

Can China Sustain Rapid Growth Despite Flawed Institutions?

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No observer, participant, or analyst, either in Beijing or elsewhere, anticipated China's enormous economic surge, now entering its fourth decade, which has rocketed the People's Republic to unprecedented global prominence. Following in the wake of equally unexpected growth spurts in Japan, Taiwan, and Korea, China's recent experience underlines an unfortunate lacuna in economic analysis: the general inability of the dismal science to anticipate major discontinuities in development.

China's protracted boom, like its Asian predecessors, has left in its wake a considerable roster of intellectual casualties – theories or prescriptions that crumble in the face of Chinese realities.

Prominent among these victims is the “big bang” approach to socialist reform, which postulates that the shift from plan to market must occur abruptly, and the related view that more or faster reform will surely improve economic outcomes. Imagine a statistical analysis in which real GDP growth among former socialist economies is “explained” by the extent of market orientation. If the observations included China's 31 province-level units (average 2005 population xxx million) as well as the states included in Jan Svejnar's (2008) analysis of 13 transition economies of Central and Eastern Europe (CEE) and the former Soviet Union (average 2005 population xxx million), the results would surely associate rapid growth with the middling pace of transition from plan to market represented by China's provinces.¹ Leaving aside the initial decade of decline and recovery in the latter group of ex-socialist states, cumulative growth in real GDP for the CEE/former Soviet Union states during 1998-2005 ranged from approximately 20-60 percent (Svejnar 2008, p. 75) vs. xxx for China's provinces (calculated from Yearbook xxx). Evidently, there is no simple relation between marketization and growth.

Recent Chinese experience severely undermines the “Washington consensus,” which advised that low-income nations could accelerate growth by implementing a policy package that includes liberalization of domestic prices, privatization of state-owned enterprises, and xxx. The slow advance of Chinese privatization, with the state sector still accounting for perhaps one-third of total output, the glacial pace of legislative changes embedding private property in China's legal system, and the gradualism surrounding price liberalization all indicate that the “Washington consensus,” like many

¹ Such an analysis could use the marketization index created by Chinese economists WANG Xiaolu and FAN Gang (xxx) to assign quantitative measures of reform progress to China's provinces.

previous policy fads, probably overstates the centrality of its main features in the development process.

China's growth path is equally destructive to the view, advanced by Douglass North in the context of European industrialization (e.g. North and Thomas 1973) and recently expanded by Acemoglu and others (e.g. Acemoglu et al 2001), that clearly defined property rights, strong judicial enforcement of ownership prerogatives and contract provisions, and other market-supporting institutions play a central role in determining long-term economic outcomes. If China's rickety financial structures, shoddy corporate governance, grudging recognition of private property, weak judiciary, and widespread corruption can coexist with record-beating growth, how can economists plausibly regard institutions as key ingredients in promoting long-term growth?

Is it possible that, as occurred in Japan around 1990, institutional shortcomings may suddenly and unexpectedly derail what many contemporary observers regard as boundless growth prospects? Leaving aside the wishful thinking of analysts who regularly predict China's impending demise, there is no shortage of sober analysis suggesting that flawed institutions will impose high and rising costs. Christine Wong and Richard Bird (2008), for example, conclude that without systematic fiscal reform, China's "attempt to build a new economy. . . may yet come to a grinding halt, pulled down by the morass of ad hoc, piecemeal, and often illicit arrangements that continue to be hastily put into place in attempts to avert imminent fiscal calamity in one or another part of the public sector" (2008, p. 463).

Chronic budget problems confronting local governments, for instance, which, especially in lagging rural areas, tend to be overstaffed, chronically indebted,² and corrupt, threaten to undermine the quality of rural education. Ironically, Beijing's recent decision to abolish agricultural taxes as well as rural school fees, while intended to relieve financial pressure on village households, could worsen matters by causing local leaders to focus less on the needs of their constituents and more on potential sources of funds at higher levels of administration. This could intensify a possible mismatch between the knowledge of young rural graduates and the requirements of future urban employers. The worst-case result: structural unemployment on a scale that might dwarf similar difficulties in the United States, France, and other market economies.

We pursue the issues surrounding China's economic prospects by reviewing the growth record, summarizing current institutional arrangements, and examining the prospects for future growth and for institutional development.

China's Record of Economic Growth

No one can doubt China's achievement in the sphere of economic growth. Applying prices of the year 2000, which, unlike prices during China's plan era, reflect approximate

² China Daily places the "huge debts local authorities have incurred" at RMB625 billion (or roughly US\$89 billion) – see Debt Clearance 2007.

market values, to official indexes of real output growth for the three main economic sectors: primary (agriculture, forestry, fisheries, and mining), secondary (industry and construction) and tertiary (transport, communication, and services), Perkins and Rawski find that average annual GDP growth accelerated from 4.4 percent during 1952-78 to 9.5 percent during 1978-2005 (2008, p. 839). Addition of 2006 and 2007, for which official measures show double-digit expansion of real GDP, would marginally raise average growth during the reform era. They argue that, once the bias inherent in plan-era prices is removed, official data provide “the best available benchmark for appraising the long-term evolution of China’s economy” (2008, p. 834).

This view is not universally shared. Anand and Segal (2008, p. 86), referring to results from Angus Maddison and the Penn World Tables, suggest a “scholarly consensus that official estimates overstate [China’s GDP growth over the past 30 years].” In my view, such conclusions are premature. Although official Chinese data remain subject many qualifications, including temporary deviations from reality during the late 1950s and, in this author’s opinion, between 1998 and 2003, efforts to replace official measures of real output growth typically fail to improve on Chinese data. I comment here on the work of Angus Maddison and Harry X. Wu because it is both clearly documented and widely followed.

The alternate measures of Chinese output growth constructed by Maddison and Wu have appeared in several versions. Their studies revolve around two key revisions: i) Wu’s alternative index of industrial output growth; and ii) Maddison’s independent measure of output in “non-productive services” – i.e. “banking, insurance, housing services, administration of real estate, social services, health, education, entertainment, personal services, R&D activities, the armed forces, police, government and party organizations.” (Maddison and Wu 2007, p. 2). When applied to China’s economy during the reform era, each substantially **underestimates** real output growth. For this reason, the observation that the Maddison-Wu estimates of Chinese GDP show slower growth than the official figures is neither surprising nor indicative of any shortcoming in the official data.

Harry Wu constructs new estimates of Chinese industrial growth in the following manner:

- Obtain physical output data for large numbers of products
- Use 1987 price and cost data from the national input-output table and other sources to obtain measures of unit value-added for each product
- Combine this information to calculate a new series of industrial value-added at 1987 prices

Following this approach, Wu has assembled a large body of data, with coverage of 56-62 percent of industrial output in the 1987 base year (Wu 2002, pp. 187-189). Recourse to input-output data gives his measures a degree of sophistication that eluded earlier efforts to apply similar methods.

The difficulty with Wu's method is the implicit assumption that product quality remains constant at the base-year level. For the plan-economy era, this is a plausible, even a generous assumption. I therefore expect Wu's approach to approximate official results, which it does.

For the reform era, however, the constant-quality assumption is erroneous. Partial information on the manufacture of televisions illustrates the devastating impact of quality change on results obtained using Wu's method of analysis. Wu's data show price and output for black and white and color TV sets in 1987, allowing him to determine the average sales price for TV sets in the base year; this price is then used to value output of televisions throughout the period of analysis.³ However, as is evident from Table 1, the share of color sets in total output rises steeply over time, resulting in overvaluation of output prior to 1987 (when the share of color sets was less than in 1987) and undervaluation of output after 1987 (when the share of black and white sets declined swiftly toward zero). Adjusting the "1987 price" to accommodate the changing proportion of color sets raises the estimated annual growth of output value for television sets during 1987-2005 from 8.4 to 11.7 percent. If we crudely allow for other improvements – larger screen size, etc. – by raising unit value in the terminal year by an additional 10, 25, or 50 percent, the discrepancy between average growth obtained from Wu's method and from an alternate calculation that allows for quality change rises from 3.3 percentage points to 3.9, 4.5, or 5.9 percentage points.

Table 1 about here

Steep improvement in product quality is not confined to television manufacture. The rapid growth and shifting structure of China's exports is one of many signs of widespread quality improvement. The list of sectors that have experienced steep quality upgrades during the past 20 years surely includes home appliances, motor vehicles and parts, machine tools, computers and other electronic equipment, garments and many, many others. Among major industrial sectors, perhaps only cement and coal, each with large shares of output originating in small-scale operations, have achieved no major quality improvement. The finding that Wu's method produces lower growth estimates than the official figures reflects the impact of the counterfactual assumption of constant quality rather than any weakness in the official figures.

Indeed, the official figures themselves may harbor downward bias due to insufficient allowance for quality change. Application of hedonic methods to sectors (like motor vehicles) that have experienced the same combination of rapid expansion, steep quality improvements, and falling prices observed in U.S. industries like semiconductors or computers (Boskin et al, 1998) seems likely to result in substantial increases in estimated rates of real output growth for Chinese manufacturing.

Turning to the tertiary sector, Maddison's output series for "non-productive services" raises the officially-estimated output level in the 1987 base year to adjust for possible

³ I ignore the shift from sales value to value-added, which is included in Wu's analysis.

under-measurement, and uses employment growth to measure changes in output after 1987. The assumption that labor productivity remains fixed at the 1987 level might pass muster for some segments of China's service economy (e.g. government, primary education), but seems deeply flawed elsewhere. The list of service occupations that have witnessed large increases in labor productivity over the past two decades surely includes major segments of banking, insurance, finance, advertising, accounting, real estate, consulting, research and development, design, sports, tourism, and entertainment.

Information about wages, which increasingly reflect the impact of market forces, confirms this expectation of rising labor productivity. Data compiled in Table 2 show above-average growth of nominal wages during 1987-2005 in every category of "non-productive services" for which data are readily available. Wage growth in all tertiary subsectors exceeds average wage growth in manufacturing even though the latter data exaggerate actual wage trends due to omission of low-paid contract workers from standard employment measures.

Table 2 about here

Figure 1 shows the tertiary sector's share of GDP during 1978-2005 as estimated in official statistics (current prices), by Perkins and Rawski (using official data recast in 2000 prices) and by Maddison and Wu (1987 prices).⁴ The comparison highlights the implausible outcome of the Maddison-Wu revisions, which show no increase in the tertiary sector's share of aggregate output during the entire reform era. According to Maddison and Wu, the proportion of GDP originating in services was lower in the terminal year of their analysis (2003) than in any year since the start of economic reform in 1978. Indeed, Maddison and Wu find the output share of services to be lower in 2003 than at any time during 1952-2003 except for the years 1973-1976 (calculated from Table 8 in Maddison and Wu 2007). This mistaken result demonstrates the danger inherent in assuming that employment trends offer a sensible proxy for output growth across large segments of China's tertiary sector.

China's statistical system, which until the 1980s reflected Soviet-inspired neglect of broad segments of the service sector, has experienced great difficulty in developing comprehensive measures of service activity. Despite multiple adjustments that invariably enlarge the estimated scale of tertiary activity, continuing revisions, most recently in 2008, suggest that future adjustments to the level (and in all likelihood, growth) of tertiary activity are likely to result in upward rather than downward adjustment to official measures relating to China's service sector.⁵

Figure 1 about here

⁴ Sources for Figure 1: official data from Yearbook 2006, Table 3-2; Perkins-Rawski data from author's file r102607GDP 1952-2005...; Maddison-Wu data from Table 8 in Maddison and Wu (2007) – where tertiary is taken to include all sectors other than agriculture, industry, and construction.

⁵ Faster Service Growth (2008) comments that "analysts have underestimated the expansion of the service sector."

China's Institutional Structure

The reality of wide deviations between Chinese institutional arrangements and the textbook arrangements prescribed by international agencies and economic researchers is widely documented. Here I propose only to add new information about what I have long regarded as the most problematic feature of Chinese institutions: a flawed investment mechanism that lavishes funds on ill-advised state-sector projects while limiting funding for private entrepreneurs. In 2002, I suggested that “many of China’s economic ills, including slow employment growth, high levels of formal and implicit government debt, vast excess production capacity, slow but persistent deflation, mountains of unrepayable loans, and insolvent banks, are strongly and directly tied to defects in the investment system” (Rawski 2002, p. 370). Six years later, much of this critique remains valid.

Recent work by Brandt, Hsieh and Zhu provides a fresh perspective on these issues using data from a limited subset of provinces. Building on earlier work by Alwyn Young, these authors develop a 3-sector analysis that includes agriculture and divides the non-farm sector into state and non-state segments. Their analysis highlights the “nonstate nonagricultural sector. . . [as] the key driver of economic growth” over the past three decades (2008, p. 720). They find that the state sector slows regional growth dynamics by channeling capital into low-payoff projects and slowing the growth of non-farm employment: their data link high (low) state-sector shares in provincial economies with high (low) state-sector investment shares, low (high) growth of provincial non-farm output, and low (high) growth of non-farm employment (2008, pp. 714-719).

We can supplement the work of Brandt, Hsieh and Zhu, which uses annual time series data for 10 provinces, with information based on quarterly GDP data for all of China’s provinces in 2000.⁶ Figure 2 shows a positive association between the state sector’s industrial output share (from Yearbook 2001, Table 13-3) and the remarkably large seasonal fluctuations in China’s economy which, as shown in Rawski (2002), reflect vast gyrations in investment spending inherited from the planned economy era. Figure 3 shows a more modest, but clearly negative association between seasonal variations in annual GDP and the provincial index of marketization developed by Wang Xiaolu and Fan Gang (xxx)

Figures 2 and 3 about here

These observations connect and reinforce the research cited previously. We conclude that China’s investment system, which uses the banking system and organized capital markets to channel state-controlled or officially-influenced capital flows into the hands of state-sector entities, contributes to a long roster of unfortunate outcomes, including:

- slowing non-agricultural growth outside the state sector

⁶ These data were collected and analyzed by Professor Yifan Zhang of Lingnan University.

- delaying productivity-enhancing transfers of labor from the farm sector
- distorting domestic factor prices, thus encouraging a premature shift toward capital-intensive technologies
- retarding the growth of employment
- elevating the level of risk surrounding China's principal financial institutions
- enlarging China's unusually high level of seasonal economic fluctuations

China's Growth Prospects

Quantitative issues.

Building on a detailed review of performance between 1952 and 2005, Perkins and Rawski (2008) project China's likely GDP growth for the period 2005-2025 in a range between 6 and 8 percent (in real terms).

For the period 1952-2005, these authors compile annual data on real GDP (combining official estimates of sectoral output growth with a 2000 price base), labor force (ages 16-65, divided into 5 levels of educational attainment), and fixed capital (using a new deflator for investment spending, and assuming annual depreciation of 7 or 9.6 percent). They find that, after allowing for the contribution of increased capital, manpower, and education, total factor productivity (TFP) rose at an average rate of 0.5 percent and accounted for 11 percent of output growth during 1952-1978. For the reform period 1978-2005, TFP rose by an annual average of 3.8 percent and accounted for 40.1 percent of observed growth (2008, p. 839).

For the period 2005-2025, the authors adopt the following method:

- project likely levels of fixed assets by assuming a gradual decline in China's (extremely high) capital formation proportions
- project likely levels of manpower by assuming no change in annual births to 2009
- project likely levels of educational attainment by assuming a rise in high school and college enrollments during 2006-2025 that parallels Japan's change in enrollments during 1995-1975
- use these input projections to derive the TFP implications of alternative rates of real GDP growth
- consider the feasibility of the TFP consequences of alternative growth rates

Perkins and Rawski consider a number of factors that might contribute to, and also detract from future growth performance. They conclude that China's current double-digit GDP growth is not sustainable, project that real GDP growth to 2025 is likely to fall within the range of 6-8 percent per year, and anticipate that China's economy is likely to experience considerable fluctuation around the projected average rates of growth.

Our purpose here is to extend the analysis in both quantitative and qualitative terms.

On the quantitative side, recent developments in global energy markets focus attention on issues that Perkins and Rawski did not consider. Although my own miserable track record (Rawski, 1974) makes me loath to prognosticate in this area, recent work by Rosen and Houser (2007a, 2007b) invites comment by focusing on the centrality of energy-related matters in China's political economy and also by revealing the complexities surrounding data on China's energy economy.

In a working paper (2007a) and somewhat abbreviated publication (2007b), Rosen and Houser offer a stimulating and comprehensive analysis that links China's energy economy to broader social and economic issues. Here I focus on the portion of their study that relates directly to China's past and future demand for energy. The authors make two key points:

1. Following a long decline that started shortly prior to the onset of China's economic reforms in the late 1970s, energy intensity suffered an unforeseen reversal early in the present century (see Figure 1 in Rosen and Houser, 2007a and 2007b).
2. Despite policy moves aimed at limiting the growth of energy use and fostering conservation, "the steel mills, cement kilns, and glass factories that are driving current demand [for energy] are feeding an infrastructure boom that is quickly locking in China's energy and environmental future" (2007a, p. 15; see also *ibid.*, p. 44).

Both observations seem premature. The first rests on questionable data. The second confuses trend and cycle.

While a careful review of energy data is beyond the scope of this paper, a brief examination of relevant information casts doubt on the "energy intensity reversal" theme. Rosen and Houser rely on a commercial data base that extracts information from Chinese statistical publications (2007b, p. 25). The problem here is that, while the authors are silent on issues of data quality, China's National Bureau of Statistics (NBS) has revised some key energy statistics; other key data are of dubious validity.

Table 3 summarizes some key figures in order to demonstrate the wide error margin surrounding efforts to trace the path of energy-intensity during China's reform era. The columns marked Coal 1 and Coal 2, show how National Bureau of Statistics first issued, and later revised data showing (highly implausible) reductions in coal production in

1998/99 and 1999/2000. These changes led to revisions in estimates of energy consumption (compare the data in the columns marked Energy 1 and Energy 2). However the latter revisions appear inadequate: with coal accounting for 69.1 and 67.8 percent of energy consumption in 1999 and 2000 respectively (Yearbook 2007, Table 7-2), how can an upward revisions of 22.49% and 30.16% in coal production translate into changes of only 2.85% and 7.57% in energy consumption (see columns labeled “upward revision” in Table 3)? The column marked “Energy 3” replicates the recent National Bureau of Statistics energy consumption data (from Energy 2) except for 1999 and 2000, for which I arbitrarily raise the initially reported consumption figures (from Energy 1) by a percentage equal to one-half of the upward adjustment in reported coal output.

Table 3 about here

Turning to GDP, I have argued that official data dramatically overstate actual growth during 1997/98, 1998/99 and (following the SARS outbreak) in 2002/03 (Rawski 2001, 2006), and to a lesser degree in the intervening years. The column marked GDP2 shows a partial adjustment that reduces real GDP for 1997/98 and 1998/99 to 2 percent, which I see as a maximum growth rate for those years. Note that the claim of overstatement, while controversial, continues to resonate within the community of Chinese economists and international observers; I believe it is fair to say that the official growth estimates for those years (shown in the column marked GDP 1) are widely believed to contain substantial upward bias.

The right-hand columns of Table 3 calculate an index of energy use per unit of real GDP, taking the prior year as 100. The columns marked EU1 and EU2, which aim to approximate the figures used by Rosen and Houser (their work displays charts only, so readers cannot verify the underlying data), use official figures for GDP growth and for energy consumption as originally estimated (EU1) or subsequently revised (EU2). EU3 combines the official GDP data with the enhanced consumption adjustment (Energy 3) described above. EU4 combines the same adjustment to energy consumption (Energy 3) with GDP2.

Focusing on the columns marked EU3 and especially EU4, which in my opinion provide a more plausible picture of actual developments than what appears in standard sources, we find a rather different picture of energy intensity trends. Instead of a long, rather smooth decline followed by an abrupt reversal early in the current decade, we see a long and continuing decline, but one in which the past decade has witnessed several temporary reversals in which energy intensity jumps upward before resuming its downward trend. Table 3 shows upward jumps in 1998, 2003, and 2004. These observations may understate the magnitude of upward jumps in energy intensity for 1998 and 2003 (because the data in GDP2 overstate actual growth, especially for 2003). Further review of the energy figures, particularly to consider the impact of smuggled imports of petroleum products in the late 1990s and to reexamine the improbable reductions in coal output reported during 1997/2000, might reveal additional instances of annual increases in energy intensity.

Where does this leave us? Rosen and Houser report that “the real surprise was a change in the energy intensity of economic growth. Energy demand elasticity. . . increased from less than 0.5 between 1978 and 2000 to 1.5 between 2001 and 2006” (2007b, pp. 29-30). Data in Table 3 suggest that, while energy intensity may have risen, only part of the increase came after 2000. In addition, the increase appears episodic rather than secular, as it is confined to individual years. Finally, much depends on the choice of dates and data. Based on the most recent data issued by China’s National Bureau of Statistics, energy elasticity during 2001-2006 is 1.10 rather than, the much higher figure of 1.5 provided by Rosen and Houser; extending the period of analysis by one year to include 2007 lowers the figure to 1.02. It thus appears that half of the increase in energy intensity reported by Rosen and Houser reflects their use of obsolete data and/or choice of dates.

I conclude that while energy elasticity is higher in recent years than before, the magnitude of change is much smaller than claimed by Rosen and Houser and, furthermore, the underlying data are shaky – further investigation might further reduce the recent rise in energy elasticity.

Regardless of the actual trend of energy intensity, Rosen and Houser are surely correct in anticipating that future increases in production and income levels will propel further growth of China’s already massive energy consumption, with powerful implications for international energy markets and for global emissions. However their expectation, quoted earlier, that new manufacturing facilities will have the effect of “locking [China] in” to a future of high energy consumption confuses trend and cycle and misreads the consequences of recent developments in energy-using industries.

As Rosen and Houser observe, the most recent phase of China’s long boom includes massive investments in steel, cement, and other energy-using industries. They err, however, in overlooking the bimodal structure of these investments, which include huge outlays on new facilities that will attain world-class levels of energy economy as well as get-rich-quick expenditures aimed at quickly erecting (often wasteful and dirty) plants with the intent of capitalizing on China’s current boom.

In steel, for example, where top-tier firms report labor productivity and material input figures that are converging toward results from plants in Western Europe and even Japan, there is a long “tail” of low-quality producers who can profit despite low productivity and high material use, but only in the current environment of surging demand and boom-time pricing (see Brandt, Rawski and Sutton 2008, pp. 593-604). At some point, demand shifts will curtail the market share of China’s low-end steel producers. A sudden decline in domestic steel demand (or even in the growth of steel demand) could rapidly precipitate such a shake-out. Alternatively, ongoing expansion of high-end producers, coupled with gradual demand shifts favoring complex products and high-quality goods, could gradually curtail sales from low-end steel-makers.

Such changes will produce steep reductions in unit energy requirements. It is entirely possible, for example, that an increase of 5 or 10 percentage points in the market share of China’s leading steel firms (an important objective of current government policy) could

reduce the steel industry's energy consumption by 10-20 percent. This exact combination of rapid growth and falling energy use, which seems "astounding" in an advanced economy with relatively uniform technical standards (Schulz 2008), may already be underway in China's thermal power sector: during 2006/07, "authorities closed down 553 small power plants, and coal consumption in the sector fell by 2.5 percent" (Wan Zhihong 2008) while output of thermal power rose by 14.9 percent (Communique 2008).⁷

Qualitative matters

Chinese experience rules out absolute versions of the "good institutions or bust" approach. Evidently, rapid and sustained growth can coexist with weak institutions – a reality confirmed by the experiences of Japan and Korea, as well as contemporary China. The wisdom of Alexander Gerschenkron, who wrote in the European context of industrialization, seems relevant: "a journey through the last century may . . . help in formulating a broader and more enlightened view of the pertinent problems and in replacing the absolute notions of what is 'right' and what is 'wrong' by a more flexible and relativistic approach" (1962, pp. 26-27).

In this context, following Gerschenkron's expectation that researchers will come to recognize "the significance of . . . native elements in the industrialization of backward countries" (1962, p. 26), I argue that China's prospects will continue to benefit from a variety of "good" historical and institutional circumstances. Furthermore, available information suggests substantial improvement in important areas of institutional weakness. We discuss each in turn.

Writing of the 1920s and 1930s, Tim Wright describes China's economy as blessed with "an abundance of small-time entrepreneurs" (1984, p. 325). This reflects a legacy that extends far beyond China's long history of markets, mercantile activity, and interregional and international exchange. In my view, China's traditional village society produced individuals who, on average, were better-prepared to function in modern market systems than their counterparts in most pre-industrial societies. It is not that Chinese individuals are greedier or quicker to spot bargains than individuals in other cultures, but rather that Chinese society equips its members with an unusually rich and flexible portfolio of organizational skills with which to pursue economic advantage (Rawski, 2007).

⁷ The meaning of "the sector" is unclear – it could refer either to the entire thermal power sector or merely to its small-scale segment. However an earlier report, noting that "large power units may consume 290 to 340 grams of coal. . . while medium and small-sized units need 380 to 500 grams" to generate 1 kwh of electricity, predicted that plans to "phase out 50,000 megawatts of . . . capacity in small thermal power plants before 2010, including 10,000 megawatts this year [2007] alone. . . . [will] save around 14.5 million tons of raw coal on a yearly basis. . ." suggesting that actual coal use may have fallen in 2007 (Sun Xioahua 2007).

Fortunately for China's economic prospects, a quarter-century of socialist planning, including intense efforts to extirpate "penny capitalist" thinking as well as individual entrepreneurship, failed to eliminate these historically-rooted organizational skills. Indeed, I believe that the commune experience, which combined two decades of inadequate nutrition with unprecedented pressures that required every rural adult to monitor and respond to external circumstances to a degree unequalled in any previous era, actually strengthened the entrepreneurial component of village culture that collectivization was in part meant to eradicate (ibid).

It was this revitalized entrepreneurial potential that transformed China's modest rural reforms of the late 1970s and early 1980s, which restored only a fraction of the market circumstances observed during the early 1950s (not to mention the full market economy of the 1920s and 1930s), into an explosive economic boom that is now entering its fourth decade.

Business observers often describe successful companies as having a "deep bench" of managerial talent. As a nation, China benefits from an exceptionally "deep bench" of entrepreneurial verve and management skill. Retrospective studies of China's farm sector tell of many failures, including the great famine of 1959-1961, but there is little evidence that Chinese villagers were unable to keep accurate records of grain stocks and flows, work points, income or outlay in the collectives and communes into which they were herded during the mid-1950s. Indeed, the indexes of research volumes such as Barker and Sinha (1982), Donnithorne (1967), Lardy (1983), Riskin (1987), Yang (1996) rarely mention "accounting" or "bookkeeping," except to note that the basic level of accounting was bounced back and forth between the production teams and brigades – apparently without disrupting the capacity of local communities to maintain suitable records. At the start of reform in 1978, China's rural communes and brigades operated over 1.5 million enterprises, including 794,000 in industry. Once reform commenced, rural China witnessed an unprecedented expansion of rural enterprise; by 1990, the number of "township and village" firms had jumped to 18.5 million, including 7.2 million industrial units (Yearbook 1991, p. 377). How did these firms, many of which recorded substantial growth of output, employment, sales, profits, and exports, recruit competent managers? Here again, the literature is largely silent, apparently because finding managerial talent was not a major obstacle to success.

As a result of this process of business expansion, China's traditional "abundance of small-time entrepreneurs" continues, now joined by an equally rich pool of big-time operators, some backed by the deep pockets of favored state entities, but many others building on their own accumulations of individual or corporate wealth.

Administrative competence surely enhances China's economic prospects. In my experience, national and provincial office-holders as well as business managers appear to be intelligent, well-informed, energetic, and competent. My (quite limited) experience with local officials, mainly in prosperous areas, points in the same direction. The functionaries that I meet may be corrupt – short-term visitors cannot judge such matters. If so, my guess is that they encounter a strong positive correlation between succeeding in

their formal governance or managerial duties and increasing flows of informal incomes to themselves, their families, and their associates.

This contrasts with circumstances elsewhere, particularly in Africa, where Uma Lele, presumably describing circumstances of the early 1970s, writes that “in Ethiopia the local-level administration. . . lacked developmental capacity almost completely,” that “agricultural projects in East Africa. . . suffer from a shortage of well-trained African accountants. . . . [who can master] a simple cost-accounting system,” and, more generally, that “autonomous programs have usually had expatriate management from the outset” (Lele 1975, pp. 127, 132, 171). If Lele’s observations are correct, many African nations routinely relied on expatriates to direct tasks that formed part of the normal routine for commune and brigade-level units throughout rural China during the 1960s and 1970s.

More recently, foreign firms, including those in “high technology” sectors, are rapidly transferring leadership responsibilities to local Chinese employees. Expatriate managers are routinely assigned to groom local executives for top positions in their firms’ Chinese operations.

Beyond these elements surrounding what might be called “Chinese economic culture,” China’s future growth prospects benefit from tangible and concrete legacies of the past:

- China’s political system rests on an informal, but real bargain between the party-state and the people: citizens acquiesce in one-party rule in return for the promise of prosperity and national prestige. As a result, policy elites at all levels focus on promoting economic growth with an intensity that is rarely matched (Japan’s performance during its high-growth period comes to mind). While this growth orientation does not prevent the adoption of bad policy – consider the current gap between domestic energy costs and global prices – it does ensure that serious economic difficulties will command immediate and concerted attention from top echelons of the policy community. China cannot suffer the sort of economic policy drift that hampers efforts to confront serious economic difficulties in Japan (prolonged slowdown) or the United States (structural fiscal and trade deficits, runaway entitlement spending).
- the international community of overseas Chinese – prosperous, entrepreneurial, oriented toward business and technology, and often motivated by an unusual blend of profit-seeking, kinship, old home ties, and linguistic/cultural affinity – will continue its immensely significant role in conveying capital, skills, information, and networking opportunities to the People’s Republic. Going forward, we can expect growing numbers of PRC citizens to deploy their own experience of overseas education, residence, employment, business development, and networking to further expand these valuable inflows.⁸ Few low- and middle income nations – perhaps India or

⁸ China’s Ministry of Education reported in 2007 a cumulative total of 1.067 million studying abroad between 1978 and 2006, of whom “275,000 have returned, 42,000 in the past year alone” (Hu Yinan, 2008).

Mexico – can come close to matching the advantages that China’s growth prospects derive from the overseas Chinese connection.

- More generally, China has already reaped massive benefits following its decision to adopt a policy of growing openness to international trade and foreign investment. The rapid expansion of incoming foreign investment to encompass design and R&D as well as manufacturing holds the promise of further large payoffs to openness, as does the prospect of further expansion of foreign investment in China’s service sector. In addition, recent increases in China’s own overseas direct investment, which jumped from under US\$1 billion in 2000 to a 2007 level of US\$18.7 billion (excluding financial sector transactions that contributed \$3.53 billion in 2006), promise to develop new return flows of valuable technical, managerial, and market intelligence that will surely enhance China’s future growth prospects (Brandt, Rawski, and Zhu 2007, p. 25; Jiang Wei 2008). Recent Chinese experience demolishes the argument that globalization endangers the economic prospects of poor nations and their workers. To be sure, China’s size confers unique benefits that skilled administrators have been quick to grasp. The inability of smaller states to match China’s success in manipulating foreign corporate partners creates the possibility that globalization may diminish welfare in some poor nations. For China, the largest poor state, the outcome is precisely the opposite.
- China’s economy continues to benefit from some legacies of the plan system – for example the dense array of technical universities, industry-oriented research establishments, and cross-national personal ties established by the old-line ministries of metallurgy, machine-building, textiles, and so on. In most low-income nations, producers of steel (or silk, machine tools, etc.) cannot recruit graduates from institutes of metallurgy, obtain technical support from long-established metallurgical research institutes, or hire managers through networks surrounding national associations of metallurgical engineers. In China, these opportunities are routinely available to firms in many sectors of the economy (Brandt, Rawski, and Sutton 2008, p. 602).
- Finally, China’s future prospects will benefit from the impact of domestic and international competition in virtually all sectors of the economy. Unlike Japan and Korea, which show an unusual combination of world-class export sectors and inefficient, heavily protected domestic industries, China’s WTO commitments, together with intense domestic competition (the latter another beneficial legacy of the planned economy which outfitted most provinces with “complete sets” of industries), ensures that fierce competition is the rule throughout the Chinese economy. Since the consequences of China’s WTO membership are widely appreciated, I focus on the latter, more contentious observation.

Audrey Donnithorne (1972) characterized China’s pre-reform economy as a “cellular” system of loosely connected and highly self-sufficient local entities.

During the 1970s and 1980s, regional governments, seeking to preserve markets for incumbent local producers, often resisted efforts of outside firms to make or sell goods locally. They also obstructed “exports” of scarce or under-priced materials, again seeking advantage for local manufacturers and, in the case of food products, for consumers. Several researchers have produced substantial analyses aimed at demonstrating that such “local protectionism” continues.

These arguments derive mainly from faulty data. I regard them as completely mistaken. I will not review the controversy here (see the summary in Brandt, Rawski, and Sutton 2008, pp. 575-576), but rather focus on new evidence that undermines the “cellular economy” view of contemporary China.

The key question is not whether local protectionism exists – everyone agrees that it does – but whether it is important. We know that foreign and domestic firms have established new manufacturing facilities in which productivity is far higher, and unit cost far lower, than in many existing producers. My question: how do incumbent producers respond to the arrival of low-cost, high-productivity rivals?

Under the “cellular economy” hypothesis, there is little need for low-end incumbents to respond. Their markets are safe. Their official patrons will prohibit interlopers from selling into protected local markets. Customers in isolated sub-economies cannot escape the clutches of incumbent suppliers. As a result, the productivity gap between low-end and high-end suppliers in specific industries must expand.

If competition rather than restriction prevails, the story is very different. When products from new, high-end producers enter the market, incumbent producers will quickly feel pressure to respond – because new competition threatens their market share and even their survival. For this reason, we expect the productivity gap between strong and weak firms to first expand (when new, strong firms enter the market) and then to decline (as weak firms either reform their operations or exit through bankruptcy, closure, merger, etc.).

This dichotomy suggests a statistical test using enterprise-level data. China Industrial Microdata, compiled by the National Bureau of Statistics, records information about all “above-norm” industrial firms – meaning state-owned firms and others whose annual sales exceed RMB 5 million. The calculation shown here focuses on data for 1993 and 2002 – a period in which the classification of industries into sub-sectors remained virtually unchanged. For both years, and for each of 535 manufacturing sub-sectors, our test involves the following:

- Calculate the coefficient of variation for sales per worker among all firms in each of 535 sub-sectors in 1993 (CV93) and again in 2002 (CV02) (the roster of firms is not necessarily the same in the two years).
- Calculate the ratio $R = CV02/CV93$ for each of 535 sub-sectors
- Examine the distribution of the ratio R. If the 535 sub-sector observations cluster in the region $R > 1$, the test supports the “cellular economy” perspective. A preponderance of observations in the range $R < 1$ supports the view that open markets prevail.

Results appear in Figure 4 (prepared with invaluable assistance from Professor Yifan Zhang of Lingnan University). With the median value of R at 0.78 and with 70.7 percent of observations falling below 1, the outcome runs strongly counter to predictions linked to the “cellular economy” approach.⁹

Figure 4 about here

Finally, what evidence can we see of improvements in areas of major institutional weakness? I comment briefly on three items:

Law. Many external observers dismiss China’s judicial system as largely irrelevant to contract enforcement. New research shows the courts occupying an unexpectedly large role in business behavior. Clarke, Murrell, and Whiting (2008, pp. 411-415) find that considerable numbers of firms include litigation in their strategies for resolving business disputes, resulting in steep increases in the volume and monetary value of economic disputes brought to court. They conclude that “courts are playing an increasingly significant role in dispute resolution and personal relationships are relatively less important at present” (ibid., p. 421).

Similar observations apply elsewhere in the legal field. The specific inclusion of private property in 2007 legislation as equal in formal legal standing to state and collective property represents a considerable advance in an area formerly marked by excruciatingly slow progress (Brandt and Rawski 2008, p. 19). Legal support for intellectual property rights (IPR) seems certain to expand, not because of external pressure, but to satisfy the demands of China’s growing army of innovative companies.

Finance. Recent developments in China’s financial sector illustrate the willingness of Chinese leaders to meet festering economic problems with bold initiatives. China’s efforts at financial reform provide a long story with no happy ending. Recognizing the danger that further marginal tinkering might not suffice to avoid a major crisis, China’s Communist leadership opted for a remarkable departure: selling minority stakes in every major financial institution, excepting only the central bank, to the corporate royalty of global finance capitalism – the arch-enemy of socialists everywhere for a century or more.

⁹ Note that splitting the sample geographically and conducting separate analyses for China’s coastal and interior regions does not alter the overall implication that competition rather than protection prevails.

Partial foreign ownership offers no automatic escape from the multiple ills that have long afflicted China's financial institutions. Nonetheless, recent signs are encouraging, with major banks, for example, recording large increases in profit (Anderlini 2008). For those, like the present author, who place little credence in the published accounts of China's financial firms, further inquiry seems essential.

Investment mechanism. The question here is whether recent developments in China's financial sector represent major steps toward the rectification of widely-recognized institutional shortcomings. Institutions and institutional change are notoriously difficult to quantify (for an example, see Clarke, Murrell and Whiting 2008, p. 421). With regard to China's financial sector, however, I have suggested that a "reduction in seasonal fluctuations of aggregate output and investment" can provide a useful metric "for monitoring the evolution of China's investment mechanism" (Rawski 2002, p. 370). This is the objective of Figure 5, which plots the time trend for the ratio of fixed investment in the first quarter of each year to investment spending in the fourth quarter of the previous year. The calculations underlying Figure 5 employ raw data – there is no adjustment for inflation (in periods of high inflation, such adjustments would lower the calculated ratio) or for seasonality – indeed our purpose is to determine whether or not the marketization of China's economy has reduced the outlandish seasonal shifts in economic activity introduced during the plan system and still visible in the early years of the present century despite a quarter-century of reform (see Perkins and Rawski 2008, p. 864).

Figure 5 about here

Figure 5 reveals a dramatic reduction in the scale of seasonal fluctuations. Prior to 2000, first quarter investment was invariably less than 30 percent of outlays in the final quarter of the previous year. In market economies, such immense declines in investment appear only amid the most profound systemic cataclysms. Unadjusted U.S. data on employment in residential construction, now suffering a major contraction, can illustrate the order of magnitude of short-term changes in normal market systems.

Between February/March of 2007 and the same period of 2008, U.S. employment in residential construction dropped by 11 percent, from 940.4 to 837.0 thousand (BLS 2008). In percentage terms, this extreme plunge is **one-sixth as much as Chinese investment spending routinely dropped from Q4 to the following Q1 prior to 2000!** The data in Figure 5 show that, beginning in 2003/04, the ratio of Q1 investment to outlays in Q4 of the prior years rose sharply, falling back only in 2005/06. The ratio of spending in Q1 to the previous year's Q4 exceeds 30 percent, the upper bound prior to 2001, in each year commencing with 2003; from 2006, the ratio exceeds 40 percent. In 2008, the ratio breaks through 50 percent for the first time, reaching the unprecedented level of 55.8 percent.

Following these improvements, seasonal fluctuations in Chinese investment spending remain at levels that must astonish analysts accustomed to market economy business cycles. After all, China's Q1 investment spending in 2008 is 44.2 percent below the

figure for Q4 of 2007 – and this in a boom period with rising inflation - compared with the “huge” 11 percent decline in U.S. employment in residential construction reported for the year ending in February/March 2008.

Conclusion

The present review reaffirms this author’s impression that, despite many serious challenges, China’s economic prospects, fortified by a long list of beneficial circumstances, including many that are unique to the People’s Republic, remain bright. Although the current double-digit growth rates appear unsustainable, there is ample reason to expect China’s economy to advance at rates that, while considerably below 10 percent, can ensure continued rapid expansion of living standards for China’s immense population.

References

- Acemoglu, D., S. Johnson, et al. (2001). "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* **91**(5): 1369-1401.
- Anand, S. and P. Segal (2008). "What Do We Know about Global Income Inequality?" *Journal of Economic Literature* **46**(1): 57-94.
- Anderlini, J. (2008). "Profits surge at China's three largest banks." *Financial Times*: 17.
- BLS. United States Bureau of Labor Statistics. Employment data obtained from <ftp://ftp.bls.gov/pub/suppl/empsit.ceseeb12.txt>, consulted 30 April 2008.
- Barker, R., R. Sinha, et al. (1982). *The Chinese agricultural economy*. Boulder, Colo.: Westview Press.
- Boskin, Michael; Ellen Dulberger, Robert Gordon, Zvi Griliches, and Dale Jorgenson. 1998 "Consumer Prices, the Consumer Price Index and the Cost of Living," *Journal of Economic Perspectives*, Vol. 12, No. 1, pp. 3-26.
- Brandt, L., C.T. Hsieh and X.D. Zhu. (2008). "Growth and Structural Transformation in China." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 683-728.
- Brandt, L. and T. G. Rawski (2008). "China's Great Economic Transformation." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 1-26.
- Brandt, L., T. G. Rawski, and J. Sutton. (2008). "China's Industrial Development." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 569-632.
- Brandt, L., T.G. Rawski, and Xiaodong Zhu. (2007). "International Dimensions of China's Long Boom: Trends, Prospects and Implications." In *China's Rise and the Balance of Influence in Asia*, ed. William W. Keller and Thomas G. Rawski. Pittsburgh: University of Pittsburgh Press, pp. 14-46.
- China Energy Development Report 2001. *Zhongguo nengyuan fazhan baogao* [China energy development report, 2001]. Beijing, Zhongguo jiliang chubanshe.
- China Monthly Statistics*. Various issues.
- Clarke, D., P. Murrell, and S. Whiting. (2008). "The Role of Law in China's Economic Development." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 375-428.
- "Debt Clearance." (2007). *China Daily*, 26 December, p. 10.
- Donnithorne, A. (1967). *China's economic system*. New York, Praeger.
- Donnithorne, A. (1972). "China's Cellular Economy: Some Economic Trends Since the Cultural Revolution." *China Quarterly*(52): 605-619.
- "Faster Service Growth." (2008). *China Daily*, 12-13 April, p. 4.
- Gerschenkron, A. (1962). Economic backwardness in historical perspective, a book of essays. Cambridge, Belknap Press of Harvard University Press.
- Hu Yanan. (2007). "Returned professionals help drive economy." *China Daily* 26 September, p. 3.
- Investment Yearbook. *Zhongguo guding zichantouzi tongji nianjian, 1950-1995* [China Yearbook of Investment in Fixed Assets, 1950-1995]. BeijingL Zhongguo tongji chubanshe.

- Jiang Wei. (2008). "Non-financial investment rises 6%." *China Daily* 23 April, p. 1.
- Lardy, N. R. (1983). *Agriculture in China's modern economic development*. Cambridge and New York, Cambridge University Press.
- Lele, U. J. and World Bank. (1975). *The design of rural development : lessons from Africa*. Baltimore, Published for the World Bank by Johns Hopkins University Press.
- Maddison, A. and Organisation for Economic Co-operation and Development. Development Centre. (2007). *Chinese economic performance in the long run*. Paris, Development Centre of the Organisation for Economic Co-operation and Development.
- Maddison, A. and H. X. Wu (2007). "China's Economic Performance: How Fast has GDP Grown; How Big is it Compared with the USA?" Conference paper presented at Hitotsubashi University Institute of Economic Research, Sept. 2007.
- National Bureau of Statistics. (2008) "Statistical Communique of the People's Republic of China on the 2007. . . ."
- North, D. C. and R. P. Thomas (1973). *The rise of the Western world; a new economic history*. Cambridge: Cambridge University Press.
- Perkins, D. H. and T. G. Rawski (2008). "Forecasting China's Economic Growth to 2025." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 829-886.
- Rawski, T.G. (1974). "China and Japan in the World Energy Economy," in Leonard Waverman and Edward W. Erickson eds., *The Energy Question*. Toronto: University of Toronto Press, I: 100-119.
- Rawski, T. G. (2001). "What's Happening to China's GDP Statistics." *China Economic Review* **14**(4): 347-354.
- Rawski, T. G. (2002). "Will Investment Behavior Constrain China's Growth?" *China Economic Review* **13**(4): 361-372.
- Rawski, T. G. (2006). "SARS and China's Economy." In *SARS in China: Prelude to Pandemic?* Ed. A. Kleinman and J. L. Watson. Stanford, Stanford University Press: 105-121.
- Rawski, T. G. (2007). "Social Capabilities and Chinese Economic Growth." In *Social change in contemporary China : C.K. Yang and the concept of institutional diffusion*. Ed. W. Tang and B. Holzner. Pittsburgh PA, University of Pittsburgh Press: 89-103.
- Riskin, C. (1987). *China's political economy : the quest for development since 1949*. Oxford and New York: Oxford University Press.
- Rosen, D. H. and T. Houser (2007a). "China Energy: A Guide for the Perplexed." Washington, Peterson Institute for International Economics.
- Rosen, D. H. and T. Houser (2007b). "What Drives China's Demand for Energy?" In *The China Balance Sheet in 2007 and Beyond*. Ed, C. F. Bergsten et al. Washington, Peterson Institute for International Economics: 25-54.
- Schulz, M. (2008). "California's Energy Colonialism." *Wall Street Journal*: May 3-4, p. A11.
- Sun Xiaohua (2007). "Power Switch." *China Business Weekly* 5-11 November, p. 3.

- Svejnar, J. (2008). China in Light of the Performance of Central and East European Economies. In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 68-90.
- Wan, Zhihong. (2008). Power shortages unlikely: Official. China Daily: 23 April, p. 4.
- Wong, C. P. W. and R. Bird (2008). "China's Fiscal System: A Work in Progress." In *China's Great Economic Transformation*. Ed. L. Brandt and T. G. Rawski. Cambridge and New York, Cambridge University Press: 429-466.
- Wright, T. (1984). *Coal mining in China's economy and society, 1895-1937*. Cambridge ; New York, Cambridge University Press.
- Wu, H. X. (2002). "How Fast Has Chinese Industry Grown? Measuring the Real Output of Chinese Industry, 1949-1997." Review of Income and Wealth **48**(2): 179-204.
- Yang, D. L. (1996). *Calamity and reform in China : state, rural society, and institutional change since the great leap famine*. Stanford, Calif., Stanford University Press.
- Yearbook (annual). *Zhongguo tongji nianjian [China Statistics Yearbook]*. Beijing, *Zhongguo tongji chubanshe*. Beijing: Zhongguo tongji chubanshe.

Table 1
Level and Growth of Output Value for Chinese TV Manufacture, 1963-2005
Wu method vs. allowing for changing quality and product mix

Quality & Growth in Chinese Industry: TV Example						
	Q	%	1987		Output (RMB Mil)	
	Million	Color	Price		Wu	Revised
1963	0.3	0	470		2.0	1.2
1987	1934.4	35	766		14809.7	14809.7
1997	3637.2	75	1104		27846.9	40141.3
2005	8283.2	100	1320		63416.9	109338.5
Growth Rate of TV Output Value 1987-2005						
Wu method				8.4		
Revised: sliding price				11.7		
Assortment effect			+10%	12.3		
on 2005 price			+25%	12.9		
			+50%	14.3		

Sources: calculated from price and quantity data in Wu (2002), Table xxx and data on the output share of color sets from Yearbook xxx. By 2005, standard output figures no longer mention black and white sets; I assume the share of color sets is 100 percent.

Table 2

China: Tertiary Sector Nominal Wage Growth, 1987-2005
National Average Wage Growth = 1

<i>Material Services</i>	
Transport	1.02
Information Transmission	2.21
Wholesale & Retail	0.94
<i>Non-material Services</i>	
Finance	1.76
Real Estate	1.12
Science, R&D	1.35
Education	1.04
Health & Welfare	1.16
Culture & Sports	1.26
Government, Party etc	1.11
<i>Manufacturing</i>	0.85 (too high!)

Source: Calculated from wage data in Yearbook 1987, Table 4-36 and Yearbook 2006, Table 5.21. See author's file AM & HW Non-material service wage. . . 092407.xls

Table 3: China's Coal Production, Energy Use, and Energy Intensity: Data Problems Muddy the Waters

Year	Production Data for Coal			Aggregate Energy Consumption				Real GDP Level		Energy Use Per Unit GDP			
	Coal 1 100 Million Tons	Coal 2	Upward Revision percent	Energy 1 10000t SCE	Energy 2	Energy 3	Upward Revision percent	Prior Year = 100 GDP 1	GDP 2	EU1	EU2	EU3	EU4
1995	13.61	13.61		131176	131176	131176		109.3	109.3				
1996	13.97	13.97		138948	138948	138948		110.2	110.2	96.1	96.1	96.1	96.1
1997	13.73	13.73		138173	137798	137798	-0.27	109.6	109.6	90.7	90.5	90.5	90.5
1998	12.5	12.50		132214	132214	132214	0.00	107.3	102	89.2	89.4	89.4	94.1
1999	10.45	12.80	22.49	130119	133831	144751	2.85	107.9	102	91.2	93.8	101.5	107.3
2000	9.98	12.99	30.16	128800	138553	148223	7.57	108.6	108.6	91.1	95.3	94.3	94.3
2001		13.81			143199	143199		108.1	108.1		95.6		89.4
2002		14.55			151797	151797		109.5	109.5		96.8		96.8
2003		17.22			174990	174990		110.6	110.6		104.2		104.2
2004		19.92			203227	203227		110.4	110.4		105.2		105.2
2005		22.05			224682	224682		111.2	111.2		99.4		99.4
2006		23.73			246270	246270		111.1	111.1		98.7		98.7
2007					265480	265480		111.4	111.4		96.8		96.8
Energy elasticity		2001-06		1.10									
		2001-07		1.02									

Note: ***Bold italics*** signify author's adjustments to official data; 2007 data from Communiqué (2007)

Sources: Coal 1: China Energy Development Report (2001), p. 125

Coal 2: Yearbook 2007, Table 14-22.

Energy 1: China Energy Development Report (2001), p. 4

Energy 2: Yearbook 2007, Table 7-2

Energy 3: for 1999 and 2000, raise total from Energy 1 by half the % adjustment in coal output

GDP 1: Yearbook 2007, Table 3-3

GDP 2: same as GDP 1 except for alternate growth rates for 1997/98 and 1998/99

EU1: use Energy 1 and GDP 1

EU 2: use Energy 2 and GDP 1

EU 3: use Energy 3 and GDP 1

EU 4: Use Energy 3 and GDP 2

Energy elasticity: calculated from most recent official data shown in Energy 2 and GDP 1

Figure 1: Tertiary Sector Share in China's GDP: NBS, Perkins-Rawski, and Maddison-Wu Data, 1978-2005

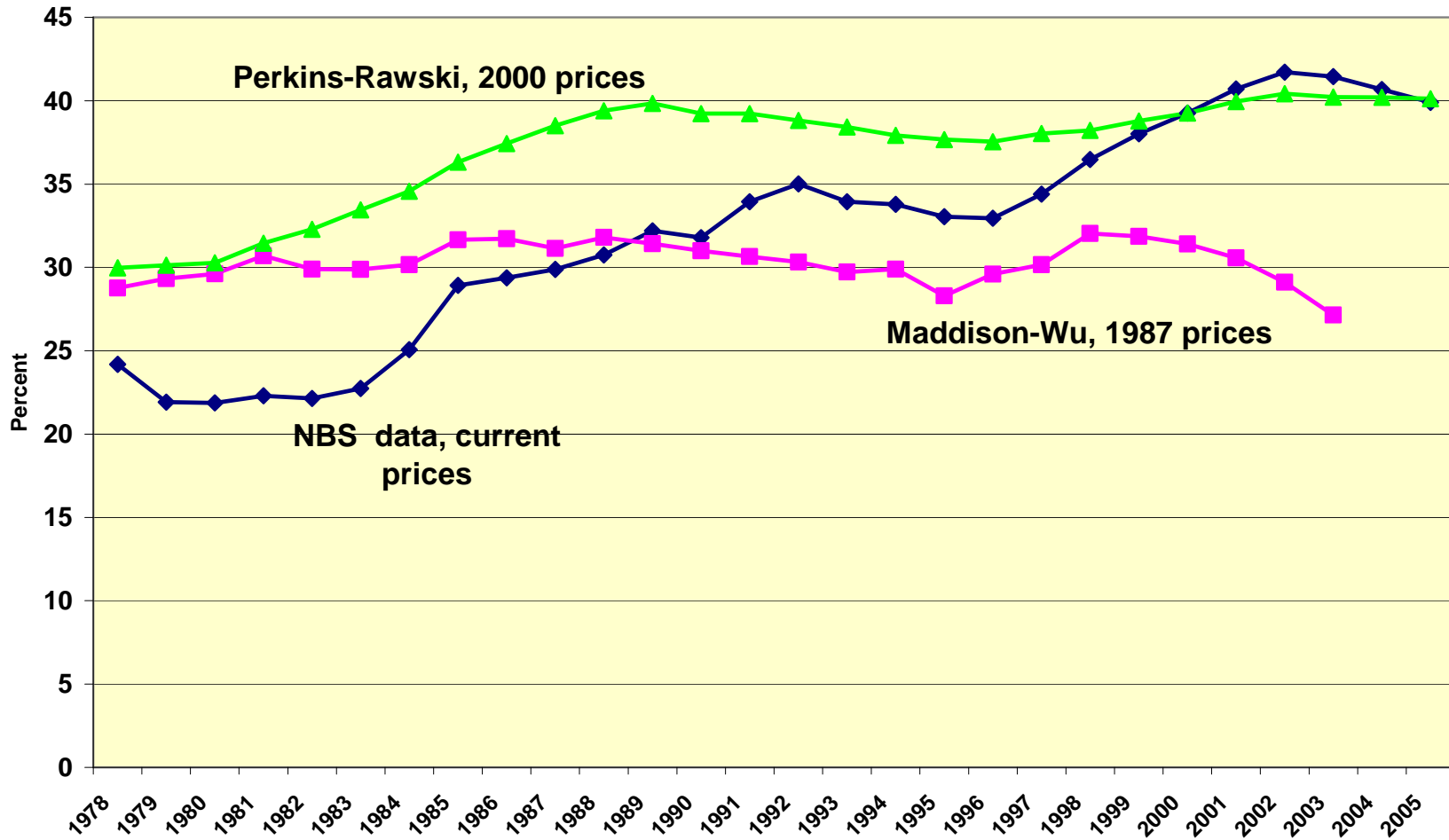


Figure 2: 30 Regions in China: Quarterly GDP Fluctuation vs. State Sector's Share in Industrial Output (2000)

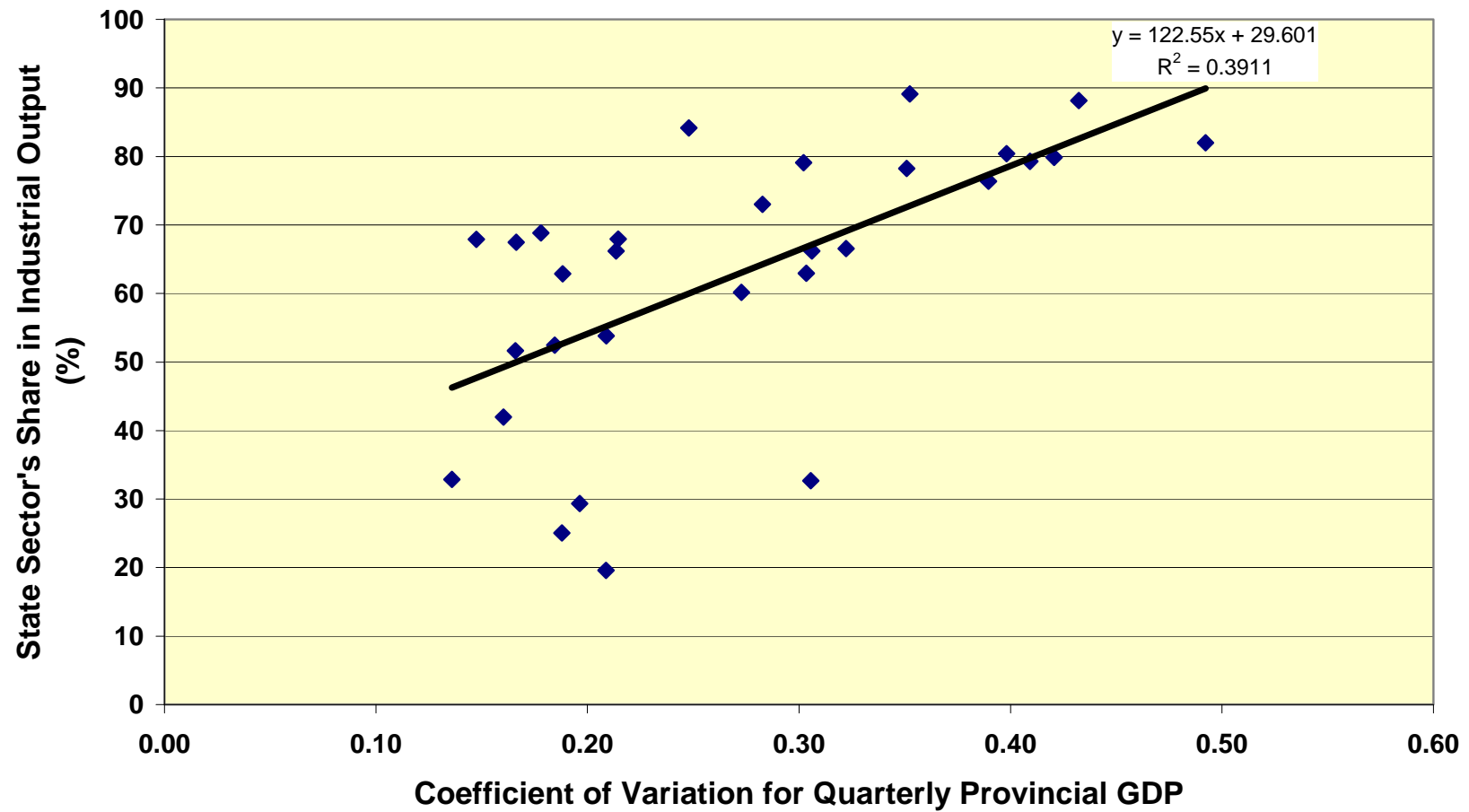


Figure 3: Provincial Quarterly GDP Fluctuation vs. Marketization Index (2000)

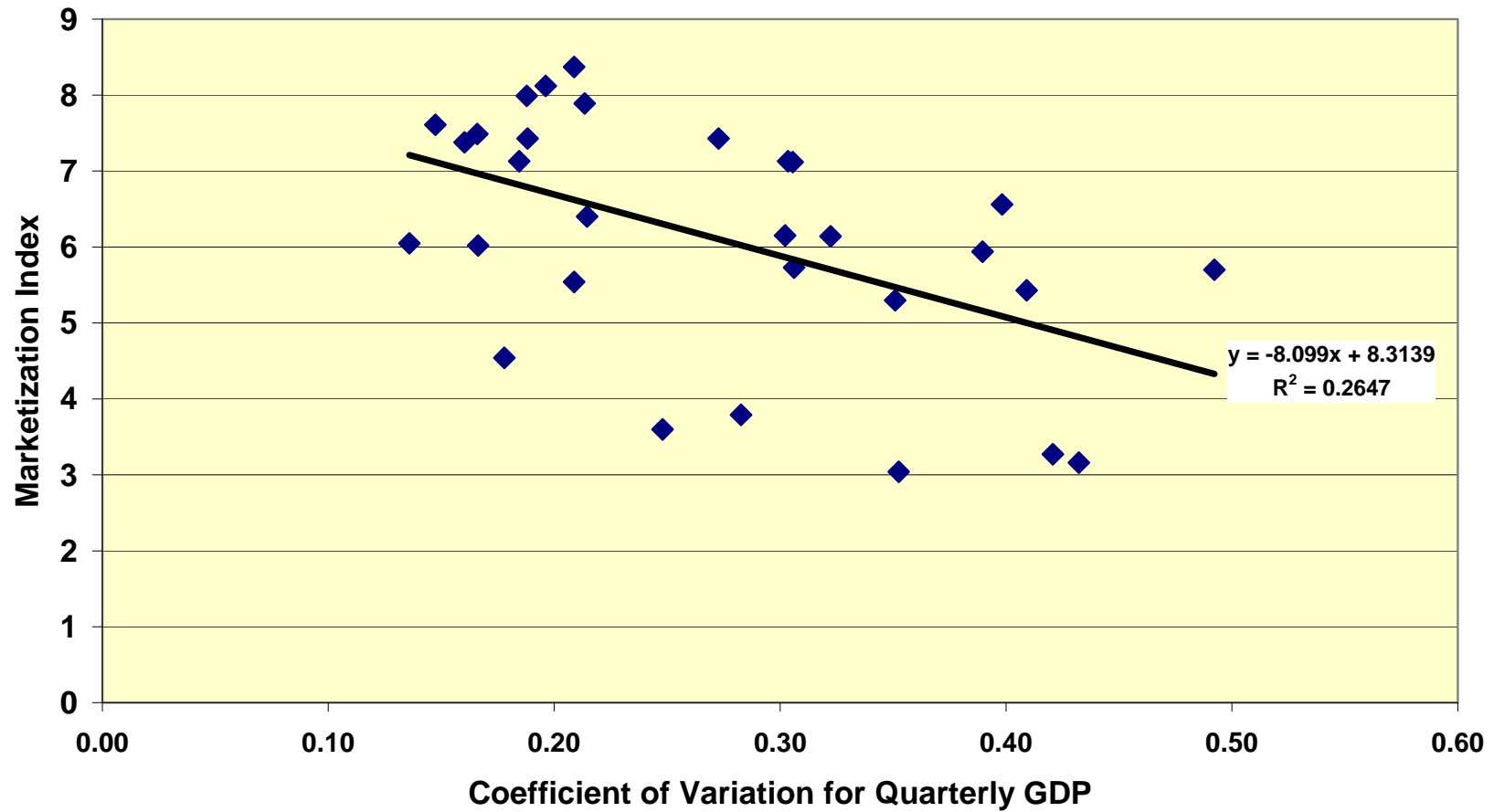
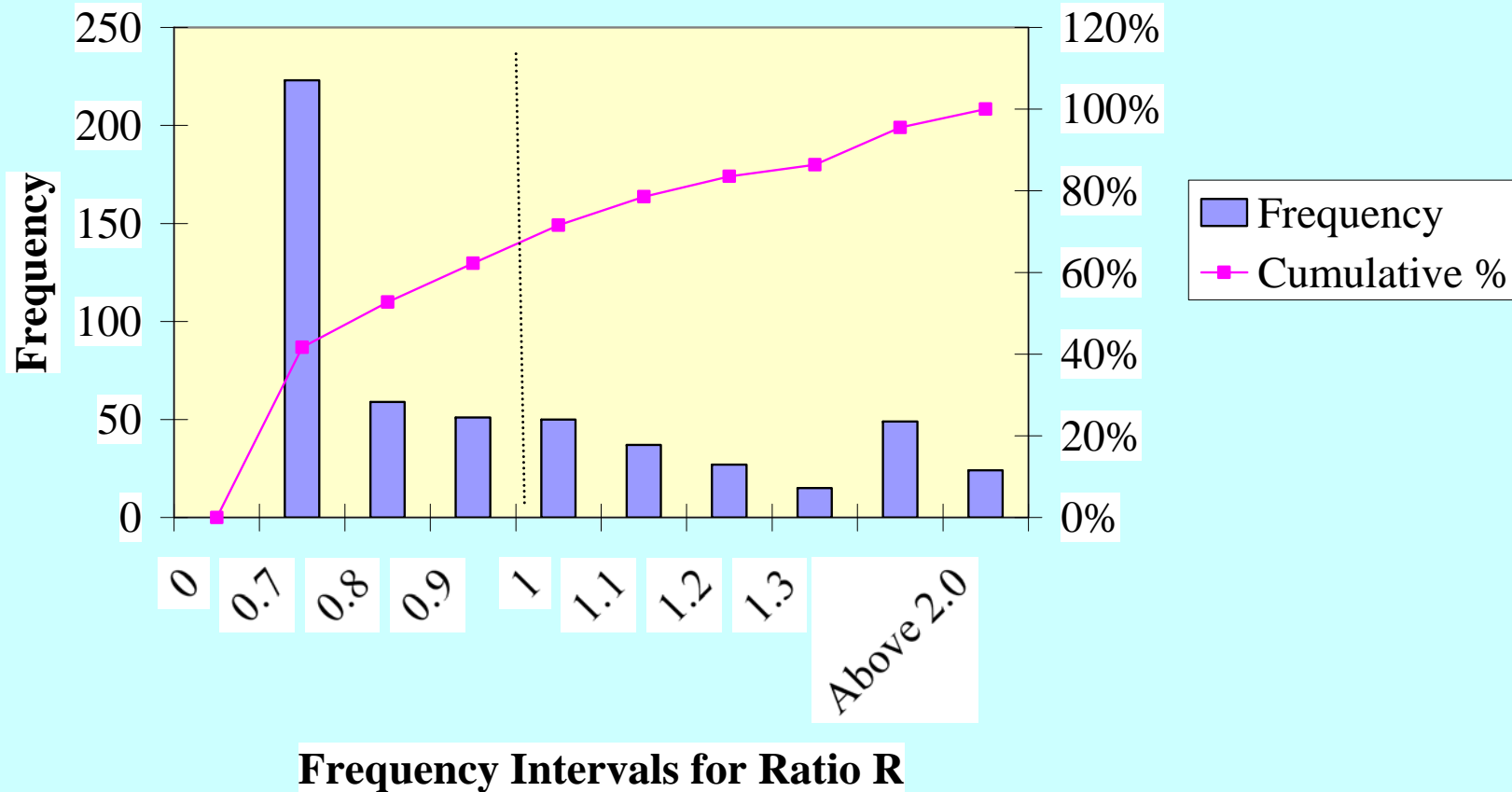
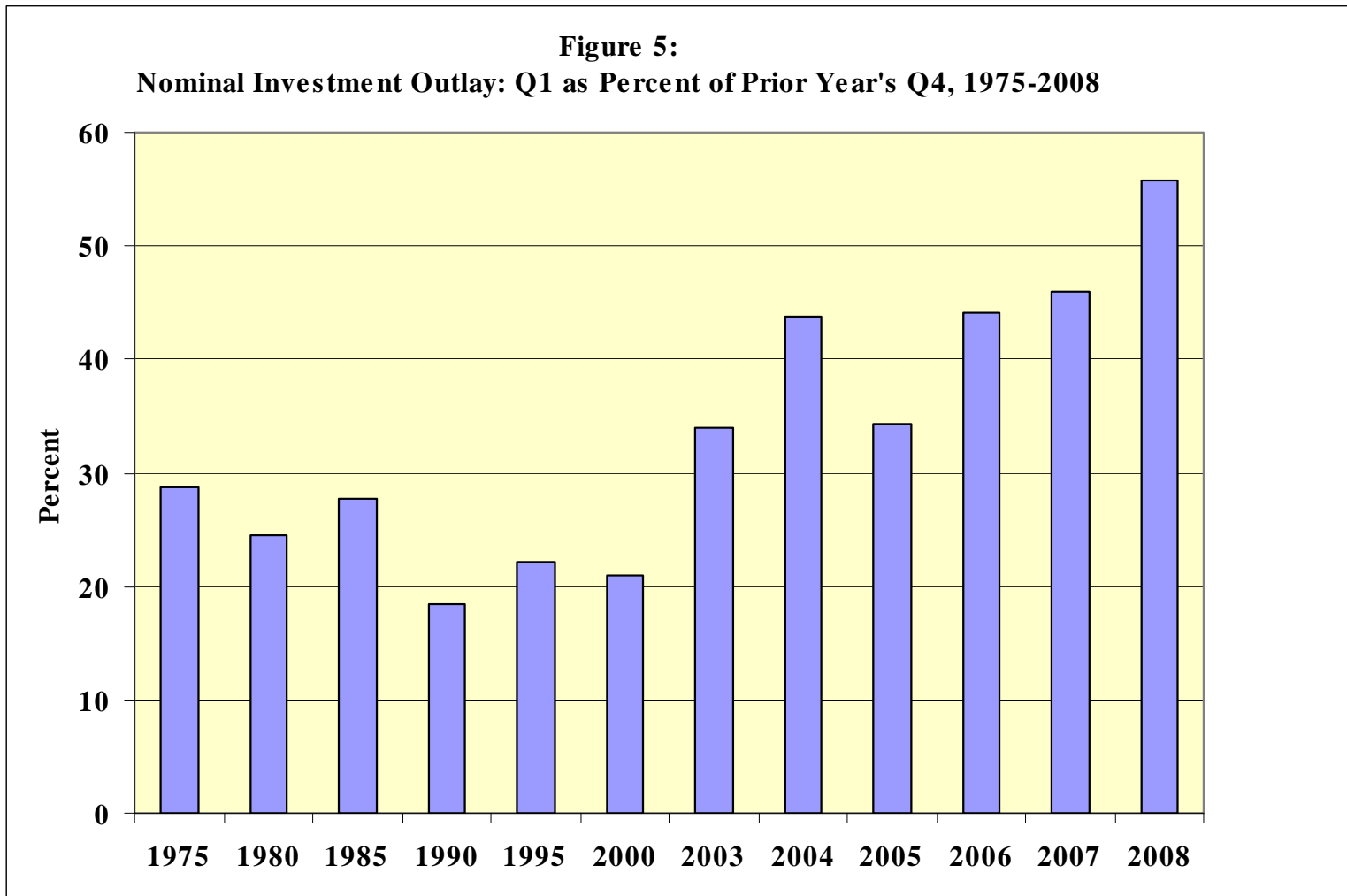


Figure 4: Distribution of Ratio R for 535 Four Digit Industries, R<1 Indicates Reduced Dispersion of Productivity During 1993-2002 R>1 Fits Cellular Economy Approach





Source: for 1975-1995, from data on capital construction in Investment Yearbook 1950-1995, p. 78; for later years, from data in China Monthly Statistics.