Proposed to the 23rd International Input-Output Association Conference, Mexico City, June 23-26, 2015

WHAT CAN THE DISCREPANCY BETWEEN CHINESE NATIONAL AND REGIONAL INPUT-OUTPUT TABLES TELL US?

Harry X. Wu[a], Bo Meng[b] and Zhan Li[a]
[a]Hitotsubashi University, Tokyo, Japan
[b]Institute of Development Economics, Tokyo, Japan

ABSTRACT

We revisit the upward-bias hypothesis of the Chinese official estimates for GDP growth from a regional perspective by examining industry discrepancies between national and regional production accounts. We conjecture that if local governments indeed have incentives to exaggerate local growth performance, locally important or dominant industries are more likely to be exaggerated. As a preliminary step, we use the national input-output tables as the benchmark to exam whether and to what extent the sum of provincial value-added by industry deviates from the national accounts assuming that the latter is correct.

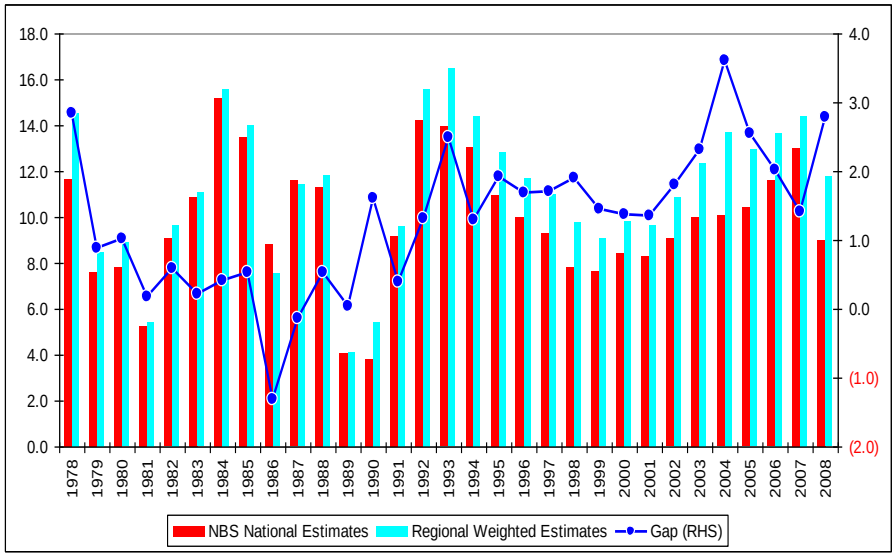
Key words: The upward-bias hypothesis of Chinese statistics; national and regional input-output accounts; regional structure by industry; industry structure by region

JEL codes: C67, C82, E16, O53, R58

1. INTRODUCTION

China's official GDP growth estimates have been criticized for being upward biased because of both methodological and institutional problems. Although it has been realized that one dimension of the problem can be revealed from national-regional accounts discrepancies (Figure 1), to out knowledge there has been no empirical investigation at industry level. Given that regional analysis of the Chinese economy is on an increasing demand, there is a serious call for more rigorous investigation in this problem.

FIGURE 1
CHINA'S REAL GDP GROWTH RATE PUZZLE:
NATIONAL AGGREGATE VIS-À-VIS REGIONAL ACCOUNTS WEIGHTED-SUM ESTIMATES



Source: NBS (.)

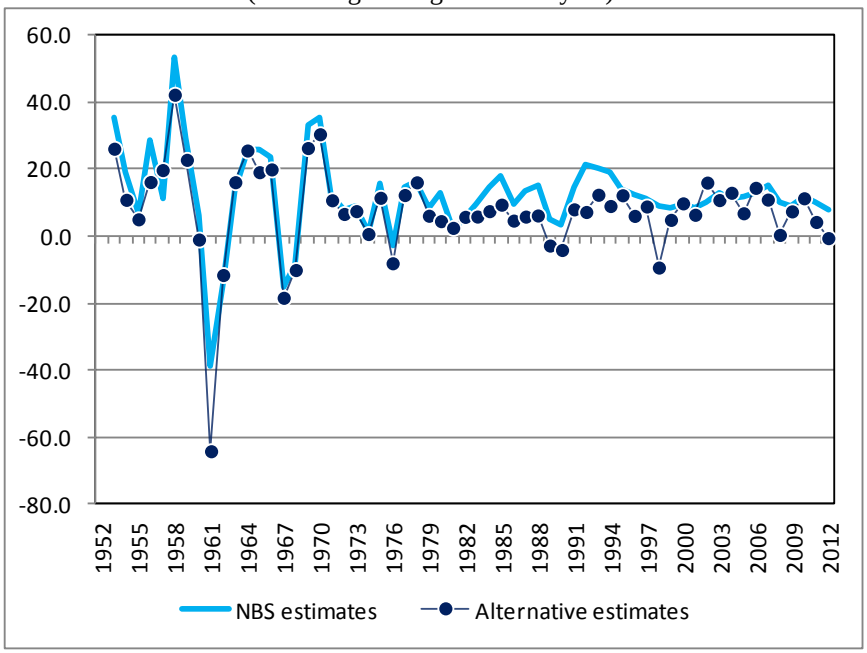
In this study, we revisit the upward-bias hypothesis of the Chinese official estimates for GDP growth from a regional perspective by examining industry discrepancies between national and regional production accounts. Our hypothesis is that if local governments indeed have strong incentives to exaggerate local growth performance, those locally important or dominant industries are more likely to be exaggerated. If so, gauging the impact of such industries at localities will shed important light on whether and to what extent such data fabrications may affect our understanding of industry performance across regions.

This paper will be organized in six sections as follows. The next section revisits the upward-bias hypothesis and then discusses the research problem from the observation of the discrepancies between the national and regional input-output accounts. Section 3 begins with the accounting identity between the national and industry accounts and the national and regional accounts and then conceptually decomposes discrepancies between the aggregate and industry by region measures for any national accounts indicator. Section 4 discusses the results of decomposed discrepancies. Section 5 provides the results of the standard impact analysis with a regional dimension. Section 6 concludes the study by recapping the remaining problems and setting up road maps for future research.

2. THE UPWARD-BIAS HYPOTHESIS REVISITED

China's official GDP growth estimates have been criticized for being upward biased because of both methodological and institutional problems. Methodologically, the "comparable price system", which was adopted together with the Soviet Material Product System (MPS) in the early 1950s, introduces segmented price weights with overlong intervals in growth indexing, hence inevitably underestimating price changes while exaggerating the real growth (Maddison, 2007). This problem can be well explained by the Gerschenkron effect (Gerschenkron, 1951), i.e., a comparison of two situations, weighted at the base-year prices, can be expected to be biased upwards because the price movements are inversely related to the quantity movements when the normal demand relationship is held. It is also known as the substitution bias. As for institutional deficiency, the output and price data are collected and processed through a long-established statistical reporting system at various levels of the government. It can be easily influenced by GDP growth-motivated local officials and the managers of state-owned enterprises to provide upward-biased data. Besides, there are political pressures from more powerful authorities at the central level to show "expected" performance (Wu, 2007 and 2013).

FIGURE 2
ANNUAL GROWTH OF GROSS VALUE ADDED IN CHINESE INDUSTRY:
OFFICIAL VERSUS ALTERNATIVE ESTIMATES
(Percentage change over last year)



Source: Wu (2013)

This upward-bias hypothesis has been empirically investigated in studies using different approaches ranging from physical output or commodity indicator (Maddison 1998; Wu, 1997, 2002, 2011 and 2013; Maddison and Wu, 2008), energy consumption (Adams and Chen, 1996; Rawski, 2001), food consumption (Garnaut and Ma, 1992), to foreign price approximation (Ren, 1997). Most of the studies focus on the aggregate output except for Wu (2002, 2011 and 2013) who has focused on

industrial sectors (see Figure 2) and Maddison (1998) who studied agriculture. Besides, Wu's recent work has also extended his volume movement approach to services (Wu 2014).

Despite different results, all alternative measures appear to be strongly supportive to the hypothesis. For example, for the period 1978-97, compared with the official GDP growth rate of 9.8 percent per annum, it is estimated as 4.8 percent by the energy approach (Adams and Chen, 1996), 6.8 to 8.5 percent by alternative price indices (Ren, 1997; Wu, 2000) and between 7.0 and 7.5 percent by volume movement approach (Maddison, 1998 and 2007; Maddison and Wu 2008; Wu 2013).

However, previous studies have mainly focused on the flaws contained in the real growth rate estimates and gauged possible biases directly based on alternative growth estimates that are arguably more plausible. Our new adventure as proposed in this study is motivated by significant discrepancies found between Chinese national and regional (provincial) input-output accounts found in an exercise that attempts to reconcile regional input-output tables with those of the national. This may allow us to investigate the problem from a new but more fundamental perspective. First, instead of gauging what the "real growth" might be, which is inevitably related to biases in both real terms and prices, we can examine the problem directly in nominal terms holding the price effect constant. Second, assuming the national accounts are correct in nominal terms, we can separate regional and industrial effects in the discrepancies to see to what extent they have deviated the regional accounts from the national accounts.

The role of local governments is particularly considered in this study, which may help our understanding of the data problem. Despite a series of reforms over the past three decades, China's economic growth is still heavily government-engineered. However, unlike in the planning period that relied on centralized, comprehensive and mandatory controls through the state ownership, local governments have been playing an important role in the reform era under a "regional decentralized authoritarian" regime (Xu 2011). The driving force is growth competition among localities. Since all efforts made by local governments are indexed by the rate of local GDP growth and assessed by upper authorities as political performance, officials are highly motivated to engage in "growth tournament" with their peers of other localities (Li and Zhou 2005). Consequently, their restlessly searching for new growth engines have not only resulted in increasing government interventions in resource allocation and business decision (Huang 2012; Wu and Shea 2008; Xu 2011), but also encouraged local officials to fabricate data to show their good performance (Wu 2013).

We conjecture that industries that play a key role in the local growth through a stronger impact effect through industry multipliers tend to be exaggerated. This however is more likely to happen in regions which are under pressure to compete with their peers of the same group, given the stage of development as defined by per capita real GDP. After we explain how to account for the national vis-à-vis regional discrepancies, we conduct the standard input-output impact analysis with measured multipliers to test our industry-impact and regional competition conjectures.

3. METHODOLOGY

This study is designed in an input-output framework. We start with a few key indicators in line with the output upward-bias hypothesis, mainly growth output (GO), intermediate input (II) and value added (VA) by industry (*j*) and by region (province) (*k*). Under the input-output framework, we set up an accounting identity for each key indicator between the national total and the sum of industries and between the same national total and the sum of regions. This is then followed by a decomposition of the aggregate-industry and aggregate-region discrepancies to identify those industries of specific localities that have played a significant role in the measured GO, II and VA discrepancies.

Taking VA as an example as well as the main focus of the present exercise, the following accounting identity for j^{th} industry should be conceptually held as given in equation (1)

(1) $$\sum_j VA_{j,k} = VA_k$$

Similarly the accounting identify for k^{th} region should be held as in equation (2):

(2) $$\sum_k VA_{j,k} = VA_j$$

There, conceptually the following total summation of industries across provinces must be equal to the national total, that is:

(3) $$\sum_k \sum_j VA_{j,k} = VA$$

In reality, however, equation (3) may not be always maintained. In this case, it means that the aggregated regional total on the left-hand side could be larger or smaller than the national total on the right-hand side:

(4) $$\sum_k \sum_j VA_{j,k} \gtrless VA$$

The total discrepancy can be defined as Δ:

(5) $$\Delta = VA - \sum_k \sum_j VA_{j,k}$$

The discrepancy can be decomposed in two ways. One is by industry, i.e.,

(6) $$\Delta_j = VA_j - \sum_k VA_{j,k}$$

In doing so, we can get the industrial structure of the discrepancy which shows the role of industries in the measured discrepancy.

The other decomposition is by province, i.e.,

(6) $$\Delta_{j,k} = \frac{VA_{j,k}}{\sum_k VA_{j,k}} * \Delta_j = \frac{VA_{j,k}}{VA_j} * \Delta_j$$

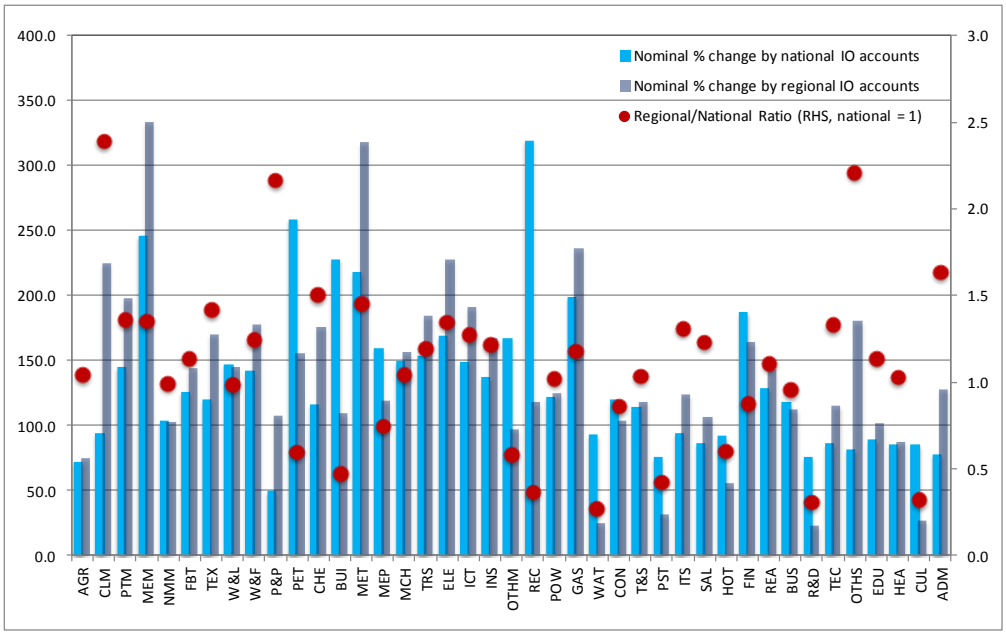
By this way, we can see the regional structure of industry j, which can be explained as regional contributions to the discrepancy of industry j.

The accounting identities for GO and II are analogous to the above approach to VA.

4. MEASURING REGIONAL AND INDUSTRY DISCREPANCIES

This section presents and discusses our preliminary results…

Figure 3 presents the national-regional discrepancies by industry in terms of nominal growth …



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1) discrepancy chart by INDUSTRY (j) for 2002 and 2007, and 2) discrepancy chart by PROVINCE (k) also for the two benchmarks.

And 3) INDUSTRY Structure by PROVINCE for the two benchmarks and 4) PROVINCE Structure by INDUSTRY.

We also show a PROVINCE decomposition of national INDUSTRY discrepancy and 6) a national INDUSTRY decomposition of PROVINCE discrepancy.

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5. IMPACT ANALYSIS

We start with a brief literature review…

By applying input-output coefficients, such as direct input coefficient, Leontief inverse matrix, Yuan *et al.* (2010) discuss the influence of Global Financial Crisis and the stimulus plan against it on China's energy consumption and economic growth. The results show that the fall of exports caused by the Global Financial Crisis will lead to a decrease of 7.33% in GDP and a reduction of 9.21% in energy consumption; the stimulus plan against the Global Financial Crisis will lead to an increase of 4.43% in economic growth and an increase of 1.83% in energy consumption.

To extend the traditional two-regional input-output model, Wu and Zhu (2010) give a method to

measure the effect such as the forward and backward linkages of intra-regional multiplier effect, inter-regional spillover effect and feedback effect of three regions by multi-regional input-output analysis. They use the data of China's multi-regional input-output tables to estimate three effects of multiplier, spillover and feedback among three regions. The result shows that the development of eastern region has small spillover effect on the western region in China, even smaller than that of the western on the eastern. The central region has not played as the role of ties in regional economies, which largely hinders the development of regional coordination. Therefore, in order to achieve the strategic coordination among regions and inter-region welfare compensation, it is necessary to fasten the industry transfer and expand the spillover efficiency of public knowledge among regions.

Based on the multi-regional input-output tables of China in 1997 and 2007, Pan (2012) discusses the features and trends of the spillover and feedback effects between Coastal and Non-coastal regions. According to parameters calculation, the intra-regional multiplier effect is bigger than inter-regional spillover effect, and the latter is bigger than inter-regional feedback effect. Meanwhile, the trend that the intra-regional multiplier effect is decreasing, and both the inter-regional spillover and feedback effects are increasing over time is also displayed. It is also shown that the spillover effect from Coastal to Non-coastal is less than that from the latter to the former. After the scale effect being considered, the result shows that the spillover effect from Coastal to Non-coastal is bigger than that from the latter to the former. From the viewpoint of industries, it is also showed that construction, machinery manufacturing and transportation equipment manufacturing have a relatively high spillover effects on both Coastal and Non-coastal economies.

Pan and An (2003) find that the sum of GDP in all provinces is larger than national aggregation in 2001. To explain the difference between national and provincial accounts data, they provide three reasons: 1. The huge difference is resulted from the current statistical system. China has adopted a unified leadership, decentralized management and decision-making administrative system, from central to the provincial, city and county, every level of governments has its own economic development plans and objectives. Except for accomplishing statistical task from the upper government, local governments will do various statistical services to better understand local economies. Due to various reasons, such as cross-region of accounting units, inflow and outflow among regions, the government intervention and so on, the smaller the jurisdictions, the lower the accuracy of statistical data. 2. From the viewpoint of production, the difference mainly comes from the tertiary industry. 3. From the perspective of usage, the difference is from net export and change in inventory.

Zeng and Xue (2014) find that over the past decade, the gap between the GDP calculated nationally and that totaled regionally has become increasingly widened and an obvious system error has been detected. From the perspective of production, the added value of secondary industry totaled regionally, especially that of manufacturing industry, is significantly larger than that calculated nationally. From the perspective of expenditure, the value of fixed assets totaled regionally is significantly larger than that calculated nationally. Through a contrastive analysis of the data of economic census, it is found that there is likely to be a very serious omission in the

data of national GDP with regard to the added value of tertiary industry. However, the added value of secondary industry has tended to be overvalued in most regions. Using the Law of Benford and its calculation model, they examine the quality of GDP data. The result shows that no significant fraud is found in the data at both the national and regional levels. The inconsistency between national and regional GDP data has resulted from either the economic management system or the statistical methods. It is concluded that we can enhance the degree of consistency between GDP data at different levels if we persist in assessing our economic achievements in a scientific way, deepen the reform of our statistical management system, and improve our GDP calculating methods.

To check the consistency between national statistics and provincial statistics, Ma *et al.* (2014) examine sectoral contributions to discrepancies between China's national aggregate statistical values and the sum of provincial figures. Their result is that the industrial sector has been the major contribution to discrepancies in both GDP and total energy consumption in recent years. In addition, technical aspects such as statistical coverage, data collection method, and double-counting cannot explain the discrepancy. To out-compete counterparts and get promoted, provincial leaders have explicit incentives to overstate provincial GDP, with industrial value added being the first statistic to be affected.

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6. Concluding Remarks

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