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The Size of China's Real Estate Sector

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In its November 27 article “Measuring the Universe’s Most Important Sector,” the *Economist* magazine discusses estimates of the size of China’s real estate sector. It features two papers, including our January 2021 paper, an October 2021 paper by Goldman Sachs (Tilton et. al.), as well as an estimate provided by Asian Development Bank economists based on a paper in progress but not yet publicly circulated. The *Economist* writer concludes that the Goldman estimate of 23.6% of GDP is perhaps the best guess. We agree this is an outstanding paper, and broadly agree with this estimate. However, contrary to what is strongly implied in the article, we view our original estimate for the size of China’s real estate sector as virtually identical to the later Goldman Sachs paper. Our estimate for the domestic value added of all direct and indirect inputs to the real estate sector (including both residential and commercial) in China was 24% (based on the 2016 data available to us at the time). The GS estimate, based on 2018 data, is 23.3%. GS reports that adding the import content adds 3% which would bring the total value of the Chinese real estate sector for 2018 to 26.3%. Our comparable estimate for 2016 was 29%. Comparing our 29% and Goldman’s 23%, as the *Economist* article does, is comparing apples and oranges.²

Moreover, again contrary to the assertions in the *Economist* article, both our estimate and the Goldman estimate encompass the same definition of real estate, including both residential and commercial, albeit the later Goldman paper is able to make use of a more disaggregated input/output matrix than was not yet available at the time of our paper. We show all this in an appendix which also includes preliminary updates for 2019-2020, based on data currently available (at present the latest input/output matrix for China is only 2018.) Our updated estimate for 2020 has the value-added of China real estate sector at 23.6%, 26.6% if imported content is included.³

Having established that our earlier results for domestic value added in the China real estate sector are essentially identical to the excellent Goldman paper (which unlike our paper is focused entirely on this question), there remains the issue of whether one wants to ignore the imported content of China’s real estate sector. That is, for 2018, is the best current estimate 23.3% or 26.3%? Actually, this very much depends on the question being asked. Our paper asks two questions. First, what might be the impact on China’s GDP if there is a fall in final demand for real estate. Here the 23.3% domestic value-added

¹ The authors are grateful to Andrew Tilton for helpful comments on an earlier draft.

² The November 22, 2021, *Economist* article incorrectly suggests that our January 2021 estimate attempts to encompass a significantly narrower measure of the real estate sector than Tilton et. al, but nevertheless arrives at a higher estimate. In fact, the two extremely similar sets of estimates are attempting to measure the exact same thing (residential plus commercial).

³ The Chinese economy has indeed slowed in 2021, in part due to the real estate sector. A very preliminary calculation, using same methodology as in the appendix but still based on incomplete data, gives 20.6% as the domestic value-added share of real estate

number for 2018) is more appropriate, and indeed that is what we use in the headline result in our abstract and conclusions, that the cumulative domestic impact of a 20% decline in Chinese real estate final demand might be 5-10% spread out (we assume since the I/O analysis does not incorporate dynamics) over several years.

However, the larger number 26.3% estimate for 2018, that includes the imported content of China's real estate production, is quite relevant to the central thesis of our paper. In particular, we argue that China might be already running into diminishing social returns in real estate construction. That is, instead of Japan's "bridges to nowhere", might China be headed towards "houses nobody lives in" or "office buildings nobody occupies" (or significant rent and price declines to clear the market.) Here, it matters not whether some component of the vast network of office buildings and housing in China has some imported content, what matters is the absolute quantity. Of course, the demand side also matters, and our paper contains extensive statistics on demographics, growth, regional distribution, square meters of housing per capita etc.; although we do not have comparable data on office buildings the metrics are highly correlated.

Our paper also makes comparisons to advanced economies, noting that China's real estate sector, even counting only domestic value added and using harmonized OECD input output tables, exceeds that of the United States and even Spain and Ireland at their peaks. Indeed, one thing we hope to do in further work is to adjust for the relative efficiency of China's real estate construction sector, which likely exceeds Western countries by a considerable margin for a variety of reasons. That is, using US relative prices to assess the size of China's real estate sector (as the World Bank does in constructing purchasing power parity GDP measures) could potentially show China housing sector to be an even larger share of GDP at PPP prices.

Lastly, as noted the *Economist* also cites the preliminary analysis of the ADB, which arrives at much smaller estimates for the size of China's real estate sector (15% inclusive of imported content, 13.8% excluding imported content). A simple back of envelope calculation shows that such low numbers are only plausible if one excludes commercial real estate. However, for the focus of our paper, which is that for too long China excessively relied on real estate construction to prop up growth and is now running into late Soviet era style decreasing returns problems in this sector, we regard the commercial and residential building problems as intimately connected.⁴

⁴ One can get a close order of magnitude of the size of the real estate sector in China with a simple back of the envelope calculation, taking advantage of the fact that construction is an extreme example of a downstream sector where final demand accounts for roughly 95% of its total output (the other 5% being intermediate demand). China's national accounts list construction total output at 28% of GDP for 2018, which gives a close approximation to construction final demand. Of course, not all of construction is real estate related, it also includes infrastructure. If one takes the share of residential and commercial real estate in final construction demand to be 72% (a good approximation for China, see Table 1), and then adds real estate services value added, one arrives at an estimate for the share of the real estate sector of roughly 27%, including imported content. This estimate does net out the modest component of real estate services that is an intermediate input, but at the same, the approximation does not consider the higher-order effects one captures with the I/O analysis.

APPENDIX

In this appendix, we use China's input-output (I/O henceforth) tables, which describe the supply and demand inter-dependencies between industries in its economy, to estimate economy-wide effects of an autonomous decline in final demand for real estate and real estate services. The framework draws on Tilton et al. (October 2021) who as noted, find very similar estimates to those in our earlier paper Rogoff and Yang (NBER working paper August 2020, published version January 2021)

Suppose that an economy has n industries. A basic I/O framework has the following key components

Intermediate demand Intermediate input	Industry 1	Industry 2	...	Industry n	Final demand	Total output
Industry 1	I				II	
Industry 2						
...						
Industry n						
Value added	III					
Total input						

Quadrant I, composed of an $n \times n$ matrix, shows flows of goods and services that are both produced and consumed in the production process. Each element in the matrix $x_{i,j}$ has dual economic significance: viewed horizontally, it represents the amount of output from industry i that is used as intermediate input in industry j ; viewed vertically, it signifies the amount of input that industry j consumes that is produced by industry i . Quadrant II presents final demand for the output of each row industry i . Quadrant III contains data of value added of each column industry j . Thus, the basic equations in the I/O model can be expressed as

$$\sum_j^n x_{i,j} + Y_i = X_i \quad (1)$$

$$\sum_i^n x_{i,j} + V_j = I_j \quad (2)$$

where Y , X , V , and I signify final demand, total output, value added, and total input, respectively. Equation (1) describes the horizontal equivalence that intermediate demand plus final demand equal the total output of an industry. Equation (2) presents the vertical equivalence. More specifically, intermediate input plus value added are equal to the total input of an industry. Taking out imports, total output should be equal to total domestic input in any given industry.

Following Tilton et al. (2021), we define $a_{i,j}$ as $\frac{x_{ij}}{x_j}$, V as an $n \times 1$ column vector of value added, and v as the diagonal matrix of value-added coefficient, namely the ratio of an industry's value added over its total output.

Then the matrix form of equation (1) can be expressed as $AX + Y = X$. Solving for total output gives $X = (I - A)^{-1}Y$. With $V = vX$, we get $V = v(I - A)^{-1}Y$. In the non-competitive I/O matrix that Tilton et al. use, total demand for imports can be denoted as $M = A_mX + Y_m$. Then equation (1) can be transformed into

$$A_dX + Y_d + A_mX + Y_m = X + M \quad (3)$$

Solving for domestic value-added gives

$$V = v[I - (A_d + A_m)]^{-1}[Y_d - A_m(I - A_d)^{-1}Y_d] \quad (4)$$

Let ΔY_d^c denote a change in final demand for construction. Then plugging into equation (4) would give us the total change in value added. Doing so symmetrically for the real estate services industry, we can obtain the change in value added due to the change in demand for real estate services.

Based on China's 2018 I/O table, Tilton et al. (2021) estimate that the share of construction and real estate in China's economy is 23.3%. They note that including imported inputs elevates that estimate to 26.3%. Building on their analysis, we extended the time series using 2017 I/O table as well as latest releases of 2019-2021 data. The 2021 data is incomplete, and final estimates for 2019 and 2020 await having the input output tables for the corresponding years. Note that adding imported inputs adds between 2.8% and 3.2% to these figures.

Table 1: Share of Real Estate Related Activity in China's GDP

	2016		2017		2018	
	VA	FD	VA	FD	VA	FD
Construction	6.7%	23.5%	6.7%	23.6%	7.1%	24.5%
- Real estate related construction	4.8%	16.9%	4.8%	17.0%	5.1%	17.7%
Real estate services	6.5%	5.0%	7.1%	5.5%	7.4%	5.6%
Total real estate related GDP	11.3%	21.9%	11.9%	22.5%	12.5%	23.3%
	2019*		2020*			
	VA	FD	VA	FD		
Construction	7.2%	24.9%	7.2%	25.1%		
- Real estate related construction	5.2%	17.9%	5.2%	18.0%		
Real estate services	7.1%	5.5%	7.3%	5.6%		
Total real estate related GDP	12.3%	23.4%	12.5%	23.6%		

* 2019-2020 estimates are preliminary awaiting I/O tables corresponding to those years.

Notes:

1. VA stands for value-added. FD stands for final demand.
2. 2016-2017 estimates are based on the newly-available 42-industry I/O table for the year 2017. 2018-2020 are based on the 42-industry I/O table for 2018. These were not available at the time of our earlier paper, which uses the less disaggregated 17-country version that was then available.
3. For years with an I/O table (2017, 2018), value added numbers are extracted directly from the I/O table, which are slightly different from national accounts (China Statistical Yearbook Chapter 3).
4. For years without an I/O table (2016, 2019-2020), value added numbers come from national accounts, and final demand numbers are obtained using the ratio of final demand over value added in 2017 and 2018.
5. Following Tilton et al. (2021), we assigned 72% of construction to real estate, which is roughly the ratio of building output plus installation output over construction total output.

The estimates for 2016 using the Tilton et al. (2021) method are slightly different from our results in Rogoff and Yang (2020) due to the following reasons:

- 1) Tilton et al. (2021) used China's 2018 I/O table, which is a more updated and disaggregated version than the 2017 version available when we published our paper. The former comprises 42 industries, whereas the latter 17 industries. Notably, in the 2017 version, real estate services and finance are merged into a single industry, giving rise to certain bias. Input output coefficients have also changed over time.
- 2) With reference to Xu et al. (2015), we used real estate investment to represent demand for real estate construction and related machinery, which is a statistic unique to China and different than the fixed capital formation that is used in Tilton et al. (See Table 19-5 of China Statistical Yearbook 2018). Real estate investment differs from fixed capital formation in that it does not include housing appreciation and intangible costs, whereas fixed capital formation includes those items. The measure we use appears to include infrastructure investment that is closely related to real estate, for example pipes and wires in new residential communities.

- 3) We used real estate investment-induced output to approximate construction total demand and adjusted for double-counting by deducting the identity matrix. The advantage of using our method is that it did not require an assumption about the share of construction assigned to real estate. The drawback is that it included a portion, albeit small, of intermediate demand, which slightly pushed up our estimate, 24% for 2016 versus 23.3% for 2018 (Tilton et al.).
- 4) The two papers used different sources of GDP figure. When performing our calculations, we used the gross domestic product number from Chapter 3 of China Statistical Yearbook 2018, while Tilton et al. (2021) took the total value-added number from the I/O table. For 2017, the former stands at 74,359 billion yuan, whereas the latter amounts to 82,322 billion yuan, leading to slightly different estimates.

Taken together, we view our original January 2021 results as attempting to measure the same real estate content Tilton et al. (October 2021) and arriving at a virtually identical figure for domestic value added; including imported content adds a few percent.

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