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From the General to the Specific—Modelling Inflation in China

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Abstract

This article uses automatic model selection procedures, based on the general-to-specific approach, to investigate inflation in China. A novelty of this article is the use of a technique called impulse indicator saturation which allows us to uncover instabilities and to specify a very general model and select down to a more specific model that best explains inflation in China. By and large, our findings suggest that China has been able to insulate itself against shocks from the US, although (maybe surprisingly) monetary growth in Europe seems to have an effect. Nonetheless, the main factors impacting Chinese inflation appear to be domestic, namely GDP growth and money growth.

Keywords: Chinese inflation, dollar peg, automatic model selection procedure

JEL Classification: C32, E52, F33

1. Introduction

Modelling and attempting to understand the determinants of inflation has a rich heritage, going back to the works of Phillips (1958) in the immediate post-war era, Friedman (1977), and to more recent attempts by Engle (1982) and Hendry (2001) amongst many others.

In recent times, China has emerged as perhaps the most interesting and absorbing case-study for economists, as it mixes both much of the command economy with a rapidly developing market economy. Naturally this has consequences and the outcomes observed can often be a confusing mix of the expected and the unexpected. In particular, it has long operated a fixed exchange rate system of slightly different variants against the US dollar. This yielded, common understanding suggests, a de-

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flationary initial period, as one would anticipate for a junior partner in a fixed exchange rate system, which is trying to import macroeconomic stability through a policy of tying its hands. Yet it is also argued that more recently the experience has been turned on its head, with China experiencing instability due to its exchange rate system.

In this article, we attempt to understand the determinants of inflation, and hence shed some light on how China's economy has functioned, and also understand the role, if any, that the exchange rate has played in this. A novelty of this article is the use of a technique called impulse indicator saturation, which will be explained in the empirical section. Impulse indicator saturation allows us to consider whether there have been changes regarding the exchange rate regime and the stability it has created.

The remainder of this article is structured as follows. Section 2 briefly reviews the literature that tries to model Chinese inflation, Section 3 details our empirical method, Section 4 displays the results of it and discusses their interpretation, before Section 5 concludes.

2. Literature Review

As mentioned in the introduction, inflation modelling has a rich heritage, perhaps most notably the attempts by Phillips and Friedman. In the context of China, a number of studies have attempted to understand its dynamics over recent years.

Ha et al (2003) consider Phillips and New Phillips curve estimations of the determinants of inflation in mainland China, and find that the New Phillips curve, which takes into account marginal costs and avoids the need to estimate the output gap, fits the data better. Scheibe and Vines (2005) also attempt to fit a Phillips curve for China over a similar sample period (1988–2002), attempting to accommodate structural change via a range of methods. Funke (2006) attempts to estimate a New Keynesian Phillips Curve but only uses annual data over the period 1982–2002, and hence is very restricted in his degrees of freedom. Zhang and Clovis (2009) are more concerned with inflation persistence, but make use of recently developed methods to uncover structural change, while Mehrotra et al. (2010) break down inflation modelling to the provincial level.

All these papers cover angles of significant interest; we naturally attempt to build upon them. We firstly update their analyses to the present day, allowing us to examine what effects have been noted since the global financial crisis, and as decoupling arguably takes greater shape. Secondly, we step back from the rigid Phillips curve estimations presented in all the above papers, with the exception of Scheibe and Vines (2005), reasoning that we wish to examine all potential determinants of inflation over and above the standard determinants contained within the Phillips Curve framework. Third, like a number of these papers but most notably Scheibe and Vines (2005) and Zhang and Clovis (2009), we take structural change seriously; we use a technique called *impulse indicator saturation*, to be introduced in Section 3, to uncover instabilities, as well as conventional recursive methods.

Hendry (2001) uses this *general-to-specific* approach to consider UK inflation over a very long time horizon, from 1875 to 1991. He models inflation as being not just caused by excess demand for goods, services and factors of production, but also money, financial assets, foreign exchange and government deficits. Castle et al. (2010) use *impulse indicator saturation* to investigate forward-looking variables in the New Keynesian Phillips Curve framework, as do Russell et al. (2010), finding that taking into account structural breaks removes the significance of forward-looking terms in these equations. As data on inflation expectations in China is of even shorter samples (and more questionable reliability) than that in the Western economies that do produce such data, in this paper we instead rely on *impulse indicator saturation* to incorporate any forward lookingness in inflation.

3. Econometric Methodology

We employ a *general-to-specific* modelling strategy in this paper. This strategy is perhaps most thoroughly espoused in Hendry (1995) and Campos et al. (2005), and involves using all available economic theory, and previous empirical investigations to form an initial set of variables that are anticipated to cause the object of interest, which for us is Chinese inflation. Over the years the applications of this strategy have been growing; for some prominent examples, see Davidson et al. (1978), Hendry (2001), Owen and Weatherston (2004), and Bauwens and Sucarrat (2008) amongst others. The approach has been automated into computer software via *PcGets* (Hendry and Krolzig, 2001) (available in the traditional GiveWin software package), and offers a more powerful alternative to other model selection methods such as stepwise regression (see for example Hoover and Perez, 1999). The initial model can be very large, and if potential dummy variables for institutional changes, structural breaks and other un-modellable-by-standard-means phenomena are included, often the number of variables can easily exceed the number of observations. This has traditionally been a very tricky problem for empirical modellers to circumvent, yet recent developments in the *general-to-specific* method have allowed practitioners to specify more variables than observations; the computer software package, *Autometrics* (available also within *OxMetrics*), has automated this (Doornik, 2009). The procedure for more variables than observations involves block-searching where overlapping subsets of the full list of candidate explanatory variables are used as regressors, allowing inference to be gained on their potential explanatory power. This block searching is employed to ensure that irrelevant variables are omitted with the expected size and power (set by the practitioner, traditionally at 5% but the recommendation now is $100/T\%$, where T is the sample size), ensuring that the investigator is provided with the model that best explains his or her object of interest out of the potentially huge number of variables suspected of being important.

Even if the practitioner should not specify more variables than observations, another aspect of *Autometrics* may well lead to such a situation occurring. *Indicator impulse saturation* is a method for detecting outliers and structural breaks in econometric models; it works by, as the name suggests, saturating the model with indicator impulses, or dummy variables, for all observations. Naturally, because of the already-discussed problem of observations and variables, these dummies must be entered in individual blocks; those dummies selected in the individual blocks are then entered into a *union* model, from which only the significant dummies in the *union* model are retained in the finally selected model. For more on the method and its statistical properties, see Hendry et al. (2008) and Johansen and Nielsen (2008), and for applications see Castle et al. (2008) (multiple structural breaks) and Ericsson (2011) (testing the appropriateness of data aggregation). Both potential uses are very applicable to our object of interest, Chinese inflation. Ha et al. (2003) consider foreign price levels as an explanatory variable, yet it may be that the method by which the constituent parts of the foreign price index is constructed is not optimal for the purpose of the study. Instead, all the individual price series could be included in a model, and Autometrics allowed to select between them, determining the most important.

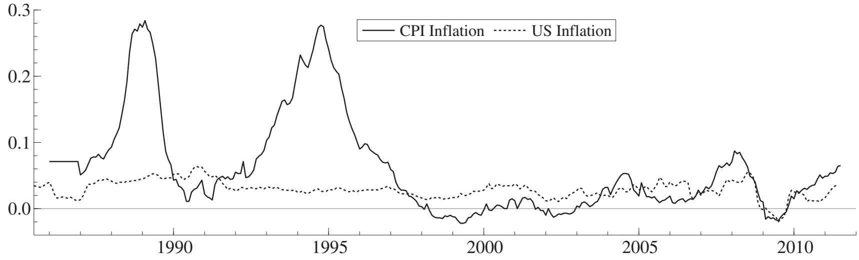
Modelling Chinese data throws up numerous difficulties, not least related to the length and quality of time series generally available, but also the already mentioned likelihood of structural change over recent decades. As such, we believe *Autometrics* and *impulse indicator saturation* to be invaluable in this situation, as it will enable us to choose between a large number of potentially important variables and still model on our smaller-than-ideal sample lengths.

4. Econometric Results and Discussion

Having set out our econometric methodology in the last Section, we now turn to a more thorough discussion of our data (Section 4.1) before proceeding to find the most appropriate model to capture the variation in that data (Section 4.2).

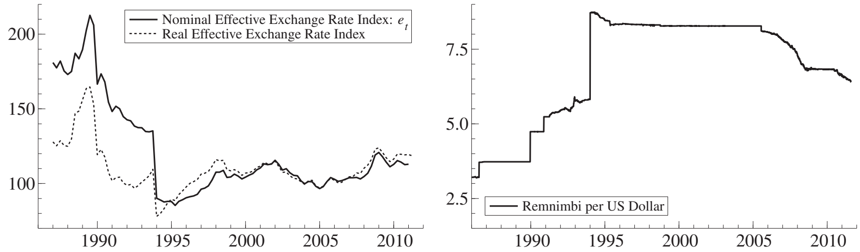
4.1 Data and General Model

Our object of interest is inflation in China. We plot this, for our sample starting in 1986, in Figure 1. We observe two distinct phases in the data; before the mid-1990s, inflation appears to have displayed large swings in China, with two large peaks in 1989 and 1994 of around 30% inflation, interspersed with a period of around 2% inflation in the very early 1990s. In 1994, China adopted a currency peg with the US dollar, in an attempt to import the low inflation in the US at the time (also plotted in Figure 1). As shown in Figure 2, the peg chosen implied a considerable devaluation of the Chinese currency, and was fixed at around that level until mid-2005. After 1994, inflation in China dramatically fell, indicative of the success of this policy of disinflation, and from the middle of 1997 through to the end of 2004, Chinese inflation was always below US inflation, and until about mid-2007, Chinese inflation remained low and stable, around the US inflation rate.



Source: National Bureau of Statistics, China, and FRED.

Figure 1: Inflation in China and the USA, 1986



Sources: IMF (nominal effective), OECD (real effective) and US Federal Reserve.

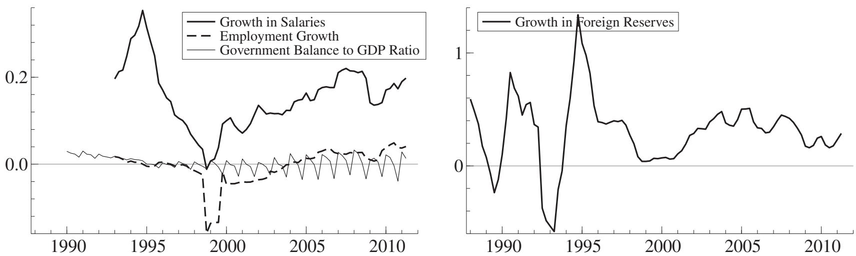
Figure 2: Exchange rates: Left hand side is nominal and real effective exchange rate indices, right hand side is Chinese remnimbi per US dollar

Surrounding the financial crisis since 2007, it is clear that inflation has become much more unstable in the US, and also in China (see Figure 5 for a more general plot of inflation); the same mechanism that imported stability appears to have also imported instability.

Figure 3 plots a number of other domestic variables we use to try and explain inflation in China; on the left panel we plot employment growth and salary growth in order to assess whether excess demand in labour markets may cause inflation, alongside the government's balance as a ratio of GDP, to help determine whether public sector imbalances may cause inflation. The government balance shows very distinct and growing seasonal patterns that get larger over the sample, while employment growth (a total measure provided by the National Bureau of Statistics in China[1]) is negative for much of the sample, only becoming positive in 2004 after a sharp decline in 1998–2000. Salary growth displays similar patterns to unemployment, but is positive apart from a quarter in late 1998. The sharp fall in salary growth after 1995 might be hoped to help explain the fall in inflation, yet the strong salary growth since the mid-2000s would suggest otherwise, since inflation did not rebound in the same man-

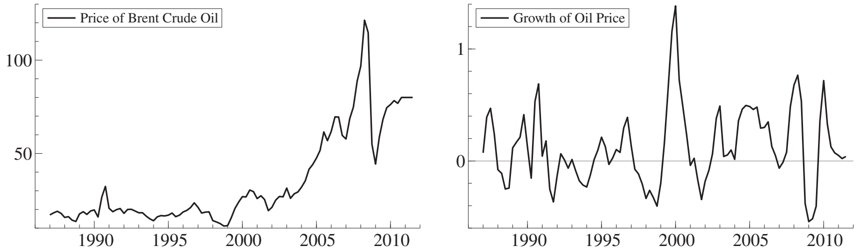
1 Datastream Mnemonic CHEMPALLP, EcoWin Code ew:cbn09002.

ner. On the right panel of Figure 3 the growth in foreign reserves at the People's Bank of China is displayed, showing again particularly strong growth in 1994 and 1995, corresponding to the large depreciation in the remninbi as the currency was pegged against the US dollar, and apart from a lull in the late 1990s and early part of the 2000s, growth in reserves has always been in the range of 20 – 40 % (year-on-year).



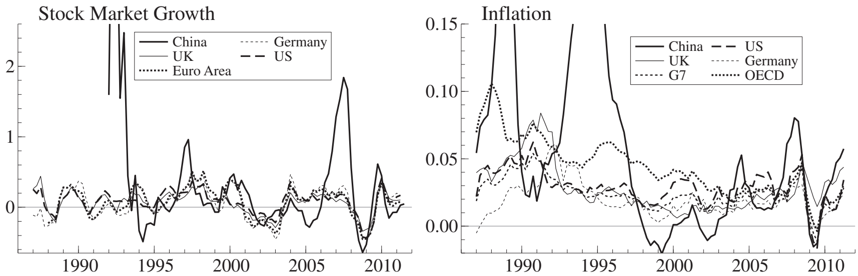
Source: National Bureau of Statistics and People's Bank of China.

Figure 3: Plots of labour market-related data and the government balance (left panel) and the growth in foreign reserves held by the People's Bank of China (right panel)



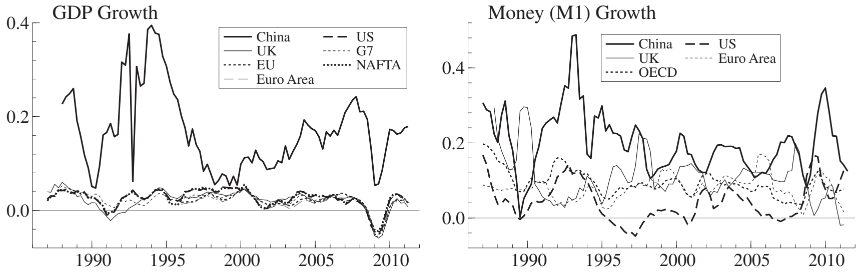
Source: OECD.

Figure 4: Oil price, Brent Crude, level (left hand panel) and growth rate (right panel)



Source: OECD.

Figure 5: Plots of stock market growth and inflation in various countries and aggregations of countries



Source: OECD.

Figure 6: Plots of GDP growth and money ($M1$) growth in various countries and aggregations of countries

We collect data from predominantly the National Bureau of Statistics in China, the People's Bank of China and the OECD. From the latter we find many price level series for numerous OECD member and non-member countries, along with GDP growth rates in them, and money supply variables. In attempting to encompass all the above-mentioned studies on inflation, our candidate variables are:

- Lags of inflation (denoted π_t)—persistence expected.
- GDP growth (denoted $\Delta_4 y_t$)—indicative of excess demands for goods and services.[2]
- Growth in employment and salaries—indicative of excess demands for labour.
- Growth in money supply ($M1$, denoted $\Delta_4 M1_t$)—indicative of excess demands for money.
- Additionally, we consider the role of the reserves held by the People's Bank of China here.
- Stock market growth (denoted $\Delta_4 sm_t$)—indicative of excess demands for financial assets.
- External sector variables:
  - Exchange rate (nominal effective, denoted e_t): Indicative of excess demand in foreign exchange markets.
  - Foreign prices, foreign stock market growth, and foreign money growth.
  - Oil price changes (denoted $\Delta_4 oil_t$).

We provide plots of all these variables in order to ascertain some idea of the nature of the data we are seeking to use to explain inflation in China. In Figure 6 GDP growth rates and money growth rates (measured by $M1$) are displayed for China

[2] In a slight abuse of natation we use Δ_4 throughout to refer to a growth rate, not a simple fourth difference.

and a number of other important economies (and collections thereof). As perhaps is expected, Chinese GDP growth stands out from that of the OECD countries.

Figure 5 shows stock market movements and inflation changes in similar collections of countries as we viewed GDP and money growth rates in Figure 6. China's stock market stands out as displaying the most volatile movements, but from the vertical axis it can be seen that all stock markets display much greater growth rates (positive and negative) compared to price, GDP and money growth. With money growth the picture appears considerably more varied, as while China generally has higher growth than the OECD economies, the disparity is not so large, and the US also appears to act as a lower bound for monetary growth, apart from in the Financial Crisis.

Finally, Figure 4 plots the price of oil over the sample period (and further back), showing the sharp increases in recent years in the price on the left-hand side, and the right-hand side shows the growth rate year-on-year in the price of oil. Naturally, an economy that has a strong manufacturing base such as China would be expected to be influenced by the price of oil.

We specify, with quarterly data, an ADL model with contemporaneous values and five lags of each of the variables listed above in our general initial model, and allow *Autometrics* to then search down to the smallest model with most explanatory power, whilst also including *impulse indicator saturation*to ensure that we detect all possible outlying observations, and are aware of any structural breaks that occur. With the restrictions imposed via data availability, our sample is 1993Q1–2011Q1, and we lose a further five observations due to including five lags.[3] However, having this sample length forced upon us has one advantage in that it corresponds to the time period after which China had begun pegging its currency to the US dollar.

Hence our initial model could be written as:

$$\pi_t = \alpha_0 + \sum_{i=1}^{5} \alpha_i \pi_{t-i} + \sum_{i=0}^{5} \beta_i x_{t-i} + \sum_{i=0}^{5} \gamma_i z_{t-i} + \ldots + \varepsilon_t, \quad \varepsilon_t \sim \mathsf{N}\left(0, \sigma^2\right), \tag{1}$$

where π_t denotes inflation at time t, and x_t and z_t are generic regressors. We specify a list of all the variables we input into our general model before we use *Autometrics* in Appendix A.

We report the final model in the next section.

[3] Five lags are chosen according to the rule of thumb 'seasonality plus one'.

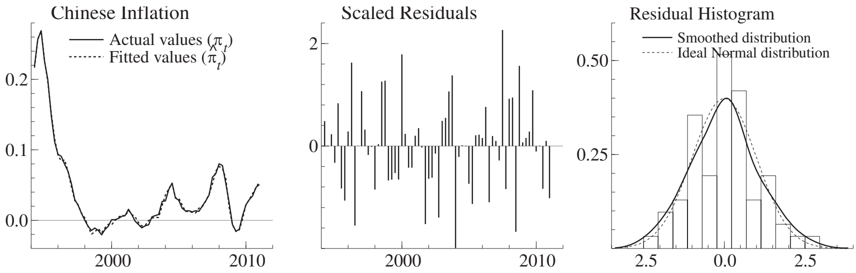


Figure 7: Actual and fitted values (left hand side) and residuals (actual values middle panel, distribution on right hand side) from reported model for Chinese inflation

4.2 Final Model

In this section, we report our econometric results. While convention is such that when reporting results, a gradual progression is displayed to the final, most general model, our general-to-specific approach precludes such a presentational style; the smaller models, while they may help with building up a story, are misspecified and thus may well be misleading in the inference they provide.

Instead, we simply present the final model selected by Autometrics. To reiterate, we include all the above variables with five lags, and include foreign variables both aggregated and disaggregated, including G7, OECD and NAFTA variables alongside variables for the US, UK, Japan and Eurozone countries. This produces a total of 248 candidate explanatory variables (with just 68 observations), not including the potential indicator impulse dummies to investigate equation stability. Very quickly the block searching reveals an intriguing, Euro-centric finding: besides Japanese inflation, German and UK stock markets appear to be significant, along with European money growth, while the other international variables (money growth elsewhere, inflation elsewhere, GDP growth elsewhere) are omitted quickly. Hence the first notable finding is an absence of any global liquidity effect in our model, and also the absence of any US variables such as inflation for explaining the Chinese inflation experience. This would appear to be suggesting that despite pegging to the US dollar, China managed to achieve a level of stability quite unrelated to the stability or instability in the US.

The final model after the block searching and subsequent tree-searching is shown in Table 1. The misspecification testing output is the most important part of any regression output since it reveals whether the assumptions made as part of the estimation of the model are satisfied. If any of the assumptions fail, then the resulting inference is unreliable in hard-to-quantify ways (see, for example, Spanos, 1994). The *p*-value column yields the probability that the null hypothesis is true, or the probability of making a mistake if we reject. In all cases the null hypothesis can be comfortably not rejected, and in each case the null hypothesis is of a well specified econometric model. Figure 7 provides a plot of the actual and fitted values for this model,

Table 1

Final Regression Model Information

Regression Model

	Coeff.	Std.Error	t-value
Constant	0.007	0.021	0.33
π_{t-1}	0.738	0.033	22.40
π_{t-4}	–0.208	0.027	–7.78
e_t	–0.001	0.0002	–5.45
e_{t-4}	0.0004	0.0001	4.10
$\Delta_4 y_{t-3}$	0.173	0.022	7.96
$\Delta_4 M1_{t-1}$	0.126	0.016	8.03
$\Delta_4 sm_{t-3}$	–0.009	0.003	–2.98
$\Delta_4 sm_{t-4}$	0.014	0.004	3.91
$\Delta_4 oil_t$	0.007	0.002	3.02
$\Delta_4 oil_{t-2}$	–0.011	0.002	–6.18
$\Delta_4 oil_{t-5}$	0.009	0.002	5.03
$\pi_{Japan,\,t}$	–0.283	0.103	–2.76
$\Delta_4 sm_{Germany,\,t-4}$	–0.019	0.004	–5.06
$\Delta_4 sm_{UK,\,t-3}$	0.027	0.005	5.13
$\Delta_4 M1_{OECD-Europe,\,t-5}$	0.077	0.023	3.33
I_{1994Q3}	0.042	0.007	6.36
I_{2004Q4}	–0.018	0.004	–3.95

Additional Information

sigma	0.004	RSS	0.001
R^2	0.997	$F(12,55)$ =	919.8 [0.00]**
Adj. R^2	0.996	log-likelihood	285.57
no. of observations	68	no. of parameters	18
mean(Y)	0.040	se(Y)	0.065

Residual Misspecification Test Output

Test (null)	Distribution	Statistic	p-value
No Autocorrelation	$F(5,45)$	1.06	[0.40]
No ARCH	$F(4,60)$	0.81	[0.52]
Normality	$\chi^2(2)$	0.48	[0.79]
No Heteroskedasticity	$F(30,35)$	0.80	[0.73]
Correct functional form (RESET)	$F(2,48)$	0.80	[0.46]

as well as a plot of the residuals through time (middle panel), and the histogram of the residuals and smoothed fitted density function for them on the right panel. These plots show firstly that the fit of the model is excellent, capturing very well the variation in inflation over the period since 1994, then from the middle and right-hand plots we find some very well behaved residuals, exhibiting the homoskedastic and non-autocorrelated distribution we assume for them; the right-hand plot is the estimated density (solid line), and we can see it is very close to the ideal Normal distribution (dotted line).

Continuing to read Table 1 from the bottom up, the next panel provides some information on the quality of the model in its fit of the data; does it do a good job of explaining the variation in inflation since the early 1990s? The term sigma refers to $\hat{\sigma}$ and hence is the estimated standard deviation of the residuals. If this is smaller than the standard deviation of the dependent variable (denoted by se(Y)), then we can be confident that our model helps explain some of the variation in that variable, and indeed this is the case. Both R^2 and the adjusted R^2 are high, and naturally the F-test of overall significance (second row of middle table) heavily rejects. We have 68 observations in our model, and 18 explanatory variables (plus a constant).

As a final recursive check, it is useful to consider the recursive stability of the regression coefficients, in order to assess whether they appear constant over the entire sample. Figure 8 shows these for all the coefficients in our model, and the clear inference from this is the stability of the model: There are no obvious structural breaks as the coefficients all settle down to their final values quite quickly and remain there.

Turning now to the actual model itself, we note first that the expected persistence in inflation is captured by a number of lags; this ADL form of the model makes it somewhat hard to read the full effects of a change in any of our explanatory variables, and hence we will calculate the long-run solution, or the ECM, for the model, shortly. It is, nonetheless, indicative to consider the lag lengths at which effects of other variables happen at, and hence we spend a little more time considering our model in Table 1. We find that the nominal effective exchange rate index is significant contemporaneously and at the fourth lag and hence the exchange rate affects inflation both immediately and with a year's delay. The immediate effect is in the expected direction; a fall in the exchange rate index corresponds to a depreciation and hence a depreciation leads to higher inflation, while the year-later coefficient is of the opposite sign but smaller, indicating some kind of correction over the longer term to that initial reaction. Output growth has a strong impact, as would be expected, on inflation, and a positive effect too. Money growth has a lagged effect at the one yearly interval. Additionally, there is a stock market effect: Overall the effect is positive, thus strong stock market growth within the previous year has a positive effect on inflation, reflecting a booming economy exerting its effect on general prices eventually.

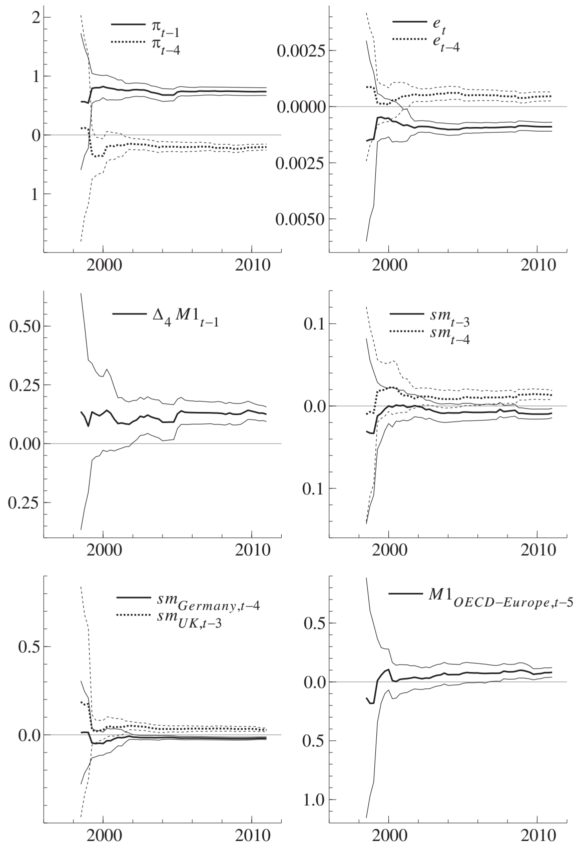


Figure 8: Recursive estimates of regression coefficients from reported model for Chinese inflation

Next we turn to the international, or predominantly European effects: Japanese inflation impacts Chinese inflation negatively, while stock market movements in Germany and the UK appear to impact inflation in China, and money growth in Europe has a delayed positive impact on Chinese inflation, perhaps reflecting either the delayed impact of monetary stimulus on European aggregate demand, or alternatively simply the response of Europeans to a growing economy nearing capacity: Import goods from China. It is perhaps worth noting that these are the only remaining international effects; the initial model was laden with numerous potential candidate international effects; US coefficients, OECD overall, OECD Europe, plus variables for Germany, the UK and Japan (plus Korea where available), yet only these effects remain. Apart from the money effect from Europe, it suggests that the use of aggregated variables such as a 'foreign price effect' may be missing more important effects of the constituent parts of those aggregated variables.

Finally, the impulse indicator saturationhas uncovered two dummy variables; this is quite remarkable given that the estimation period covers the sharp disinflation and the recent financial crisis. Only 1994Q3 as the disinflation took hold, and 2004Q4 when inflation sharply dips after a minor peak at 5% in 2004Q3.

We turn now to the long run solution, which strips out all the dynamics, and yields the steady state impact of our explanatory variables on inflation. We can think of this as the sum of all partial derivatives to infinity, hence the full impact of a change today in, say, output growth on inflation over an indefinite horizon. It is given by:

$$(2) \qquad \pi = \underset{(0.044)}{0.015} + \underset{(0.03)}{0.368}\,\Delta_4 y - \underset{(0.0004)}{0.001}\,e + \underset{(0.03)}{0.268}\,M1 + \underset{(0.004)}{0.010}\,sm + \underset{(0.007)}{0.009}\,oil$$
$$- \underset{(0.223)}{0.602}\,\pi_{Jap} - \underset{(0.008)}{0.041}\,sm_{Germany} + \underset{(0.013)}{0.058}\,sm_{UK} + \underset{(0.046)}{0.165}\,\Delta_4 M1_{OECD-Europe}\,.$$

Hence we see that a percentage point increase in GDP growth will lead to a 0.368th of a percentage point long-term increase in inflation, while overall the impact of a one percentage point increase in the money growth rate is about a quarter of a percentage point of inflation. The overall exchange rate effect is, as expected, negative. The exchange rate index, as described above, decreases with a depreciation, and hence if the renminbi depreciates, then over time the impact is positive on inflation since imported goods are more expensive. The effect is very small however (despite its significance), perhaps reflecting the manner in which China's economy is insulated from world events via its dollar peg: A one percentage point decrease in the value of the remnimbi leads to a 0.001 percentage point change in inflation. Finally again we have the stock market effect, which is positive, albeit small, adding to the GDP growth impact of a booming economy on inflation. The huge swings in stock markets over the sample period can explain the small coefficient for this variable.

Discussing quickly the international effects, the Japanese inflation coefficient is quite large, and the biggest in the ECM, yet Japanese inflation has been very small and negative over much of the sample. The stock markets of the UK and Germany have naturally fluctuated greatly over the sample period, as has that of China, and this is reflected in small coefficients. Strong stock market growth in Germany leads to a negative effect on inflation in China, while strong stock market growth in the UK leads to an increase in inflation, perhaps reflecting the UK's status as a trade deficit country, importing particularly from China.

The only global liquidity effect of note in the model is the already-mentioned effect of money growth in Europe, which has a positive impact on inflation in China. Any other variables for global liquidity did not appear to have any impact on Chinese inflation.

The long-run solution found in (2) can be nested within a more general model, known as the error (equilibrium) correction mechanism (see, for an example, Davidson et al., 1978), which displays both the short- and long-term movements in our data; in the general case, using (1), we have:

$$\Delta\pi_t = \alpha[\pi_t - 1 - \kappa_0 - \kappa_1 x_t - \kappa_2 z_t - \ldots] + \sum_{i=0}^{4} \phi_i \Delta x_t + \sum_{i=0}^{4} \psi_i \Delta z_t + \ldots + \varepsilon_t . \quad (3)$$

Here, α denotes the speed of adjustment of inflation to disequilibrium, where disequilibrium is any deviation of the variables in the long-run solution from the linear combination that makes up that solution. Like κ_k, $k = 0, K$ for all variables in our model, and ϕ_i and ψ_i, α differs depending on the lag structure of the finally selected model, and hence for example in our case, $\alpha = 1 - \alpha_1 - \alpha_4$, where α_1 and α_4 are the coefficients on the first and fourth lags of inflation. The details of such a model can be found in any standard time series econometric textbook, such as Hendry and Nielsen (2007).

Thus α denotes the speed of adjustment of inflation to disequilibrium, and in our model we find that around 48 % of any disequilibrium is corrected each period as inflation either rises or falls according to the new levels of the other variables in its long-run steady state relationship. This translates into a half life for inflation deviations of about 1.5 quarters, or 4.5 months. We can plot the combination of variables that constitutes the long-run solution, and in doing so we get some expression of, at various points throughout our sample, how far out of equilibrium inflation was. This is plotted in Figure 9, and shows that indeed early in our sample, inflation was above its steady state value before being brought into equilibrium, hovering around equilibrium quite closely until the large swings associated with the instability around the Financial Crisis.

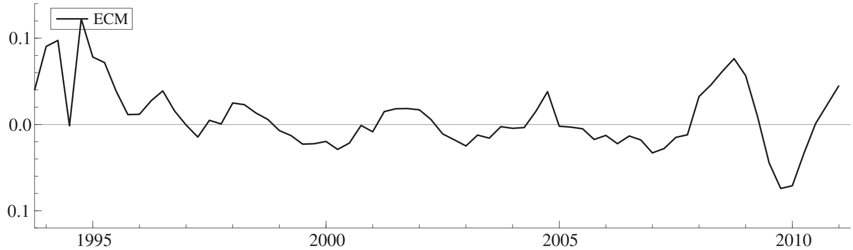


Figure 9: Plot of the long-run solution for our estimated model

While a forecasting exercise based on our estimated model would be interesting, it would also require forecasts for the exchange rate, the oil price and inflation in Japan, making forecasting all the more difficult. Nonetheless, the long-run solution (and the adjustment to it) suggests that should Chinese GDP grow strongly inflation should be expected, while also large movements in the effective exchange rate, which may happen in the coming years, will also have an impact on domestic inflation. It would appear most of all however, based on this model, that China's domestic policy is the most important factor in determining what happens to inflation in the coming months and years in China.

5. Conclusions

We have used automatic model selection procedures in this article to consider inflation in China. In doing so we are able to consider a vast number of potentially important variables whilst also being careful of the possibility of structural uncertainty. We build on previous attempts to explain Chinese inflation by updating the analysis to the current day and including further variables that may be expected to impact Chinese inflation. Our resulting model is well specified and recursively very stable, and suggests that, by and large, China has been able to insulate itself against shocks from the US via its exchange rate policy, but nonetheless not fully insulate itself against the impact from other parts of the industrialised world, notably Europe, via this mechanism. However, the main factors affecting inflation in China appear to be domestic via GDP growth and money growth, although naturally much of that growth is affected by international patterns of demand.

The findings in this article corroborate earlier research which suggests that China has been apparently able to limit the impact of international shocks (and US shocks in particular) on its macro economy (e.g. Cheung et al., 2007; Reade and Volz, 2010). This has been achieved in part through the maintenance of capital controls, but also through a reliance on monetary policy instruments other than the interest rate. Arguably, applying a monetary framework that has relied to a large extent on relatively blunt, non-market instruments such as targets or ceilings for credit growth and "administrative measures"—while being relatively effective in containing inflation to date—did not come without costs. First, it has delayed monetary policy reform geared towards a more effective management of the Chinese macro economy. Second, by allowing for negative real interest rates for deposits for a sustained period of time, the People's Bank of China has allowed the development of a gigantic property bubble which is a huge liability for the future. Only recently, in the face of strong inflation pressure—and rampant food price inflation in particular—the People's Bank of China has increasingly reverted to using the interest rate for combating inflation, as is evident through a series of rate hikes since the fourth quarter of 2010. It remains to be seen how quick the progress in monetary policy reform will be, and whether it will include a further liberalisation of China's exchange rate policy.

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A. List of Variables Included in General Model

Contemporaneous values, and five lags of the following:

- Chinese data:
  - Inflation.
  - GDP growth.
  - Nominal exchange rate index.
  - Stock market growth.
  - Money growth ($M1$).
  - Growth in central bank reserves.
  - Growth in salaries.
  - Growth in employment.
- Overseas data:
  - Price of oil.
  - Inflation:
    - US.
    - UK.
    - Germany.
    - Korea.
    - Japan.
    - G7.
    - OECD Europe.
    - OECD Total.
  - GDP growth:
    - US.
    - UK.

    * Japan.
    * NAFTA.
    * OECD Europe.
    * OECD Total.
  – Stock market growth:
    * US.
    * UK.
    * Germany.
    * Euro area.
  – Money growth ($M1$):
    * US.
    * UK.
    * Euro area.
    * OECD Europe.
    * OECD Total.