Can Consumption Growth in China Keep Up As Investment Slows?*

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Abstract

Rebalancing away from investment to consumption has been on China's agenda in order to keep up higher growth rates. This paper uses both national- and provincial-level data to empirically answer the question how a slowdown in investment could have an impact on household consumption. Our empirical results from both the national- and provincial-level data using Bayesian vector autoregressions and panel regression methods suggest that investment has had a significant impact on household consumption beyond the standard household income channel. The effects are particularly strong in the post-global-financial-crisis period. Policy measures to encourage rebalancing away from investment should take the extra effect it may have on consumption beyond the impact on household income into account.

Keywords: Reforms · Investment · Consumption · China

JEL Classification: E21 · E22 · E27 · E44 · E47 · E52 · C12 · C32 · C33 · O53

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1 Introduction

"Over the past five years, new growth drivers have rapidly grown in strength. Economic growth, in the past mainly driven by investment and exports, is now being fueled by consumption, investment, and exports. In the past dependent mainly on secondary industry, growth is now powered by a combination of the primary, secondary, and tertiary industries. This is a major structural transformation that for years our sights had been set on, but we were never able to achieve."

Li Keqiang, First Session of the 13th National People's Congress of the People's Republic of China on March 5th, 2018

Over the past years, China's declining growth has increasingly been driven by consumption (Figure 1 left) despite its share in GDP still remaining at a relatively low level (Figure 1 right) compared to other economies. While investment propelled the economy in the aftermath of the global financial crisis (GFC), when the Chinese authorities engineered a large stimulus to mitigate the effects from the GFC (RMB 4 trillion, which is around US$ 600 billion and, hence, amounting to about the same size as the subsequently announced stimulus in the US with the Chinese economy being only a third of size), consumption has become a larger contributor to overall GDP growth more recently. Despite the slowdown in growth contribution of investment, the investment to GDP ratio reached unprecedented levels (Figure 1 right). Measuring the investment ratio using gross fixed capital formation (GFCF) these levels reach around 45 percent in recent years and measuring the ratio using fixed asset investment (FAI) as reported by firms these levels reach around 80 percent of GDP. However, since the latter measure also includes land purchases, part of this strong increase might be driven by a recent increase in land prices.

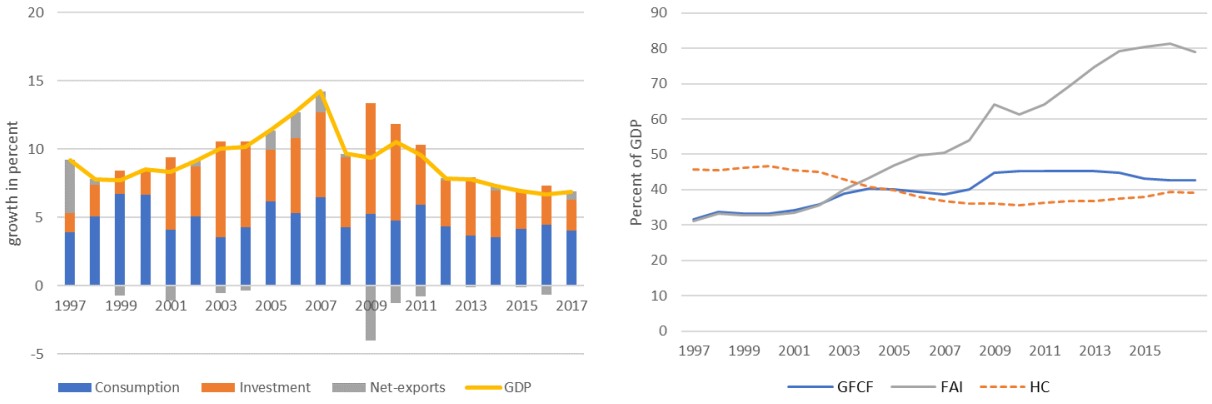

Figure 1: Contribution to GDP growth (left) and investment to GDP ratio (right; Household consumption to GDP ratio for reference). Source: CEIC.

A sizable part of the investment expenditures were financed via credit. Figure 2 (left) shows the credit to GDP ratio for various non-financial sectors of the economy. In 2009, when the Chinese government initiated the RMB 4 trillion stimulus, credits to non-financial firms (including privately owned firms and township and village enterprises (TVEs)) sharply increased and has been steadily increasing since then imposing threats to financial stability, while credit to the general government and to households remained moderate. Household income and consumption growth have been robust (Figure 2 right), but with declining GDP growth both household consumption and income growth started to slow down. With investment-driven growth reaching its limits, China is now facing a big challenge of structural transformation after growth rates have started to decline towards a new normal in the last decade. Hence, as China continues to rebalance towards a consumption-driven growth, questions arise whether household consumption itself would be adversely affected by a slowdown in investment. Therefore, this paper attempts to explain the drivers of Chinese household consumption and to address the channels through which an expected slowdown in investment could have an impact on household consumption. We use both country- and provincial-level data, in order to capture the heterogeneity of provinces, to empirically answer this question. Our empirical results suggest that investment has had a significant impact on household consumption beyond the usual household income channel. The effects were especially strong in the post-GFC period and in more salient sectors, indicating the that the stimulus has affected households' decision to consume. We propose, that investment in China functions as a proxy for expected future household income which affects consumption decisions today.

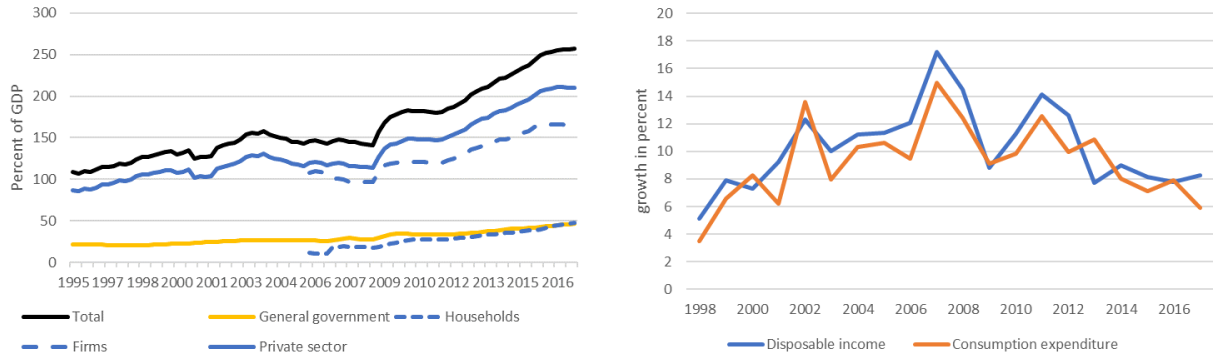

Figure 2: Loan to GDP ratio (left; Note: Since 2006, private sector split into households and firms) and income and consumption growth (right). Source: CEIC, BIS.

This paper is structured as follows: Section two reviews the literature and section three briefly develops theoretical links between investment and consumption in China. Section four discusses the data. In section five we use a Bayesian Structural Vector Autoregression (BSVAR) to estimate the drivers of Chinese household consumption on the national level.

Thereby we find that consumption reacts positively to a shock in investment. In section six we employ panel regression methods to account for the dispersion of investment across provinces. The results indicate, that there is a positive significant relation between investment and household consumption in the period since the GFC which goes beyond the household income channel. A panel Granger causality test affirms these findings. In section seven we discuss the nexus between investment, expected future income, and consumer confidence. Section eight concludes.

2 Literature Review

Household consumption and saving in China have been widely investigated in the context of a high household saving rate and a relatively low consumption ratio. Many theories have been put forth including the precautionary savings motive in conjunction with relatively high income risks and changes in the social safety net (Chamon et al. (2013)), sex-ratio imbalances (Wei and Zhang (2011)) which increase saving incentives, and demographic change (Curtis et al. (2015), Horioka (2010)).

Consumption dynamics at the macro level are less investigated. A few studies on monetary policy transmission, which is considered to be a key driver of household consumption, have touched on this. Chen, Chow and Tillmann (2017) examine the effectiveness of monetary policy in China using a Qual VAR and find that consumption growth falls and reaches its minimum about 8 months after a tightening shock, however, the impact is relatively small. Furthermore, the wealth effect on consumption has also been explored in several studies. Koivu (2012) uses a SVAR model and quarterly data between 1998 and 2008 to examine monetary policy transmission as well as asset price effects on consumption in China. She finds that a positive shock to income increases consumption. Following a positive shock in house prices, however, consumption initially drops and only after a lag of almost two years the reaction turns positive. The results reflect the relatively small role that asset markets play in household income and consumption at the aggregate level. Chen, Funke and Mehrotra (2017) find a significant and positive long-run relationship between property prices and consumption in China, beyond the expected relationship between household income and consumption, using city-level data from 1998 to 2009. Peltonen et al. (2012), however, do not find a significant relationship between property prices and consumption in China, using quarterly macro-level data from 1990 to 2008.

The relationship between investment and household consumption has not received much attention yet. Theory offers a direct channel where investment leads to a higher capital stock and eventually to higher growth and household income which in turn translates into higher

consumption. However, there might be more indirect effects and channels through which consumption is affected. Lee et al. (2013) offer an alternative explanation. If investment is excessive, their hypothesis is that consumption would not be self-sustaining but dependent on recent investment. In addition, excessive investment should result in greater corporate profitability rather than boosting household income since wasted investment contributes to corporate income during the implementation period and to a lesser extent to household income, the scope of which would depend on the share of labor costs. Testing their hypothesis, Lee et al. (2013) find evidence that investment Granger-caused private consumption. Using provincial panel data, they find that investment has a significant impact on household consumption through household income. When adding investment to a panel estimation which includes household income, however, investment turns out to be insignificant, implying that investment only influenced consumption through the income channel. Their results also suggest that investment in the coastal areas elicits more of a sustained consumption response than in China's inland provinces, drawing the conclusion that investment in the inland area may be excessive and not self-sustaining.

3 Theoretical relationship between investment and consumption

The main drivers of consumption according to (neoclassical) theory are the level of (permanent) income, the distribution of wealth, expectations about prices, interest rates, changes in fiscal policy, the availability of goods, the attitude towards saving, and preferences. Investment, however, does not directly show up in the (neoclassical) consumption function. Nevertheless, investment leads to a higher capital stock and eventually to higher growth and household income which then translates into higher consumption. Taking into account that financial markets in China are still relatively underdeveloped, and hence, one assumes that financial frictions exist, the standard permanent income hypothesis, in which consumption depends on the permanent level of income, does not hold and rather disposable income matters for consumption decisions. Taking all that into account, investment in China should affect household consumption through the household disposable income channel. This is not only in line with the permanent income hypothesis with financial frictions (borrowing constraint) where the agents cannot borrow against the future but also in an economy with a large fraction of hand-to-mouth consumers (e.g. Kaplan et al. (2014)), with New Keynesian models with heterogeneous agents (e.g. Kaplan and Violante (2018)), or even with the Keynesian view of the consumption function.

Another channel besides household income which may fit well with China's situation is that investment could be a good proxy for expected future household income. Beyond the current disposable income channel, investment may have an impact on the households' decision to consume through their income expectation. If this was the case, this effect should be stronger for more salient investment. As the government still has an important say in driving economic growth, especially through investment expenditure, households can expect that strong investment today could bring better job prospects and higher income in the future. There is evidence that household income expectation is an important factor in determining household consumption in other countries (see for example Pounder Demarco (2009) for the US and Estrada et al. (2015) for advanced economies). If this was the case, consumption should not only indirectly depend on investment through disposable income but also directly on investment with a stronger effect of more salient investment. We will further discuss this issue in Section 7.

4 Data

China's national accounts are still a work in progress. On the expenditure side, nominal consumption, investment, and net exports are published annually. Since 2015, growth rates and contribution to GDP growth are published on a quarterly basis. Moreover, the reliability of the Chinese official data is highly controversial. This prompts researchers to look beyond the national accounts and to estimate their own real and quarterly series.

There exist two measures for investment in China: gross fixed capital formation (GFCF) from the national accounts and fixed asset investment (FAI) as reported by firms subject to reporting. GFCF, available annually and since 2015 in quarterly growth rates, measures how much of the output of the economy is invested and excludes purchases of land, inventories, and other already pre-owned resources (ownership change). FAI, which is available monthly, measures investment in long-term assets as reported by firms and includes purchases of land, used facilities and equipment, and mergers and acquisitions. Since FAI is published in a year-to-date format, it is difficult to calculate period-over-period growth rates although first-differences could be applied. However, since the data also includes revisions and accounting problems could distort the monthly data, this approximation would be inaccurate (for a detailed discussion see Barnett and Brooks (2006)). This fact is revealed by a relatively low correlation between GFCF and FAI on a quarterly basis of about 0.33 whereas this correlation is relatively high on an annual basis of around 0.8. Therefore, we use quarterly GFCF in the national-level estimations. Since it is only available on an annual basis, quarterly gross fixed capital formation (GFCF) estimates were derived from Soudan (forthcoming). As FAI

is available on the sectoral level and as the correlation is relatively high on an annual basis, we use annual FAI growth in the provincial-level estimations.

At the national level, we use quarterly data from 2002Q1 to 2015Q4 from the CEIC database. Data for household income and consumption is taken from the household survey since consumption from the national account is available only on an annual basis. Household income and consumption are measured as urban disposable income per capita and urban consumption expenditure per capita. Moreover, we use the lending rate as interest rate and, since housing wealth is difficult to approximate for China (data on housing stock is not available), residential property prices to capture the wealth effect. All variables are in real terms. To account for political uncertainty and its effect on consumption decisions, we use the political uncertainty index by Baker et al. (2016).

Since there is no quarterly data available at the provincial level, we use annual data from 1991 to 2015 from the CEIC database. The variables remain basically the same as at the national level except for investment where we use annual FAI data as discussed before. Household income and consumption per capita are again taken from the household survey but at the provincial level. Real variables are obtained by deflating household income and consumption with provincial consumer price indices (CPIs) and investment with provincial fixed asset investment price indices. We use the national lending rate and the provincial residential property price series, both deflated by provincial inflation and provincial CPIs. Similar to before we use the national political uncertainty index. Tibet is excluded from the estimations due to missing data. To account for different demographic dynamics across provinces, we use investment per capita.

5 Results at the national level

As the sample is relatively short at the national level, we estimate a Bayesian Vector Autoregression (BVAR), which has proven to be more efficient with shorter samples, of the reduced form

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + \epsilon_t \qquad \text{where} \qquad \epsilon_t = B_0^{-1} u_t, A_i = B_0^{-1} B_i$$

to examine consumption dynamics using the BEAR toolbox (Dieppe et al. (2016)). The vector of variables includes our six variables: economic uncertainty pu_t, interest rate r_t, investment I_t, residential property prices pp_t, household income inc_t, and household consumption hc_t as discussed in the section before. Investment, household consumption, household income, and property prices are in year-over-year percentage changes. The real interest rate

and the uncertainty index are in levels. The optimal lag length of four is determined by the Akaike information criterion. We use the independent normal-Wishart prior since this prior imposes less restrictions than the somewhat more standard Minnesota prior or the standard normal-Wishart prior. We checked our results with respect to the choice of the prior and the results seem to be robust. For the calibration of the BVAR we use standard values, i.e. an autoregressive-coefficient of 0.8, an overall tightness of 0.1, a cross-variable weighting of 0.5, and a lag decay of 1. We perform 2000 iterations of which 1000 are burn-in iterations.

We structurally identify the shocks by using a recursive Choleski ordering of the variable ordering $y_t = (pu_t, I_t, inc_t, pp_t, hc_t, r_t)$ which is derived from economic theory and literature as discussed below. Political uncertainty, as constructed by Baker et al. (2016), is measured by news about real politics and hence, assuming that real policy takes time to adapt to a new economic situation by several rounds of consultations, should not react contemporaneously to the economic variables in the VAR. However, this uncertainty instantaneously influences the economic agents. Real investment is supposed to be inherently sluggish (Sims (1998)) and hence contemporaneously unaffected by the other economic variables. This is due to a planning lag, i.e. it takes time for actual investment to materialize after the decision of investing. Household income is also sluggish (e.g. Ludvigson et al. (2002)) since for example interest rates only affect savings income at the end of the next period. Investment, however, increases the income of the workers responsible for the implementation. The contemporaneous effect of investment and household income on house prices are derived from a supply and demand model. An increase in demand for housing, either through an increase in real estate investment or through an increase in disposable income and hence in private demand, leads to higher property prices (e.g. Tsatsaronis and Zhu (2004)). However, prices are contemporaneously unaffected by consumption and by the interest rate as mortgages still play a relatively small role in China. Since the planning lag for household consumption is smaller than the one of investment, consumption can contemporaneously react to shocks in income, prices, and investment but only reacts with one lag to changes in the interest rate as consumer credits are still used relatively less in China as compared to other countries like the US (e.g. Bagliano and Favero (1998)). We allow monetary policy, which follows a policy rule taking into account the economic situation, to react contemporaneously to all economic variables in the model (e.g. Bernanke and Mihov (1998)). However due to the planning lag and the realization of interest income after one period, monetary policy affects the other variables only with one lag.

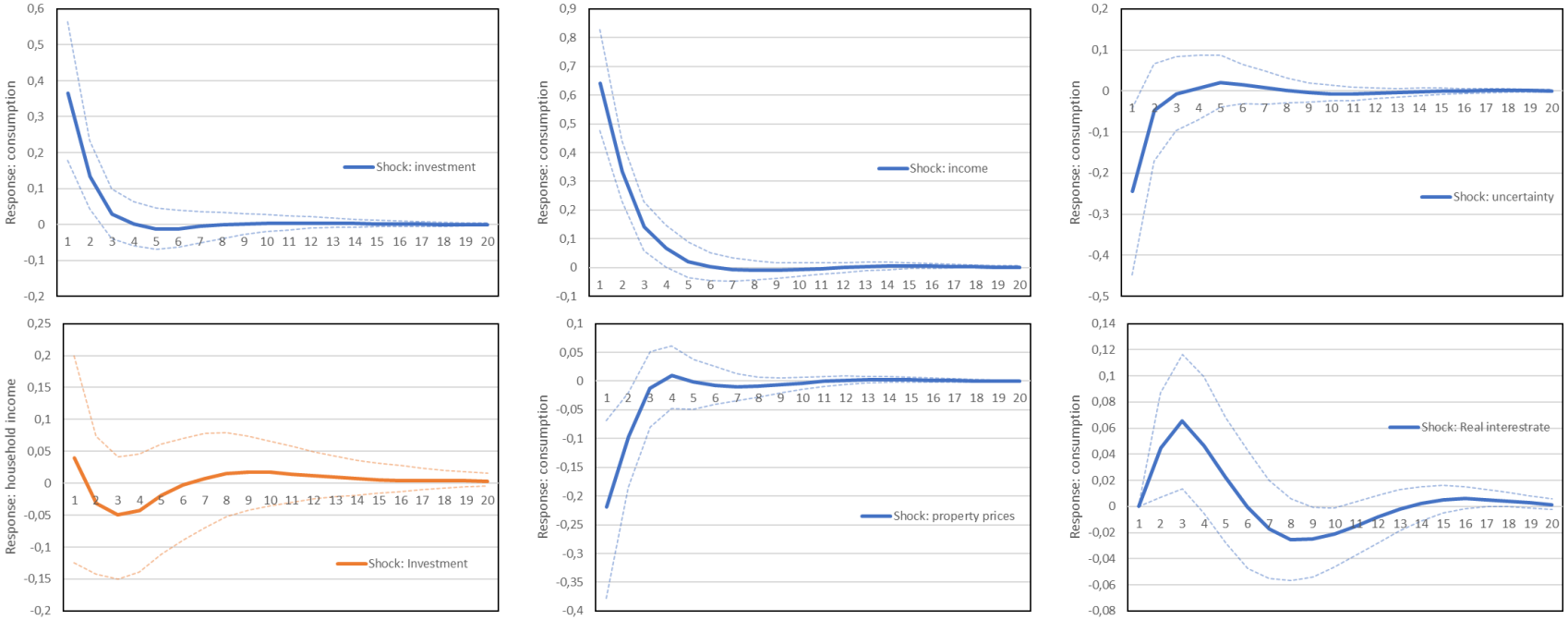

Figure 3: Impulse response functions of consumption (blue) and household income (orange) to different one-standard-deviation shocks. Dotted lines represent one-standard-deviation credibility bands.

The impulse response functions of consumption and household income are depicted in Figure 3 (Figure A.1 in the appendix shows the full set of impulse response functions). The result of an income shock is as expected: a positive shock to income increases consumption. A positive shock to investment significantly increases household consumption as well. The effect lasts about 4 quarters, just a little shorter than the impact of the income shock. A positive shock to residential property prices, however, leads to a negative impulse in consumption. This result is similar to the findings from Koivu (2012) and may be driven by the need for households to save more in order to be able to afford housing as residential property prices go up. Hence, the wealth effect of increasing residential property prices seems to be inferior. This reflects the relatively small role that asset markets play in household income and consumption decisions at the aggregate level. Household consumption responds mildly in the positive direction to an interest rate shock. This is likely driven by two factors. First, borrowing for consumption in China remains relatively small and second, with a higher interest rate households may have to save less towards their targets (Nabar (2011)). Interestingly, household income is only weakly and insignificantly affected by an investment shock and the effect is rather short-lived.

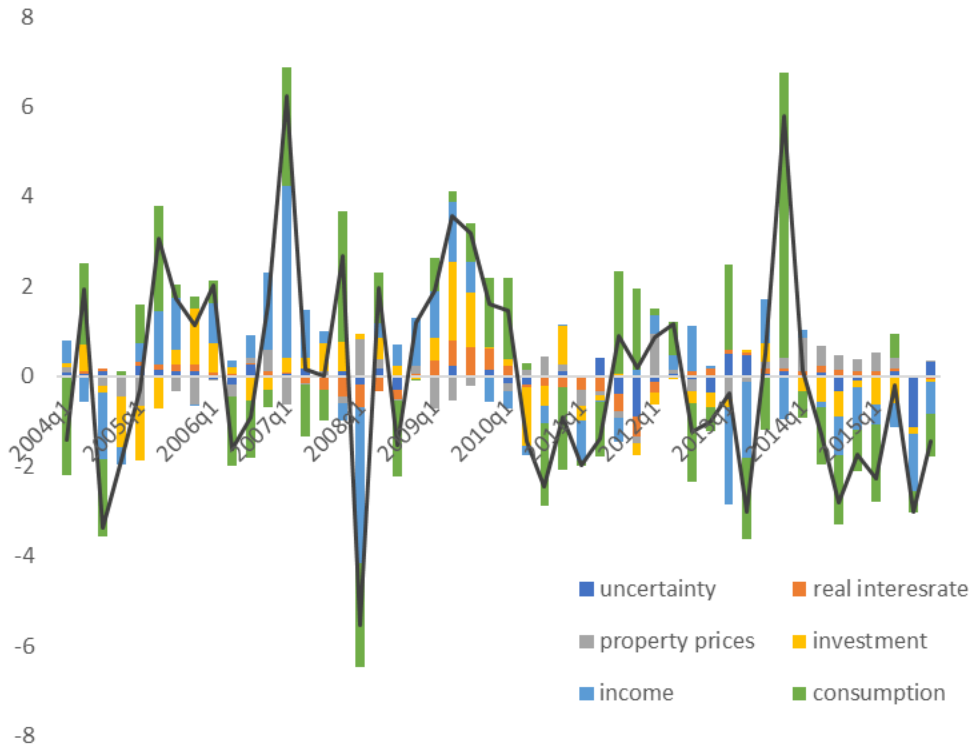

Figure 4: Historical decomposition (deviation from unconditional model forecast).

Historical shock decomposition (Figure 4) suggests that the impact of investment on

household consumption was especially strong during the immediate aftermath of the GFC in 2009 when China ramped up investment to counter the effects of the GFC. In the most recent period, household income accounts for most of the deviation of household consumption. At the same time, investment also plays an important role, while uncertainty, which spiked in 2015, also contributed significantly to deviation in household consumption.

We furthermore conduct a forecast error variance decomposition for household consumption growth. The results presented in Table 1 suggest that, apart from the residual shock, income played the biggest role in the forecast error of household consumption. However, investment is the second biggest contributor. This suggests that investment has had a non-negligible positive direct impact on household consumption. Furthermore, this relationship seems to be relatively stable over time.

Table 1: Household consumption forecast error variance decomposition

	Percent of h-Step Ahead Forecast Error Variance Explained by shock in:					
	(1)	(2)	(3)	(4)	(5)	(6)
	uncertainty	investment	income	property price	interest rate	residual
Horizon	shock	shock	shock	shock	shock	shock
1	.03	.07	.21	.02	.00	.61
2	.03	.06	.23	.02	.00	.59
3	.03	.06	.23	.03	.00	.59
4	.03	.07	.23	.03	.00	.58
8	.04	.07	.23	.03	.01	.57
∞	.04	.07	.23	.03	.01	.57

6 Results at the provincial level

To exploit variation across regions in China, we also use provincial-level data. Since quarterly data is not available, we use annual data to analyze the way investment interacts with consumption over a longer time horizon.

We estimate a dynamic panel regression with the same set of explanatory variables as at the national level covering the period from 1991 to 2015. However, as discussed in Section 4, we use FAI rather than GFCF in order to be able to estimate sectoral specific effects. We use investment in per capita terms to control for different demographic dynamics in the provinces. Investment, household consumption, and income are measured in log first differences. The interest rate is measured in percentage point changes and the uncertainty index in level changes.

We first conduct a fixed effect (FE) estimation. However, as Nickell (1981) showed, the FE estimator is inconsistent in dynamic models if the number of time periods is finite even if

the number of cross-sections goes to infinity. The estimator for the lagged variable is usually downward biased while in the standard OLS it is upwards biased due to the fixed effects. For dynamic panel data models with many cross-sections (large N), the difference GMM (Arellano and Bond (1991)) and system GMM (Arellano and Bover (1995); Blundell and Bond (1998)) are popular choices. Under appropriate assumptions, these GMM estimators are asymptotically unbiased as N goes to infinity and T is finite. The use of an instrument variable approach in these estimators often leads to poor small sample properties. Roodman (2009) shows that when T is large compared to N, many instruments are available. In our case with moderate number of both N and T the GMM estimator, which has become a standard approach to dynamic panel data, is not asymptotically unbiased and therefore may not be suitable. Hence, we consider another alternative: a bias-corrected Least Squares Dummy Variable (LSDVC) estimator (Kiviet (1995) and Kiviet (1999)). Due to the moderate number of cross-sections in our data ($N = 30$) and time-periods ($T = 25$ or less in some specifications), we use the LSDVC estimator for an unbalanced panel as proposed by Bruno (2005). The LSDVC estimator has been found to be appropriate for small T[1]. We use bias correction for small T and for small N up to order $O(N^{-1}T^{-1})$ and bootstrapped standard errors. The Anderson-Hsiao estimator is used for the initial consistent estimation of the error term.

Table 2 shows the results for the full sample. The results suggest that there is a significant and positive correlation between investment and household consumption, even after controlling for household income. While the coefficients of investment may be moderate compared to the coefficients of household income, they are not negligible. Interestingly, policy uncertainty also has a significant and negative coefficient, mostly in the LSDVC specifications. We also note that the housing price variable does not appear to have a significant effect on consumption in all specifications. When it is omitted, the coefficient of the interest rate becomes significant with a negative sign. As the property price is only available after 1994, omitting the price leads to a larger sample and, thus, to a larger R^2.

Splitting the sample into pre- and post-GFC periods (Table 3), the effects of investment

[1]Judson and Owen (1997) compare three groups of estimators for small N and finite T (small to moderate): (i) the Anderson and Hsiao (1982) estimator based on IV procedures; (ii) the one and two-step GMM by Arellano and Bond (1991); and (iii) the bias-corrected LSDV estimator by Kiviet (1995). They find that in general the one-step GMM outperforms the two-step GMM, but the LSDVC and Anderson-Hsiao estimators consistently outperform all other estimators. They find that the Anderson-Hsiao has a lower bias, but the LSDVC is more effective. Hence, there is a certain bias-effectiveness trade-off. They conclude that, for small T, the LSDVC estimator seems more appropriate while the Anderson-Hsiao estimator is more appropriate for larger T. A drawback of the LSDVC estimator as proposed by Kiviet (1995) is, that it cannot be applied to unbalanced panels. Bruno (2005) extends the version of Kiviets LSDVC to unbalanced panel data. De Vos et al. (2015) proposed a bootstrap-based bias corrected FE (BCFE) estimator which, however, imposes more restrictions.

Table 2: Regression results for the full sample

	(1)	(2)	(3)	(4)
Dependent variable:	All years	All years	All years	All years
Δ Household consumption	FE	FE	LSDVC	LSDVC
Δ Household consumption$_{t-1}$	-.1064***	-.1055***	-.0294	-.0408
	(.0296)	(.0307)	(.0353)	(.0368)
Δ Disposable income$_t$	.8933***	.8331***	.8873***	.8276***
	(.0685)	(.0539)	(.0602)	(.0506)
Δ Residential property price$_t$	.0118		.0111	
	(.0151)		(.0148)	
Δ Interest rate$_t$	-.0017	-.0019	-.0012	-.0019**
	(.0012)	(.0011)	(.0011)	(.0009)
Δ Investment$_t$	.0559***	.0543***	.0528***	.0514***
	(.0149)	(.0150)	(.0171)	(.0153)
Δ Policy uncertainty$_t$	-.00009	.00004	-.0002***	-.0002***
	(.00013)	(.00008)	(.00003)	(.00003)
Observations	485	583	485	583
Groups	30	30	30	30
Year dummies	yes	yes	yes	yes
R^2	0.598	0.746	0.598	0.746

All variables in real terms and log difference. Interest rate in percentage point changes; Policy uncertainty index change.
LSDVC estimator based on Bruno (2005). Stars indicate the significance level.

Table 3: Regression results for different time periods

	(1)	(2)	(3)	(4)
Dependent variable:	Pre-GFC	Pre-GFC	Post-GFC	Post-GFC
Δ Household consumption	LSDVC	LSDVC	LSDVC	LSDVC
Δ Household consumption$_{t-1}$	.0423	.0039	.3162***	.3105**
	(.0496)	(.0561)	(.1223)	(.1237)
Δ Disposable income$_t$	.8323***	.7680***	.9610***	.9600***
	(.0649)	(.0402)	(.0989)	(.0992)
Δ Residential property price$_t$	.0093		-.0017	
	(.0223)		(.0313)	
Δ Interest rate$_t$	-.0026	-.0027**	-.0002	-.0002
	(.0019)	(.0011)	(.0030)	(.0030)
Δ Investment$_t$	.0212	.0319	.0884***	.0891***
	(.0250)	(.0230)	(.0284)	(.0285)
Δ Policy uncertainty$_t$	-.0002	-.0001	-.0002***	-.0002***
	(.0002)	(.0001)	(.00006)	(.00006)
Observations	248	346	237	237
Groups	30	30	30	30
Year dummies	yes	yes	yes	yes
R^2	0.660	0.804	0.505	0.504

All variables in real terms and log difference. Interest rate in percentage point changes; Policy uncertainty index change.
LSDVC estimator based on Bruno (2005). Stars indicate the significance level.

on household consumption are only significant in the post-GFC period. The coefficient for household income also becomes larger in the post-GFC period. These results suggest stronger correlation between income and consumption as well as investment and consumption after the GFC. The interest rate only has a significant effect in the pre-GFC period, while policy uncertainty only has a significant effect in the post-GFC period. Overall, government policy, not just monetary policy, has become important in driving household consumption after the GFC. This is not a surprise as the Chinese government launched a large fiscal and credit stimulus after the GFC which boosted investment growth and overall GDP growth as well as several other reforms increasing political uncertainty.

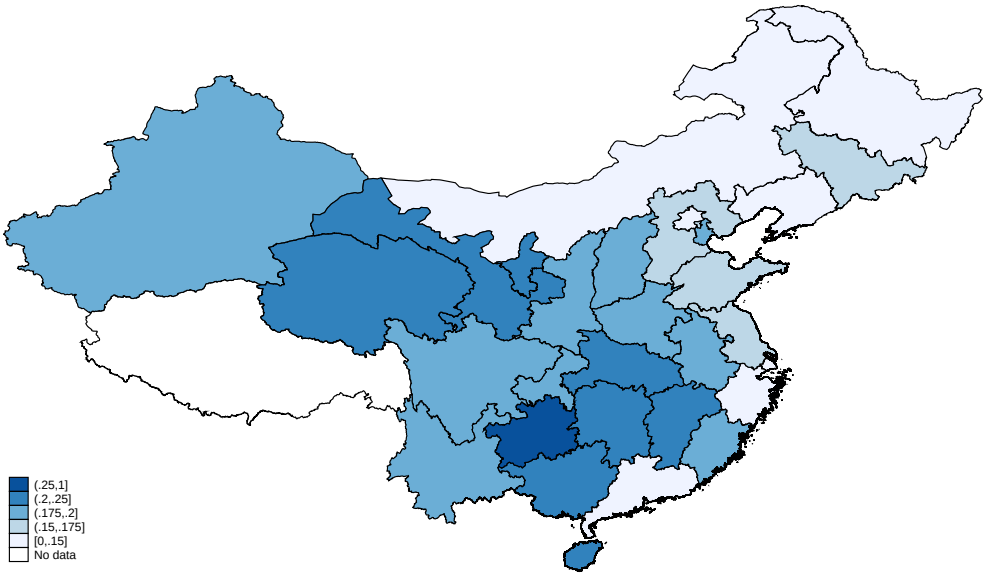

Figure 5: Average growth rates of FAI between 2008 and 2016. (Source: CEIC)

The Chinese provinces differ strongly from each other; Provinces with higher per capita income along the coast in the east, provinces with a large heavy industry in the north-east, metropolitan areas such as Shanghai and Beijing and less developed rural provinces in the west. Especially these rural provinces have been subject to investment projects in recent years under the "Go-West" policy of the government. The regional dispersion if investment among the provinces can be seen in Figure 5, which shows the average growth rates of FAI between 2008 and 2016.

When the sample is split into less-developed regions and all other regions (including the developed coastal regions as well as the industrial north-east and metropolitan areas), the results in Table 4 show that there is a positive significant correlation between investment and household consumption for both regions with the coefficient in the other regions being slightly higher and more significant. This contradicts the results of Lee et al. (2013) who

find the opposite result. The coefficient of household income is similar across the regions. Interest rates seem to be significant only in less developed regions.

Table 4: Regression results for different regions

	(1)	(2)
Dependent variable:	Less developed	Others
Δ Household consumption	LSDVC	LSDVC
Δ Household consumption$_{t-1}$	.0532	-.0497
	(.0591)	(.0581)
Δ Disposable income$_t$	.8224***	.8574***
	(.0522)	(.0653)
Δ Residential property price$_t$		
Δ Interest rate$_t$	-.0025*	-.0018
	(.0013)	(.0016)
Δ Investment$_t$	.0399*	.0575***
	(.0229)	(.0212)
Δ Policy uncertainty$_t$	-.00007**	-.0003***
	(.000003)	(.00005)
Observations	335	248
Groups	17	13
Year dummies	yes	yes
R^2	.771	.758

All variables in real terms and log difference. Interest rate in percentage point changes; Policy uncertainty index change.
LSDVC estimator based on Bruno (2005). Stars indicate the significance level.

To exploit the effects of different investment channels, we replace overall investment with fixed asset investment of different types of industries. In particular we group five categories of fixed asset investment: manufacturing, construction, real estate, infrastructure (including transportation, information transmission, utilities, and resident services), and other investment. Due to multicollinearity concerns we first estimate the investment channels separately. The results (Table 5) show that manufacturing, real estate as well as infrastructure investment have significant and positive effects on household consumption, with larger coefficients for real estate and infrastructure than the one for manufacturing.

These results suggest that investment has a significant impact on household consumption beyond the household income channel. This effect has become stronger after the GFC with real estate and infrastructure having the strongest and most significant impact on household consumption. While the availability of sectoral FAI data (only available starting 2004) makes it difficult to compare sectoral investment effects on consumption in the pre- and post-GFC period, the last set of regressions are mostly influenced by the post-GFC period. Overall, the results therefore suggest that the great stimulus package introduced after the GFC had a significant and positive impact on household consumption.

Table 5: Regression results for different investment channels

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	All years	All years	All years	All years	All years	All years
Δ Household consumption	LSDVC	LSDVC	LSDVC	LSDVC	LSDVC	LSDVC
Δ Household consumption$_{t-1}$	.1262*	.1243*	.1175*	.1081*	.1249*	.1016
	(.0667)	(.0671)	(.0646)	(.0639)	(.0662)	(.0640)
Δ Disposable income$_t$	1.0026***	1.0088***	1.0119***	.9998***	1.0063***	1.0055***
	(.0676)	(.0666)	(.0664)	(.0670)	(.0645)	(.0644)
Δ Residential property price$_t$	.0235	.0252	.0260	.0217	.0272	.0194
	(.0233)	(.0238)	(.0232)	(.0237)	(.0235)	(.0232)
Δ Interest rate$_t$	.0007	.0004	.0004*	.0001	.0004	.0004
	(.0019)	(.0019)	(.0018)	(.0019)	(.0019)	(.0019)
Δ Investment manufacturing$_t$	.0184*					0.0118
	(.0109)					(.0119)
Δ Investment construction$_t$		.0009				.0003
		(.0024)				(.0025)
Δ Investment real estate$_t$			.0398***			.0343**
			(.0146)			(.0153)
Δ Investment infrastructure$_t$				.0275**		.0213
				(.0138)		(.0148)
Δ Investment other$_t$					.0077	-.0091
					(.0119)	(.0135)
Δ Policy uncertainty$_t$	-.0002***	-.0002***	-.0002***	-.0002***	-.0002***	-.0002***
	(.000003)	(.000003)	(.000003)	(.00003)	(.000003)	(.00003)
Observations	328	328	328	328	328	328
Groups	30	30	30	30	30	30
Year dummies	yes	yes	yes	yes	yes	yes
R^2	.519	.518	.528	.524	.518	.532

All variables in real terms and log difference. Interest rate in percentage point changes; Policy uncertainty index change. LSDVC estimator based on Bruno (2005). Stars indicate the significance level.

The results so far indicate correlations rather than causality. In order to exclude reverse causality, we conduct a Granger causality test adapted to a panel framework as proposed by Dumitrescu and Hurlin (2012). In general, Granger causality tests check whether the lags of the explanatory variable contain further information which is important for the current value of the dependent variable, conditional on its own lags. We use log-first-differences for all variables. The optimal number of lags is derived from the Akaike information criterion in the full sample from 1991 to 2015. The optimal number of lags found for the whole sample is also used for the according subsamples, as the results might be influenced by the number of lags and it would not be quite clear whether the different results come from the adaption of the number of lags or from a structural change in the Granger causality. We allowed for a maximum number of four lags as four lags represent about half of a business cycle. Due to the rather small samples and the economic interpretation, a higher number of lags seems to be unreasonable. The Granger causality test adapted to a panel framework as proposed by Dumitrescu and Hurlin (2012) takes heterogeneity between cross-section units into account

allowing coefficients to differ. The following linear model is considered:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \epsilon_{i,t}$$

where the individual effects α_i are supposed to be time-invariant, and the lag orders K to be identical for all cross-section units of the balanced panel. The coefficients $\gamma_i^{(k)}$ and $\beta_i^{(k)}$ are allowed to differ across groups but are constant in time. The Granger causality test tests the Homogeneous Non-Causality hypothesis where the null hypothesis is defined as:

$$H_0 : \beta_i = 0 \qquad \forall i = 1, ..., N$$

which means, that x does not Granger-cause y.

Table 6: Granger causality test on the provincial level p-values

H_0: Non causality						
Specification	All	Metro	Coast	Ind. NE	Less dev.	lags
Investment on consumption	.0000***	.2484	.1985	.7943	.0000***	4
Consumption on investment	.1603	.2617	.0395**	.5828	.1086	4
Investment on income	.0000***	.0001***	.1945	.0000***	.0000***	4
Income on investment	.0020***	.0563*	.0039***	.4900	.1435	4

Number of lags determined by AIC in full sample. Data in per capita real terms and in log first differences from 1991-2015. Stars indicate the significance level.
Metro: Beijing, Tianjin, Shanghai. Coast: Guangdong, Fujian, Jiangsu, Zhezhiang.
Industrial NE: Liaoning, Jilin, Heilongjiang, Hebei, Shandong.

The test results (Table 6) suggest that we can reject the null hypothesis of no causality from investment to consumption for all provinces and for less developed provinces. This seems to confirm Lee et al. (2013) that in less developed areas, consumption is reliant on investment. At the same time, we find that we cannot reject the null hypothesis of no causality from investment to household income for coastal provinces which seems to contradict the results of Lee et al. (2013), that investment in coastal provinces leads to higher household income which helps to drive consumption in a more sustainable manner, who use a different provincial grouping and GFCF instead of FAI. We cannot, however, reject the null hypothesis that consumption does not Granger-cause investment. Overall, the empirical evidence suggests that the causality in the panel regression tends to go from investment to consumption.

7 Investment, income expectations, and consumer confidence

The results that the effects are stronger for more salient investment suggest that investment in China may be a good leading indicator for expected future household income and, thus, affect consumption through consumer confidence (see Figure 6). Under the general permanent income hypothesis, household consumption should only react to unexpected changes in permanent income. If, however, households are liquidity constrained, as it is likely to be the case in China, consumer confidence could be related to consumption growth (Ludvigson (2004)).

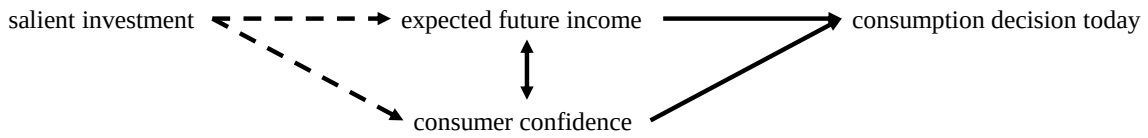

Figure 6: Schematic representation of the possible channel of an effect of salient investment on household consumption. Solid lines represent relationships found in the literature, dashed lines a possible explanation for the effect of investment on consumption.

There is evidence that household income expectation is an important factor in determining household consumption in other countries such as the US (Pounder Demarco (2009)) or advanced economies (Estrada et al. (2015)).

The effect of consumer confidence on consumer spending has been extensively examined mostly for developed economies. Ludvigson (2004) indeed finds for the US that consumer confidence has a significant predictive power for consumption spending. Moreover, evidence suggests that consumer confidence reflects households' expectations about future income since consumer confidence has some predictive power for future labor income. Dees and Brinca (2013) find that in the US and the Euro area confidence indicators can be a good predictor for household consumption especially when there are large changes in these indicators. Dion (2006) discusses various aspects in the relationship between consumer confidence and consumption.

Since emerging economies are even more liquidity constrained than developed economies, the effect should be even stronger for emerging economies from a permanent income hypothesis view. There is, however, less empirical reasearch on this relationship in emerging

markets, mostly due to data availability. Fan and Wong (1998) examine the relationship between consumer sentiment and household spending in Hong Kong and find little explanatory power of consumer sentiment. This is due to the fact that consumer sentiment rather measures well-being than expected future income.

The determinants of consumer confidence or income expectations have received less attention in the literature. Lopez and Durre (2003) examine standard drivers of consumer confidence for the US and Belgium, such as unemployment and wages, as well as the role of stock market returns. Celik et al. (2010) examine drivers for emerging markets and propose two important drivers: production and financial markets. If salient investment was a driver of consumer confidence, there should be a positive correlation between investment growth today and consumers expectations about the future. Heim (2010) indeed finds a positive relationship between investment spending and consumer confidence in the US. Using a measure of consumer confidence with respect to expectations about the future in China in order to confirm our hypothesis seems straightforward. The National Bureau of Statistics of China publishes a consumer confidence index which is, however, remarkably stable over the whole time horizon and, hence, regarded as unreliable. Another measure, which seems to capture consumer confidence better, is the confidence indicator by Union Pay, a private credit card company. This series is, however, only available after 2010 and does not include the time of the great stimulus. Therefore, there exists no good measure to test this hypothesis and we have to remain with our proposition that investment in China might act as proxy for future household income which in turn influences the decision to consume today based on our empirical findings in the previous sections. This leaves room for future research about the drivers of consumer confidence in China once reliable statistics are available.

8 Conclusion

Investment propelled the Chinese economy in the aftermath of the GFC as the Chinese authorities introduced a large stimulus to mitigate the effects from the GFC. This sent the already high investment-to-GDP ratio to unprecedented level. The inevitable rebalancing towards consumption has been on China's agenda during the last years. More recently, consumption has become more important in driving growth as investment started to slow down. Lower investment could have an impact on consumption beyond the standard channel through household income. This paper attempts to explain the drivers of Chinese household consumption and to address how an expected investment slowdown could have an impact on household consumption. We use both national-level (BVAR) and provincial-level data (panel regression) to empirically answer this question. Our empirical results from both

the national- and provincial-level data suggest that investment has had significant impact on household consumption beyond the household income channel. The effects are especially strong in the post-GFC period and for more salient investment, indicating the extent that the stimulus has affected households' decision to consume. The results suggest that investment in China may be a good leading indicator for future household income. The rebalancing from investment driven growth towards consumption driven growth is very important considering the very high investment to GDP ratio and the very high credit to GDP ratio. A further increase in investment might have adverse effects for the financial stability of the corporate sector. However, policy to encourage rebalancing away from investment should consider the extra effect it may have on consumption beyond the impact on household income and foster household consumption via increasing consumer confidence by improving the social safety net which in turn would decrease the high savings rate and increase consumption expenditure.

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A Appendix

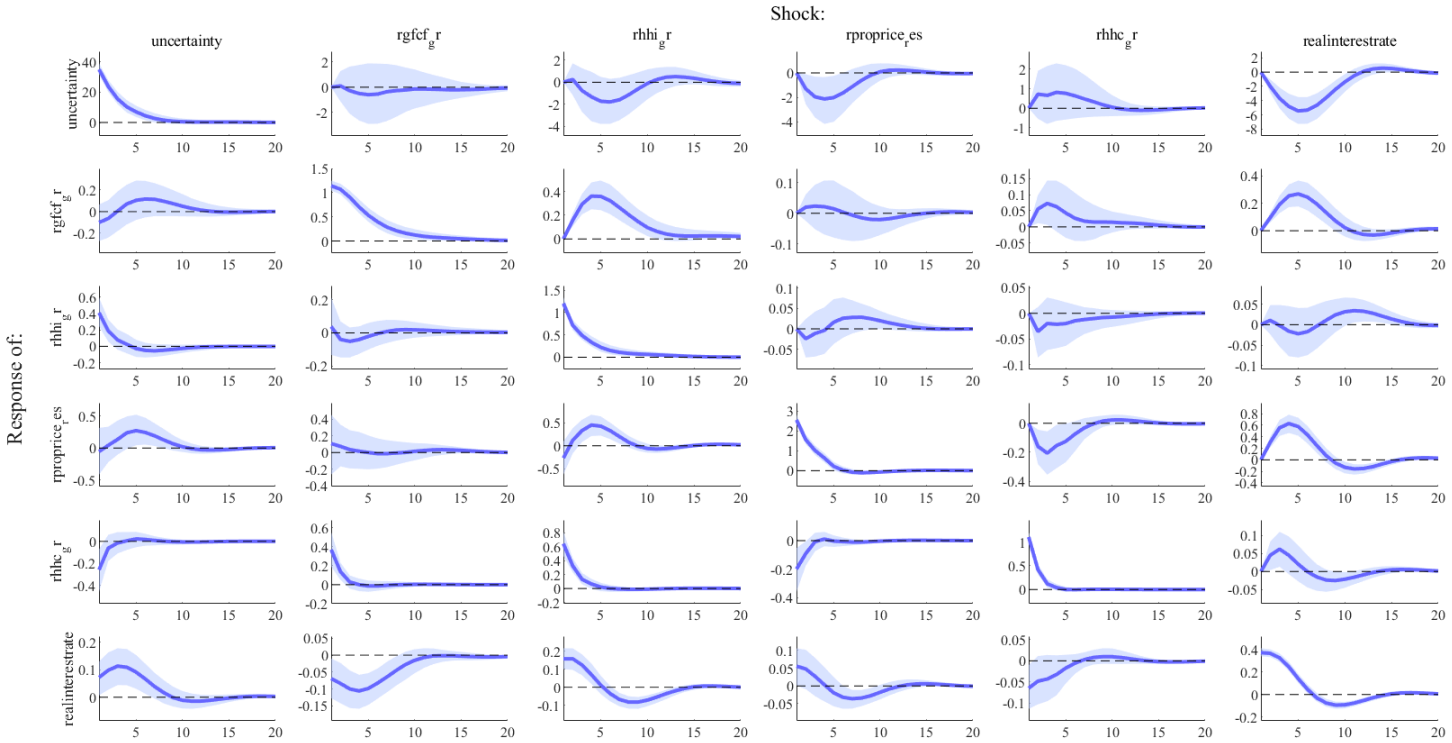

Figure A.1: Full set of impulse response functions to a one-standard-deviation shock. Dotted lines represent one-standard-deviation credibility bands.