

***The 'new' normal is 'old' in China:  
Very Late Catching-up and Return  
to the (pre-WTO) Old Normal***

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Abstract

The recent slowdown in Chinese growth is often viewed as a new (lower) growth normal. However, increasing doubts about the reliability of Chinese macroeconomic data make it necessary to reassess the validity of the official view of a three-decade-long episode of miraculously rapid growth to determine if China is indeed entering a new stage of growth or returning to its old normal. We thus propose a two-step strategy. First, we construct a monthly industrial output index based on commodities in order to minimize mismeasurement biases. We show that Chinese industrial growth was overreported in the 1980s and 1990s but smoothed in the 2000s, confirming earlier findings using annual data in Maddison and Wu (2008) and Wu (2013). Growth tournaments between local governments that resulted in exaggerated reported performance appears to have been somewhat replaced by collusion. Second, in order to account for the intermingling of trend and cycle (typical of emerging countries as shown in Aguiar and Gopinah, 2007) we use a parametric regime-dependent approach to determine the timing and magnitude of growth phases. We find that contrary to conventional wisdom, rapid catching-up industrial growth in China did not last thirty years following the reforms but started only with WTO entry in the early 2000s. The 'old' normal (moderate) growth, typical of the 1980s and 1990s, resurfaced after 2010 but interrupted by recurring recessions.

Key Words: Industrial output; catching up; growth trend and cycle; classical recession; growth recession

JEL Codes: C43, E32; O14; P27

## Introduction

In the second decade of the new Millennium ‘low’ growth in China has grabbed the attention of domestic scholars and policy makers as well as of international observers. However, there is sharp disagreement, especially within China, on its nature and durability. It could be only a temporary and cyclical interruption along a decades-long path of fast trend growth justified by a still huge untapped potential (Lin, 2013). Alternatively, it could represent a durable downward shift to a ‘new normal’ (Xi Jiping) of reduced trend growth due to the unsustainable nature of previous high growth in an economy falling into the middle income (and other: environmental, aging, debt, etc) trap(s) (Liu, 2013; Liu et al, 2011) and regressing to the world mean growth (Pritchett and Summers, 2014).

However, beyond these sharp disagreements, there is a surprising consensus on two related issues: rapid growth China with catching up would have taken place over the three decades prior to the GFC, and, over this long time span, China would not have experienced any classical recession, since there was no absolute fall in output. We argue that it is only by reassessing the validity of these two accepted stylized facts that the notion of new or old normal can be given a precise meaning.

A rising number of observers have in the last few years voiced their perception of a much more substantial slowdown than officially reported. However the faith in the reliability of official Chinese macroeconomic activity data during the rapid growth period has provided the foundations of the consensus on its unique durability. The common misperception of stylized facts characterizing the Chinese economy may be due to mismeasurement of industrial activity such that official data, through either over-reporting or smoothing, blurs the distinction between growth and cycles (Rawski, 1993; Maddison, 1998; Maddison and Wu, 2008; Wu, 2013). So reconstructing high-frequency industrial activity data is a prerequisite. Measurement biases of very different types, affecting alternative measures of economic activity, are particularly acute in the case of industrial output (Rawski, 1993; Wu, 2002 and 2013)<sup>2</sup>. This is all the more important that catching up rapid growth can only happen through industrialization (except for primary resource abundant economies), as widely documented by Rodrick (2006).

The current debate in China echoes academic controversies between specialists of cycles in OECD countries and those of growth in emerging economies. The first focus

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<sup>2</sup> Mismeasurement of economic activity has been a long-debated issue in other countries, associated with government interference (as for Argentine GDP since 2007, Coremberg, 2014,), or free from the latter (as in OECD countries, Nalewaik, 2012, for US GDP; Girardin, 2005, for Japan’s GDP). Mismeasurement is also widespread in private sector activity in the reporting of firms’ profits (Toshiba’s example as a symptom of general practice). However, in China’s case the reach of mismeasurement goes much deeper.

on cyclical fluctuations around a stable trend, while the latter emphasize the acceleration of growth followed by sharp decelerations, leading to regression to the mean (Pritchett and Summers, 2014). Existing work on cycles has taken as conventional wisdom that classical recessions are not present in emerging economies engaged in catching up. Such work has used a classification based on growth cycles rather than on business cycles (i.e. growth slowdowns rather than absolute decreases in aggregate activity in Zarnowitz, 1991; Zarnowitz and Ozyildirim, 2006). Given the very volatile nature of the industrial growth process, it is likely that classical recessions could be present at high frequencies. In addition, such work has accepted the idea that catching up implies rapid growth before recessions, in contrast with Friedman's (1993) view of rapid growth following recessions, due to a bounce-back effect.

Literature that is built on the notion of "stop-start" growth (e.g., Rodrik 1999 and Jones and Olken 2008) shows that in emerging economies the growth process is marked by changes in "growth regimes" with large accelerations and decelerations (Pritchett 2000; Hausmann, Pritchett, and Rodrik, 2005; Kar, Pritchett, Raihan, and Sen, 2013). Along these lines, the new (low) growth normal in China has been identified (Pritchett and Summers, 2014) with a regression to the world mean growth rate, typical of all emerging economies. However, in the case of China existing empirical literature has not to date clearly determined, for the post-1978 reform period, what normal growth is, and whether it coincides with or differs from catching-up growth. In other words the 'world mean growth rate' may not (yet) represent the 'normal' growth rate in China.

However, such debates may be artificial in emerging economies. The two sides may actually be studying the same phenomenon. Indeed, in emerging economies 'the cycle is the trend' (Aguar and Gopinah, 2007), since shocks to trend growth drive the economy at business cycle frequencies, in other words shocks make trend growth itself volatile. The view of temporary fluctuations around rather stable trend growth, possibly suited to advanced economies, does not match the experience of emerging economies. Accordingly growth and cycles should be approached together for emerging markets, as opposed to the separate treatment typical of advanced economies (especially based on the use of Hodrick-Prescott or Band-Pass filters).

The challenges faced in empirically addressing this issue are daunting. In the case of China, the complexity of the diagnostics has been compounded by the doubts often raised on the reliability of the macroeconomic data on which it is based.

A similar driving force with different facets underlies the two issues we have identified thus far: 'the cycle is the trend' in emerging economies, and mismeasurement biases hamper a proper empirical analysis in the case of China. This common factor is government economic policy and State intervention. Indeed the shocks to trend growth which drive the economy at business cycle frequencies are generated by frequent domestic (monetary, fiscal or trade) policy reversals (Aguar and Gopinah,

2007). Such sharp reversals imply 'frequent regime switches'. Besides, China's macroeconomic data is a symptom or a reflection of the extent of central and local government intervention, not simply ex post, in the data generating and reporting process, but also ex ante, as a major driver of economic activity. Not only do the varying promotion-tied incentives offered by the central government lead local governments to actively manage growth reporting, but, more fundamentally, to engineer growth by providing economic incentives to industrial firms in their jurisdiction (Xu, 2011). In addition the behavior of the central government itself may pertain to the same logic, in order to preserve its legitimacy and pursue its development strategy within a State-led growth model and implement macroeconomic stabilization policies.

To help settle the debate about the nature of the recent slowdown, we need to find a reliable measure of China's industrial activity, sidestepping mismeasurement problems. The difficulty is that mismeasurement may not be invariant over time, due to varying priorities of the (top and local) leadership, sometimes being overoptimistic, while practicing growth smoothing at other times. Such mismeasurement matters a lot, especially seen in the perspective of existing studies which have documented the absence of classical recessions in China along a path of 'record' growth only interrupted by short-lived growth recessions. If data smoothing or overreporting were at work it is possible that classical recessions are not in the data only because they were 'suppressed'. But, as a side benefit, cycle-smoothed data would be informative on long-run growth phases. By contrast over-reporting may be able to preserve the cyclicity of industrial activity.

In the Chinese case the empirical work is made all the more difficult by the very short time elapsed since the start of the reforms in December 1978. While the experience of growth in say the USA or European countries was spread over one-and-a-half or two centuries, that of China occurred at best within only one third of that time. Accordingly while, for the former countries, growth analysis usually focuses on very long time-spans of data and business cycle studies on the last six decades, in the case of China both types of analyses have to be carried out on the same short sample spanning only a few decades. And the sample available for statistical analysis is even shorter, due to the unavailability of high frequency data for economic activity from the start of the late 1970s' reform. In the best of cases available indicators of economic activity, at the monthly frequency, the usual frequency for cycle dating, start only in 1986. Accordingly backtracking on top of reconstruction of monthly industrial data is on the agenda. A pioneering attempt in this direction was made by Holz (2014) who, based on available official gross output data for large firms in the statistical reporting system, proposed his own long time-span reconstruction of an industrial activity index from the early 1980s, which unfortunately suffer from many of the drawbacks of the official series on which it draws.

An alternative measure of industrial activities using annual data was early proposed by Wu (2002) and improved in his subsequent revisions (Wu, 2011 and 2013). This commodity-based index idea was preliminarily applied to monthly data in Ozyildirim and Wu (2013) combining major commodity and commodity group data. The attractiveness of commodities, as a measure of economic activity to industrial output, is that not only it should be less subject to measurement bias than the official data, and also may capture information on the economy that the official measure is likely to miss.

This paper offers two major contributions. First, it substantially improves the monthly commodity-based industrial output indices constructed earlier by Ozyildirim and Wu (2013) and extends them forwards and backwards to cover China's industrial growth in the period January 1980 to May 2015. Second, it explores the performance of all alternative indicators including series of NBS, and Holz in dating business cycles in China over that sample of three and a half decades. We estimate parametric as opposed to non-parametric (championed by Bry-Boschan, 1971) models which only allow two regimes and are thus unable to account for catching-up rapid growth. We use a version of univariate Markov-switching models à la Hamilton (1989) which accounts for separate volatility regimes (à la McConnell and Perez-Quieros 2000).

We obtain three major results which run counter to conventional wisdom. First, classical recessions, defined as an absolute fall in the level of industrial activity, are present in China, and not limited to the late 1980s. Annual data miss such episodes which are not longer than one semester or even one quarter. Second, The WTO boost to growth was exceptional and temporary. It represented THE very late catching up episode in China compared to the 'normal' growth in the 1980s and 1990s. Third, rapid growth left room after the GFC to a return to China's 'normal' growth. This return may be rationalized by some bounce-back effect and the record government engineered fiscal cum credit boost of 2009 (associated with the 2010 real estate crash, Deng, Girardin and Joyeux, 2015). However recurring recessions soon arose, due to the diminishing returns of repeated fiscal boosts (Renmin, 2014), as well as deepening balance-sheet recession (a new variety of the Japanese vintage well described by Koo, 2008). The commodity data is the only one able to documents this while smoothing in official-derived data does not.

We provide in section two a sketch of the lessons to be drawn from previous (Chinese language) work dating China's growth cycles. We then present in section three an analysis of mismeasurement biases associated with various measures of economic activity in China, and detail the first reconstruction of alternative series of monthly industrial activity data over three and a half decades. We then introduce in section four the methodology used in the subsequent estimates. Section five presents our

dating of the cycles in China with alternative indicators of industrial activity as well as our rationalization of the dating. Section six gives some conclusions.

## **2. Cycle dating in the Chinese literature**

Studies by Chinese economists on business cycles in China using modern quantitative techniques only began in the early 2000s. They were largely a response to the urgent policy call for macroeconomic management following China's shift from 'supply-driven' to 'demand-driven' growth in 1996 (Liu J. and Wang, 2003). Facing much more complicated driving forces from the demand side, the government was confronted with a new and significant challenge on how to maintain 'State's fundamental influences in resource allocation in a rapidly-developing market system' through 'complete and effective macroeconomic policies' (CPC 14<sup>th</sup> Congress, 1993 and CPC 15<sup>th</sup> Congress, 1998). This call motivated Chinese economists to study the behaviour of the economy using available standard econometric models that have been applied to the advanced economies.<sup>3</sup> This new wave of macroeconomic studies left aside the simple descriptive statistical approach to identifying peaks and troughs (see e.g. Liu S., 1996). However, the learning process of using more sophisticated models among the Chinese economists seems very fast. There was soon a gradual deepening of research from ARCH-GARCH models (e.g. Liu J. and Wang, 2003), Friedman's (1993) Plucking model (Liu J., Liu Z. and Yu, 2005), to State-Space models and then to Markov regime-switching models (Wang, 2007; Chen and Liu H., 2007; Liu J., Sui and Yan, 2009; Tang, 2010; Liu L. and Zhang, 2011; Zheng and Guo, 2011).

Scanning through these studies, two major 'features' should be highlighted. Firstly, none of the studies seriously addresses the serious measurement biases in Chinese official GDP, and especially industrial output, statistics (Maddison and Wu, 2008). The most-often discussed 'data problem' is the insufficient length of the time series of quarterly GDP. This has encouraged several attempts to apply Markov regime-switching models to several decades of annual GDP data (Wang, 2007; Tang, 2010). It has also motivated researchers to use other high-frequency indicators such as the RMB exchange rate (Xie and Liu, 2003) and inflation (Zhao et al, 2005) to try and approximate macroeconomic dynamics. However, the work by Zheng and Guo (2011) is perhaps the only exception. By examining the impact of the official revisions of GDP data on the estimated cyclical behaviour and growth performance of the economy, they conclude that the revisions have smoothed out the fluctuations and hence caused confusion on the growth regime of the economy, which may mislead policy makers. This may be no surprise, given the rather odd nature of GDP revisions in China (as scrutinized by Sinclair, 2012) which always generate a rise in reported growth, but of a varying amplitude.

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<sup>3</sup> Unfortunately, almost all these studies are published in Chinese, which cannot be easily shared by international researchers who are interested in this topic.

Secondly, most studies tend to simply apply standard specifications to available Chinese GDP data rather than search for sensible specifications that may better describe the cyclical behaviour of the Chinese economy, taking into account institutional settings, policy regimes, and specific seasonal effects. The decision of adopting two or three growth regimes often appears to be arbitrary. For example, Liu J. and his associates changed from an earlier three-regime (Liu J. and Wang, 2003) to a two-regime specification (Liu J. Liu Z. and Yu, 2005) and later returned to a three-regime model (Liu J., Sui and Yan, 2009) without any clear explanation. In this situation, it is not a surprise to see that there are no detailed comparisons of different empirical findings in the literature and hence there is no real debate among these active researchers on which results may or may not have provided better dating and understanding of China's business or growth cycles.

The views about the behavior of China's business cycles are generally diversified in the literature (Table 1). However, they can be summarized in four stylized facts: i) There are clear asymmetrical fluctuations over the business cycles over the long run. Before the reform of the late 1970s, the expansion period is longer than the contraction period, but the ranking is completely reversed after the reform (Wang, 2007). ii) There is a clear "Plucking effect" observed in the Chinese economy in that fluctuation-induced expansion tends to be greater than fluctuation-induced contraction. That is why there is co-existence of high (low) fluctuation and high (low) growth (Liu J., Liu Z. and Yu, 2005). iii) The economy tends to exhibit stronger growth response to expansionary policy (Tang, 2010). iv) There are however contradictory findings in terms of the growth rate, duration and switching probability of different regimes. Chen and Liu H. (2007) find that once having entered the high-growth regime, the economy tends to stay there for the longest period. Tang (2010) also shows that when the economy has entered an expansionary regime, it is highly likely to stay in that regime. However, Liu L. and Zhang (2011) show that the probability of staying in the high growth regime is zero. The dating of cycles obtained by those studies using a three-regime classification is plotted in Figures A.I.1 and A.I.2 in Appendix I. It is noteworthy that 5 of those studies missed the GFC.



Table 1: Markov-switching estimates in existing literature

Authors	Indicators	Type of data	Period	Method	Regimes	Low	Normal	High
						g1	g2	g3
Liu L.-Zhang (2011)	GDP (NBS)	quarterly	Q1/91-Q1/10	Markov MSIAH	3	6.3	6.9	9.3
Liu J.-Sui-Yan (2009)	GDP (NBS)	quarterly	Q1/94-Q1/09	Markov MSM	2 vs 3	7.6	9.6	11.6
Chen-Liu H. (2007)	GDP (A)	quarterly	Q1/79-Q4/04	MSMV(3)-AR(2)	3	1.45	6.82	11.7
Liu J.-Wang (2003)	GDP (NBS)	monthly	M1/90-M3/02	GARCH	3			
Liu J.-Liu Z.-Yu (2005)	GDP (A)	quarterly	Q1/78-Q3/04	Plucking	2			
Liu J.-Zheng (2008)	GDP (NBS)	quarterly	Q1/90-Q3/07	SETAR	2 vs 3			
Wang-Gao (2006)	CEI (S)	monthly	M1/85-M3/05	DMSF	2	-1.83		0.37
						Contraction		Expansion
Tang (2010)	GDP (NBS)	annual	1952-2008	Markov MSM	2			
Wang (2007)	GDP (NBS)	annual	1953-2005	Markov MSA	2 (pre-refo)	2.05		12.1
					2 (post-ref)	6.81		11.1

### 3. Data reconstruction

It is unquestionably important to avoid misdiagnosing the growth cycles for China, especially given the serious problems in the Chinese industrial activity statistics, which have been hotly debated (Maddison 2006; Holz 2006; Rawski 2008; Maddison and Wu 2008; Wu 2007 and 2013). We consider three different measures of industrial activity in China: China's National Bureau of Statistics (NBS) official industrial value added; Holz's (2014) attempted reconstruction of the official-data based industrial activity, and our commodities-based proxy. All series are compared on a similar sample spanning January 1980 to May 2015. In order to seasonally adjust the data, allowing for the fact that seasonality may vary over time, we use Census X-12 with its moving seasonality module.

#### *Problems in official Industrial activity estimates*

The official estimates of China's industrial activity growth have been criticized for upward biases due to methodological and institutional problems. Methodology-wise, China's 'comparable price system', which was adopted together with the Soviet Material Product System (MPS) in the early 1950s, introduced segmented price weights with long intervals in growth indexing, hence inevitably generating a substitution bias while underestimating price changes, and hence exaggerating real growth (Maddison, 1998). In practice, this 'comparable price system' was implemented in enterprises through 'price manuals' issued by planning authorities listing commodities at specific base-year prices, which created leeway to exaggerate real output value (Maddison 1998; Rawski 1993; Woo 1998; Wu 2000). This system was maintained up to 2002, incompatible with China's transition from MPS to the United Nations System of National Accounts (SNA) and inappropriate when China underwent substantial price changes during the 1990s (the last set of constant prices is based on 1990 and used for the entire period 1990-2002).

Institution-wise, the output and price data are collected and processed through a statistical reporting system at various levels of the government. Thus, it can be easily

influenced by growth-motivated local officials and the managers of state-owned enterprises. Besides, there has been evidence showing that pressures to show 'expected' performance may also come from powerful authorities at the central level. For example, in the 2004 Census-based substantial revision to the GDP series between 1992 and 2004, the original exaggerated growth estimate for 1998, when the economy was badly hit by the Asian financial crisis, was left untouched (Wu 2007).

The upward-bias hypothesis in GDP and industrial-output growth data in China has been investigated and tested by various empirical studies using different approaches ranging from physical output or commodity indicators (Maddison 1998; Maddison and Wu 2008; Wu 2002 and 2013), energy consumption (Adams and Chen 1996; Rawski 2001), or food consumption (Garnaut and Ma 1992), to foreign price approximation (Ren 1997).<sup>4</sup> Despite different results, all alternative measures appear to be strongly supportive to the hypothesis. Robust findings from Wu's most recent study (2013), which applies multiple input-output table weights in order to correct for substitution biases, clearly show that the official estimates of industrial output are exaggerated whenever there are external shocks. This means that official GDP (and thus industrial activity) growth estimates may either or both be upward-biased and smoothed for politically favourable results. This is why one cannot rely on official GDP (industrial activity) estimates to date the growth and business cycle phases of the Chinese economy.

#### *Holz's (2014) reconstruction of industrial economic activity*

Within a long time span reconstruction of national industrial output (backdated to the early 1980s) Holz works on a monthly basis using both monthly and annual indicators based on three assumptions: i) official annual industrial GDP estimates are accurate; however, as shown in Wu (e.g. 2002, 2013) they exaggerate growth at times of external shocks; ii) the monthly distribution of DRIE (enterprises in the direct reporting system) output is accurate because the distribution of subsets (state vs non-state firms) is nearly identical, which is impossible (the two are concentrated in different sectors)! iii) DRIEs are representative of economy-wide industrial output: this also lacks a firm foundation as DRIEs have only hired less than 60% of industrial workers but, in an odd way, their value added would have been greater than national industrial GDP since 2005 (Wu, 2013). Holz's heroic approach<sup>5</sup>, accordingly, in a first step takes annual estimates in nominal levels and 'real' growth rates as 'control totals', and in a second step uses monthly distributions to 'splice' the 'control totals'.

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<sup>4</sup> There are also studies on this topic from the expenditure side of the economy whose results have also lent a strong support to the upward-bias hypothesis, such as Keidel (1992) and Shiao (2004).

<sup>5</sup> The procedure used by Holz is due to his attempt to reconstruct nation-wide industrial value added from 1980 onwards, while this data is only available since 1986, and monthly DRIE's data is available since 1980.

### *Commodity-based proxies*

The choice of relying on commodities (Wu, 2002, 2011 and 2013) is justified by the fact that: i) they are less influenced by local authorities: there is no easy manipulation at this level of details in physical terms, unlike price and value of output which do not often refer to micro and physical details; ii) they are representative of not only the majority of the output but also input-output linkages, hence more reliable for detecting the underlying trend; iii) they are transparent and straightforward, which is not at all the case with the official industrial output data and unfortunately Holz's reconstruction procedures have made the official series even less transparent.

In order to construct our commodities-based index, 56 consistent and (mostly) continuous commodities are selected from 87 available items in official statistics, covering the period from M01/1986 onwards. They are constructed into an Industrial Production (IP) index by the following steps: i) Filling gaps: Gaps, if any, are filled by changes of related commodities; ii) Pricing: Use 2005 factory-gate prices (based on detailed price information that covered 2000 major products up to 1997 and then updated to 2005 by official industry-specific PPIs); iii) Weighting: With the 2005 value weights, the commodities are aggregated into various groups at stages to explore relationships between producer and consumer goods industries, between upstream and downstream industries, and with passenger cars (available only from M01/1993).

**Table 2: Descriptive Statistics for Alternative Monthly Industrial Output Growth Indices**

	NBS Value-added		Holz IP		Commodities	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
1980(2)-2015(5)	9.86	32.1	10.42	34.9	8.63	29.1
1980(2)-2001(11)	8.27	37.6	10.61	37.9	6.82	25.2
.....1980(2)-1991(12)	4.43	45.2	8.81	35.24	5.51	24.7
.....1980(2)-1988(2)	10.5	46.7	12.77	37.8	8.29	25.6
.....1992(1)-2001(11)	12.89	24.9	12.78	40.8	8.40	25.7
.....1990(1)-1997(6)	13.92	27.6	14.51	44.3	8.85	26.2
2001(12)-2015(5)	12.43	20.3	10.10	29.8	11.54	34.5
.....2001(12)-2008(8)	14.76	13.4	11.56	27.2	15.92	28.7
.....2008(9)-2015(5)	10.11	25.1	8.64	32.0	7.16	38.9

Sources: Authors' calculation.

In the current exercise, we are using a commodity index that is based on all 56 commodities plus passenger cars. Next, to match the NBS IP index, hence Holz's variation of the NBS IP index, we extend our monthly commodity index from M01/1986 back to M01/1980 by the following steps: Converting annual series of 1980-85: This conversion exercise is conducted using monthly changes in the official gross output IP; and Pricing by 2005 prices, and then incorporated with the established series since 1986.

Descriptive statistics reported in Table 2 over different subsamples provide very valuable information on the relative characteristics of the three series. The contrast between the pre- and post-WTO entry periods is sharp. Indeed, while growth exaggeration was limited in the 1980s (i.e. pre-1989 events) to one-fifth, this dramatically changed subsequently. Accordingly, in the 1990s, average growth as reported by NBS data is around 50% larger than growth implied by the commodities series, while, after December 2001, average growth is very similar among the two series. In other words official overreporting seems to have left room to smoothing. This first impression is confirmed when noticing that in the 1990s the volatility of the two series (as measured by the standard deviation) is very close. However, it is 40% smaller for the official than the commodities series in the post-WTO entry sample<sup>6</sup>. This also confirms Wu's findings using annual data. He shows that for the period 1990-2001 the annual industrial growth measured by official GDP is twice that implied by commodities. For the post-WTO 2002 to 2012, the former is only 20% larger than the latter. Besides, Wu's commodity-based measure is 174% more volatile than that of official pre-WTO but only 20% more volatile post-WTO (Wu, 2013). These features are even accentuated by Holz's series, which for instance overreports growth by more than 50% in the two decades prior to WTO compared to the commodities series.

#### **4. Methodology**

We will focus here on growth cycles. This is an established concept (Zarnowitz, 1991; Zarnowitz et al. 2006), which was used in early indexes of general business conditions and trade. Growth cycles differ from business cycles not only quantitatively but also qualitatively. Intensive work on growth cycles in numerous Western (but few, mostly North, East Asian) countries was conducted by Mintz at the NBER and Moore at the Centre for International Business Cycle Research (CIBCR). When carefully interpreted, growth cycles provide lessons on when and how normal growth speeds up and slows down, and retardations do not develop into contractions. The usefulness of the distinction was emphasized by Zarnowitz (1991) in the case of Japan (as confirmed by Krolzig, 1997, 2001a), where slowdowns without growth recession prevailed strongly, while slowdowns with growth recession were more common in other G7 countries. Since growth cycles include both types of slowdown, they may be much more numerous than business cycles, which are defined by the presence of absolute decreases in aggregate activity, i.e. classical recessions (Zarnowitz, 1991; Zarnowitz and Ozyildirim 2006).

Since Slutsky (1927) and Yule (1921) it has been acknowledged that autoregressive processes convert serially uncorrelated shocks into persistent outputs and the dynamics then resembles closely the processes followed by growth-cycle indicators. An alternative tradition, a la Burns and Mitchell (1946) favours non-linearities, through its

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<sup>6</sup> The fall in volatility has been noticed by Zhang (2013), who attempted to rationalize it.

emphasis on successive periods of expansion and contraction. This second tradition is able to identify turning points in economic activity. As stressed by Diebold and Rudebusch (1999, p. 122), “it is only within a regime-switching framework that the concept of a turning point has intrinsic meaning”. A Markov-switching approach is particularly suited to this task. It has been customary since Hamilton (1989) to divide the growth cycle into two phases, negative and positive trend growth, and to assume that the economy switches between them according to a latent state variable. Accordingly, following the trough of a growth recession, since output switches back to the normal-growth phase, it will never regain the ground lost during the downturn. The effects of growth recessions on the level of output will thus be permanent. This is a strong view of growth-cycle patterns, which has been challenged (Kim and Piger, 2000) on the basis of an alternative model where growth recessions are characterized as periods where output is hit by large negative transitory shocks, labeled ‘plucks’ by Friedman (1993). According to such an alternative view, following the trough, output enters a high-growth recovery phase, returning to the trend. This is a ‘bounce-back’ or ‘peak-reversion’ effect (Kim and Nelson, 1999; see also Sichel, 1994). Output then begins a normal-growth phase with slower growth. On this basis a number of researchers have suggested using a three-regime model of the cycle to capture growth recessions as well as rapid-growth episodes, viewed respectively as persistent positive and negative deviations in the mean growth rate from the ‘normal’ long-term growth rate (Krolzig, 2000; Krolzig and Toro, 2000; 2001). From another perspective, the rapid-growth regime has been viewed as accounting either for the catching up of middle-income countries or for structural change leading to growth slowdown (Krolzig, 2001). Such a three-regime model was vindicated with quarterly data for GDP growth in 10 East Asian countries, including China, by Girardin (2005).

We draw the time-series implications of the “frequent regime switches” conjecture (of Pritchett, 2000), proposing to use Markov-switching techniques. Actually, while the separate treatment of the cycle from the trend has motivated the Bry-Boshan (1971) and Harding-Pagan (2002) approach to business cycle dating widely used for advanced economies, the joint treatment of growth and cycles has been part and parcel of the Hamilton (1989; and 2014 for a survey) Markov-switching approach. This framework is also better suited than the Bai-Perron structural break tests to detect changes in “growth regimes” with large accelerations and decelerations (Kar, Pritchett, Raihan, and Sen, 2013; Hausmann, Pritchett, and Rodrik, 2005) since such tests<sup>7</sup> interpret structural breaks as deterministic events, abstracting from the fact that regimes are often recurrent events (Hamilton, 2014). An added difficulty faced by the dating of business cycles in emerging economies is linked to the presence of a third regime alongside the usual recessions and expansions. Such a third regime matters especially

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<sup>7</sup> Another drawback of such tests is that it is not clear how they can be incorporated into models based on rational decision makers (Hamilton, 2014).

for China, due to the debate mentioned above about the possible disappearance of the regime of (catching-up) rapid growth<sup>8</sup>. We also need a framework flexible enough to determine whether downturns correspond to classical recessions or to growth recessions.

In existing literature, growth cycles of macroeconomic time series have increasingly been examined within a framework allowing for regime-switching (Krolzig, 2001). In a regime-switching model of the growth cycle some or all parameters of a time-series model of an output variable depend on an underlying unobservable stochastic variable  $s_t$ , which aims at representing the phases of the cycle. This approach enables us to assign probabilities to the occurrence of the different regimes. In its most popular version, which we will use here, such a model assumes that the process  $s_t$  is a first-order Markov process (Hamilton, 1994).

Hamilton's (1989) original specification assumed that a change in regime corresponds to an immediate one-time jump in the process mean. We rather consider the possibility that the mean would smoothly approach a new level after the transition from one regime to another. We do it in a univariate context for alternative measures of economic activity, as follows<sup>9</sup>:

$$\Delta y_t = \mu(s_t) + \alpha_1 \Delta y_{t-1} + \dots + \alpha_n \Delta y_{t-n} + (\sigma_m)^{1/2} (z_t) \varepsilon_t \quad (1)$$

where  $s_t$  is the mean state variable (number of growth regimes,  $n$ ),  $z_t$  the volatility state variable (number of volatility regimes,  $m$ ) and  $\Delta y_t$  alternative output growth (change in the logarithm multiplied by 100) indicators : official industrial value added , Holz's reconstructed series, and commodity output.

We model in turn a (regime-dependent) growth equation for each of our three indicators. We allow for separate volatility regimes in an extension of Hamilton's approach in the Markov-switching literature, accounting for the fact that mean regimes may differ in their timing from volatility regimes, and thus these two types of regimes should not be constrained to be identical, as stressed by McConnell and Perez-Quieros (2000).

We model a (regime-dependent) growth equation for each output indicator with such a univariate Markov-switching autoregressive model. We also allow intercepts,  $\mu(s_t)$  to switch between states ( $s= 1, \dots, 3$ ). Each growth regime will be associated with a specific average value of the process (Jermanovski, 2006). Thus the persistence of growth shocks in a given regime will be given by the sum (noted  $\lambda$ ) of the

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<sup>8</sup> A regime usually present before, and not after, growth recessions (unlike the Friedman (1993) type bounce-back or Plucking effect)

<sup>9</sup> We follow the Hamilton lead since autoregressive coefficients are not regime dependent.

autoregressive coefficients (from  $\alpha_1$  to  $\alpha_n$ ). Then the long-run growth rate will correspond to  $\theta = (\mu / (1 - \lambda))$ . The taxonomy of mean regimes will be three-pronged:

$$\theta(s_t) = \theta_1 < \text{or} > 0, \text{ if } s_t = 1 \text{ (Recession/Growth recession)} \quad (2a)$$

$$\theta(s_t) = \theta_2 > 0, \text{ if } s_t = 2 \text{ (Normal growth)} \quad (2b)$$

$$\theta(s_t) = \theta_3 > 0, \text{ if } s_t = 3 \text{ (Rapid growth)} \quad (2c)$$

Where  $\theta_1 < \theta_2 < \theta_3$ .

This involves three mean regimes: mildly negative or low positive ('recession/growth recession'), moderate ('normal growth'), and rapid ('rapid growth'). Besides the volatility ( $\sigma$ ) is allowed to switch between a low and a high volatility state.

In addition, with respect to the evolution of regimes, we assume that the probability distribution over the states for the next periods only depends on the history of the states through the current state:

$$P\{s_t = j \mid s_{t-1} = i, s_{t-2} = k, \dots\} = P\{s_t = j \mid s_{t-1} = i\} \quad (3)$$

For a given parametric specification of the model, (constant) probabilities are assigned to the unobserved regimes conditional on the available information set which constitute an optimal inference on the latent state of the economy. We thus obtain the probability of staying in a given regime when starting from that regime, as well as the probabilities of shifting to another regime.

The classification of regimes and the dating of the growth cycle imply that every observation in the sample is assigned to a mean ( $s=1, \dots, 3$ ) or a volatility regime  $z$  ( $z=1, 2$ ). The rule followed to assign an observation at time  $t$  to a specific regime depends on the highest smoothed probability. The smoothed probability of being in a given regime is computed by using all the observations in the sample. We assign an observation to a specific regime when the smoothed probability of being in that regime is higher than one half.

## 5. Dating growth phases and business cycles in China

Two major issues should be addressed when exploring the regimes of China's industrial growth over the last three and half decades with alternative indicators. First what was the magnitude and duration of rapid growth, in contrast with normal growth. Second whether classical recessions did occur and when. In order to address these two questions, we estimate univariate Markov-switching models for the monthly growth rate of each of three indicators: official industrial value added, Holz's reconstructed series and a commodity indicator. This is what we do in a first paragraph, while we provide some tentative rationalization of the contrast between over reporting and smoothing of growth with official data in a second paragraph.

### 5.1. Growth and Cycles dating

The estimation of the Markov-switching model for the different measures of economic activity shows that the third regime corresponds in two out of three cases to recession, implying negative growth (Table 2). The only exception arises with Holz's data where classical recessions never take place, with growth recessions in their stead.

**Table 3: Estimated Markov-switching models for alternative measures of economic activity**

	NBS-VA	Holz	Commodities
<b>A. Mean</b>			
Sum AR {n}	-0.13*** {6}	1.16*** {4}	-0.706*** {4}
Intercept([Growth] Recession)	-3.06 (1.07)	[15.48] (11.6)***	-3.27 (0.92)
Intercept(Normal Growth)	11.02 (8.16)***	28.09 (16.6)***	16.58 (9.36)***
Intercept(Rapid Growth)	18.41 (7.04)***	44.86 (16.0)***	28.38 (10.7)***
<b>B. Variance</b>			
$\sigma$ (Low)	6.31 (13.4)***	5.35 (14.9)**	10.08 (14.0)***
$\sigma$ (High)	63.66 (5.84)***	51.33 (13.69)***	48.64 (12.0)***
Log-likelihood	-1740.8	-1828.5	-1887.3
AIC	8.53	8.79	9.06
SC	8.69	8.95	9.20

'NBS-VA' is based on segments of official and alternative value added estimates; 'Holz-IP' is based on reconstructed official IP series and decomposition of annual series. 'Commodities' is based on physical output data. Monthly data, sample: 1981(2)-2015(5). t-statistic between brackets (robust SE) and p-value between square brackets. Significant at 10% (\*), 5% (\*\*), and 1% (\*\*\*).

Long-run annual growth is for both official and commodities data much larger in the rapid growth as in the normal growth regime, with the former around 17% and the latter 10% (Table 3). Recessions have also similar magnitudes with the two series, with



minus 2%. The only outlier in this classification is Holz's series with growth recession (at 7% per year) instead of recession, as well as a rapid growth regime with more than 20% per year.

In all cases it is necessary to account for separate volatility regimes. Indeed we documented in preliminary estimates (not reported) that, when such a separation is not done, mean and volatility regimes are not clearly distinguished. The different data series are associated with quite contrasted patterns in the range of volatilities. Indeed, the high-volatility regime corresponds to very large numbers with all series, but the magnitude is noticeably higher in the low volatility regime with the commodities series than with the other two.

**Table 4: Long run mean growth rate in different regimes for industrial activity**

% per annum	NBS-VA	Holz	Commodities
[Growth] Recession	-2.68	[7.16]	-2.23
Normal Growth	9.67	13.0	9.83
Rapid Growth	16.16	20.77	17.11

This corresponds to the intercept in the different regimes divided by 1 minus the sum of the autoregressive terms in Table 3. The long run coefficient thus corresponds to  $\theta=(\mu/(1-\lambda))$  in equation (1).

A glance at the average duration of regimes (Table 4) immediately highlights the smoothed nature of official value added data, which is alone in reporting a very durable normal-growth regime. The commodities series finds an exceptionally long-lasting rapid growth regime (see below). The Holz series implies that all regimes are almost equally short-lived. As expected the duration of the low-volatility regime is always longer than for the high-volatility one, by a factor of three to four. The dating of the high volatility regime for the three series is reported in Appendix II.

**Table 5: Duration of regimes**

Months	NBS-VA	Holz	Commodities
<u>Mean</u>			
[Growth] Recession	2.80	[7.95]	3.60
Normal Growth	27.40	9.40	13.40
Rapid Growth	9.95	5.00	80.0
<u>Volatility</u>			
Low	10.33	8.75	11.07
High	2.15	3.00	3.03

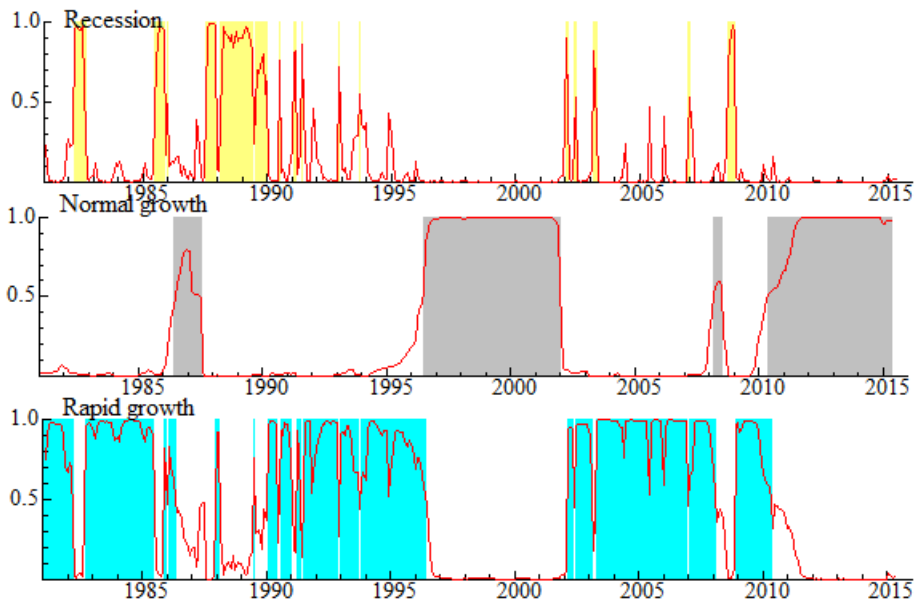
The distribution over time of the different regimes is plotted in Figures 1 to 3 and summarized in Table 5 for the [Growth] recession regime, and Table 6 for the Rapid growth regime. The dating of the regimes associated with the NBS value added data is

very much in line with the official Chinese view about growth and cycles over the post-reform period, with three main features. First, it portrays rapid growth as the dominant regime over the last three and a half decades, characterizing the first half of the 1980s, the first half of the 1990s, as well as the pre-GFC period, from 2002 onwards, with a brief resumption after the GFC. Second, it portrays recessions as being a lasting event only in the late 1980s, and (less so) during the GFC. Third, it characterizes the second half of the 1990s, including the Asian Financial Crisis, as free from recession, but associated with a growth slowdown, a 'growth normal', of which the mid-2010-mid-2015 period is only a new occurrence, and thus not a 'new' normal.

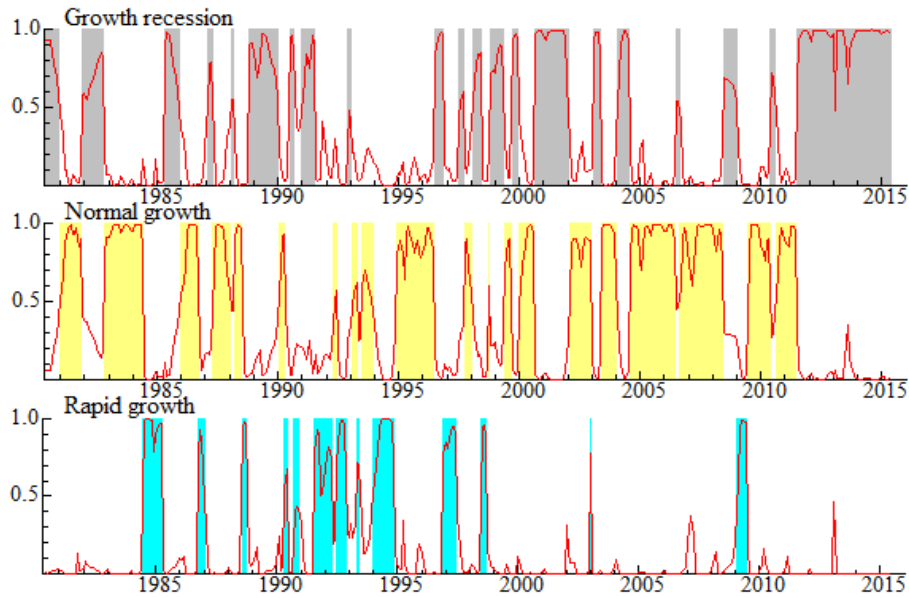
The dating offered by the Holz data seems at first sight to depart substantially from the periodization offered by the NBS data. Indeed, it detects only growth recessions and not recessions, and it limits the occurrence of the rapid growth regime, at an accelerated rate, to short periods, from the mid-1980s to the late 1990s. However, beneath such appearances, the Holz dating shares most features with the official value added one. This is linked in particular to the fact that, as noted previously, the rates of growth associated with each regime seem to have been amplified in the Holz series. Thus the dating of the normal growth (recession) regime in the Holz series is quite similar to the dating of the rapid (normal) growth regime in the NBS series, though in a much less steady way.

The commodities-based series provides a periodization of regimes which departs very substantially from the dating obtained with the other two series. First, with the commodities series, normal growth, which overwhelmingly dominated for two decades after 1980, was replaced by rapid growth precisely when China entered WTO and vanished with the GFC. Second, normal growth resumed after the GFC recession, thanks to the large credit cum fiscal reflation package, from 2009 onwards. However, and this is the third feature, recession resurfaced twice for a semester in 2013, and again from mid-2014 onwards, which may be due to the combination of three factors: the European debt crisis, the decreasing returns of the reflation packages (Renmin, 2014) and a balance-sheet recession, Japanese style (Koo, 2008). Such recurrent switches to recession are particularly striking, and unique to that series. However a glimmer of hope is present in as much as this slowdown was followed in the last two months of the sample by a return to normal growth. The commodities data series is thus the only one able to pick up distinctly the post-GFC movements in Chinese economic activity. This is likely due to its focus on components of industrial activity, which, by nature, should be more able to pinpoint the transformations in the character of growth. The commodities series also detects five recessions prior to the GFC, in the early, mid, and late 1980s, around the East-Asian crisis, as well as the early 2000s, with a timing not dissimilar to the growth recessions detected by the Holz series.

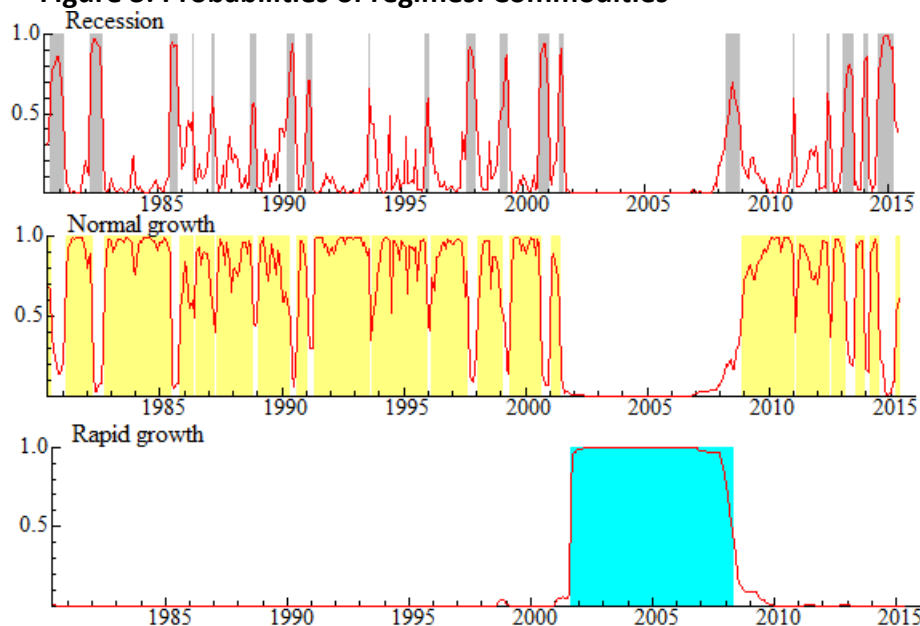
**Figure 1. Probabilities of regimes: industrial output (NBS-VA)**



**Figure 2. Probabilities of regimes: Holz**



**Figure 3: Probabilities of regimes: Commodities**



**Table 6: Chronology of China's Industrial Economic Activities: [Growth] Recessions based on Markov-Regime-Switching Model**

[Growth] recessions	NBS-Value added	Holz	Commodities
Early 80s: Agricultural reform	1982(4) - 1982(9)	[1980(6)-(12)] [1981(12) -1982(10)]	1980(8)-1981(2) 1982(4)-(9)
Mid 80s: Kick off nation-wide industrial reform	1985(8) -(11) 1987(8) -(12)	[1985(5) -(12)] [1987(2) -(4)]	1985(5)-(10)
End 80s: Tiananmen turmoil and aftermath	1988(3)-1989(11)	[1988(11)-1990(1)] [1990(7)-(9)] [1991(1)-(7)]	1988(11)-1989(1) 1990(5)-(8) 1991(2)-(4)
Mid to late 90s: Zhu's financial stabilization and East Asian Crisis		[1996(7)-(11)] [1997(7)-(9)] [1998(2)-(6)] [1998(11)-1999(5)] [1999(10)-(12)]	1997(9)-1998(1) 1999(2)-(5)
Pre-WTO (Nov. 2001) deflation		[2000(9) -2002(1)]	2000(9)- 2001(1)
Post-WTO blues	-	[2003(2)-(5)] [2004(2)-(7)]	
GFC and aftermath	2008(8) - (11)	[2008(7) - 2009(1)]	2008(5)-(11)
EU debt crisis		[2010(6) - 2010(8)]	
Renewed slump		[2011(7) - 2015(5)]	2013(3)-(7) 2014(8)-2015(3)

This table reports only Recessions [Growth recessions] lasting at least 3 months.

**Table 7: Chronology of China's Industrial Economic Activities: *Rapid growth* based on Markov-Regime-Switching Model**

Rapid growth	NBS-VA	Holz-IP	Commodities
Early 80s reform	1981(2)- 1982(3) 1982(10) - 1985(7) 1986(2)-(8) 1987(5)-(7)	1984(7) - 1985(4) 1986(10)- 1987(1)	
late 80s		1988(8) - (10)  1990(10)-(12)	
Early 90s: Deng's call for bolder reforms	1990(2)-..	1991(8) - 1992(11)  1994(1)-(11)	
Mid to late 90s:	...-1996(5)	1996(12) - 1997(6)  1998(7) -(9)	
WTO	2002(3)- 2008(6)		2001(9)-2008(4)
Post-GFC	2008(12) - 2010(4)	2009(2) - (6)	

This table reports the dates of rapid growth episodes with a minimum duration of one quarter

## 5.2. The political economy of growth reporting.

To what extent can shifting incentives in the decentralized structure of decision making in the Chinese government be a candidate for explaining the shift after two decades of over-reporting of industrial growth to a smoothing of growth figures in the new millennium.

The tournament hypothesis ('yardstick competition') based on growth performance has been considered as one of the roots of China's 'miracle' growth. It involved decentralization with center-controlled promotion. Evidence of this was particularly strong for the 1980s and especially the 1990s (Huang, 1996; Bo, 2002; Li and Zhou, 2005; Xu, 2011 for a review). Local officials competing at the provincial and county

levels for promotion would engineer growth in order to outcompete their peers. This is a likely source of growth overreporting in the 1980s and 1990s.

An alternative approach has stressed fiscal revenue maximizing behavior. Particularly with the 1994 reform centralizing standard fiscal revenues, and its decisive deepening in 2002-2003, local governments had to shift to other sources of revenue, essentially extra-budgetary ones. Enabling legislation passed in 1998 enabled the local governments to monopolize the land conversion and associated land lease fees (Han and Kung, 2015). Indeed in 2002 the local retention rate of enterprise tax revenues was halved [further reduced to 40% in 2003] by the central government. As a response, local governments were compelled to rely both on the business tax (falling principally on the construction and real estate sectors) and in a major way on non-budgetary revenue from selling the usufruct of land (Kung et al. 2014). So from that time onwards, land conveyance fees became a dominant source of revenues at the local level.

Responding to the fall in the local retention rate of enterprise tax revenue, local governments managed to recoup part of the loss in revenue by shifting their efforts from the stimulation of industrial growth to urbanization, i.e. the conversion of arable land for commercial and residential use. The fiscal incentive view is able to rationalize such behavior which is at odds with the political incentives. However such a shift may wrongly give the impression of a trade-off between promotion enhancing growth and urbanization. While the former has not been altered for the provincial leaders who are not the beneficiaries of the land revenue windfall, the decisive change in the new millennium took place at the sub-provincial (i.e. prefecture and county) level (land conveyance fees came to account for 80% of county revenue in 2008). Chen and Kung (2014) document for 1753 counties over a ten year period (1999-2008) that land revenue<sup>10</sup> dampens (or nullifies, depending on control variables) the significance of Gross Regional Product growth as a driver of promotion. To the extent that growth in economic activity becomes dominated by land revenue as a driver of local officials' promotion, it is reasonable to expect that such officials would start refraining from trying to outcompete each other in growth reporting, and may even collude.

## **6. Conclusion**

The increasing role played by the fluctuations in the Chinese economy as a driver of cycles in not only East Asia (via supply-chain effects), but also Oceania, Africa and Latin America (as suppliers of raw materials) amply justifies the need to develop a reliable dating of growth and business cycle phases in China.

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<sup>10</sup> County leaders have « signalled » their achievements through ostentatious 'image' building public projects

In so doing this paper shows that the dating strategies based on series derived from official industrial output data suffer from major biases. The dating of growth regimes based on this data supports the official view that China experienced three decades of rapid growth in the post-reform period. It also portrays the 2010's as corresponding to a growth slowdown (an 'old' not a 'new' growth normal), which China previously experienced in the second half of the 1990s. The reconstruction of industrial output data proposed by Holz (2014) mainly supports these two stylized facts established with official data.

We reconstructed a commodities-based alternative series of industrial activity at a monthly frequency also over three and a half decades. With such alternative data, our univariate Markov-switching modeling does show the presence of recessions in China, contrary to some widespread belief. Such data also imply that WTO entry late 2001 was associated with a temporary boost to growth, with a doubling of industrial growth rates from the 'normal' rate prevailing over the previous two decades, as well as a return to such 'normal' growth in the second decade of the new millennium, interrupted by recurring recessions. The strength of such a commodity-based indicator thus lies in its ability to show the sequence of phases characterizing the post-WTO events, and to provide the most reasonable dating of classical recessions, thus improving upon available dating estimates of recessions for China.

We infer from our results with alternative series for China's industrial growth that while the decade after the mid-eighties was characterized by sharp over-reporting (supporting the argument made for instance by Wang and Meng, 2001), the first decade of the new millennium seems to have seen official growth smoothing. The sources of over-reporting of growth in the late eighties and nineties have been widely studied and rigorously modelled within a game theoretic framework by Zhou (2009), stressing that local (provincial, city and county) leaders competed in the late eighties and the nineties to report higher growth than their peers in order to get easier promotion. By contrast the smoothing of growth in the first decade of the new millennium has been rather overlooked, even though some recent evidence documents that local leaders were rather concerned with maximizing local fiscal revenues, especially in the wake of the fiscal reforms started in 1994 and deepened subsequently. Theoretical modeling of this alternative to the tournament hypothesis still remains to be done.

## Appendix I:

### Growth cycle dating in previous literature

Figure A.I.1: Growth recessions in a 3-regime model in Chinese-language work:

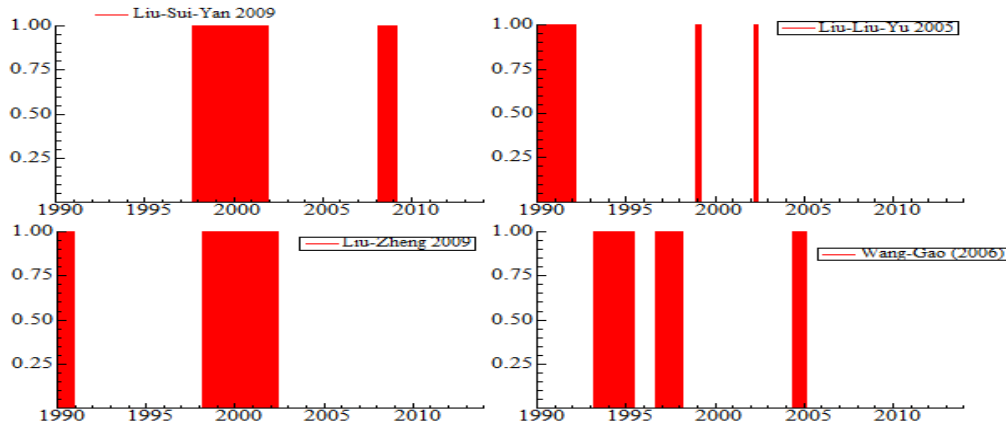
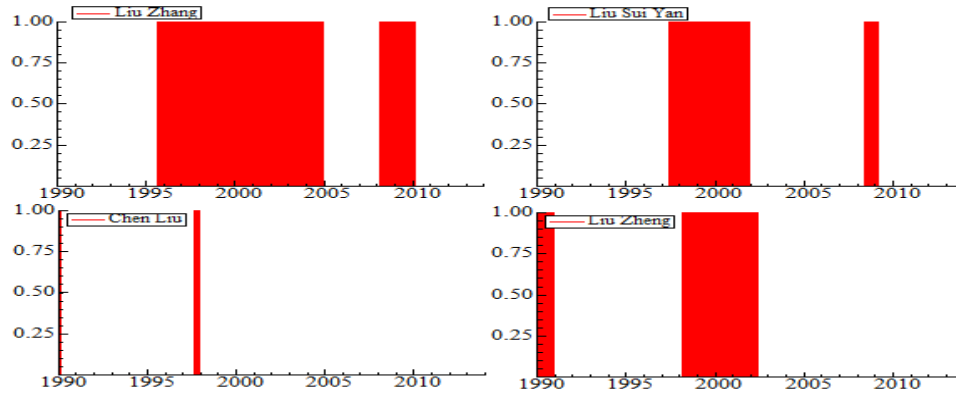


Figure A.I.2: Growth recessions in a 3-regime model in Chinese-language work

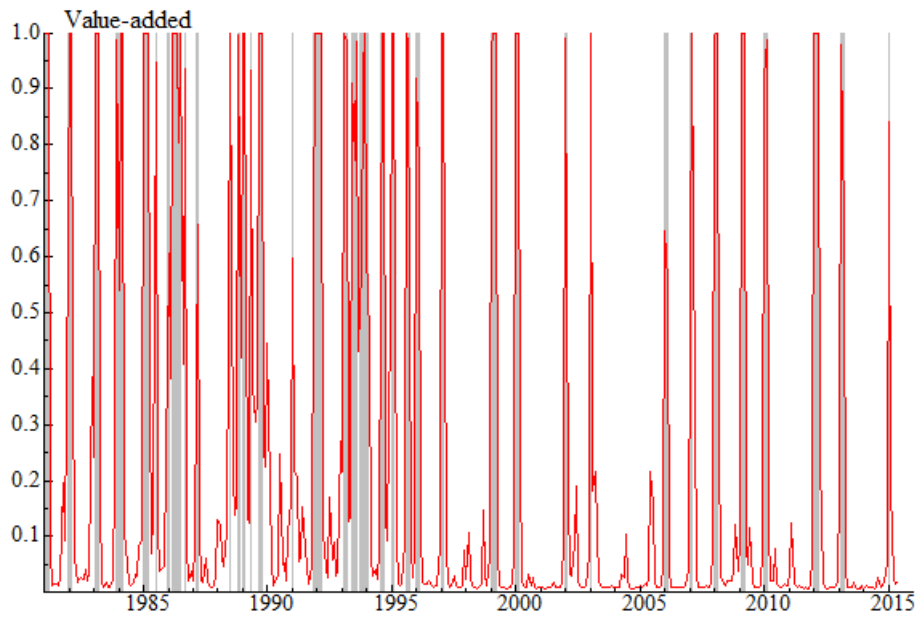




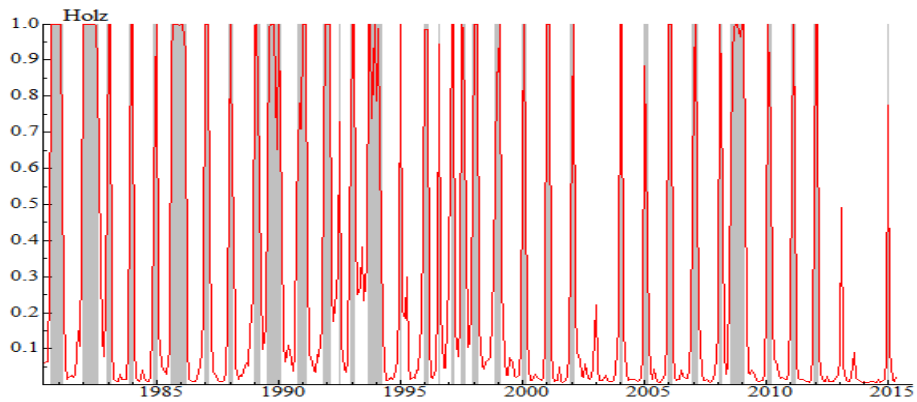
**Appendix II:  
Probabilities of high-volatility regimes**

**Figure A.II. Probability of high volatility regime:**

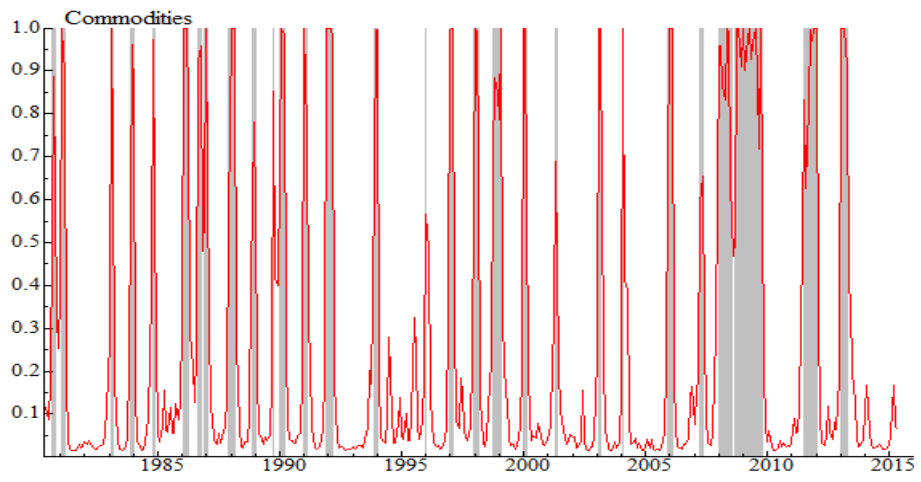
**A. IP-VA-TCB**



**B. Holz**



### C. Commodities



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