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## Comment

*John Fernald, Federal Reserve Bank of San Francisco*

The paper by Chang, Chen, Waggoner, and Zha is a rich, big-picture paper about China's recent growth experience. The authors create a new and valuable data set, identify new and perhaps surprising stylized facts about China, and propose a consistent story to explain those facts.

First, the authors create new, internally consistent macro data. It is incredible that this is a contribution for a country of the size and importance of China. But it is. For example, official year-over-year data does not match the official quarter-to-quarter data. It is completely unclear to a researcher which series to use. Making a benchmark series available is a valuable contribution.

Second, the authors identify new stylized facts. A key one is that China does not have the typical comovement patterns between consumption and investment, or between investment and labor income. They also find that labor's share declines over time and that favored industries grow more quickly than less favored ones.

Third, the authors explain the facts with a new model of credit-fueled, investment-led growth.<sup>1</sup> The model is closely related to Song, Storesletten, and Zilibotti (2011). But, rather than emphasize the distinction between state-owned versus privately owned companies, Chang et al. argue that since the late 1990s, China has favored firms in heavy industries. This includes support for large privately owned firms in particular industries.

Before going into the details, let me summarize my takeaways. First, the data still are not very good and need to be treated with caution. The authors have done the best they can, but they cannot escape the problem of "garbage in, garbage out."

Second, the comovement properties of the data are, indeed, surprising in international context. China is a big outlier. The uncertain quality of the data raises a concern about whether we should really take that as a robust fact. Nevertheless, at least for consumption and investment, the data problems mean that the true correlation might even be *more* negative than is measured. Also, I am more impressed by the low labor share than by its downward trend.

Third, in terms of model, the broad story they are telling is plausible and somewhat intuitive. It fits previous Asian experience, where lots of countries have had industrial policies that picked winners (favoring particular firms and industries).

Now take these points in reverse order.

### A Model of Favoritism with Chinese Characteristics

The authors present a stylized two-sector model to explain the patterns they see in the data. One sector comprises capital-intensive firms. I will later argue they should be called “favored” firms, but for now I will keep their labels. They produce only with capital and live only one period. Their production function is  $Y^K = K^K$ .

These favored/capital-intensive firms face a borrowing constraint that comes from incentive compatibility:

$$RB^K = R(K^K - N) \leq \theta P^K K^K.$$

This constraint says that interest payments cannot be too large relative to revenues. The gross interest rate is  $R$ . They borrow  $B^K$ , which is the difference between the capital they use and their net worth.

The key parameter is  $\theta$ , which is the maximum the firms can borrow relative to their revenues. One way to interpret  $\theta$  is as loan guarantees/loan quota by the government. If the government increases their loan guarantees, then favored firms can borrow and invest more; if the firm’s net worth  $P^K K^K$  goes up, the firm can also invest more.

Labor-intensive firms produce with both capital and labor:  $Y^L = (K^L)^\alpha (\chi L)^{1-\alpha}$ . These firms have to fund labor costs before production, so they borrow for working capital purposes. The amount they borrow is  $R^L wL = B^L$ . So their labor costs—the amount they borrow—depends on their borrowing rate,  $R^L$ , as well as their actual wage bill.

In the model,  $K^L$  is predetermined by the savings of “old entrepreneurs”—labor-intensive firms cannot borrow this period to increase capital this period, and  $L$  is fixed. So in the model,  $Y^L$  is also predetermined.

Banks face a convex loan processing cost,  $C(\cdot)$ . They always meet the capital-intensive firms' demand for investment loans first, then they will make working capital loans. The first-order condition for the bank's problem turns out to be that the working-capital loan rate is rising in total loans:  $R^L = 1 + C'(B^K + B^L)$ .

What happens if the government raises the loan quota  $\theta$ ? The capital-intensive firm borrows and invests more. Because of the bank's first-order condition, that raises  $R^L$  and crowds out working-capital loans  $B^L$ . Since  $R^L wL = B^L$  goes down, the model implies that the wage and hence labor income has to fall. Lower worker income, in turn, reduces consumption. We thus get negative comovement between consumption and investment.

Of course, the trends are also very important here. In transition, capital-intensive firms are growing faster, which raises the investment rate. So this is a model of a credit-fueled, investment-led growth.

This is a very simple and highly stylized model to summarize a complex and heterogeneous economy. There is a lot one could quibble with or object to. It is missing key features, along various dimensions. But stepping back from any such quibbles, it is telling a particular story of "industrial policy with Chinese characteristics."

In this regard, the paper is implicitly arguing that China is following the example of other Asian economies—picking "winning" industries/firms. Many people have discussed industrial policy in postwar Japan.<sup>2</sup> When I was writing a paper on East Asian productivity puzzle (Fernald and Neiman 2011), we found lots of books and articles where the titles had phrases like, "the Role of Government in East Asian Industrialization" (Wade 1990), or "Korea: A Case of Government-Led Development" (Kihwan and Leipziger 1997). For Singapore, we found that every description of Singapore emphasized favoritism toward particular industries.

These economies have all been incredibly successful growth stories. The successes may have been, in part, because of these policies or, as many studies suggest, in spite of them. Nevertheless, it is not surprising that China might think it is a good idea to emulate that experience.

### **Stylized Fact on Comovement**

A key stylized fact in macroeconomics is the positive comovement of consumption and investment. In contrast, the mechanism in the model

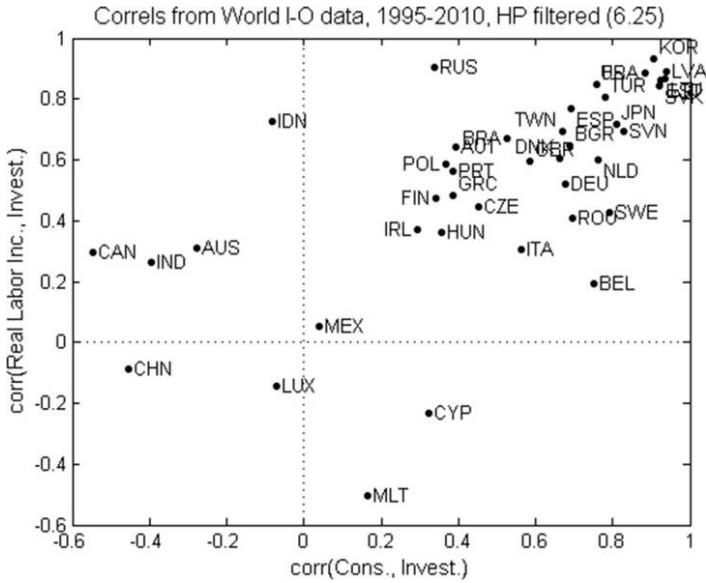


Fig. 1. Business-cycle comovement

Source: World Input-Output Database (Timmer, ed. 2012).

provides a way to generate negative comovement between these variables, as well as between labor income and investment. The model only has one shock, to  $\theta$ . When  $\theta$  changes, consumption and investment move in opposite directions. Of course, there could be other factors in the world that they have not modeled, so even finding a positive correlation between these variables would not necessary force us to dismiss the model. But it is, at least, indicative of whether we need such a model.

So how different is China, in fact, in terms of comovement? Figure 1 shows correlations for 40 countries in the World Input-Output database (Timmer, ed. 2012). That database includes real consumption, real investment, and real labor income for the period 1995–2010. Conveniently, that is approximately the period when Chang et al. argue their model applies. As in the paper, I HP-filtered the data before taking correlations, but results were not very sensitive to the filtering parameter or to doing everything in growth rates.

In figure 1, the horizontal axis is the correlation of consumption and investment. The vertical axis is the correlation of real labor income and investment. China is, indeed, an outlier with very low or nega-

tive correlations for both of these. Most economies are clustered in the upper-right corner, above 0.5 on both. Positive comovement is, indeed, a defining feature of the business cycle for most economies!

I would note that Korea is way in the upper-right corner. In the past they had an active industrial policy, so I also looked at the Organisation for Economic Co-operation and Development (OECD) data for Korea going back to 1970. The correlation between consumption and investment in Korea is strongly positive in the 1990s and the first decade of the twenty-first century. However, it was negative in the 1970s and 1980s, when industrial policy was arguably more central.

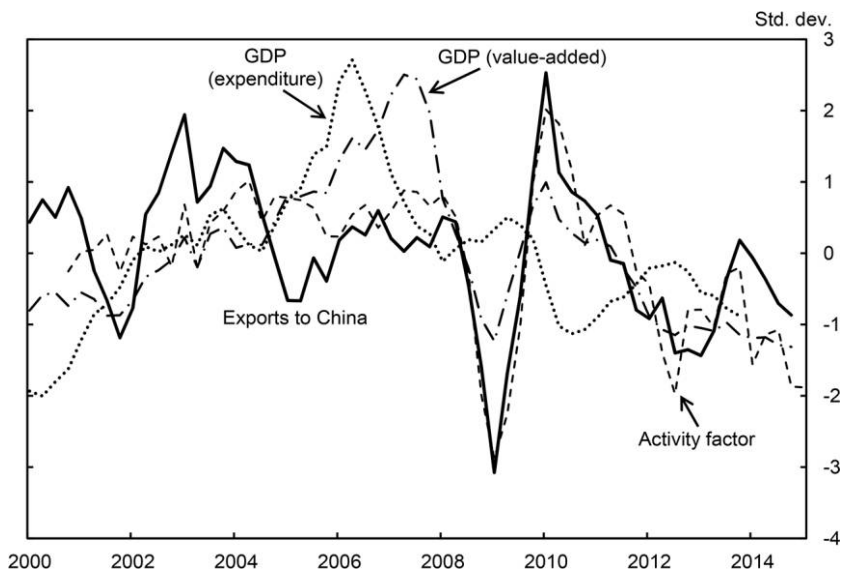
### Can We Trust the Chinese Data?

Still, can we really be sure that these stylized facts are actually facts? Concerns about the quality of Chinese data are longstanding. For example, problems could reflect statistical challenges, political manipulation, or a lack of resources to compile appropriate data. The best efforts of the authors of this paper cannot overcome those problems.

One approach is to compare China's national accounts to alternative indicators of Chinese activity, like electricity or rail car shipments or the like. Indeed, in Fernald, Spiegel, and Swanson (2014), we look at Chinese monetary policy without using official gross domestic product (GDP) data at all. Rather, we used an activity factor from other data. In figure 2, I show an activity factor based on the first principal component of nine alternative series.

But of course, even those data are produced in China and could be subject to manipulation or statistical problems. In Fernald, Hsu, and Spiegel (2015), we use exports *to* China and Hong Kong, as reported by trading partners, as an externally verified measure of economic activity in China. There are reasons China's imports might be more or less representative of the overall economy, but I would note that even for a relatively closed economy like the United States, the correlation of year-over-year changes in imports and in GDP is around 0.8. Fernald, Hsu, and Spiegel (2015) find that an activity indicator does, in fact, move quite closely with year-over-year growth in exports to China. In figure 2, I show that measure as well. The correlation with the activity factor is about 0.75.

I would note that figure 2 converts everything into four-quarter growth rates (to avoid seasonal adjustment issues with some of the in-



**Fig. 2.** Indicators of economic activity in China

Source: Fernald, Hsu, and Spiegel (2015) and Chang et al. (2015).

Note: Four-quarter percent changes, normalized (mean zero, unit s.d.).

dicators) before taking principal components. I have also normalized all variables to have mean zero and unit standard deviation.

Chang et al. have two measures of GDP. The first is the “headline” one that usually gets reported in the press, which is from the production side, measuring value added. As figure 2 shows, that value-added GDP measure corresponds much less well to exports to China than the activity factor does. For example, it is much stronger in 2007 than either the activity factor or exports to China. But since 2008, value-added GDP also qualitatively tracks activity and exports to China quite well.

Unfortunately, this is not so true on the expenditure side. The expenditure measure of GDP has a zero or negative correlation with either the activity factor, or with exports to China. In the global financial crisis itself, the figure shows that expenditure GDP rises slightly when everything else collapses. Then, during the recovery, expenditure slumps just as other indicators shoot up. Looking at the components of consumption and investment, those are both negatively correlated with the activity indicators as well.

There is more formal evidence that the official consumption data are not accurate. In particular, Nakamura, Steinsson, and Liu (2014) ar-

gue based on Engel curves that true Chinese consumption was much weaker than reported in this period, though especially in 2007–2008.

Still, it is not obvious that the low correlation between consumption and investment is just attenuation bias from classical measurement error. Classical measurement error would tend to raise the variance of the measured data. In contrast, the usual view for China (a view supported by Nakamura et al.) is that measured consumption and output are too smooth.

That said, anecdotally, investment was indeed very strong in the run-up to the financial crisis and, even more so, during the crisis itself. During the crisis, there were clear stimulus efforts by the government to boost investment. If Nakamura et al. are right, then actual consumption *fell* relative to trend during this period.

Thus, the true correlation between consumption and investment could be even more negative than in the data. In other words, measurement error may be attenuating a negative correlation, not a positive one. So although the data are not reliable, the comovement puzzles in the Chinese data that Chung et al. highlight do appear to be ones we want to explain.

### **Favoritism Not Capital Intensity**

Let me now turn to something that initially worried me even more—and that I thought was really damning for their story. That is, relative growth of capital-intensive industries. To do this, I started with the industry data in the World Input-Output database for 1995–2010. I then divided them based on the classifications in table 11 of the paper. When I did so, I could not replicate figure 18 of their paper that showed capital-intensive industries grew faster.

I talked to the people who put together the World Input-Output database. They directed me to Harry Wu at Hitotsubashi University. I also asked Dale Jorgenson about Chinese industry data. Dale told me to talk with Harry Wu.

I called Harry Wu. He is the world's expert on Chinese industry and input-output data, and he sent me his updated data (which are now available online).<sup>3</sup> The dotted line in figure 3 shows the ratio of real (chain weighted) gross output in capital-intensive industries to that in less capital-intensive industries. The capital-intensity classifications come from table 11 of the Chang et al. paper. Unfortunately for the au-



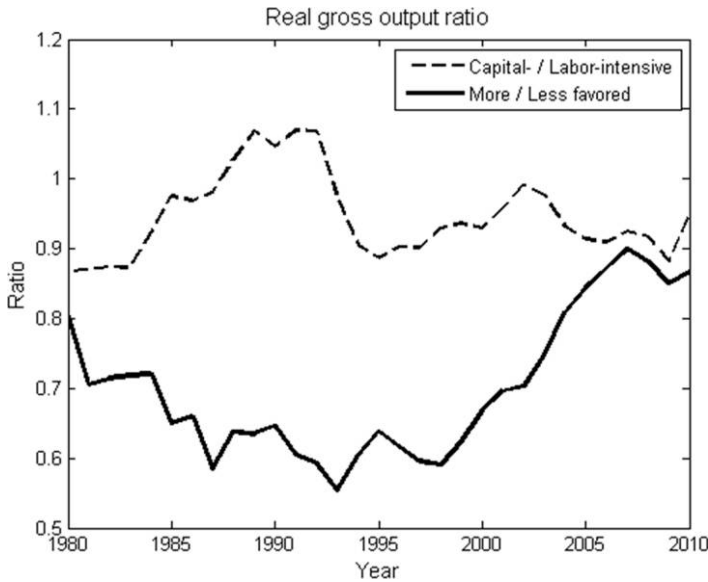


Fig. 3. Gross-output ratios

Source: Wu and Ito (2015). Capital-intensive versus labor-intensive categories are based on table 11 of Chang et al., and favored versus unfavored is also based on the text of Chang et al. Detailed industries are aggregated using chain weights.

thors, it does not show any evidence for their claim that capital-intensive industries grew faster.

More fortunately for the authors, I then read the text of section V.B of Chang et al. more carefully. The Chinese government emphasized infrastructure, basic industries, and various “pillar” industries. This industry classification turns out to be correlated with capital intensity, but not perfectly. Some capital-intensive industries do not show up on this list, and some less capital-intensive industries do—including machinery and motor vehicles.

When I use the specific list of favored industries from the paper, I get the solid line in figure 3. It matches their argument! These industries grew much faster, in both real and nominal terms (the nominal ratio is not shown), and they start growing faster just when the authors say that policies changed to favor this group.

What about labor share? Their story is that the shift toward low labor-share industries explains a decline in labor share. Figure 4 shows that this story still roughly works. The favored industries do

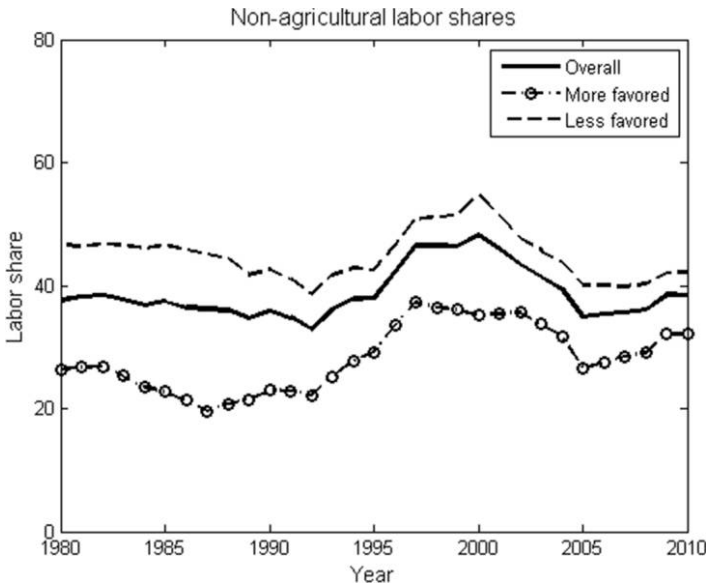


Fig. 4. Nonagricultural labor shares by sector

Source: See notes to figure 3. Vertical axis is percent.

have relatively low labor share, and so a shift toward these industries can contribute toward reducing the aggregate labor share from the late 1990s on.

But what strikes me as being at least as important is that labor's share is always very low. It rose in the 1990s toward almost one-half, then it retreated a bit. One-half is extraordinarily low in cross-country perspective. The usual problem is self-employment/proprietors' income getting counted in gross-operating surplus (see Gollin 2002). However, it turns out China historically put all self-employment income in labor,<sup>4</sup> so these data already control for proprietors' income.

How do we explain the low labor share? Fernald and Neiman (2011) looked at this for Singapore, and argued that the answer was pure economic profits. For example, we found that the state telecom company, the port, and public utilities were all highly efficient, but prices were not low. There are lots and lots of complaints in the press about how these utilities were taking advantage of their monopoly power to earn profits.

So, my presumption is that the model needs to include a role for large markups and pure economic profits.

## Conclusions

To conclude, this is a valuable contribution to the ongoing debate regarding China's investment-led growth model. Popular discussions raise concerns about whether the model is sustainable. Still, other Asian economies also relied on policies that favored particular industries, sometimes in ways that also seemed unsustainable, but the policies evolved over time. Despite the occasional bump (such as the Asian financial crisis of the 1990s), their growth experience has by and large been favorable. China certainly hopes to continue that tradition.

## Endnotes

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1. As described by the *Financial Times* on April 16, 2015 (p. 5).
2. See, for example, Beason and Weinstein (1995) or, for that matter, Wikipedia (2015).
3. See <http://www.rieti.go.jp/en/database/CIP2015/index.html>. For a description, see Wu and Ito (2015).
4. I thank Harry Wu for pointing this out to me.

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