the mid-1990s, asserted an upward bias in the US Consumer Price Index (CPI)

related to substitution, quality change and new-goods effects (Boskin et al. 1996). The Boskin Commission made more than a dozen specific recommendations to the Bureau of Labor Statistics (BLS) on how to improve the nation's price indices. The conclusions of the Boskin report had significant practical implications for the federal budget, as the CPI was used to adjust federal programme spending and income tax brackets.

As the role of China in the world economy is rising, the interest in China's official statistics is also on the rise. News announcements made by the National Bureau of Statistics (NBS) gain increasing attention in the international media and can now be considered on a par with news coming from US statistical agencies in terms of their relevance to investors and financial markets. However, Chinese official statistics seem to have a serious 'image problem', as news reports (especially in the western media) tend to depict Chinese official statistics as inaccurate and unreliable.¹ Lack of understanding about the official statistics system of China also contributes to the wider audience perception that it is confusing and potentially misleading. In the end, answers to questions concerning the quality of official statistics can only be provided through in-depth and detailed analysis by academic researchers.

This article aims to provide a brief review of the scholarly research on China's official statistical system from the early 2000s to the present day. The reviewed studies represent English-language publications that investigate the process of data collection and compilation, peculiarities of methodology and structure, and the dynamics of specific social and economic indicators. As publications in other languages (mainly Chinese) were not included in the sample, the results of the present study can be interpreted as a general view of China's official statistics from outside of China.

In terms of methodology, the first step in identifying relevant studies was to search through EconLit, ScienceDirect and JSTOR economic literature databases using the following keywords: 'China' and 'official statistics'. Some articles were filtered and excluded on the basis of their titles and abstracts, as they were irrelevant to the present study. Upon reading the papers one by one it was possible to supplement the mechanical database search by identifying additional sources (articles in academic journals, book chapters, working papers and reports) referenced in the original batch of publications. When two similar studies were reported from the same author(s), the most recent publication was included in the analysis.

The article is organized as follows: 1) quantitative summary of main characteristics of the studies, 2) summary of research results on main economic indicators and approaches used by researchers, and 3) main research findings and conclusion.

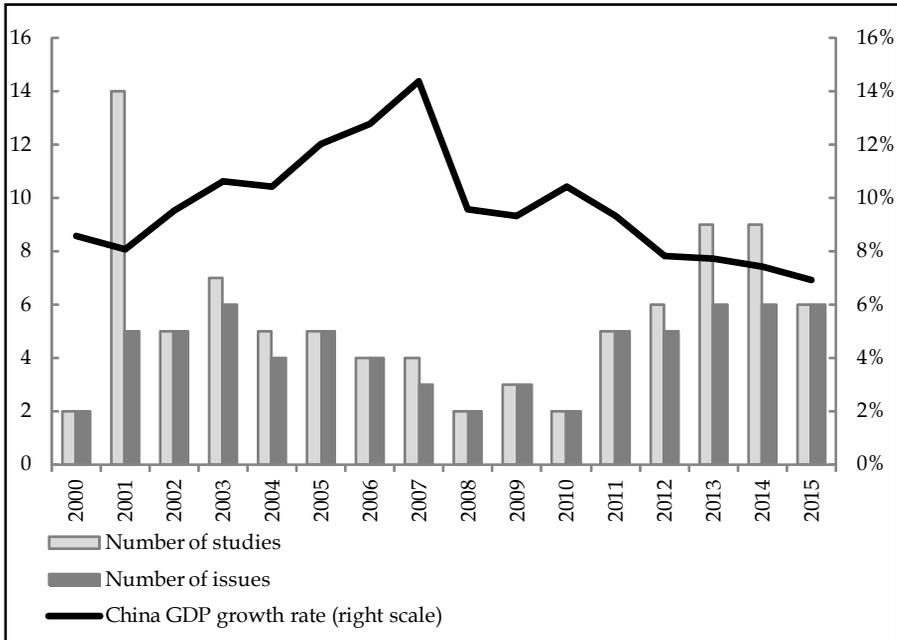
Studies of the Chinese Statistical System: Quantitative Summary

The database of studies dealing with analysis of the Chinese statistical system consists of 88 publications dating from 2000 to 2015; these illustrate the interest of researchers in the official statistics of China. Figure 1 (below) shows the frequency and distribution of publication years of all the studies reviewed, as well as the number of issues (to control for the fact that in some cases several articles were published in one issue of academic journal).² As this figure shows, since the early 2010s researchers have paid increasing attention to various aspects of the Chinese statistical system (methodology, data collection, compatibility with international standards, etc.). In 2011-2015 the average number of studies on Chinese statistics rose to seven publications per year as compared with three publications per year in 2006-2010. Figure 1 also indicates that prior to the recent period, Chinese official statistics had already come under scrutiny in the early 2000s. Increased interest of international research community in the Chinese statistics system at that time can be attributed to a series of reforms which were undertaken by the Chinese authorities prior to the country's entry to WTO in 2001 and were aimed at transforming the national statistical system and making it more compatible with international standards. Besides, analysis of gross domestic product (GDP) statistics anyway intensified as foreign economists were surprised by the relatively stable performance of the Chinese economy after the Asian Financial Crisis (1997-1998) (Rawski 2001).

The dynamics of the number of publications since the early 2000s suggests that research interest in the official statistics of China can be linked to the pace of economic development. In the mid-2000s attention waned, as it seems economists and the general public became accustomed to the stable and steady growth rates of the Chinese economy. However, doubts about the quality of statistics sprang up as the economy began to slow down. Now, as the Chinese economy is undergoing the process of transformation and rebalancing, reliable statistical data are vital for researchers and analysts trying to predict China's future path and possible turning points in economic development. Consequently, analysis

of Chinese official statistics can be expected to remain a popular topic of research in the near future.

FIGURE 1. Frequency distribution of publication years of studies reviewed and China's GDP dynamics.

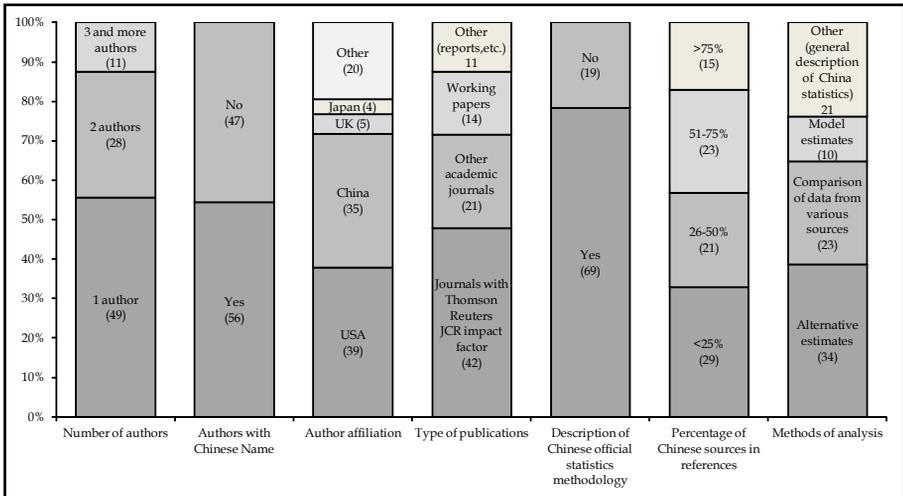


Source: author's own calculations (studies); NBS (GDP)

Studies on Chinese official statistics differ in terms of authorship, research content and publication media. All the studies reviewed in the present research sample were classified according to the following characteristics: number of authors, authors affiliation, authors name, type of publication, methodology description, use of Chinese sources and quantitative estimates. Figure 2 provides an overview of the various characteristics of the studies included in the sample. The 88 studies collected in the research sample were written by 103 different authors. About half of all publications (49 studies, 56 per cent of the total) were written by a single author rather than co-authored. The study covers only English-language publications, though this limitation was somewhat mitigated by the inclusion of publications written by authors who had affiliations in mainland China and/or had a Chinese name, which may indicate some connection to mainland China. Geographically, the largest portion of researchers included in our sample belongs to academic institutions or other entities based in the United States (39 authors, 38 per cent of the total number) and China (35 authors, 34 per cent). This fact indicates that the research sample is balanced at least in geographical terms.

As Figure 2 shows, the majority of studies included in the sample were published in academic journals (63 studies, 72 per cent of the total), among which 42 studies were published in journals with an impact factor from Thomson Reuters Journal Citation Report (JCR), released in the year 2016.

FIGURE 2. Breakdown of the research sample by authorship, type of publication and research content attributes



Note: Figures in parenthesis represent number of authors (for the first three left-hand columns) and number of studies (for the rest of the columns).

As far as research content of studies is concerned, the majority of publications (69 studies) contained description (in various degrees of detail) of Chinese official statistics. Chinese language sources were actively used by researchers in their analysis of Chinese official statistics: 38 studies (43 per cent of the total) included Chinese sources that accounted for more than half of the reference list. Among the studies reviewed there was substantial heterogeneity in the research methods used by researchers. Thirty-four studies provided alternative estimates of various types of Chinese social and economic indicators, 23 studies were engaged in comparison of data from various sources of official statistics. A small subset of publications (10 studies) that reported results of various statistical models used to test the reliability of Chinese statistics (principal component analysis, etc.) was also identified.

Main Points of Criticism

Official statistics of China have long been criticized for being subject to different types of mistakes, from underreporting or inadequate coverage

of various areas of economy to misclassifications and even data manipulation. The following analysis of the published studies allows to summarize the main points of criticism. Table 1 shows that inadequate methodology can be considered the main area of concern for researchers, as about 60 per cent of studies contained references to this type of data problem.

Underreporting is another widespread problem identified by authors (38 per cent of studies). For example, high-income households are widely believed to be under-represented in the NBS samples (Yu & Abler 2014; Zhang & Zhu 2013). Problems of data gathering are also persistent, as indicated by the open letter published in September 2013 on the NBS website by the then acting chief statistician Ma Jiantang, citing emotional comments from on-the-ground statisticians about data collection problems while contacting respondents.³ All in all, the NBS's difficulty in capturing economic activities in smaller, non-state units has become more relevant in recent years (Holz 2013a).

The third most cited problem is data manipulation. The problem of data manipulation as identified by researchers stems mainly from institutional factors. Firstly, the independence of statistical authorities is called into question. The NBS is a bureau directly under the administrative leadership of the State Council, which also appoints major personnel and provides funding (Holz 2015). Secondly, the NBS has very little authority over provincial statistics bureaus and statistics divisions of other central government departments. To get promoted local leaders have an obvious incentive to overstate local GDP by exerting pressure on their subordinate statistical bureaus (Ma et al. 2014). It is worth mentioning, however, that the cases of provincial-level data manipulation cited by researchers are usually taken from official NBS statements.⁴ Thus, the Chinese authorities at least acknowledge the problem and take some measures to improve the situation.⁵

Analysis of studies published between 2008 and 2015 shows that researchers have begun to pay increasing attention to lack of transparency on the part of the NBS and the problem of data inconsistency. The way in which statistical authorities disclose their data and provide additional information – such as revisions data and methodology explanations – is a longstanding problem in China's official statistics. Lack of transparency further complicates interpretation and analysis of disseminated data. For example, China does not publish GDP price deflators and therefore researchers who are interested in examining price changes in the Chinese economy have to derive implicit GDP deflators from nominal GDP figures (Wu & Ito 2015). The problem of data inconsistency arises when

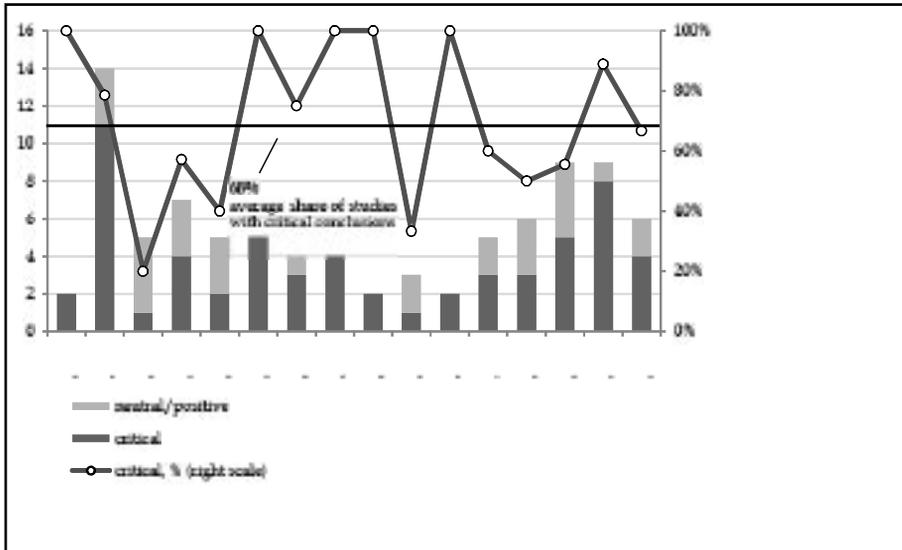
a researcher can derive different estimates for a particular statistical indicator from different sources of official statistics. For example, in the reviewed studies researchers provided examples of data inconsistency in official statistics on city population (Zhou & Ma 2005), wages (Han & Zhang 2010) and industry added value (Wu & Ito 2015).

TABLE 1. Main points of criticism of China's official statistics.

Problem/Description	% of studies citing particular problem		
	Total sample	2000-2007	2008-2015
Inadequate methodology Methodology used does not correspond to the best international practice	56%	59%	52%
Underreporting Statistical authorities fail to collect adequate data, respondents do not cooperate	38%	43%	31%
Data manipulation Data can be deliberately falsified by local or central authorities	32%	33%	31%
Data inconsistency Different estimates of a particular statistical indicator can be derived from different data sources	20%	13%	29%
Data series inconsistencies Breaks in time series occur due to changes in coverage and redefinition	20%	24%	17%
Lack of transparency Explanations on statistical data, methodology and revisions are missing	16%	11%	21%
Data divergence Different statistical indicators do not correspond to each other	9%	9%	10%

Note: The column sum does not equal 100 per cent as some studies highlighted several types of problems.

FIGURE 3. General attitude towards quality of China's official statistics in studies reviewed



General Attitude to Official Statistics

The survey of academic research on the Chinese official statistics reveals a generally critical attitude towards the data quality. Sixty-eight per cent of studies reviewed have critical remarks on various aspects of the official statistics system in their conclusions section (Figure 3). It seems quite natural that studies on the quality of China's statistical data are skewed towards critical assessment of the official statistics system. After all, from a methodological point of view, it is impossible to provide the final proof of data reliability and accuracy. As Klein and Ozmuur have noted, 'no one knows the correct estimate' (2003: 193). The reliability and accuracy of alternative estimates of China's official data can also be questioned, as there are examples of debates among scholars proposing different approaches to analysis and interpretation of the official data (see, for example, Holz (2006) and Maddison (2006)).

As noted, the sample included only English-language publications, but quite a large sub-sample of articles were published by authors with a Chinese name. These authors on average have a more critical attitude towards the quality of Chinese statistics system. 77 per cent of studies prepared by authors with a Chinese name contained critical remarks in the conclusions section as compared with 68 per cent for the general sample of studies reviewed. To subject these descriptive observations to more rigorous analysis, Table 2 presents the results of a binary logistic

regression model, which was used to investigate whether the characteristics of the studies affected their outcomes (i.e. the conclusions of authors about the Chinese official statistics). The dependent variable was 'attitude to official statistics' (coded as 0, if conclusion section contained critical comments on official data; and 1, if authors provided some neutral or positive remarks). Such independent variables have been included in the model as number of authors; review of methodology in a study (1 = yes/ 0 = no); use of quantitative estimates (1 = yes/ 0 = no); percentage of Chinese sources (statistical yearbooks, academic papers and media reports in the Chinese language, etc.) in references; impact factor of the academic journal from Thomson Reuters Journal Citation Report (JCR) and two additional dummy variables. The first dummy variable was used to indicate whether any author of the study had a Chinese name and any affiliation in mainland China (1 = yes/ 0 = no). And the second dummy variable was used to indicate those studies with Chinese name authors, who did not have any affiliation with the mainland. Negative parameter estimates in the first column of Table 2 indicate that higher levels of an independent variable are associated with higher odds of critical conclusions about official data. Thus, binary logistic regression results can be interpreted as follows. First, studies using quantitative estimates tend to take a more critical stance towards

TABLE 2. Results of binary logistic regression

	B	S.E.	Wald	Sig.	Exp(B)
Number of authors	0,120	0,367	0,106	0,744	1,127
Review of methodology	0,000	0,681	0,000	1,000	1,000
Percentage of Chinese sources in references	1,194	0,982	1,479	0,224	3,301
Quantitative estimates	-1,393	0,614	5,144	0,023	0,248
Publication in academic journals with JCR impact factor	-1,353	0,591	5,251	0,022	0,258
Author(s) with a Chinese name/with Chinese affiliation	-0,909	0,687	1,749	0,186	0,403
Author(s) with a Chinese name/No Chinese affiliation	-1,265	0,700	3,271	0,071	0,282
Model Summary:					
-2 Log likelihood	Cox&Snell R Square		Nagelkerke R Square		
91,326	0,167		0,234		

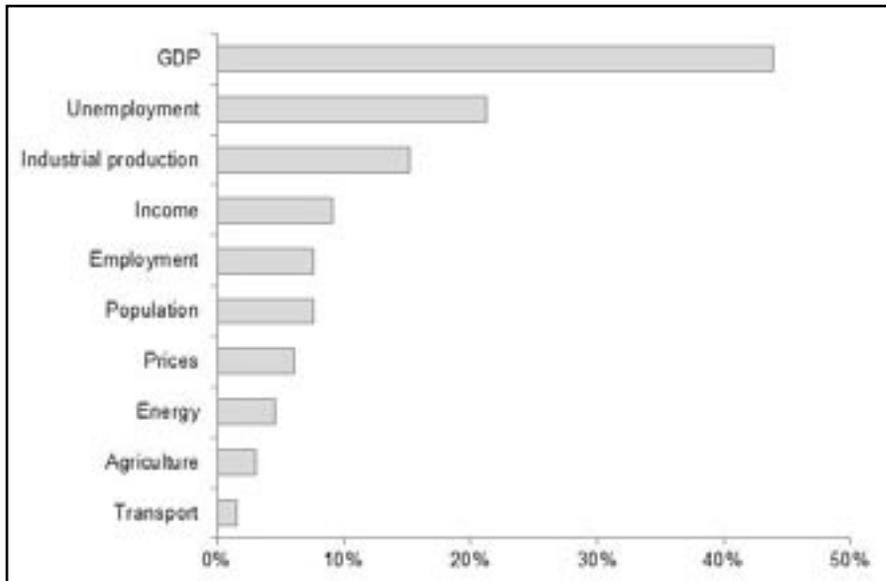
Notes: Significant coefficients are highlighted in bold

official statistics than studies without quantitative estimates. Second, studies published in academic journals with a higher JCR impact factor report more critical conclusions. Third, studies fulfilled by author(s) with a Chinese name but without any affiliation with the mainland China also provide more critical assessment of the Chinese official data. Thus, it can be concluded that a critical stance towards official statistics among the Chinese name authors is mainly attributable to researchers employed at institutions outside of China.

Main Indicators of Interest

The national statistical system of any country deals with a large array of raw data and produces a wide range of statistical indicators. However, some of them attract more public attention than others. This survey of studies on Chinese statistics reveals that researchers tend to concentrate their attention on a very limited set of economic indicators. The most popular area of research is analysis of GDP data and methodology of national accounts in general. About 40 per cent of studies in the sample are actually dedicated to analysis of GDP statistics (Figure 4). Unemployment and industrial production data also attract a lot of attention

FIGURE 4. Distribution of studies by type of economic indicators reviewed



Note: the sum does not equal 100 per cent because some studies may actually review several indicators.

from scholars (20 per cent and 14 per cent, respectively). All in all, 60 per cent of studies in the sample analysed at least one of these three economic indicators.

Review of Studies by Types of Economic Indicators

Indicator 1. Gross Domestic Product (GDP)

Various aspects of Chinese statistics have been subject to research to understand possible deficiencies and sources of problems. As can be seen from the present sample of studies, researchers basically apply four different approaches to analysis of China's GDP statistics. The first approach can be called 'general survey', under which research efforts are mainly concentrated on analysis of GDP methodology and institutional framework in general. Thorough analysis can provide valuable insights into GDP estimation procedures in China in comparison with other countries and allows researchers to make assumptions about possible causes of data inconsistencies and discrepancies. The second approach represents various attempts made by researchers to reconstruct GDP data on the basis of assumptions concerning main GDP components. The third approach aims at testing the quality of GDP statistics by monitoring correlation between GDP dynamics and specific indicators of 'key' economic sectors.

General Survey of GDP Estimation Process

A basic understanding of how official statistical systems work is indispensable for data users. The general description of China's statistical system and the process of GDP estimation can provide valuable insights into possible limitations of the data and caution against jumping to quick conclusions. The most thorough analysis to date on the topic in the English language publications is presented in the studies of Carsten Holz (Holz 2002, 2003, 2004a, 2013b). Holz provides a detailed and balanced account of changes in the Chinese official statistical system (and GDP statistics in particular) over time. The author's conclusions are reinforced by predominant use of original Chinese language publications in his analysis. According to Holz (2002), it is wrong to make judgements on the quality of China's statistics on the basis of standards set by statistical systems in highly developed and relatively stable market economies. In the case of the rapidly developing and transition-

ing economy of China, coverage of nation-wide economic activities is naturally complicated. The author also documents multiple cases of data falsification on the local level. But he also argues that the evidence of aggregate nation-wide output and economic growth data is invalid and that the NBS appears to be making sincere efforts to prevent data falsification (2003). He also stresses that criticism of China's GDP data is sometimes based on misunderstandings about meaning and coverage of particular data; consequently, it concentrates a lot of research efforts on careful examination of national data collection methods, statistical concepts and variables. According to Holz (2004), changes implemented by the NBS in data compilation methods (introduction of censuses and sample surveys) led to a reduction in the margin of error inherent in the nation-wide aggregate data. However, he goes on to argue that the official data are still beset by a variety of problems, such as breaks in data series, underreporting and difficulties of the Chinese statisticians in measuring economic activities in small, non-state units (2013b).

The official view on the quality of China's official statistics can be found in the studies of Xu Xianchun (Xu 2004, 2009; 2013). As an official representative of the NBS, Xu (2004) provides a very detailed explanation of the GDP estimation process in China, reforms adopted by the NBS in the 1990s and remaining problems.⁶ Xu specifies several problems associated with GDP estimation in China such as lack of price indices, local leaders interference with statistical data, lack of information about the 'nonmaterial services' sector and the 'nonobserved' economy. He argues that further improvement of the national statistical system is necessary, and that a relatively independent statistical management system free from interference by local leaders is required. About a decade later Xu shifted the focus of his analysis from examining pitfalls of official statistics to addressing questions raised in the foreign media about various types of differences between expenditure-based GDP accounting and relevant common economic indicators, such as household consumption expenditures, retail sales, investment in fixed assets and foreign trade (Xu 2013). The author responds to these 'influential doubts' by pointing out that expenditure-based GDP component indicators do not directly correspond to economic indicators due to differences in data sources, statistical concepts and data-collection purposes. However, he acknowledges that in the official statistics there is a certain degree of underestimation of household income and consumption and overestimation of investment in fixed assets.

Estimates of GDP by Components

Scholars clearly do not have capabilities to reconstruct GDP data from scratch. Usually a narrow approach is applied, where researchers assess official statistics, identify specific data problems, investigate the nature of these data problems and propose alternative estimates for various GDP components. Until the end of the 1980s China used the Soviet system of national accounts, the Material Product System (MPS), which was developed in the Soviet Union and was widely used by countries with centrally planned economies. The MPS system was fundamentally different from System of National Accounts (SNA), introduced by the United Nations in the 1950s as the internationally accepted statistical standard. Therefore, the purpose of the majority of foreign studies in the pre-reform period was to provide a quantitative assessment of Chinese performance in accordance with internationally accepted statistical concepts. But such estimates were basically absent for the 1970s and 1980s due to limited availability and irregular publication of official statistics (Wu 2000). In view of these problems most observers simply used Chinese official statistics, as the task of data adjustment appeared to be so complicated (Maddison 1998).

Chinese official statistics on GDP have repeatedly come under scrutiny since the early 1990s. The rise in the interest was basically motivated by two factors. Firstly, the NBS established a system for GDP estimation on the basis of United Nations SNA, which made international comparisons more convenient for researchers. Secondly, the period of transition in the official statistics coincided with the detection of multiple cases of intentional data falsification on the provincial level (Rawski 2001). In the 1990s reports on data falsification became quite common in the Chinese press in general and in official NBS publications in particular. It should therefore come as no surprise that researchers tried to adjust official GDP data.

Among the recent studies, the most elaborate approach to adjustment of the official GDP figures was developed over several years by Angus Maddison and Harry Wu (Maddison 1998; Wu 2000; Maddison & Wu 2008; Wu 2011; Wu 2014). The foundation of the approach was laid out most fully in Maddison (1998), who proposed to adjust official GDP estimates using alternative estimates for industrial production and the 'non-material' services sector. Industrial performance was measured on the basis of estimates provided by Wu (1997). Growth in the 'non-material' services sector was estimated on the basis of employment data as it was assumed that there was no productivity growth during the period reviewed (1952-2003). It is worth mentioning though that the

assumption of 'zero productivity growth' and employment estimates were heavily criticized by Holz (2006). According to Holz, comparison with other transition economies suggests positive labour productivity growth in the services sector, whereas Chinese employment data are biased and tend to slightly underestimate employment growth in the services sector. The adjustment approach was further elaborated in their joint study (Maddison & Wu 2008). Wu (2011, 2014) adjusted estimates by using multiple weights and time-variant value added ratios (for converting production data into GDP estimates) and providing alternative estimates for 'non-material services' sector as compared with estimates made by Maddison and Wu (2008).

All in all, the most recent estimates provided by Wu and Ito (2015) show an annual GDP growth of 9.4 per cent in 1981-2010, which is 0.8 percentage points lower than the official estimate of 10.2 per cent. However, researchers found significantly faster GDP growth in the post WTO period (2001-2007) of 12.7 per cent instead of the official 11.3 per cent per annum. The new estimates for the 1991-2001 sub-period were also significantly higher than alternative estimates provided earlier by Maddison and Wu (2008). Thus, whereas the adjustment technique initially used by Maddison showed significant overestimation of the official GDP growth rates, later studies provided more mixed results.

Another popular approach for adjusting the official figures was motivated by the fact that some researchers cast doubts on the quality of China's price statistics. As late as the 1990s, some scholars argued that China's GDP deflator could be underestimated due to the methodological peculiarities of the official statistics that require enterprises to report their output at 'constant prices' of the benchmark year, chosen by the NBS (Woo 1998; Wu 1997). Movshuk (2002) points out that reporting entities can have trouble estimating 'constant prices', if some products or the entity itself did not exist in the most recent benchmark year. It is quite possible that Chinese enterprises may choose to override this obstacle by simply reporting identical nominal and real output, which eventually can lead to lower deflator estimates on the national level. It is worth mentioning, however, that some researchers argue that China's deflators and price indices can be overestimated. For example, Klein and Ozmuur (2003) argue that if product quality changes remain unobserved or underestimated in the official statistics that can actually lead to overestimation of the deflator. However, as the NBS has not yet started to disclose data on GDP deflators, the quality of price indices and their use in official GDP estimation still remains a hotly debated issue.⁷

The researchers who called into question the quality of China's GDP deflators proposed to assess GDP growth rates on the basis of alternative GDP deflators (Keidel 2001; Movshuk 2002; Young 2003). The basic framework of this approach is as follows: 1) the nominal values of GDP components are taken as given; 2) alternative deflators are constructed using available price indices; 3) nominal GDP figures are adjusted by alternative deflators. If GDP decomposition is based on production approach, then sectoral price indices are used. In the case of the expenditure approach, price indices for different types of expenditures are proposed. For example, Keidel (2001) uses different price indices for different expenditure categories to estimate GDP level and growth on the basis of expenditure accounts. Rural and urban consumer price indices were used to deflate rural and urban household consumption, while the retail price index was used for the trade balance. The author calculations showed mixed results as official figures for some years during the research period (1990-2000) were actually lower than alternative estimates derived from the adjustment of nominal GDP components by price indices. Movshuk (2002) substituted implicit GDP deflators using survey-based price indices for seven major sectors of the Chinese economy (primary industry, industry, construction, telecommunications services, transport and storage, wholesale and retail trade and other services). He concluded that 'underestimated GDP deflator overstated growth in terms of GDP by about 2 per cent during 1991-1999' (Movshuk 2002: 37). The underestimation was especially pronounced during 1993-1995. Young (2003) substituted the NBS price indices for the implicit deflators of the primary, secondary and tertiary sectors of the economy. For example, for the tertiary sector consumer price sub-index for services was used. According to authors' estimates the use of alternative price indices lowered the official estimates of GDP growth rates during 1978-1998 by 1.7 per cent. And downward adjustment actually took place after the year 1986. During 1986-1998 the average growth rate was estimated at 6.2 per cent per year (three percentage points lower than the official figure).

The 'alternative deflators' approach represents a rather critical attitude towards the quality of official statistics. However, it is actually based on shaky assumptions about price dynamics in various sectors of the Chinese economy, as scholars have to rely on official price indices as a substitute for implicit deflators. According to Holz (2015), all deflation methods come with inherent deficiencies. For example, they can give too much weight to high-growth sectors due to high initial prices (leading

to high growth rates), or neglecting quality change and thus causing deflators to be too high and growth rates to be too low.

GDP Vs. Alternative Indicators

Another popular approach to testing the quality of China's official statistics is double-checking the official GDP growth rates against alternative economic indicators (energy use, output of specific industrial products, freight transportation, etc.). This approach was popularized when the acting prime minister of China Li Keqiang, while taking the post of Provincial Committee Secretary in Liaoning in 2007, was reported to state that instead of provincial GDP data he prefers to look at a narrow set of three economic indicators, namely electricity consumption, railway cargo volume and loans disbursed by banks.⁸ *The Economist* combined these indicators to become the so-called 'Li Keqiang Index' in 2010.⁹ Since then, a lot of research institutions proposed their own alternative indices of the Chinese economy using the same approach but using different sets of economic indicators. For example, Capital Economics uses an 'activity proxy' comprising freight movement, sea shipments, electricity use, property sales and passenger travel.¹⁰

Several scholars proposed to test the reliability of China's GDP statistics by comparing movements in various economic indicators with GDP dynamics. Overall, the main research results show that movements in China's real GDP are not significantly different from movements in related data. For example, Klein and Ozmucur (2003) examined several strategic indicators (electricity production, passenger traffic, retail sales, etc.) and concluded that the principal components of these indicators reflected the movement of official estimates of the Chinese economy. However, according to Klein and Ozmucur, 'it cannot be claimed that we have proved that GDP as officially measured is correct' (2003, p. 193). Mehrotra and Paakkonen (2011) used factor analysis to summarize information from a variety of macroeconomic indicators (using quarterly data from 1997 to 2009) – including supply-side (energy production, output of various industrial products) and demand-side (household income, number of tourists and passengers) indicators – and found that the estimated factors matched the GDP dynamics well. Mehrotra and Paakkonen (2011) also indicated that some discrepancies between indicators were observed, perhaps unsurprisingly, at turning points of business cycles, or times of international crises. Thus, it can be concluded that the use of alternative

indicators as a proxy for GDP growth rates can provide rather weak results when the economy undergoes structural change and old statistical relationships no longer stand.

Indicator 2. Unemployment Rate

The survey of studies on the Chinese official statistics shows that, among the main economic indicators, unemployment data can be considered the major area of concern in terms of quality and reliability. Some researchers even stated that the official unemployment rate is 'almost useless' (Cai et al. 2013). In another recent paper, Feng et al. (2015) noted that it is implausible that official unemployment rate was so stable, as the Chinese economy has been through a series of major events including restructuring of the state-owned enterprises (SOEs), rural-to-urban migration, WTO entry and expansion of college enrolments. Since 2002, unemployment figures in China remained remarkably flat within a narrow range between 4 per cent and 4.3 per cent. But low levels of variability during such a long period of time are not the only cause for concern; many studies also point to other problems in unemployment statistics.

The main point of criticism remains basically unchanged. The official unemployment rate in China is still calculated on the basis of administrative data rather than survey data.¹¹ The low information content of the official registered urban unemployment rate (RUUR) is aggravated by inadequate counting of urban migrants. A large fraction of the Chinese working-age population lacks local household registration status, and thus is not qualified to register with local employment service agencies. In recent years, the situation has started to change, albeit slowly, as the Chinese government relaxed rules on urban residence registration. But as official statistics show the relaxation of requirements did not have any significant effect. According to the recent NBS survey, only 10.5 per cent of rural migrants were covered by the unemployment insurance system and thus were eligible to receive benefits.¹² Even those people who are qualified to register may lack the incentive to apply because of low levels of unemployment benefits. The unemployment benefits are pegged to local minimum wages, which are set up by provincial level governments, normally in the range of 60-80 per cent. Compared with the monthly average wages in urban regions, the unemployment insurance benefits take about 17.8 per cent. According to reports in the Chinese media, rural migrants can also lack knowledge about the unemployment insurance system in general, as employers and local authorities may be reluctant to provide them with information.¹³

As the official unemployment rate is widely considered to be uninformative it comes as no surprise that a lot of researchers attempted to estimate the 'actual' unemployment rate. Two different approaches were proposed. The first approach was to adjust official data on unemployment using information from other official sources. This technique was initially adopted in the 1990s, when SOEs restructuring led to the phenomenon of laid-off (*xiagang*) workers not counted in official statistics on unemployment. This was actively used until the mid-2000s. The most common technique was to add laid-off workers to the registered unemployed in order to calculate a total unemployment figure (Xue & Zhong 2003; Wu 2003, Knight & Xue 2006). Cai and Chan (2009) tried to calculate urban unemployment on the basis of various assumptions about unemployment in different population groups (urban formal employed, urban informal employed, college graduates, rural migrants, etc.).

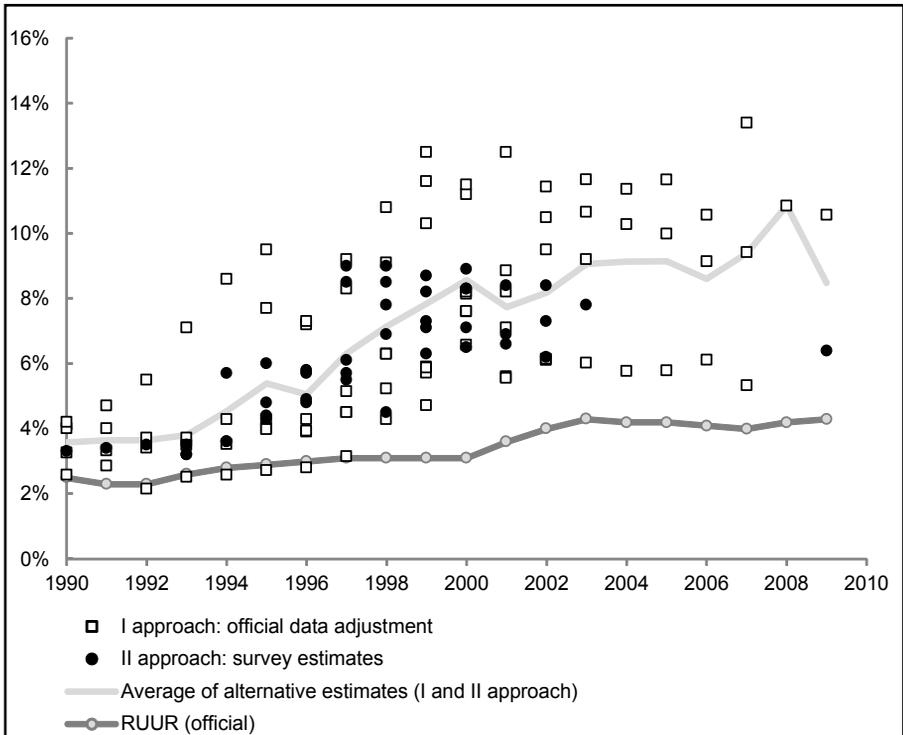
However, the 'adjustment' approach has serious shortcomings. For example, as pointed out by Giles et al. (2005): 1) many officially laid-off or registered unemployed workers may actually be working part- or full-time or may be out of the labour force; 2) official numbers by definition exclude the large numbers of unemployed without official status.

The second approach was developed when researchers gained access to various sets of survey data on the Chinese population. These studies usually employed micro-level data collected by the NBS or other government related institutions (for example, the Chinese Academy of Social Sciences). The main drawback of this approach is that survey data are only available for a limited number of regions and for a limited number of years. For example, Giles et al. (2005) used self-collected data in five big cities in 2002 and retrospective information for the 1996-2001 period to estimate the national level of unemployment. Wang and Sun (2014) used data from survey of 30 provincial capital cities conducted in 2007. Feng et al. (2015) provided the longest time-series of unemployment rates estimates so far using microdata from the Urban Household Survey (UHS) administered by the NBS. Owing to the differing data sources and methodologies used, the existing alternative estimates also vary greatly, although since the late 1990s the gap between the average of alternative estimates and official data has remained remarkably steady (Figure 5). In the 2000s, unemployment rates, estimated by researchers, were on average 2.2 times higher than official figures. The NBS actually started to conduct unemployment surveys in the mid-2000s, but it still does not publish survey-based estimates of unemployment rates on its website.¹⁴

Indicator 3. Industrial Production

Industrial output is an important indicator of economic activity, especially in the case of an investment and export-oriented economy such as China. Official announcements concerning 'industry value added' – the main monthly indicator of industrial production in China – attract a lot of attention as indicators of development in various industrial sectors and as a proxy for growth of the whole economy. Papers on the quality of China's industrial production statistics can be roughly divided into two main groups. The first group of studies pay close attention to statistical methodology and problems associated with data revisions (for example, see Holz 2001, 2013c; Szirmai et al. 2005). According to Szirmai et al. (2005), the consistency of long-term time series is affected by changes in statistical concepts and, most importantly, absence of overlapping year, which would allow linking of different series together. The second group of studies is devoted to reconstruction of nation-wide and industry level output indices using data on individual industrial products and other alternative indicators (for example, see Wu 2002, 2014).

FIGURE 5. Estimates of urban unemployment rates by different approaches



The most comprehensive and thorough review of the impact of constant redefinition and reclassification on the quality of industrial production data in China is provided by Holz (2001) and Holz (2013c). According to Holz (2001), the major problem of China's industrial statistics is the numerous changes in statistical definitions and classifications. As a lot of these changes are poorly reported by the NBS, data analysis becomes even more complicated for external users of official statistics. For example, Holz indicates breaks in time series data on industrial output that took place in 1993 and 1998. The scope of enterprise coverage and official statistics classifications was re-defined several times, which led to problems of data comparability. He also notes that periodic adjustments were actually necessitated by the rapid transformation of the Chinese economy, namely transition from central planning to market economy, advance of new ownership forms and rapid increase in the number of reporting enterprises. Later, Holz (2013c) proposes to construct consistent economy-wide and public sector monthly nominal and constant price series for the period May 1983 through 2011. In contrast to the official monthly data, the alternative estimates cover all industry (rather than a varying subset of directly reporting enterprises) and a consistently defined public sector (rather than state-owned enterprises prior to 1998 and state-owned and state-controlled enterprises afterwards). Although he documents various problems associated with frequent and incomplete enterprise coverage, he does not question the reliability of official data itself.

A more critical approach to the quality of industrial production data is presented in studies made by Wang and Meng (2001) and Wu (2002, 2011, 2014). These scholars claim that Chinese official statistics have a serious upward bias due to underestimation of inflation, institutional and political factors, etc. Consequently, they propose alternative estimates mainly on the basis of data on the quantity of physical output, as these figures are considered more reliable than data on the value of output.

Wang and Meng (2001) provide alternative estimates of industrial production figures using three different approaches. Firstly, they recalculate industrial growth rates using output quantity data for 168 specific industrial products and show that the discrepancy between official growth rates and alternative estimates actually increased for the period 1991-1999 in comparison with the period 1979-1990. Secondly, they compare growth rates of freight turnover and power consumption with the growth rates of industrial production and state that the abnormal growth rate differential can only be caused by statistical errors. Thirdly,

the Cobb-Douglas production function is used to examine the credibility of industrial growth rates. Wang and Meng state that significant acceleration of total factor productivity (TFP) in 1992-1997 is difficult to explain as a result of economic reforms or any other factors. They attribute this sudden jump in TFP growth rate to a statistical error.

Wu (2002) constructs an alternative output index for 17 industrial branches and total industrial production in general. Indices are constructed using data on individual industrial products. The results of the study show that China's industrial growth performance was overestimated in official statistics. The extent to which the official data were overstated varies across different periods. According to Wu (2002), the difference between official and alternative estimates was about 1.2 percentage points for the pre-reform period (1952-1978) and 3.3 percentage points for the post-reform period (1978-1997). The estimates method was further elaborated by Wu (2011) using new price weights based on data covering more recent years (1992 and 1997). He also examined and rejected the problem of 'product quality' (i.e. commodity-based output index may underestimate actual output dynamics as it ignores quality improvements), which had been raised by Holz (2006).

Conclusion

The increasing economic importance of China has prompted international observers and researchers to look more closely at various aspects of economic and social developments in the country. Consequently, there has been greater scrutiny of official data quality. The Chinese economy is currently in the midst of a transformation and rebalancing phase where reliable, detailed and up-to-date information is of prime importance for decision-makers, researchers and analysts. This article has sought to survey the general situation of research on the quality of China's official statistics at this particular historical moment. The key results are as follows:

Firstly, in recent years researchers have paid increasing attention to various aspects of the statistical system of China (methodology, data collection, compatibility with international standards, etc.). In 2011-2015, the average number of studies on Chinese statistics rose to 7 publications per year in comparison with 3 publications per year in 2006-2010.

Secondly, the majority of studies reviewed represent a rather critical view of the Chinese statistical system. About 70 per cent of studies include critical remarks on various aspects of the official statistics system in their

conclusions. Among studies reviewed, those using quantitative estimates, published in journals with higher JCR impact factor and fulfilled by researchers with a Chinese name but without affiliation with mainland China are associated with higher odds of critical conclusions about official data. Critics provide descriptions of the official statistics system, point to examples of data inconsistency and data discrepancies, propose methods to prove inconsistency among various economic indicators, and adjust official statistics data to provide alternative estimates.

Thirdly, this survey of studies of China's official statistics reveals that researchers tend to concentrate their attention on a very limited set of economic indicators. About 60 per cent of studies are dedicated to analysis of three main economic indicators, namely GDP, unemployment and industrial production. Among these indicators, data on the unemployment rate can be considered the major area of concern in terms of quality and reliability.

Fourthly, the survey allows us to summarize the main points of criticism of the Chinese official statistics. According to the findings presented in this article, Chinese statistical authorities should pay special attention to the problems of inadequate methodology and data collection at the local level. In some areas significant progress was achieved in terms of data availability and the statistical techniques used. For example, a system of regular national censuses and surveys was established, a seasonally adjusted measure of quarterly GDP growth rates was introduced, and a new method for accounting research and development expenditures in GDP calculation was adopted in accordance with internationally accepted 2008 SNA standards.

However, in recent years, Chinese official statistics have been increasingly criticized for lack of transparency and problems of data inconsistency. As more official data become available for users, questions arise about how the NBS collects and calculates specific indicators and why different sources of data can provide different estimates of a particular statistical indicator. Significant gaps in data dissemination still remain; for example, the NBS does not disclose survey-based measures of unemployment in a timely and consistent manner.

Fifthly, although many researchers cast doubt on the Chinese official statistics, and examples of data unreliability actually abound, from an academic point of view it is almost impossible to prove that official data has been deliberately manipulated and falsified. After all, only the NBS has access to the raw data, and any alternative sources of data in China are still in the infancy stage of development (for example, alternative

surveys cover a limited number of cities and provinces). The limitations of publicly available data may hinder the abilities of researchers to double-check the accuracy of official statistics.

Finally, alternative estimates of Chinese economic indicators are not immune to criticism either. In fact, to construct alternative indicators researchers have to make some assumptions about official data inconsistencies and 'actual' economic developments. As no one knows for certain what the 'actual' economic situation is, alternative estimates do not represent 'exact' figures, but are rather informed guesses; they should consequently be viewed with caution. An interesting topic for future research would be to apply the same methods proposed to test the quality of China's statistics in the analysis of more developed economies' statistics to provide some basis for comparison. For example, the use of alternative indicators as a proxy for GDP growth rates can be tested on a larger sample of countries.

Overall, academic research on this topic is extremely valuable as it contributes to a better understanding of the official statistical system. Scholars provide useful insights into official statistics methodology, the progress made by the China's statistical system, and the possible limitations of using official data.

Dmitriy Plekhanov is a senior researcher at the Institute for Complex Strategic Studies (ICSS), a Russian-based think tank focusing on policy-relevant research, providing policy advice to government and business, and facilitating dialogue between business, government, science and education. He is also a lecturer at the Lomonosov Moscow State University Business School (Lomonosov MSUBS). Email: plekhanov@icss.ac.ru

NOTES

- 1 See for example *Financial Times* (8 January 2016) 'A frail global economy caught in China's tumble' at <https://www.ft.com/content/86f524ca-b539-11e5-8358-9a82b43f6b2f#ixzz3wvAQ4y4a>. Accessed 11 January 2016; *Financial Times* (3 May 2016) 'China crackdown on data sales opens gaps in economic statistics' at <https://www.ft.com/content/fe50f19e-1113-11e6-91da-096d89bd2173#ixzz47gFyudjs>. Accessed 4 May 2016; *The Wall Street Journal* (18 April 2016) 'China's Economic Data Paints Mixed Picture, Raises Questions' at <http://www.wsj.com/articles/chinas-economic-data-paints-mixed-picture-raises-questions-1460982962>. Accessed 5 May 2016.
- 2 For example, in 2001 an issue of *China Economic Review* (no. 12) contained a collection of 9 articles concerning interpretation and reliability of Chinese statistics. Inclusion of such special issues in the analysis can lead to significant spikes on the graph. Thus, number of sources (adjusted for the number of papers published in the same

- issue of academic journals) can provide a more balanced estimate of the research community interest in the official statistics of China.
- 3 Ma Jiantang's address to the statistical staff of NBS, 16 September 2013, http://www.stats.gov.cn/ztc/zthd/sjtjr/d4jkfr/kfrxw/201309/t20130916_422920.htm. Accessed 4 October 2016.
 - 4 For example, according to a statement on the NBS website in June 2013, Henglan, a town in Guangdong, had grossly exaggerated industrial output by including firms below the reporting threshold, and firms that had gone bust or left town, in their sample (Orlik 2014).
 - 5 For example, under the nationwide anti-corruption campaign, launched in China in 2012, a central inspection team visited the northeastern province of Liaoning in 2014 and demanded, among other things, improvement in the quality of local investment statistics. After the inspection team left the province, the growth rate of fixed-asset investment began to slow rapidly, and by the end of the year the provincial statistical department reported reduction in investment. The *Wall Street Journal* (30 September 2016) 'Number's Game: One Province's Statistics Problem Is a Drag for China' <http://blogs.wsj.com/chinarealtime/2016/09/30/numbers-game-one-provinces-statistics-problem-is-a-drag-for-china/>. Accessed 1 October 2016.
 - 6 The author is a renowned expert on national accounts in the NBS and in 2006 was promoted to the post of Deputy Commissioner of the organization. See Xu's biography page at the NBS website: http://www.stats.gov.cn/zjtj/gtjj/jld/201310/t20131029_449587.html. Accessed 27 September 2016.
 - 7 For critical comments on the official GDP deflator see for example *Financial Times* (28 September 2015) 'China data: Making the numbers add up' at <http://www.ft.com/intl/cms/s/0/cb446e10-6057-11e5-97e9-7f0bf5e7177b.html#axzz3n74KGhTN>. Accessed 2 October 2015.
 - 8 See *Reuters* (6 December 2010) 'China's GDP is "man-made," unreliable: top leader'. <http://www.reuters.com/article/us-china-economy-wikileaks-idUSTRE6B527D20101206>. Accessed 4 October 2016.
 - 9 See *The Economist* (9 December 2010) 'Keqiang ker-ching'. <http://www.economist.com/node/17681868>. Accessed 4 July 2017.
 - 10 China Activity Proxy (CAP) is based on a set of low-profile indicators chosen to reflect activity across a wide section of the Chinese economy. See Capital Economics China Activity Monitor, 22 September 2015, <https://www.capitaleconomics.com/wp-content/uploads/2015/08/growth-fears-at-odds-with-stronger-activity-data.pdf>. Accessed 4 October 2016.
 - 11 In the Chinese official statistics the term 'registered unemployed persons' refers to the persons in urban areas with non-agricultural household registration at certain working age (16 years old to retirement age), who are capable of working, unemployed and willing to work, and have been registered at the local employment service agencies to apply for a job. See <http://www.stats.gov.cn/tjsj/ndsj/2015/html/zbe04.htm>. Accessed 20 October 2016.
 - 12 Results of the NBS survey for the year 2014 can be found at http://www.stats.gov.cn/tjsj/zxfb/201504/t20150429_797821.html. Accessed 20 October 2016.
 - 13 See http://media.worker.cn/sites/media/grrb/2015_02/05/GR0501.htm. Accessed 17 October 2016.
 - 14 According to press reports, first official surveys were conducted in 2005. See Southcn.com at <http://www.southcn.com/weekend/economic/200611300024.htm>. Accessed 19 October 2016.

REFERENCES

- Boskin, Michael, Ellen Dulberger, Robert Gordon, Zvi Griliches, and Dale Jorgenson 1996. 'Toward a More Accurate Measure of the Cost of Living,' Final Report to the Senate Finance Committee from the Advisory Commission to Study the Consumer Price Index. Washington DC: Senate Finance Committee.
- Cai, Fang and Kam Wing Chan 2009. 'The Global Economic Crisis and Unemployment in China', *Eurasian Geography and Economics* 50(5): 513-531.
- Cai, Fang, Du Yang, and Meiyang Wang 2013. 'Demystify the Labor Statistics in China', *China Economic Journal* 6(2-3): 123-133.
- Feng, Shuaizhang, Yingyao Hu, and Robert Moffitt 2015. 'Long Run Trends in Unemployment and Labor Force Participation in China', NBER Working Paper Series No. 21460.
- Giles, John, Albert Park, and Juwei Zhang 2005. 'What is China's True Unemployment Rate?', *China Economic Review*, 16:149-170.
- Han, Jun, and Junsen Zhang 2010. 'Wages, Participation and Unemployment in the Economic Transition of Urban China', *Economics of Transition* 18(3): 513-538.
- Holz, Carsten, and Yimin Lin 2001. 'Pitfalls of China's Industrial Statistics: Inconsistencies and Specification Problems', *The China Review*, 1(1): 29-71.
- Holz, Carsten 2002. 'Institutional Constraints on the Quality of Statistics in a Developing and Transitional Economy: the Case of China', *China Information*, 16(1): 25-67.
- Holz, Carsten 2003. 'Fast, Clear and Accurate: How Reliable Are Chinese Output and Economic Growth Statistics?', *The China Quarterly*, 173: 122-163.
- Holz, Carsten 2004a. 'China's Statistical System in Transition: Challenges, Data Problems, and Institutional Innovations', *Review of Income and Wealth*, 50(3): 381-409.
- Holz, Carsten 2006. 'China's Reform Period Economic Growth: How Reliable Are Angus Maddison's Estimates?', *Review of Income and Wealth*, 52(1): 85-119.
- Holz, Carsten 2013a. 'Chinese Statistics: Output Data', Stanford Center for International Development Working Paper No. 473.
- Holz, Carsten 2013b. 'Chinese Statistics: Classification Systems and Data Sources', Stanford Center for International Development Working Paper No. 471.
- Holz Carsten 2013c. 'Monthly industrial output in China since 1983', MPRA Paper No. 43867.
- Holz, Carsten 2015. 'The Quality of China's Gross Domestic Product Statistics', EAI Working Paper No. 165.
- Keidel, Albert 2001. 'China's GDP Expenditure Accounts', *China Economic Review*, 12(4): 355-367.
- Klein, Lawrence, and Suleyman Ozmucur 2003. 'The Estimation of China's Economic Growth Rate', *Journal of Economic and Social Measurement*, 28(4): 187-202.
- Knight, John, and Jinjun Xue 2006. 'How High Is Urban Unemployment in China', *Journal of Chinese Economic and Business Studies*, 4(2): 91-107.
- Ma, Ben, Guojun Song, Lei Zhang, and David Sonnenfeld 2014. 'Explaining sectoral discrepancies between national and provincial statistics in China', *China Economic Review*, 30: 353-369.
- Maddison, Angus 1998. 'Chinese Economic Performance in the Long Run', Development Centre of the Organisation for Economic Co-operation and Development, Paris.
- Maddison, Angus 2006. 'Do Official Statistics Exaggerate China's GDP Growth? A Reply to Carsten Holz', *Review of Income and Wealth*, 52(1): 121-126.
- Maddison, Angus, and Harry Wu 2008. 'Measuring China's Economic Performance', *World Economics*, 9(2): 13-44.
- Mehrotra, Aaron, and Jenni Pääkkönen 2011. 'Comparing China's GDP Statistics with Coincident Indicators', *Journal of Comparative Economics*, 39: 406-411.

- Movshuk, Oleksandr 2002. 'The Reliability of China's Growth Figures: A Survey of Recent Statistical Controversies', *The Journal of Econometric Study of Northeast Asia*, 4(1): 31-45.
- Orlik, Tom 2014. 'Reform at China's National Bureau of Statistics under Ma Jiantang 2008-2013', *China Economic Review*, 30: 304-308.
- Rawski, Thomas G. 2001. 'What is Happening to China's GDP statistics?', *China Economic Review*, 12(4): 347-354.
- Szirmai, Adam, Rouen Ren, and Manyin Bai. 2005. 'Chinese Manufacturing Performance in Comparative Perspective, 1980-2002', Yale University Economic Growth Center Discussion Paper No. 920.
- Wang, Xiaolu, and Lian Meng 2001. 'A Reevaluation of China's Economic Growth', *China Economic Review*, 12(4): 338-46.
- Wang, Xiaoxia, and Wenkai Sun 2014. 'Discrepancy between Registered and Actual Unemployment Rates in China', *China & World Economy*, 22(4): 40-59.
- Woo, Wing Thye 1998. 'Chinese Economic Growth: Sources and Prospects', in Michel Fouquin and Francoise Lemoine, eds., *The Chinese Economy*. Economica: London.
- Wu, Friedrich 2003. 'Chinese Economic Statistics - Caveat Emptor!', *Post-Communist Economies*, 15(1): 127-145.
- Wu, Harry 1997. 'Reconstructing Chinese GDP According to the National Accounts Concept of Value Added: the Industrial Sector', COPPAA Working Paper, 4, Centre for the Study of Australia-Asian Relations, Griffith University, Brisbane.
- Wu, Harry 2000. 'China's GDP Level and Growth Performance: Alternative Estimates and the Implications', *Review of Income and Wealth*, 46(4): 475-499.
- Wu, Harry 2002. 'How Fast Has Chinese Industry Grown? - Measuring the Real Output of Chinese Industry, 1949-97', *Review of Income and Wealth*, 48(2): 179-204.
- Wu, Harry 2011. 'Accounting for China's Growth in 1952-2008: China's Growth Performance Debate Revisited with a Newly Constructed Data Set', RIETI Discussion Paper Series 11-E-003.
- Wu, Harry 2014. China's Growth and Productivity Performance Debate Revisited: Accounting for China's Sources of Growth with a New Data Set, Conference Board Economics Program Working Paper Series EPWP 14-01.
- Wu, Harry, and Keiko Ito 2015. 'Reconstructing China's Supply-Use and Input-Output Tables in Time Series', RIETI Discussion Paper Series 15-E-004.
- Xu, Xianchun 2004. 'China's Gross Domestic Product Estimation', *China Economic Review*, 15(3): 302-322.
- Xu, Xianchun 2009. 'The Establishment, Reform, and Development of China's System of National Accounts', *Review of Income and Wealth*, 55(s1): 442-465.
- Xu, Xianchun 2013. Understanding China's official statistics', *China Economic Journal*, 6(2-3): 63-79.
- Xue, Jinjun, and Wei Zhong 2003. 'Unemployment, Poverty and Income Disparity in Urban China', *Asian Economic Journal*, 17: 383-405.
- Young, Alwyn 2003. 'Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period', *Journal of Political Economy*, 111(1): 1220-1261.
- Yu, Xiaohua, and David Abler 2014. 'Where have all the pigs gone? Inconsistencies in pork statistics in China', *China Economic Review*, 30: 469-484.
- Zhang, Jun, and Tian Zhu 2013. 'Debunking the myth about China's low consumption', *China Economic Journal*, 6(2-3): 103-112.
- Zhou, Yixing, and Laurence Ma 2005. 'China's Urban Population Statistics: A Critical Evaluation', *Eurasian Geography and Economics*, 46(4): 272-289.