The Effectiveness of Monetary Policy in China: Evidence from a Qual VAR

Hongyi Chen[1]   Kenneth Chow[1]   Peter Tillmann[2]

[1]Hong Kong Institute for Monetary Research

[2]University of Giessen, Germany

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Motivation

- Understanding Chinese monetary policy becomes increasingly more important.
- At the same time, the policy framework is not straightforward to model using conventional models.
- The PBoC uses more than one instrument to implement policy:
  - Makes standard VARs not suitable.
  - Difficult to quantify the effect of the overall policy stance.
- Here we propose a Qual VAR to model Chinese monetary policy:
  - A latent variable filtered out of the data summarizes the policy stance.
  - The model retains the usefulness of standard monetary policy VARs.

- We use Dueker's (2005) Qual VAR: Include binary information on policy announcements in an otherwise standard VAR.

- The binary policy announcements are interpreted as realizations of a latent, unobservable pressure for policy tightening or easing, respectively.

- Advantages:
    1. Handles the multitude of different instruments: RRR, lending rates, deposit rates, ...
    2. Acknowledges the endogenous nature of policy steps by allowing for a feedback of the business cycle on policy.
    3. Identifies the shock component of policy using sign restrictions.

Literature

- Two recent papers are particularly related to what we do.
    1. He and Pauwels (2008):
        - Code tightening/easing actions implemented by different instruments as a -1/ 0/ +1 series.
        - Estimate a discrete choice model.
        - Show that the reaction function of the PBoC is a function of the inflation and money gap, but not the output gap.
    2. Fernald, Spiegel and Swanson (2014):
        - Estimate a Factor-augmented VAR model in order to handle concerns about data quality and structural change.
        - A shock to RRR or policy-determined interest rates is transmitted in a way that is similar to advanced economies.

The Qual VAR

- Suppose we observe a binary dependent variable, $y_t \in \{0, 1\}$, driven by a continuous latent variable y^*

$$y_t = \left\{ \begin{array}{ll} 0 & \text{if } y_t^* \leq 0 \\ 1 & \text{if } y_t^* > 0 \end{array} \right. \tag{1}$$

- A Qual VAR puts an equation that relates the latent variable to observables into a VAR system.
- A Qual VAR with k variables and p lags can be written as

$$\Phi(L)\mathbf{Y}_t = \mu + \varepsilon_t \tag{2}$$

where

$$\mathbf{Y}_t = \left(\begin{array}{c} \mathbf{X}_t \\ y_t^* \end{array} \right) \tag{3}$$

consists of macroeconomic data, $\mathbf{X}_t$, and the latent variable, y_t^*.
- The latent variable is estimated using MCMC techniques.

- Dueker (2005) shows that Gibbs sampling enables the joint estimation of the VAR coefficients, Φ, the covariance matrix of the VAR residuals, Σ, and the latent variable, y_t^*.
- Distributional assumptions:
    1. The VAR coefficients, Φ, are normally distributed with the mean and the variance given by the OLS estimates.
    2. For the covariance matrix, Σ, an inverted Wishart distribution is assumed.
    3. The latent variable, y^*, that is required to be positive whenever y_t is equal to one, is said to follow a truncated normal distribution.
- We do 10,000 draws, from which the first 2,000 are discarded.

Data

- We estimate the Qual VAR on monthly data from 1999:01 to 2015:07.
- The following y-o-y growth rates are included in $\mathbf{X}_t$:
    1. industrial production.
    2. CPI.
    3. real consumption
    4. stock prices.
- Alternatively, we include the y-o-y growth of
    1. loans to non-financials.
    2. house prices.
- Most growth rates exhibit a low-frequency trend. We believe this reflects structural developments and detrend the variables with a three-year moving average.

- We model tightening and easing steps in separate models, a *tightening model* and an *easing model.*

$$y_{t,i} = \begin{cases} 0 & \text{if } y_{t,i}^* \leq 0 \\ 1 & \text{if } y_{t,i}^* > 0 \end{cases} \quad \text{for } i \in \{tight, \ ease\}$$

- The two alternative variables should be interpreted as reflecting tightening and easing pressure relative to a neutral stance.

- Separate tightening and easing estimates shed light on asymmetry of policy transmission.

date	RRR	Lending Rate	Dep. Rate	date	RRR	Lending Rate	Dep. Rate
2003/09	+1.00			2008/01	+0.50		
2004/04	+0.50			2008/03	+0.50		
2004/10		+0.37	+0.27	2008/04	+0.50		
2006/04		+0.27		2008/05	+0.50		
2006/07	+0.50			2008/06	+1.00		
2006/08	+0.50	+0.27	+0.27	2010/01	+0.50		
2006/11	+0.50			2010/02	+0.50		
2007/01	+0.50			2010/05	+0.50		
2007/02	+0.50			2010/10		+0.25	+0.25
2007/03		+0.27	+0.27	2010/11	+1.00		
2007/04	+0.50			2010/12	+0.50	+0.25	+0.25
2007/05	+0.50	+0.18	+0.27	2011/01	+0.50		
2007/06	+0.50			2011/02	+0.50	+0.25	+0.25
2007/07		+0.27	+0.27	2011/03	+0.50		
2007/08	+0.50	+0.18	+0.27	2011/04	+0.50	+0.25	+0.25
2007/09	+0.50	+0.27	+0.27	2011/05	+0.50		
2007/10	+0.50			2011/06	+0.50		
2007/11	+0.50			2011/07		+0.25	+0.25
2007/12	+1.00	+0.18	+0.27				

Tightening steps of the PBoC

date	RRR	Lending Rate	Dep. Rate	date	RRR	Lending Rate	Dep. Rate
1999/06		-0.54	-1.53	2012/05	-0.50		
1999/11	-2.00			2012/06		-0.25	-0.25
2002/02		-0.54	-0.27	2012/07		-0.31	-0.25
2008/09	-0.25	-0.27		2014/11		-0.40	-0.25
2008/10	-0.50	-0.54	-0.54	2015/02	-0.50		
2008/11		-1.08	-1.08	2015/03		-0.25	-0.25
2008/12	-1.75	-0.27	-0.27	2015/04	-1.00		
2011/12	-0.50			2015/05		-0.25	-0.25
2012/02	-0.50			2015/06		-0.25	-0.25

Easing steps of the PBoC

Identification

- To identify a monetary policy shock, we impose sign restrictions following Uhlig (2005).

model	latent variables	ΔIP	ΔCPI	$\Delta Cons$	$\Delta StockP$
tightening	+	-	-		unrestricted
easing	+	+	+		unrestricted

- The restrictions are imposed for $t = 1,...4$.
- We also report Fry-Pagan median-target responses.

Results
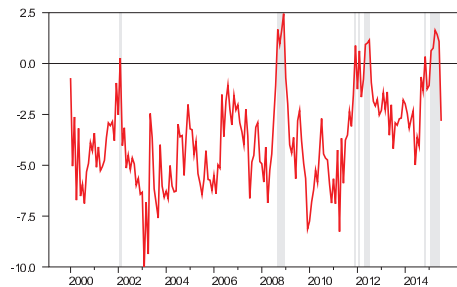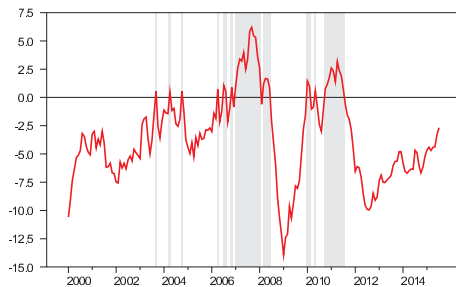
Latent tightening (left) and easing (right) pressure for the baseline model
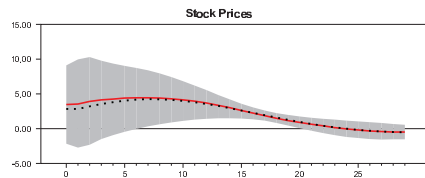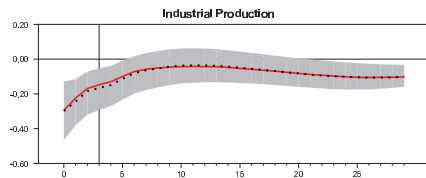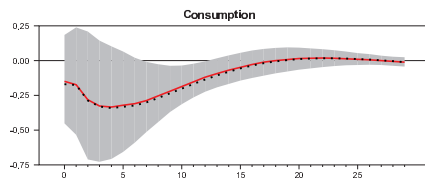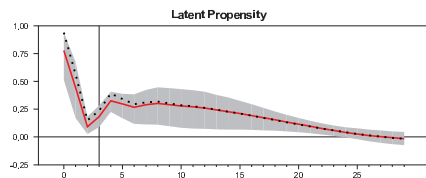
Response to PBoC tightening in the baseline model
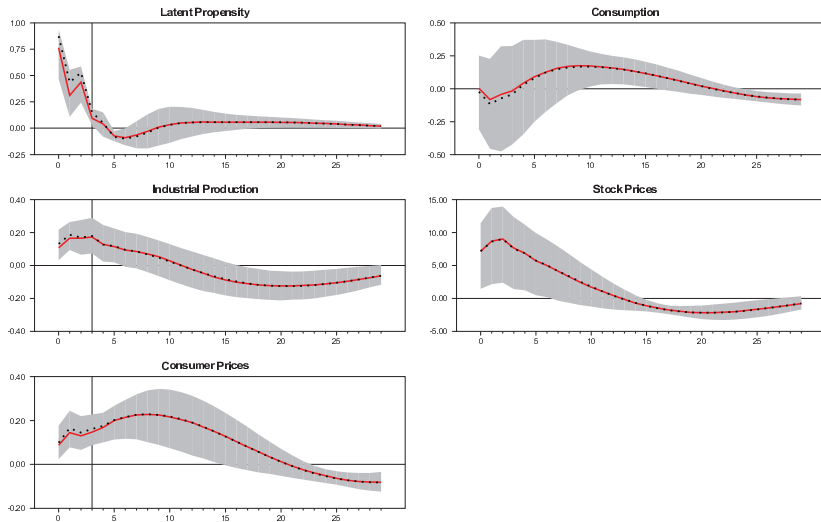
Response to PBoC easing in the baseline model
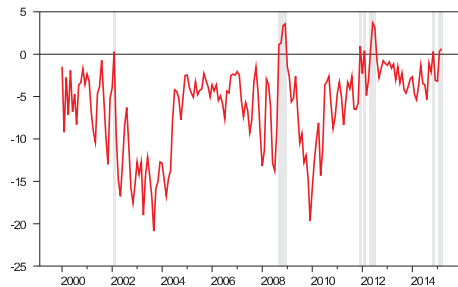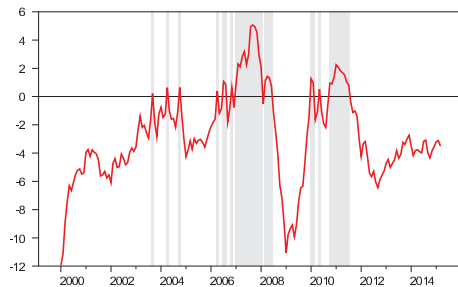
Latent tightening (left) and easing (right) pressure for the model with loans
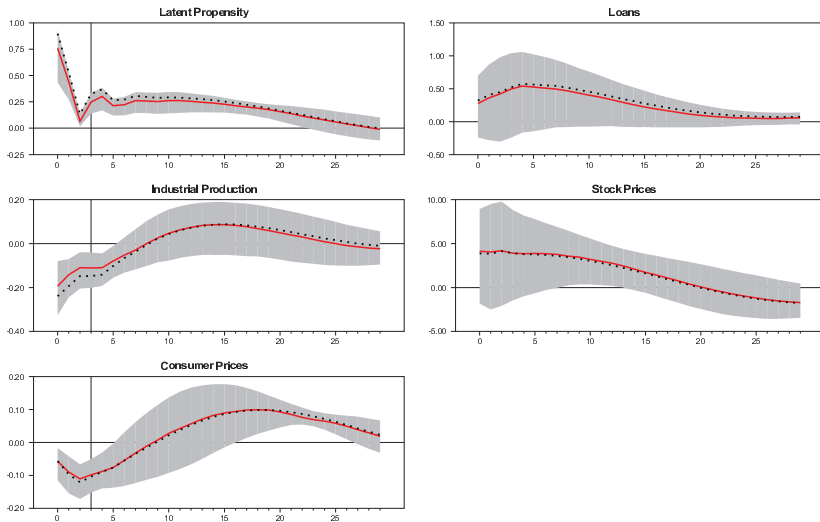
Response to PBoC tightening in the model with loans and stock prices
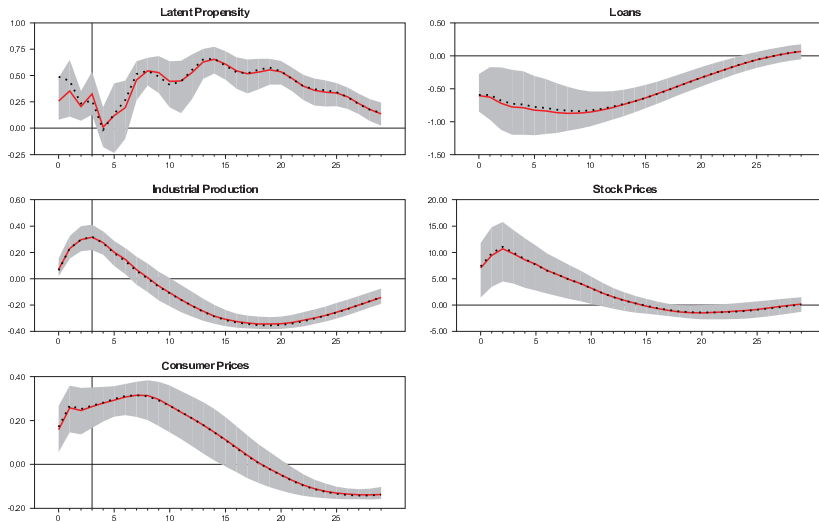
Response to PBoC easing in the model with loans and stock prices
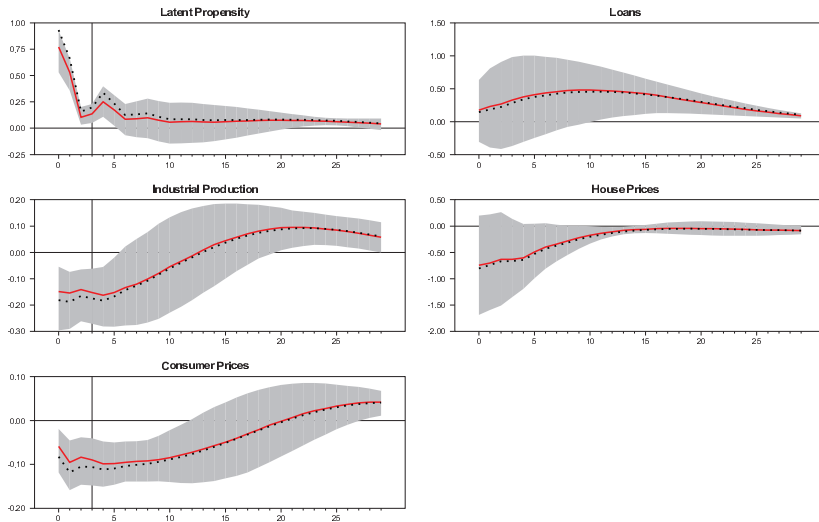
Response to PBoC tightening in the model with loans and house prices
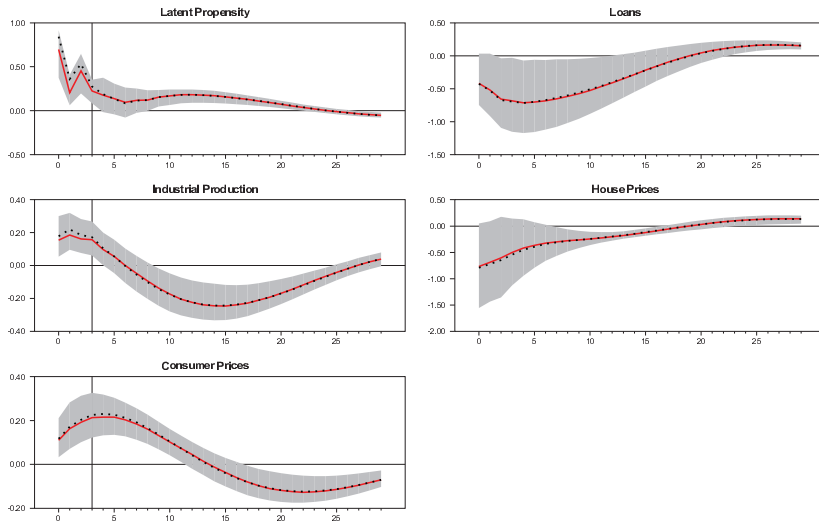
Response to PBoC easing in the model with loans and house prices

A Conventional VAR

- How large is a one-standard deviation shock in the latent variable?
- For comparative purposes, we transform the Qual VAR into a VAR with RRR as the policy instrument.
- All other aspects (restrictions, variables, sample, ...) remain unchanged.
- When scaled by the response of ΔIP we find that a latent easing shock is equivalent to a 0.20pp cut in RRR.
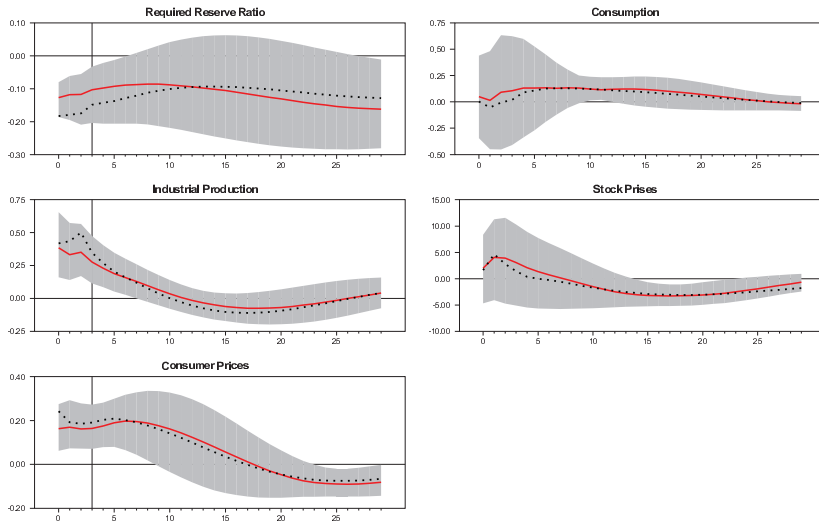
Shock to Required Reserve Ratio in conventional VAR

Robustness

- Concerns about the quality of Chinese macro data.

- Famously, Li Keqiang, then party secretary in the Liaoning province, suggested measuring real activity using electricity consumption, new bank loans and cargo freight volume.

- We construct a pseudo Li-Keqiang-index from electricity and freight volume (normalized series, average of electricity and freight, in y-o-y growth rates).

- The baseline results remain unchanged. Again, we find a strong effect on real activity.
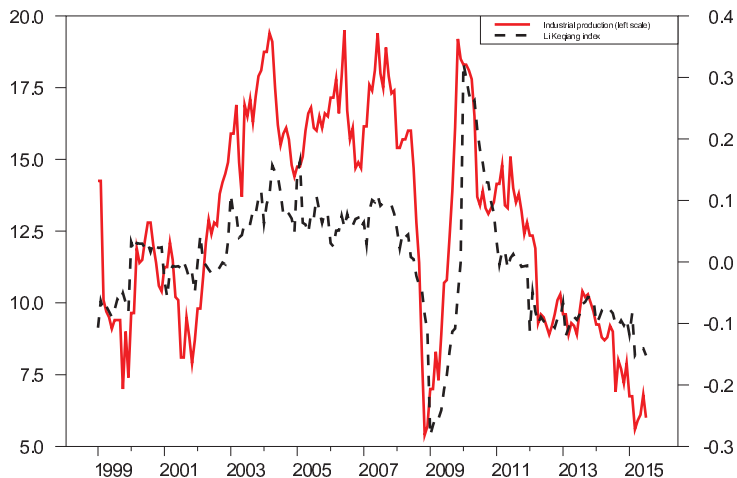
Growth of industrial production and pseudo Li-Kequiang-index
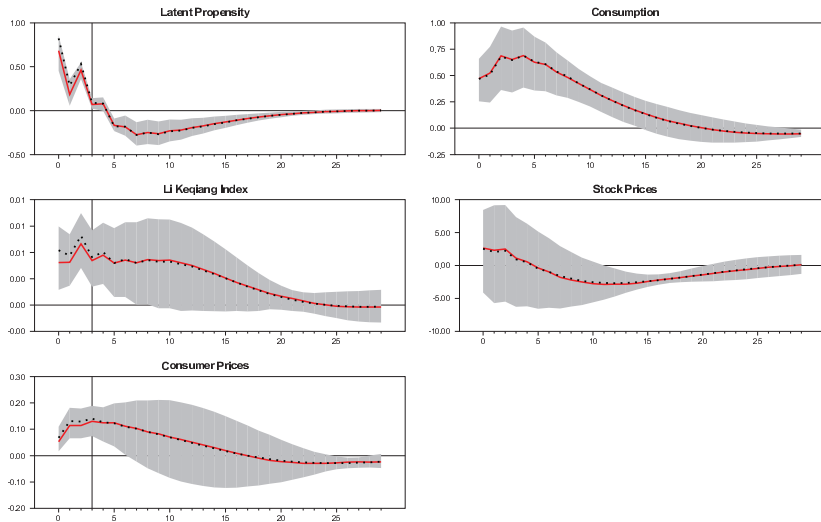
Response to PBoC easing in the model with Li Keqiang index of economic activity

- An experiment: Is the monetary transmission different between state-owned and shareholder-owned firms?

- We substitute industrial production by the change in value added by these two firm types.

- The transmission of policy shocks is indeed highly different: after a tightening state-owned firms suffer less, after an easing they benefit more.

- Certainly an interesting topic for a separate paper.
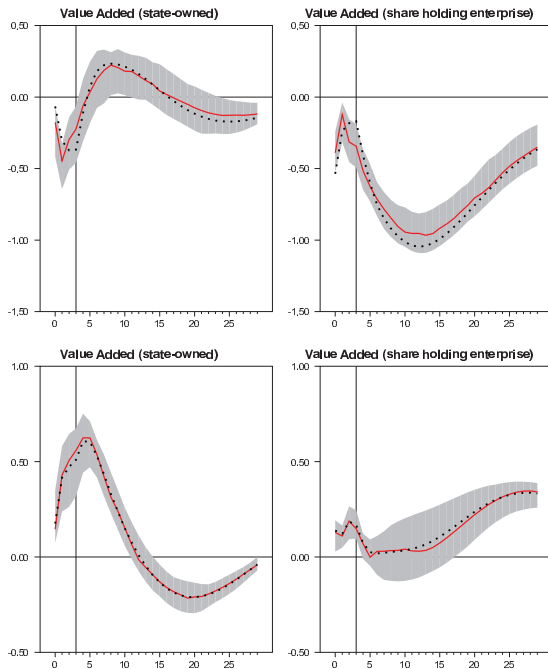
Conclusions

- We proposed a Qual VAR to model Chinese monetary policy:
  - Summarizes the policy stance by a latent variable.
  - Allows policy to be analyzed in a VAR framework - with all the advantages of a VAR over alternative models, e.g. focuses on unexpected shocks, facilitates a comparison with advanced countries' policy framework, ...
  - Sheds light on the asymmetry of the transmission process.
- Main findings:
  1. The monetary transmission to output and inflation is similar to Western economies - despite less developed financial system and weak institutions.
  2. A monetary tightening lacks grip on asset prices - which raises financial stability concerns.

Additional slides
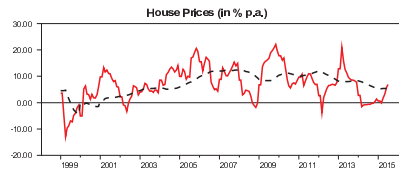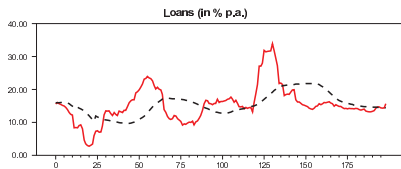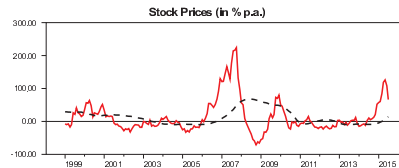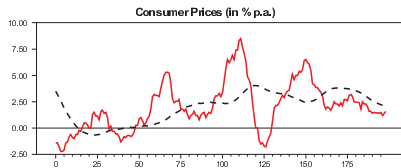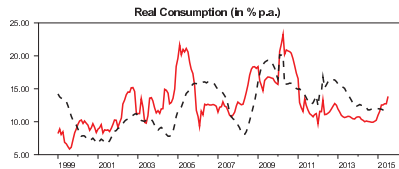
Growth rates (red) and three-year moving average (dotted)

Financial Times, September 29 2015