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Greater Risks in China

Summary

Our views about China have changed as a result of recent developments in the stock market. We previously conveyed our thinking about the debt and economic restructurings being negative for growth over the near term and positive for growth over the long term—i.e., that it is a necessary and delicate operation that can be well managed. While we had previously considered developments in the stock market to be supportive to growth, recent developments have led us to expect them to be negative for growth. While we would ordinarily consider the impact of the stock market bubble bursting to be a rather small net negative because the percentage of the population that is invested in the stock market and the percentage of household savings invested in stocks are both small, it appears that the repercussions of the stock market's declines will probably be greater. Because the forces on growth are coming from debt restructurings, economic restructurings, and real estate and stock market bubbles bursting all at the same time, we are now seeing mutually reinforcing negative forces on growth. While at this stage it is too early to assess how strongly the stock market's decline will pass through negatively to credit and economic growth, we will soon have indications of this. We will be watching our short-term indicators of Chinese credit and economic growth carefully to see what the pass through to the economy of these developments is like, and we will continue to share our thought about what is happening. Since the linkages in China are broadly analogous with those in other countries that we do have good perspectives on, it is worthwhile to look at the dynamic with this perspective in mind. This is the same perspective as we have taken in looking at China's debt and economic situations. I will explain in more detail how our thinking has changed as a result of recent events in **Section 1**.

The stock market and debt bubble bursting simultaneously has happened many times before in many countries. We identified 28 cases among major economies in the last 100 years. While no two cases are exactly the same, the basic dynamics of such cases and the tools for treating them are essentially the same. Looking at these other cases provides perspective concerning the range of possible outcomes and the most effective ways of using the available tools. We provide that perspective in **Section 2**. The most analogous cases created a depressant on real GDP growth of 1.8% on average, annually, for three years relative to what growth would have been without these events; bad cases saw an annual drag of 4% for three years; and, well managed cases saw no drag over three years (i.e., growth averaging its potential). We would expect China's outcome to be within that range, depending on how Chinese policy makers use their tools.

The negative effects of the stock market declines will come from both the direct shifts in wealth and the psychological effects of the stock market bubble popping. Though stock prices are significantly higher than they were two years ago, the average investor in the stock market has lost money because more stocks were bought at higher prices than were bought at lower prices. We now estimate stock market losses in the household sector to be significant—i.e., about 2.2% of household sector income and 1.3% of GDP. However, these losses appear

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to be heavily concentrated in a small percentage of the population as only 8.8% of the population owns stocks. These are rough estimates. We don't yet know who is experiencing what losses. Such information usually surfaces in the days and weeks after the plunge. Even more important than the direct financial effects will be the psychological effects. Even those who haven't lost money in stocks will be affected psychologically by events, and those effects will have a depressive effect on economic activity. For example, there are now no safe places to invest and the environment looks riskier, which we would expect to encourage the holding of cash and lessen the marginal effectiveness of easing monetary policy. Our analysis of the expected losses is explained in **Section 3**.

Chinese policy makers have a lot of resources at their disposal and are already responding to these pressures very forcefully, both with general economic stimulus and with stimulus targeted at the stock market. In **Section 4** we comment on policy moves. The Chinese policy makers and we at Bridgewater will of course have to get a better sense of the pass-through effects of the stock market bubble bursting in the statistics that will be released over the next several weeks and months. That will determine their rates of easing. Concerning how they would ease, if we were in their shoes, we would slow the pace of reforms (though remain steadily on the reform path) and increase both monetary and fiscal stimulations. Since interest rates don't have a lot of room to fall, lowering reserve requirements, making selective asset purchases, and broadening collateral supports are the most obvious monetary alternatives, while selective tax cuts would seem to be the quickest way of producing broad based fiscal stimulation. Along with these stimulations we would expect to see rapid progress toward the development of alternative locomotive industries for growth. Nonetheless, this confluence of debt, economic restructuring, and stock market shocks makes managing the economy even more difficult. We will be watching credit and economic growth reactions to recent developments closely as we are now at the point of maximum uncertainty.

Section 1: Why Our Thinking Has Changed

The evolution of our thinking was as follows:

1. While we identified the debt and economic bubbles of a number sectors early (i.e., local governments, some SOEs, and real estate), we have steadfastly believed that they could be well managed (via debt restructuring/swaps and a shifting of credit and economic activity from inefficient areas to more efficient areas). Until recently we felt that managing these shifts was a serious, but achievable operation—like a heart transplant. As with most heart transplants in the hands of capable people, the operation (in this case, the shifts in credit flows and economic activity), while risky, is typically successful, and it leaves the patient (i.e., the Chinese economy) weaker in the near term and healthier in the long term. That is what we expected and would have kept expecting if it wasn't for the recent developments in the stock market. While the popping of the real estate bubble happening at the same time added to the challenge, we felt that it was manageable because of the strong balance sheets of the household sector.
2. As for the stock market, we felt that the stock/capital market liberalization, and the classic bubble being created, was a double-edged sword, though much more good than bad. The bull market and the development of the equity market was good, but, like all early stage equity markets, it was fueled by a classic bubble (e.g., it had lots of naïve speculators all betting on leverage that speculative stocks would rise). The bubble expanded and burst much faster and more dramatically than we expected. It seemed like a normal developmental cycle until recently. Up until last summer, Chinese equities fell for about four years, even though its companies' earnings were rising and there was a global rally. It classically got too cheap and was disliked, creating the ingredients for a rally that was helped by reforms. Rising prices drew in unsophisticated speculators, and the number of new brokerage accounts exploded so that a bubble bursting seemed likely because unsophisticated speculators were gambling with borrowed money. Consider that 67% of those opening new accounts had less than a high school education, and that an extraordinarily high amount of buying was done on margin. Anyone who has been in the markets awhile knows how that goes. Besides buyers becoming overextended, these moves created a huge IPO pipeline of supply.

The development of a speculative bubble is normal at this stage in the evolution of the development of stock markets (though it could have been better managed through standards controls on margin borrowing and investor qualification standards). In any case, having such speculators lose money is a normal part of the development process. Painful mistakes are part of the learning process. They eventually lead to learning about how to invest well. Typically, smart institutional investors enter the market and bring greater efficiency to it. With time, investment managers' track records are built up, the good survive and the bad die, and funds are more effectively allocated. The opening of the Chinese stock market to qualified international institutional investors that was planned would help that process in much the same way as China's open door policies brought know-how to industry (then called "technology transfer"). Smart Chinese investors will soon surface and will demonstrate smart practices. While we expected a correction in prices, we did not expect anything that would produce major losses or major psychological impacts because such a relatively small percentage of the population (8.8%) and a small percentage of the household sector's assets (8%) were invested in equities. Also, as stock prices rose, it was net stimulative for the economy because of the positive wealth effects that come from holders of equities becoming richer, psychology improving, and increased funding of companies via IPOs. It seemed that even with a significant correction, what was happening in equities would be net positive for growth at a time when the debt and economic adjustments were net negative for growth.

3. We did not properly anticipate the rate of acceleration in the bubble and the rate of unraveling, or realize that the speculation in the markets was so big by established corporate entities as well as the naïve speculators. We should have. Because we are not active in this market we did not give it the type of meticulous attention that is required for us to have that knowledge.
4. The bursting of the stock market bubble has led us to examine the sizes of the wealth transfers more closely (shown in Section 3) and to become more concerned about their sizes. We also observed that the psychological reactions of non-investors have been much larger than we expected. We will explain our increased concerns in the next section of this report.

Section 2: Our Increased Concerns Arose from the Estimated Sizes of Losses and the Deterioration in Psychology

We define a bubble as an unsustainable amount of buying that is financed by an unsustainable rate of debt growth.

We believe that the stock market was in a bubble that has burst, and the fact that this is coming on top of both the debt bubble bursting and the economy transitioning growth from sectors that cannot sustain their growth rates to other sectors is more reason for concern. Our concern arises more from how this confluence of events can affect the debt and economic restructurings than because of the direct financial impacts, though those direct financial impacts are serious.

As mentioned, the stock market bubble bursting at the same time as the debt and economic adjustments are being made has raised our concerns. To gain perspective, we looked at analogous cases where there was a debt and equity bubble. Warning signs for us include a) whether debts are rising faster than incomes, b) whether the pace of stock market appreciation is very fast, averaged over the prior three years, c) the amount of margin debt that is financing stock purchases, d) housing price changes, and e) monetary and fiscal policy changes. Based on these factors we identified 28 analogous cases across major countries over the last century. In cases in which there were both debt bubbles and stock market bubbles that burst, the subsequent growth rate was on average 1.8% per year lower over the subsequent three years relative to what growth would have been without these events. The average numbers are shown in the table below.

Subsequent 3 Years after Bubble Burst			
	Subsequent Growth vs Potential <i>Min</i>	Subsequent Growth vs Potential <i>Avg</i>	GDP Gap <i>Bottom</i>
Avg All Cases	-6.5%	-1.8%	-3.1%
High Debt/Low Rates/ Mainly Domestic Debt	-6.9%	-2.5%	-2.2%
Mainly Domestic Debt	-5.2%	-1.6%	-2.3%
Significant FX Debt	-10.3%	-2.7%	-5.4%
Worst 1/3 Outcomes	-11.9%	-4.0%	-6.0%
Best 1/3 Outcomes	-1.9%	0.2%	-0.6%

While the mechanics are the same across these cases, no one case is the perfect analog. The factors that distinguish the severities of the downturns the most are whether they had mostly domestic or foreign debt, how well developed were their capital markets, how close the countries were to their debt limits, and whether they had capacity to ease monetary policy (e.g., how close their interest rates were to 0%).

In the next page we show all the cases. We also did a few cuts to see some of the outcomes across different types of cases. To make the comparison with China's situation, we looked at cases in which debts were mostly domestic, moderately high (above 200%) and interest rates were relatively low (below 5%), which were mostly from 2007. We also looked at all cases where debts were mostly in local currency (which is the case in China) versus in foreign currency. Charts walking through these cases are in the attached appendix.

Characteristics of Debt and Equity Bubbles Bursting

Country	Bubble Top	Signif. FX Debt % Total	% FX Debt	Margin Debt % MKCap	Debt % GDP	Debt % GDP	Bubble (3 Years Leading into Top)			Outcomes (Subsequent 3 Years)			Levers (Subsequent 3 Years)			Recoveries		
							Debt % GDP	Debt % GDP	Debt % GDP	Home Prices	Consumer Confidence	Stock Prices	Real GDP	Real GDP	Real GDP	Real GDP	Real GDP	Real GDP
							3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann	3yr Chg Ann
Thailand	1995	Yes	20%	155%	-	11%	5%	10%	7%	18%	0%	-40%	-8%	-9%	-5.0%	-17.4%	6%	4.2
Malaysia	1997	Yes	15%	195%	-	20%	3%	6%	9%	15%	-	-48%	-7%	-4%	-4.2%	-8.9%	4%	2.3
United States*	1929	No	-	121%	9%	6%	0%	5%	13%	30%	-	-48%	-2%	-20%	-9.0%	-14.5%	-	6.9
Ireland	2007	No	-	27%	-	24%	4%	9%	24%	24%	-	-79%	-31%	-4%	-5.4%	-11.1%	-	25.1
Hong Kong	1997	Yes	8%	265%	-	14%	3%	7%	7%	26%	-	-56%	-9%	-4%	-5.4%	-10.3%	-	6.9
Hong Kong	2007	Yes	27%	253%	-	12%	2%	5%	3%	3%	-	-52%	-9%	-4%	-5.4%	-10.3%	-	2.5
Greece	2007	Yes	204%	-	204%	-	14%	4%	10%	26%	-	-73%	-7%	-6%	-4%	-8.8%	-	2.1
Hungary	2007	Yes	163%	-	163%	-	11%	1%	3%	26%	-	-73%	-16%	-1%	-3.7%	-9.7%	-	7.3
Sweden	2007	No	-	380%	-	22%	10%	6%	3%	12%	1.5%	-43%	-6%	-5%	-2.4%	-8.8%	-	3.2
United Kingdom	2007	No	-	422%	-	22%	10%	6%	3%	12%	0.3%	-22%	-6%	-4%	-2.6%	-7.6%	-	5.6
Sweden	1990	Yes	37%	226%	-	12%	5%	4%	4%	23%	3.7%	-40%	-6%	-6%	-3.2%	-8.9%	-	4.4
Portugal	2007	No	-	266%	-	12%	5%	4%	4%	23%	-	-55%	-3%	-1%	-2.0%	-4.9%	-	3.1
Japan	1973	No	-	164%	-	12%	5%	4%	3%	11%	-	-35%	0%	-4%	-1.7%	-6.4%	-	0.1
United States	2007	No	8%	250%	2%	13%	1%	5%	3%	4%	1.6%	-4%	-4%	-4%	-2.2%	-4.2%	-	5.4
Korea	2007	No	-	245%	-	8%	4%	3%	3%	20%	1.8%	-10%	-3%	-2%	-1.8%	-5.3%	-	1.5
France	2007	No	-	310%	-	12%	0%	5%	5%	28%	1.6%	-52%	-4%	-1%	-1.5%	-4.4%	-	3.5
Spain	2007	No	-	348%	-	13%	0%	5%	5%	28%	-	-52%	-4%	-1%	-1.5%	-4.4%	-	2.3
Norway	2007	No	-	176%	-	13%	0%	5%	4%	34%	-	-46%	-2%	-1%	-0.3%	-3.4%	-	0.4
Portugal	2000	No	-	170%	-	13%	0%	5%	4%	34%	-	-46%	-2%	-1%	-0.3%	-3.4%	-	0.1
United Kingdom	1987	No	-	251%	-	12%	3%	2%	2%	34%	4.8%	-48%	0%	-1%	0.1%	2.7%	-	0.1
Germany	2000	No	-	249%	1%	6%	2%	3%	3%	19%	3.6%	-46%	0%	-1%	0.1%	2.7%	-	1.5
United States*	2000	No	-	249%	-	12%	3%	2%	2%	34%	4.8%	-48%	0%	-1%	0.1%	2.7%	-	0.1
Japan	1989	No	-	370%	-	12%	3%	2%	2%	34%	4.8%	-48%	0%	-1%	0.1%	2.7%	-	0.1
Norway	1990	Yes	338%	-	338%	-	12%	3%	2%	34%	4.8%	-48%	0%	-1%	0.1%	2.7%	-	0.1
United States	1987	No	-	208%	1%	13%	2%	7%	1%	23%	2.6%	-52%	-3%	-4%	-0.2%	-2.0%	-	1.5
China	1999	No	-	124%	-	10%	1%	8%	4%	36%	-	-37%	0%	-3%	-0.7%	-1.7%	-	0.1
Australia	2007	No	-	288%	-	15%	5%	7%	2%	22%	1.7%	-51%	0%	-3%	-0.7%	-1.7%	-	0.1
United Kingdom	1999	No	-	276%	-	14%	1%	6%	1%	18%	2.3%	-47%	0%	0%	0.7%	-0.1%	-	0.1
China	2015	No	7%	238%	3%	17%	2%	3%	3%	30%	0.4%	-21%	-4%	-3%	-1.8%	-6.5%	-	2.2
Avg All Cases		24%	17%	252%	3%	15%	3%	6%	5%	26%	2.1%	-56%	-4%	-3%	-2.5%	-6.9%	-	2.6
High Debt/Low Rates/ Mainly Domestic Debt		No	n/a	275%	2%	16%	4%	4%	5%	23%	2.2%	-61%	-5%	-2%	-2.5%	-6.9%	-	1.6
Mainly Domestic Debt		No	8%	256%	3%	14%	3%	5%	4%	26%	2.1%	-58%	-4%	-2%	-1.6%	-5.2%	-	3.5
Significant FX Debt		Yes	20%	241%	-	16%	3%	8%	6%	27%	3.7%	-66%	-6%	-5%	-2.7%	-10.3%	-	12.1
Worst 1/3 Outcomes		56%	20%	217%	9%	14%	3%	6%	8%	28%	1.0%	-73%	-10%	-6%	-4.0%	-11.9%	-	7.7
Best 1/3 Outcomes		11%	-	252%	1%	15%	3%	7%	3%	26%	3.3%	-47%	-7%	0%	0.2%	-1.9%	-	0.3

* Some useful comparison cases didn't flag with the simple indicator, we included those above.
USA 1929 FX Debt was 20% of GDP, but the indicator was 15% because of the 1929-1933 crash.
Excluded USA 1946 post-World War II boom, which was 19% of GDP, but the indicator was 15% because of the 1946-1947 boom.
High Debt/Low Rates/ Mainly Domestic Debt cases are defined by 3 rules: 1) No significant FX debt; 2) Debt level above 200% of GDP; and 3) Short Rates < 5% at the top.
Best and Worst 1/3 Outcomes are measured by subsequent Minimum Real Growth vs Potential.
While Spain, Ireland and Greece didn't literally have foreign FX debt, they had debt in euros, a currency they could not print.
Stock prices are shown in local currency for developed countries and in USD terms for emerging countries.

Section 3: Sizes of the Losses (Wealth Transfers)

As described in the summary, the stock market decline has both psychological effects, and direct economic effects from those who are taking losses. While the psychological effects are more important, the direct losses in recent weeks to households have been substantial.

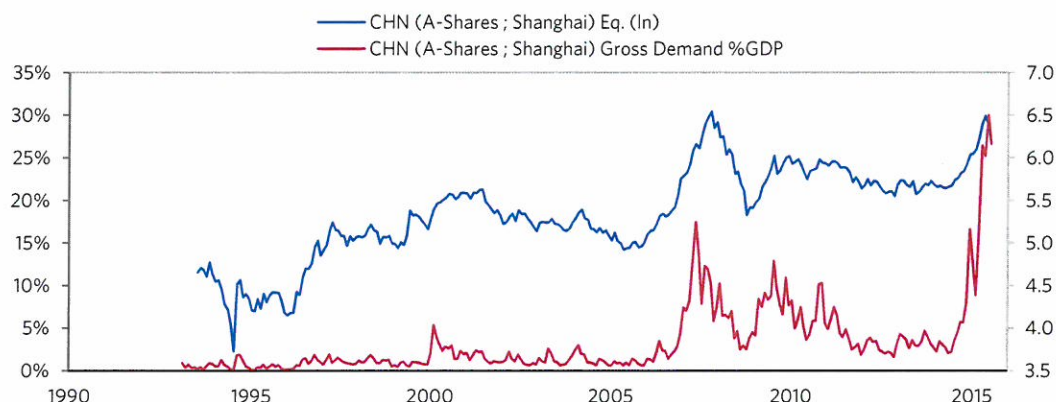
Our initial expectation was that an equity bust in China would be less impactful on spending than in other countries because Chinese households hold a much smaller percentage of their wealth in the stock market. So we expected there would be in fact less of a 'wealth effect'. And it's true that that the change in wealth from the top of the market has been less than in other countries—the roughly 30% decline in the stock market has translated to a loss of wealth of 6% of GDP for households, which is much smaller than the decline in wealth that we saw in the US in 2008, the US in 2000, or Japan in 1989, where the declines in wealth from the top were larger (ranging from -20% in Japan 1989 to -40% in US 2008).

However, what we learned as we stared closer at the situation is that there were significant losses for households who bought in the last year at higher prices than where they are today. We estimate the direct stock market losses of the household sector to be about 2.2% of household sector income and 1.3% of GDP—a level of direct losses somewhat higher than what was experienced in previous stock market crashes, as conveyed in the table below. And since these losses are concentrated in the small share of the population that owned stocks (about 8.8%) rather than diffused, the pain for that group is much more severe. These are rough estimates based on the relatively crude data that we now have, but they are broadly indicative. These losses are what have raised our concern about the magnitude of psychologic and direct effects on spending.

Losses During Stock Market Crashes (%GDP)

	CHN Today	US 2008	US 2000	JPN 1989	
	About 1m	12m	12m	12m	
Household Losses	-1.3%	-0.1%	-0.7%	-1.0%	Chinese Household losses much larger than in other cases
Direct Household Holdings	-0.4%	0.0%	0.0%	-0.1%	
Indirect (Mutual Funds)	-0.5%	-0.1%	-0.7%	-0.4%	
Margin Purchases	-0.4%	-	-	-0.5%	
Corporate Losses	0%	-3.0%	-1.6%	-0.1%	
Other Investor Losses	0%	-1.2%	-0.7%	0.2%	
Total:	-1.3%	-4.3%	-3.0%	-0.8%	

There are two reasons why Chinese household losses are larger than in other cases, even though stock holdings as a %GDP are overall lower than in these other more developed markets. Firstly, households are a more significant participant in the Chinese equity market than the others—about 80% of trading volume is from households in China. Secondly, much of the household buying was done at the peak of the market, as conveyed in the red line in the chart below.



Of course, losses for some market participants are gains for others. While we don't have great information on who gained, it looks like the winners were households who got in early, insiders who sold their holdings into the bubble, and corporations who issued into the bubble. And as conveyed above, the losers were households who bought late in the bubble. Since the stock market overall has gone up over the past year or so, the gains are larger than the losses. But the losses are still painful, and given the type of buyer who entered in at the peak (which were typically new stock market participants, many of whom were uneducated), the losses may be concentrated in those less able to bear them.

Gains and Losses (%GDP over Past Year)		
Player	Losses	Gains
Households	-1.3%	1.1%
Corporate	0.0%	0.5%
Foreigners	0.0%	0.0%
Unidentified	0.0%	3.0%
	-1.3%	4.6%

Our understanding of government-related purchases of equities is limited to those which China's policy makers and brokers have announced and what we have heard through rumors. The announced amount is around 400 billion RMB, which would be too small to achieve the goal; however, unconfirmed news reports suggest that the total amount is over 3 trillion RMB which would be enough to provide meaningful support to the stock market, at least over the short run. That amount is roughly equivalent to the large buying of stocks on margin borrowing (which totaled about 3 trillion RMB), a third of which has already been sold anyway. As we understand it, the largest source of support will be from the CSFC, which is financing purchases through the PBoC and large commercial banks, though the exact size is unconfirmed. We are not sure how large a few other support measures will end up being. For instance, several corporations have made announcements for large buybacks to support prices for their stocks, and pension funds will likely be able to allocate up to 30% of their asset allocation to stocks, up from 0%. Confirmed purchases are 120 billion RMB of promises from brokers to buy blue chip stocks, and another 260 billion RMB of broker purchases financed by the CSFC. The list of support measures we're tracking is shown below.

Announced Support Measures

Action	RMB bn	%Float	%GDP	Notes
Brokers to buy blue chips	120	0.6%	0.2%	-
CSFC extends credit line to 21 brokers to buy stocks	260	1.4%	0.4%	-
Direct CSFC Purchases of Equities	Size unconfirmed, Up to 3trln?	18.4%	5.4%	Financed by PBoC/Banks. Size reported in media, but not officially confirmed
Corporate Buybacks	Unknown	-	-	Likely small
Regulators ban shareholders holding more than a 5% stake from selling	Small	-	-	-
Increase QFII program from \$80 bn to \$150 bn	Small	-	-	Likely little impact, as QFII was not fully utilized at previous cap.
Central Huijin to buy ETFs	Unknown	-	-	-
Relax margin rules	Unknown	-	-	-
Reduce commissions on stocks	Small	-	-	-
Total of Confirmed Size of Measures	380	2.0%	0.6%	
Est. Size of Total Ammunition	Approx. 3.5trln	18%	5%	

Possible Further Support Measures

Action	RMB bn	%Float	%GDP	Notes
Creation of a market stabilization fund	1,600	8.4%	2.5%	Rumored PBoC and MoF would each commit RMB 500bn
Pension funds reallocation	600	3.2%	0.9%	Proposed increase in equity allocation cap from 0% to 30%
Chinese mutual funds to buy stocks	Unknown	-	-	-
Possible reduction to stamp duty	Small	-	-	Possible 5bp reduction
Total	2,200	11.6%	3.4%	

Section 4: Policy Moves

While China's moves to support the stock market are interesting, in that they convey the importance that they are giving to the stock market bubble bursting, and their inclinations to affect prices by being active in directing purchases and sales, rather than to be less active and more trusting in the free market's ways of working things out, we do not believe that the moves will be a major factor affecting the economy. History has shown in other countries that the central banks' and other governments' purchases of stocks, while sometimes supportive to prices over the short term, are usually not effective. They are typically too small to be effective, or, to be effective, must be undesirably large. When these purchases are not large enough to have the desired effects, they undermine the government's credibility and can be politically controversial; failed interventions are embarrassments as well as expensive costs. On the other hand, large enough interventions to support prices are typically uneconomic. Astute policy makers assess such moves in terms of their costs (based on the expected profit or loss they produce), and compare this path with other ways of deploying money in support of the market or the economy. It is wise for policy makers to consider who they are trying to help and what is the best way to help them. For example, in making purchases of stocks to support prices, one supports all stock holders over the short term rather than supporting those who one thinks are most important to support. History has shown that smart investors tend to sell when the government is artificially supporting prices and buy when they are liquidating positions. One other consideration is that large stock interventions by governments tend to discourage institutional investors' participation because they consider that to be price manipulation that makes investing more confusing and less economically based. So, while we would not have been as active in influencing the supply and demand for stocks as Chinese policy makers have been, and we think that their policies have been short-term supportive to prices but longer term slightly negative for the markets and for development of the Chinese equity markets, we do not believe that these actions will materially affect the economy.

Conclusions

The Chinese economy is big and important, so developments in it must be watched closely. The stock market bubble bursting has created a significant new challenge for policy makers. We won't know the size of this challenge until we see its effects on credit and economic growth numbers and losses of key entities over the next several weeks. In any case, managing a stock market bubble bursting at the same time as a debts and economic activity are being restructured is difficult because these negative forces on growth are strong and self-reinforcing. It will require more monetary and fiscal stimulation. As previously conveyed, I believe that China's policy makers have both considerable resources and skills and the willingness to manage it well, though the new development makes me less confident that it can be managed without a painful economic slowdown along the way. We will watch developments closely and keep you informed.

Appendix Enclosed: Charts of Different Bubbles and Their Bursting

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