THE DIFFUSION AND DYNAMICS OF PRODUCER PRICES, DEFlationARY PRESSURE ACROSS ASIAN COUNTRIES, AND THE ROLE OF CHINA

Hongyi Chen, Michael Funke and Andrew Tsang

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The Diffusion and Dynamics of Producer Prices, Deflationary Pressure across Asian Countries, and the Role of China

Hongyi Chen
Hong Kong Institute for Monetary Research

and

Michael Funke
Hamburg University
Department of Economics
and
CESifo Munich

and

Andrew Tsang
Hong Kong Institute for Monetary Research

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Abstract

The ongoing producer price deflation in China and other Asian economies is a genuine concern. In particular, China’s producer prices are down a cumulative 12.7 percent from their peak in 2011, extending the stretch of negative producer price readings for 52 months in a row. Given the problem of overcapacity and heavy debt burden, this persistent decline in the producer price index could hurt corporate revenue, which limits fixed investments and the country's overall growth. Against this background, the paper analyses the determinants of the producer price decline across 11 Asian economies, and finds that the recent synchronous and protracted producer price deflation is driven by weak production growth, sharp declines in commodity prices, spillover effects from China’s producer price deflation and policy uncertainty and, to a lesser extent, exchange rate pass-through. Since China is at the heart of the region’s producer price deflation challenge, we also discuss the necessary structural adjustments in China to cope with the decline and head off deflationary threats.

Keywords: Producer prices, international spillovers, deflation, Asia, structural adjustments, China

JEL-Classification: C23, C32, E31
1. Introduction

Producer prices across Asia have been on an unrelenting downward trajectory in recent times, and this entrenched deflationary trend has now become an important macro concern for Asian economic policymakers. The weakness in aggregate demand has resulted in a feedback loop which has exacerbated the mounting deflationary pressures. The aggregate producer price indices are at their lowest average point for six years in the 11 largest economies in Asia. Only Indonesia is still experiencing producer price inflation, while South Korea, Taiwan and Singapore have experienced deflationary pressures for around three years. China is at the heart of the region’s deflation challenge and has notched up 52 straight months of falling factory gate prices from March 2012 to June 2016, making it the only large economy apart from Japan in the 1990s to experience such a persistent deflationary trend. Overall, up to June 2016, China’s producer prices are down a cumulative 12.7 percent from their peak in 2011. The speed at which prices are falling is a cause for alarm. As recently as September 2014, the producer price index was showing only a 1.8 percent drop; in December 2015 the decline was 5.9 percent. Even a country such as India, with an otherwise robust economy, has slipped into producer price deflation in 2015. The recent synchronous and protracted producer price deflation in Asian economies may be due to the spillover within the region or, alternatively, common factors and similar development of the local factors in regional economies. This paper applies a spillover index proposed by Diebold and Yilmaz (2009) to measure spillovers among the Asian economies, and investigates the possible determinants of Asian producer price deflation using a dynamic panel model.

A pessimistic deflationary scenario is that falling producer prices in Asia will continue to cut corporate profits, prompting lower employment and reducing consumer demand. The drag that this imposes on global demand may then intensify, depressing feeble economic growth in Europe and Japan as well as damping dynamism in the US. Aspects of this scenario are apparently already in place. A specific danger in China is that rather cost-insensitive state-owned enterprises will continue operating despite low prices and excess demand, crowding more efficient private firms out of the market. In other words, falling producer prices may prevent a redistribution of market shares necessary for productivity
improvements. A subsequent problem is that producer price deflation will eventually filter down to affect CPI, which still remains in solid positive territory despite hitting a five-year low. A high correlation between changes in the PPI and the CPI has been found in long-term historical data (Eichengreen et al., 2016 and ADO, 2016). Although Borio et al. (2015) find some evidence against the traditional view of the adverse impact of deflation on growth using the CPI data, Eichengreen et al. (2016) provide the empirical evidence confirming a negative spiral between PPI deflation and growth. It is clear that this is a critical policy issue and has significant regional and global implications. In particular, tackling the deflationary threat is a key challenge for monetary policymakers in the region.¹

The remainder of the paper is organised as follows. Section 2 shows some stylized facts. Section 3 analyses how the PPI decline in Asia is transmitted across countries. Section 4 covers the estimation results for the PPI model identifying the reasons for the PPI decline. Since China is at the heart of the region’s PPI deflation challenge, Section 5 sheds light on the policy options for coping with the PPI decline in China. Section 6 concludes.

2. Trend and Development of PPI Inflation in Asian Economies

This section is aimed at finding the main characteristics of PPI inflation in Asian economies. A sample of PPI inflation for eleven Asian economies from January 2000, after the Asian Financial Crisis, to December 2015, due to the data availability, is used in this paper. During the sample period, the monthly PPI year-on-year inflation shows a similar development across Asian economies (Figure 1).

Specifically, PPI inflation in all Asian economies shows a time-varying trend. The year-on-year PPI changes were in positive territory until the Global financial crisis (GFC), followed by a sharp drop during the GFC and afterwards a structural break with a declining trend since 2012, beginning a prolonged period of weakness. Besides the sharp PPI deflation during late 2008 to 2009, which was

¹ For a sketch of the problem, see Asian Development Bank (2016), pp. 22-29.
mainly driven by the impact of GFC, the recent decline has been unusually synchronous and protracted.²

From Table 1, the correlations of PPI inflation among most of the Asian economies are high (over 0.5), with the possible exception of the Philippines/Indonesia. The volatility of PPI inflation in the Philippines and Indonesia seems higher than in other economies, however, the pattern of development of PPI inflation is similar to other Asian economies. The high correlations among Asian economies support our above observations that PPI inflation of Asian economies has a common trend. This common trend, in particularly the recent PPI deflation in most of the Asian economies could be driven by some common factors. In addition, the correlations between China and other Asian economies are very high ranging around 0.7 to 0.9 (except the Philippines and Indonesia, which the correlations are still relatively high at 0.37 and 0.55 respectively), which probably shows that PPI inflation in other Asian economies is affected by the spill-over effects from China. The common factors and spill-over effects will be investigated by econometric analysis in Section 4. As the next step of our analysis, we explore the extent to which producer prices reflect idiosyncratic behaviour linked to individual countries, and the extent to which the producer price dynamics reflects spillovers across countries in the next section.

3. Measuring International Producer Price Spillovers

We first describe the spillover methodology, directly followed by our empirical findings. The approach by Diebold and Yilmaz (2009) provides measures of the intensity of interdependence across countries and variables and allows a decomposition of spillover effects by source and recipient.³ The spillover

² To put developments into perspective, the average monthly y-o-y changes in PPI for the US and Euro Area were -2.5% and -2.9% respectively during September 2008 to December 2009, while the median of average monthly y-o-y changes in PPI for 11 Asian economies was lower at -0.8%. However, during January 2012 to December 2015, the PPI deflation was more severe in Asian economies, as the median of average monthly y-o-y changes in PPI for 11 Asian economies was -1.4%, and the average monthly y-o-y changes in PPI for the US and Euro Area were -0.4% and -0.2% respectively.

index approach builds on the well-known notion of forecast error variance decompositions. It allows an assessment of the contributions of shocks to variables to the forecast error variances of both the respective and the other variables in the system. The starting point for the analysis is the following $p$-order, $N$-variable VAR:

$$x_t = \sum_{i=1}^{p} \theta_i x_{t-1} + \varepsilon_t,$$

where $x_t$ is an $N \times 1$ vector of $N$ endogenous variables, $\theta_i$ are $N \times N$ parameter matrices and $\varepsilon_t \sim N(0, \Sigma)$ is an $N \times 1$ vector of iid disturbances. Assuming covariance stationarity, the VAR can be transformed into the MA($\infty$) representation:

$$x_t = \sum_{j=0}^{\infty} A_j \varepsilon_{t-j},$$

where the $N \times N$ coefficient matrices $A_j$ are recursively defined as:

$$A_j = \theta_1 A_{j-1} + \theta_2 A_{j-2} + \cdots + \theta_p A_{j-p},$$

where $A_0$ is the $N \times N$ identity matrix and $A_j = 0$ for $j < 0$. In order to define spillover measures, we are interested in the $H$-step ahead forecast at time $t$. The associated variance decompositions then allow the fraction of the $H$-step ahead forecast error variance $x_i$ owing to shocks in $x_j$, $\forall j \neq i$, for each $i$ to be measured.

Diebold and Yilmaz (2009) employ Cholesky decompositions, which yield variance decompositions depending on the ordering of the variables. To resolve the dependency on the ordering Diebold and Yilmaz (2012) extend the approach and use the generalised VAR framework of Koop et al. (1996) and Pesaran and Shin (1998), in which variance decompositions are invariant to the ordering of the variables. The calculation of robust spillover measures is accomplished by averaging the results over all possible permutations of the system.\(^4\)

\(^4\) We refer the reader to Diebold and Yilmaz (2009, 2012) for a detailed exposition of the algorithm. For further reading, we also suggest Gaspar (2012) who gives a good overview on the spillover literature.
The variance decompositions yield an $N \times N$ matrix $\phi(H) = \left[\phi_{ij}(H)\right]_{i,j=1,\ldots,N}$, where each entry gives the contribution of variable $j$ to the forecast error variance of variable $i$. The main diagonal elements contain the (own) contributions of shocks to the variable $i$ to its own forecast error variance, the off-diagonal elements show the (cross) contributions of the other variables $j$ to the forecast error variance of variable $i$. When employing the generalised impulse response functions, the own- and cross-variable variance contribution shares do not sum to one, i.e. $\sum_{i=1}^{N} \phi_{ij}(H) \neq 1$. Therefore each entry of the variance decomposition matrix such that $\tilde{\phi}_{ij}(H) = \phi_{ij}(H)/\sum_{j=1}^{N} \phi_{ij}(H)$ with $\sum_{j=1}^{N} \tilde{\phi}_{ij}(H) = 1$ and $\sum_{i,j=1}^{N} \tilde{\phi}_{ij}(H) = N$ by construction. These assumptions allow a summary of all of the information on the various spillovers into a single number, a total spillover index:

$$TS(H) = 100 \times \frac{\sum_{i,j=1,i\neq j}^{N} \tilde{\phi}_{ij}(H)}{N}$$

The index $TS(H)$ gives the average contribution of spillovers from shocks to all other variables to the total forecast error variance in percent. The index is invariant to rescaling of the variables.

Furthermore, the approach allows us to obtain a more differentiated picture by calculating directional spillovers. Specifically, the directional spillovers from all other variables $j$ to variable $i$ is measured as

$$DS_{i\leftarrow j}(H) = 100 \times \frac{\sum_{j=1,i\neq j}^{N} \tilde{\phi}_{ij}(H)}{N}.$$  

Likewise, the directional spillovers from variable $i$ to all other variables $j$ to variable $i$ is calculated as

$$DS_{i\rightarrow j}(H) = 100 \times \frac{\sum_{j=1,i\neq j}^{N} \tilde{\phi}_{j i}(H)}{N}.$$  

In a nutshell, the set of directional spillovers provides a decomposition of total spillovers into those coming from (or to) a particular variable.

The spillover table should be interpreted as follows. The $ij^{th}$ entry in the table is the estimated contribution to the forecast error variance of country $i$’s PPI y-o-y growth rates resulting from innovations to country $j$. Hence the off-diagonal column sums (labelled “To Others”) or row sums (labelled “From Others”), when totalled across countries, give the numerator of the spillover index. Similarly, the column sums or row sums (including diagonals), when totalled across countries, give the denominator of the spillover index. In other words, the spillover table provides an input–output
decomposition of the spillover index. For example, we learn from Table 1 that innovations to China’s PPI y-o-y growth rates are responsible for 29.9% and 25.9% of the error variance in forecasting Singapore’s and Taiwan’s PPI growth rates 6 months ahead but only 7.8% of the error variance in forecasting PPI growth rates in Hong Kong 6-month-ahead. An observation which stands out is that spillovers from Malaysia are higher than the spillovers from other countries. Also worth highlighting is that the spillovers from Hong Kong to all other countries are very small. Another key insight is that the deflationary producer price spillovers from Japan are generally negligible. A summary result to emerge from the Table 2 is that, distilling all of the various cross-country spillovers into a single spillover index, we find in the lower right-hand corner of the Table that 52.2% of forecast error variance comes from spillovers. The above findings imply moderate spillovers on average. To scrutinize our findings, we have extended the forecast horizon to 12 periods in Table 2. As expected, the comparison of the results in Table 2 and Table 3 reveals that the spillovers increase in magnitude for $h = 12$.

Overall, our results underline the importance of a more fine-tuned approach to the study of the dynamics of producer prices. Such an approach is the research objective in the next section of this study.

4. Econometric Model Estimates

As shown in Figure 1, the recent declines in Asian PPI firstly appeared in 2012. They show a further sharp fall since the second half of 2014. In particular, PPI deflation occurs during 2015 in all Asian economies, except Indonesia. Unlike the sharp PPI deflation during late 2008 to 2009, which was mainly driven by the impact of GFC, the recent PPI deflation among Asian economies is protracted. The synchronous nature of the PPI decline suggests that common factors may be at work. These factors could be associated with either external factors or a coincidence of similar domestic developments. In addition, spillover effects among Asian economies could also explain recent PPI
deflation. This section aims to discuss the key drivers of the decline and to shed light on discussion about policy options for coping with the decline.

What are the mechanisms through which aggregate producer prices in the 11 Asian economies are affected by demand and supply shocks? In principle, firms adjust their producer prices (i) in response to exchange rate movements, (ii) because of changes in marginal cost, and/or (iii) because of markup adjustments (firms may adjust their markup to keep the foreign currency export price stable when they are pricing in foreign currency). Turning to the econometric specification, we shall combine these elements in the following baseline pass-through panel model:

\[
\Delta P_{i,t} = \beta_0 + \beta_1 \Delta P_{i,t-1} + \beta_2 \Delta E_{i,t-1} + \sum_j \beta_3^j \Delta E_{i,t-1} D_{i,t-1}^j + \beta_4 \Delta Y_{i,t-1} + \beta_5 \Delta P_{i,t-1}^\text{input} \\
+ \sum_j \beta_6^j \Delta P_{i,t-1}^\text{input} D_{i,t-1}^j + \beta_7 \Delta P_{t-1}^\text{China} + \beta_8 U_{t-1}^\text{China} + \beta_9 \text{GFC}_t + \beta_{10} \Delta S_{i,t-1} + \epsilon_{i,t}
\]

where \(\Delta P_{i,t}\) is the y-o-y growth rate of PPI in country \(i\) at time \(t\), \(\Delta E_{i,t}\) is the y-o-y growth rate of the nominal effective exchange rate, \(D_{i,t}^j\) are dummy variables of country-specific exchange rate regimes. Equation (7) zooms in to study the determinants of Asian producer prices. The interaction of \(D_{i,t}^j\) and \(\Delta E_{i,t}\) will enable us to explore structural differences across countries arising from country-specific exchange rate regimes, \(\Delta Y_{i,t}\) is the y-o-y growth rate of production in country \(i\), and is included to control for fluctuations in factor demand.\(^5\) A notable feature of equation (7) is that import price shocks are not restricted to those resulting from exchange rate movements but also include commodity price shocks. The variable \(\Delta P_{i,t}^\text{input}\) is the y-o-y growth rate of an input price index (proxied by the global commodity price index multiplied by exchange rate of country \(i\)). A distinct feature of this study is to single out the interaction of \(D_{i,t}^j\) and \(\Delta P_{i,t}^\text{input}\). This enables us to explore the different impact of input prices among different exchange rate regimes across countries. \(\Delta P_{t}^\text{China}\) and \(U_{t}^\text{China}\) measures spillovers of the y-o-y growth rate of PPI and policy uncertainty index from China and engage with the extensive debate, dating back to 2000, prior to the global financial crisis, on the role of globalisation in bringing about a subdued inflation pattern despite buoyant economic growth. \(\text{GFC}_t\) is the dummy variable for global financial crisis (Sep 2008 to Mar 2009). Finally, \(\Delta S_{i,t}\) is the y-o-y growth rate of

\(^5\) It is worth adding that the degree of exchange rate pass-through is a key determinant of the optimal exchange rate policy regime. See, for example, Devereux and Engel, (2003, 2007).
representative stock index of country $i$, $\varepsilon_{it}$ is an i.i.d. error term. Moreover, all the regressions include fixed effects. Finally, all regressors are included with a one-period lag in order to reduce potential simultaneity bias.

Contrary to the much-studied exchange rate pass-through literature analyzing the transmission of exchange rate shocks to import prices and CPI (Gagnon and Ihrig, 2004), we investigate the degree to which currency changes are transmitted to domestic producer prices. By doing so we investigate the capability of exchange rates to transmit or absorb the external inflation pressure to domestic producer prices. Given that exchange rates first pass through to import prices, which in turn affect producer prices, we gauge the ultimate pass-through of exchange rates to producer prices, taking observed changes in import prices as given. Moreover, our exchange rate pass-through approach allows for a broader interpretation since import price shocks are not restricted to those resulting from exchange rate movements but also include commodity price shocks.

There are two main key drivers of the PPI, cost of input and production cost. The cost of input is affected by global commodity prices. For instance, recent PPI deflation in all Asian economies may share a common external factor, that is declines in global commodity prices. Small increases and even declines have occurred in global commodity prices since 2012. Global commodity prices recorded sharp declines starting in the second half of 2014, and reaching around 30 percent in 2015, which was mainly driven by a sudden drop in petroleum price. The similar development in global commodity price change and PPI inflation may confirm that the commodity price shock is a determinant of recent PPI deflation.

For the second key driver, PPI, is expected to be affected by production directly. Higher production growth indicates a higher demand for industrial output. Given these demand effects, there should have higher prices for production output. As the results show in Section 3, the spillover effects within Asian economies are high. In addition, there is always a saying that China’s price is influential to the Asian market. Such spillover effects from China should be included in the model to see how China’s PPI developments and risk factor affect Asian economies. A dummy variable for the GFC period is
included to control for the impact of the GFC. Finally, the change in stock prices is included in the model as a control for risk levels. Decreases in stock prices indicate a higher risk, which could lower PPI inflation.

This paper uses monthly data from 2000 to 2015 for 11 Asian countries. The definition and source of data is introduced as follow: The macroeconomic data, including the data for producer price index (PPI) and industrial production are taken from national sources and dated back using the data in IMF International Financial Statistics. The Bank for International Settlements (BIS) broad indices for the nominal effective exchange rate (NEER) are used in the model to capture the exchange rate impact on the PPI inflation. The dummy variables for exchange rate regime are created based on IMF’s four-group classification (Hard-peg, soft-peg, floating and residuals) for the de facto exchange rate regime. The classification can be found in the IMF’s annual report on exchange rate arrangements and exchange restrictions. The input price is proxied by the global commodity price index (in US Dollar) multiplied by the exchange rate of country \(i\), rebased to an index with the same base period (2005=100). In other words, the input price is the commodity price in local currency, and the changes in this variable represent the dynamic combination of the effects of changes in commodity price and the exchange rate in local currency. A higher the y-o-y change of input prices means a higher commodity price in local currency. Specifically, either a higher IMF commodity price index or a higher value of the exchange rate per USD (i.e. the local currency depreciates) represents a higher value of commodity price in local currency.

To examine the spillover effect from China to the rest of Asian economies, the model includes two variables, the spillovers of China PPI inflation and the spillovers of China policy uncertainty. The direct spillover effects is proxied by multiplying China’s PPI inflation by the country’s import share from China, (for which the data source is described above). For the impact of China’s policy uncertainty on each of the Asian economies, the China policy uncertainty index multiplied by the import share from China is included in the model. The China policy uncertainty index is downloaded from the website of Economic Policy Uncertainty.\(^6\) This index is a news-based index measuring economic policy

\(^6\) The website is [http://www.policyuncertainty.com/china_monthly.html](http://www.policyuncertainty.com/china_monthly.html).
uncertainty for China, which is constructed by counting the number of newspaper articles on the China's policy-related economic uncertainty. A higher index means greater uncertainty, and it is expected that the PPI inflation will be lower. The import share from China is calculated by dividing the nominal value of import from China by the total value of imports. As a large portion of Hong Kong’s imports from China are for the re-export purpose, the Hong Kong import share from China is calculated by using the share of retained imports. For the import share from China, the figure for China is using the import share of the remaining countries outside the estimation sample. The import data are from national sources. For the changes in stock price, the y-o-y changes of the representative stock index downloaded from Bloomberg are used in the model.

The panel model is estimated by a dynamic panel with fixed effects using the Kiviet method (Kiviet 1995 and Bun and Kiviet 2001). The Kiviet method is a least squares dummy variable (i.e. fixed effects) estimator (LSDV), which corrects the bias in the estimation of the dynamic panel model due to a finite number of time and groups simultaneously. Bun and Kiviet (2001) suggested that this corrected LSDV method is an asymptotic consistent estimator and yields a lower mean squared error comparing with IV and GMM methods.

Table 4 reports the estimation results. Model 1 is the basic model including the explanatory variables of lagged PPI inflation, change in the NEER, industrial production growth and change in commodity price in local currency only. In this model, lagged PPI inflation and changes in industrial production and commodity prices are significant, but the change in the NEER is insignificant. Model 2 adds the spillover effect from China (China’s PPI inflation multiplied by import share from China), which is statistically significant. Model 3 adds one more explanatory variable, the spillover of China policy.

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7 The news articles are including those appeared in the South China Morning Post (SCMP), a Hong Kong’s leading English-language newspaper. The method follows our news-based indexes of economic policy uncertainty for the United States and other countries.

8 Specifically, China: Shanghai Composite Index; Hong Kong: Hang Send Index; Indonesia: Jakarta Composite Index (JCI); India: Sensex Index; Japan: Nikkei Index; Korea: Korea Composite Stock Price Index (KOSPI); Malaysia: Kuala Lumpur Composite Index (KLCI); Philippines: Philippine Stock Exchange (PSE) Composite Index; Singapore: Straits Times Index (STI); Thailand: Stock Exchange of Thailand (SET) Index; Taiwan: Taiwan Stock Exchange Weighted Index.

9 Making us of the asymptotic bias derived by Nickell, Kiviet (1995) proposed a direct bias correction method. The basic idea is the approximation of the unknown bias by a two-stage procedure. While in the 1st round empirical estimates are derived, an empirical estimate if the bias is derived in the 2nd step. The motivation for the procedure lies in the well-known fact that the LSDV estimator is biased but has a much smaller variance as compared to instrumental variables estimators. Alternatively, GMM estimators may be used. The asymptotic properties of GMM are well established in the econometric literature. However, these are only asymptotic results which do not necessarily hold in small sample as shown by Guggenberger (2008). Furthermore, the efficiency of the GMM estimator relies heavily upon $T$ being fixed and $N$ going to infinity. This is not valid in our sample.
uncertainty. It is significant too, and in this model, the NEER is also significant. Model 4 includes the dummy for the GFC, on top of Model 3. The dummy for the GFC is significant, but industrial production becomes insignificant. Model 5 further includes the change in stock price, an indicator of risk. In Model 5, the change in stock prices is significant but the spillover of China policy uncertainty becomes insignificant. Model 2a to Model 5a add the interactive dummy variables of the exchange rate regime multiplied by the change in commodity prices to Model 2 to Model 5. The results are similar between both sets of models when the interactive dummy variables are added.

Summarizing the results from different models, lagged PPI is significant in all of the models with a high coefficient, ranging between 0.88 – 0.91. This result confirms the use of the dynamic panel model as the PPI inflation can be explained by its lagged term.

The exchange rate sensitivity is rather low and sometimes insignificant (Models 1 and 2). The results confirm that the higher the change in the NEER, the lower is PPI inflation, which is consistent with the relationship shown in Figure 2 (the relationship for the whole region and by country). The exchange rate sensitivity is significantly different if the exchange rate regime is a hard or soft peg. The low exchange rate sensitivity may be explained by slow trade growth. Since 2010 global trade growth has slowed significantly, and, given that many Asian countries are highly open economies, the slowdown in world trade has weighed heavily on their exports. The post global financial crisis trade slowdown may be attributed to anemic advanced economy growth. It may also be attributed to the maturation of global value chains reducing the elasticity of trade flows to world GDP. During the 1990s, trade liberalization and a decline in shipping times and cost encouraged rapid fragmentation of production across countries. With maturing supply chains, this trade growth has lost momentum.¹⁰ As a result, trade has become less sensitive to world GDP and effective exchange rate changes.

Some recent studies have sought to test the proposition by Taylor (2000) that global competition should reduce the extent to which exporting firms can pass through exchange rate movements into

¹⁰ Some supply chains may even have begun to shorten again as higher-value added activity moved to emerging markets. The world trade data can be found in the website [http://www.cpb.nl/en/data](http://www.cpb.nl/en/data). The study by Auer and Mehrotra (2015) has also demonstrated that the real integration through the supply chain matters for domestic price dynamics in the Asia-Pacific region.
the domestic currency prices charged to importers. This has been found to have considerable empirical support (see, for example, Olivei, 2002 and Gagnon and Ihrig, 2004). This decline is found to be due to both a shift of imports away from commodities to manufacturing goods which tend to have lower pass-through rates and to a general decline in the exchange rate pass-through across all product categories.\footnote{This interpretation rests on the assumption that the regressors are weakly exogenous to the system. Testing for weak exogeneity using Wu-Hausman tests indicates that this condition is met. The test entails regressing the explanatory variables on a set of variables that are clearly exogenous and then testing whether the residuals from this regression have any explanatory power in addition to the variables already included in the empirical framework.}

For the growth in industrial production, it is positive and significant in some models, which indicates that higher production growth will push up PPI inflation. In particular, recent PPI deflation is in line with the decline in industrial production among Asian economies (Figure 3). However, this variable is insignificant if the dummy for the GFC is included in the models, as significant GFC effects may capture most of the significance of industrial production growth. As expected, the dummy for the GFC is significant and negative, which confirms that PPI inflation has a significant negative impact from the global turmoil in financial and economic conditions during the GFC period.

The change in input prices, proxied by commodity prices in local currency, is significant in all models. The positive relationship between PPI inflation and changes in input prices is confirmed by the estimation results. This result also confirms that recent PPI deflation is driven by sharp declines in commodity prices (Figure 4). Adding the interactive dummy variables for the exchange rate regime multiplied by commodity price change, reveals that the effect of commodity price changes is significantly different if there is hard peg. Floating exchange regime, in some models (Models 2a and 3a), shows significant differences in the commodity price change effect. The spillover from China PPI inflation is significant in all the models including this effect, indicating that the spillover effect from China is one of the determinants of Asian PPI inflation. This confirms the results shown in Section 3. In addition, the spillover of China policy uncertainty is also significant, which confirms that PPI deflation in Asian economies may be partly explained by the risk spillover from China (the development of China policy uncertainty can be found in Figure 5). However, this effect is insignificant if the change in local stock prices is included in the model. The risk of the individual country is
captured by the stock price variable and the change in stock prices is significant in the model. The change in local stock prices may be a better proxy for the risk of an individual country as it captures both local risks and risk spillover from other countries. In general, PPI inflation has the positive correlation with change in stock prices, although there are some exceptions in some economies in 2015 (Figure 6).

In sum, recent PPI deflation in Asian economies can be explained by similar developments in local factors like exchange rate pass-through, production growth and risk factor (stock price), and common factors like the sharp drop in commodity prices. The spillover effect from China is also a key determinant. This suggests that the economic development and the policy response in China will be crucial to the development in Asian PPI. The next section will discuss this issue and the prospects for China PPI deflation in order to shed light on the discussion of policy options for coping with the decline in PPI of Asian economies.

5. Slippery Slope—Prospects for deflation in China

China is at the heart of the region’s PPI deflation challenge. With entrenched PPI deflation, there is a strong worry in financial markets that continuing PPI deflation may result in a feedback loop where deflationary PPI pressures are intensifying, which could eventually cause deflation in consumer prices. If this happens, it will have serious negative impact on the Chinese and the world economy.

5.1 Fundamental Problems of Chinese Economy

While it is linguistically and semantically fashionable to compare PPI deflation with CPI deflation, we think that the comparison is far-fetched. A gap has persisted between China’s PPI and CPI series since 2011. While PPI has declined for fifty-two consecutive months until June 2016, the CPI and in particular the core CPI has remained solidly in positive territory. This divergence is at odds with the experience of Japan but it is also an unusual phenomenon in China. Both indexes moved in tandem
in the aftermath of both the 1997 Asian financial crisis and the 2008 global financial crisis — periods when China ran into deflation. In any case, the divergence since 2011 plays down the signaling effect of producer prices for future deflation.

Can we proclaim that everything is fine and give an all-clear? Is this a silver lining? No! While CPI and core CPI inflation are still positive, CPI inflation has drifted to below 2 percent. The most recent June CPI inflation rate is 1.9 percent. Although PPI deflation is getting smaller, it is still -2.6 percent in June. According to a Bloomberg survey, PPI will post a 1.5 percent decline in 2017 before rising 0.2 percent in 2018.\textsuperscript{12} With weak aggregate demand, it remains a challenge for firms to raise factor gate prices as well as profits. Deflation in CPI is also a potential challenge.

The current divergence of CPI and PPI deflation is a pernicious threat because it seems almost benign. As PPI inflation drops, slipping into CPI deflation becomes ever easier. A short spell of PPI deflation would in some circumstances be a tolerable thing. Indeed there are times when PPI deflation can be a symptom of encouraging underlying developments. It can, for example, be brought about when advancing productivity enables the economy to produce more goods and services at lower cost, raising consumers’ real incomes. Another example could be a persistent decline in global commodity prices. By contrast, bad PPI deflation results when demand runs chronically below the economy’s industrial capacity, leaving a negative output gap and reducing profits. That prompts firms to cut prices and wages; which weakens demand further. Debt aggravates the cycle: as prices, profits and incomes fall, the real value of debt rises, forcing borrowers to cut spending to pay down their debt, which ends up making matters worse. This is fertile ground for a pernicious negative spiral, which then also affects expectations.

Currently for the Chinese economy, among others, there are three fundamental problems that are of great concern: declining corporate profit, overcapacity and a heavy debt burden. These three problems are interconnected and reinforce each other. All three are more serious for state-owned

enterprises. Without taking fast measures to address these three problems, PPI deflation will become worse, which could lead to CPI deflation, which in turn will make all three problems worse.

Figure 8 shows that corporate profit growth and PPI inflation are positively correlated. Therefore declining producer prices leads to declining profitability.\textsuperscript{13} With slowing economic growth, profit growth from corporations with different ownership structure all decline. For state-own enterprises (SOEs) profit growth on average becomes negative, with many SOEs encountering losses (Figure 9). The worst happens in those sectors with overcapacity. Almost all have drifted into negative profit growth recently (Figure 10).

Figure 11 shows that production capacity utilization and PPI inflation/deflation are positively correlated. After the Asian financial crisis, China entered a period of increasing production capacity utilization because of the real estate boom and entering the WTO. The global financial crisis of 2008 drove down production utilization for a short period, then the four trillion RMB stimulus package quickly pulled it back. Since 2012, production utilization has gradually drifted down. All along these periods, PPI growth rates have moved in tandem with the production utilization index.

With the recent economic slowdown, especially the slowdown in real estate sector, which is the key driver of many related industrial sectors such as steel production, cement, flat glass, China’s over capacity problem become acute. This partly explains why firms lack pricing power and the persistent decline in PPI. Figure 12 shows that in all seven sectors, the overcapacity problem has become worse since the start of global financial crisis in 2008. Part of the reason is that in late 2008 to 2009, in order to stabilize the economic growth right after the start of global financial crisis, the Chinese government implemented a RMB 4 trillion stimulus package, plus another matching fund of RMB 10 trillion bank lending. The majority of these funds went to investment, especially into state own enterprises related to infrastructural development, housing and energy. These stimulus packages

\textsuperscript{13} Some uncoupling is visible since 2011. Since the year 2012, lower costs have allowed companies to stabilize profits at a low level even as producer prices have fallen further. In other words, firms have acclimatized to declining producer prices to some extent.
further increased production capacity, which lead to even lower capacity utilization rate when the economy slowed down, as has happened recently.

China’s overcapacity concentrated in six sectors: coal mining, iron & steel, cement, flat glass, aluminium smelting and ship building. Table 5 shows that in 2015 the total six sectors accounted for 10.4 percent of the industrial employment (or about 17 million workers) and around 12 percent of industrial value added. Among them, coal and steel accounted for more than 82 percent of both the total industrial employment and industrial value added of the six sectors. It is estimated that the capacity utilization rate of coal sector was about 65.8 percent, of the steel sector was about 67 percent in 2015 (UBS, 2016). The six sectors accounted for 14.8 percent of total industrial assets, but only generated 2.3 percent of total industrial profits and accounted for 31.6 percent of total loss.

Table 6 shows that in 2015 the profit margin of the six overcapacity sectors was only 1.3 percent, 26.5 percent of the firms in these six sectors were loss-making. The return on equity (ROE) was only 3.0 percent and return on assets (ROA) was 1 percent. The total liability was RMB 10 trillion, among them, debt was RMB 8.7 trillion and bank loan was RMB 4.9 trillion. The six sectors accounted for 17.7 percent of the total industrial liability. It is estimated that companies in the overcapacity sectors with earnings before tax and interest lower than interest payment account for 25-30 percent of the total debt, which means the potential bad debt could be as high as 25-30 percent (UBS, 2016). A heavy debt burden erodes the ability to invest. In 2015, the coal and steel sectors accounted for only 1.5 percent of total fixed asset investment.

Lower capacity utilisation rates have eroded producer prices, thereby compounding the effects of higher debt levels. Furthermore, firms in industries marked by low capacity utilisation lack sufficient retained earnings for R&D and thus cannot move up the value chain. This self-perpetuating negative spiral is an obvious obstacle to future growth.\footnote{The analysis in Borio et al. (2016) suggests that when considering the macroeconomic implications of financial booms and busts, it is important to go beyond the well-known and very real aggregate demand effects and to examine also what happens on the supply side of the economy. In particular, credit booms tend to undermine productivity growth by inducing...}
Recently the fast accumulation of debt in the Chinese economy has become a major concern. According to a BIS estimate, China’s total non-financial debt was about 255% of GDP in 2015. Of that, government debt represented about 44 percent of GDP, household debt was about 40 percent of GDP, and the non-financial corporate debt climbed above 171 percent of GDP (Figure 13).

The relatively low household debt suggests an underdeveloped consumer credit market. Consequently monetary easing has had a larger impact on firms’ fixed investment than household consumption. How worrying are China’s debt levels? They are certainly enormous. Sooner or later China firms will have to reduce this pile of debt. History suggests that the process of deleveraging will be painful, and not just for the China. The rapid build-up of debt is a relatively recent phenomenon. Most of it has been accumulated after 2008, when the Chinese government loosened policy and began pumping credit through the economy to fight off the global financial crisis. The majority of the increased credit went to state-owned enterprises (SOEs). Figure 14 shows that the debt-asset ratio of the SOEs increased rapidly since 2008, while that of the private enterprises continued to decline. According to the IMF, SOEs account for about 55 percent of corporate debt, while their output is about 22 percent of total output (Lipton, 2016). This is much smaller than their debt share in total corporate debt. The SOEs are far less profitable than private enterprises. The rapid pace of credit growth in SOEs makes a benign outcome ever less likely. For the economy as a whole, the incremental capital output ratio has increased very quickly in recent years, which means that new investment is much less efficient in producing additional output. The leverage level of the zombie firms has reached as high as 71.6 percent (Wang et al., 2016).

With declining corporate profits, overcapacity and a heavy debt level and high corporate leverage, will the Chinese economy drift into a debt-deflation spiral? What are the policy options available to avoid the zero lower bound quicksand?\textsuperscript{15}

\textsuperscript{15} Gertler and Hofmann (2016) have revisited the long-run link between credit growth and financial crises. The analysis reveals that the credit-crisis nexus is stronger in regimes characterized by low inflation and liberalized financial systems.
5.2 Structural Reform: a Difficult Choice by the Chinese authorities

With the fast deterioration in Chinese economic growth, it is believed that policies should stabilize short-term growth as well as address the medium and long-term structural problems. In the following, we first try to analyse the supply side reforms needed, then to analyse how fiscal and monetary policies can be used to arrest a possible hard-landing.

The central issue for supply side reform is to reduce overcapacity, and improve the efficiency and profitability of state-own enterprises, which will further lead to a reduction in debt levels and leverage. It is estimated that 1.8 million workers will be laid off if the overcapacity firms are shut down (Lu, 2016). Together with the redundant workers in related sectors, the total number of workers that need to be relocated amounts to about 3 to 3.5 million (UBS, 2016). This is a daunting task for the government, which explains why the reduction of overcapacity has been difficult and slow. However, if history is any guide, the Chinese government should be able to resolve this issue because in late 1990s, the government successfully relocated 30 million redundant workers in the last round of reform and privatization of state-own enterprises. With more resources in hand and a much larger economy now, the government should have more room to succeed this time. Some have argued that the government should rely more on market-based measures to resolve the overcapacity problem. Instead of using administrative orders to force firms in the overcapacity sectors to shut down the excess production capacity, the government should tighten the soft budget constraints of non-profitable state-own enterprises and through merging and acquisition let the market to absorb these firms. This will be more cost efficient and can help to develop more dynamic and efficient firms, at the same time as building a market-based mechanism for economic restructuring. The restructuring of the US steel industry could be a good example.

The second issue is deleveraging. As can be seen from Figure 14, private sector leverage has been consistently declining since 2008, while the leverage in SOEs has gone up. This not only shows that the credit supply from the stimulus package went mostly to the SOEs, but also that SOEs are not as profitable as private sector firms in bringing down debt levels. One way to reduce leverage is to tighten the overall credit growth. With a fast economic slowdown, this is very difficult. If it is done, it
might actually increase leverage given that many firms rely on bank credit for their continued operation. Another way is to convert the debt into equity. The government has done this on a trial basis. This measure turned out to generate perverse incentives. Some firms choose not to pay their debt and try to get their debt convert to equity. The third way is to close down non-profitable zombie firms. The continuing operation of zombie firms wastes a lot of resources and creates huge potential risk for the banking system. Again the process turns out to be tricky. Just like dealing with overcapacity, the relocation of redundant workers becomes a central issue, not to mention the choice over which zombie firms to close down.

Other aspects of supply side reform is for the government to reduce distortions such as price, tax, credit supply distortions and create the right incentives for private sector firms to invest, especially in R&D so that they can help the economy to climb the technology ladder. Measures include reducing corporate taxes, encouraging bank lending to real sectors especially small-medium enterprises, target incentives for R&D expenditure. Although all industries have shown PPI deflation, industries with lower technology turn out to face the worse deflationary pressures. A possible reason could be that lower technology sectors are more competitive and have less pricing power, and are therefore less profitable. So in the long run it is very important to move up the technology ladder (Figure 15 and 16).

Structural reform and creating a knowledge-based economy has never been easy. Throughout history, governments in many parts of the worlds have tried to achieve these goals. But the results did not necessarily meet their initial wish. The German Industry 4.0 initiative in Ruhr region could be a good example. Since the globalisation of the world economy, cyclical swings in regional economies have become more pronounced. Many of the specific problems in the old industrial areas are related to path dependency and lock-ins. The decades-long transformation of the Ruhr region in Germany is an exemplary case for managing change from traditional industry based, resource and material intensive economic activity towards a knowledge based resource efficient economy. The coal mines and hot metal furnaces that transformed the region into Europe’s industrial engine a century ago have long since shut down, destroying 500,000 jobs. To revitalize the Ruhr, state and local governments have invested in R&D and education, transformed abandoned steelworks into industrial parks, and
seeded new startups. But despite two decades of redevelopment effort, unemployment across the valley’s main cities remains well above the national average and growth remains chronically weaker than in other German regions. Even optimists recognize it will take decades for the area’s new-technology-driven industries to boost employment (Hospers, 2004).

5.3 Short-term Policy Responses

In the short run, the Chinese economy faces strong headwinds and the overall growth of fixed asset investment (FAI) has been declining. In particular, the growth of private sector fixed asset investment has declined very fast. The relatively high growth of FAI by SOEs is mainly driven by government policies to stabilize economic growth (Figure 17). In order to avoid a hard-landing, what would be the right policy mix from both the fiscal and monetary sides?

From the fiscal side, the government still has some room given that government debt/GDP is only 44 percent, and the primary budget deficit is below 3 percent of GDP. There are a lot of areas where the government can invest such as in infrastructure projects, education, and medical services. The main issue is how to invest in an efficient way to improve the quality of services in these areas and create a base for future economic growth.

On the monetary side, the People’s Bank of China (PBoC) has kept ample liquidity in the banking system through the Medium-term Lending Facility (MLF) and Standing Lending Facility (SLF). It has also reduced reserve requirements and lowered benchmark interest rates. In other words, the monetary policy stance is quite loose. Given this, why is there persistent PPI deflation and declining CPI inflation which has fallen below 2 percent most recently?

In theory, monetary easing trickles through the economy via two channels. First, lower interest rates trigger an inter-temporal substitution effect whereby households (firms) find it more worthwhile to consume (invest) today than tomorrow. Second, a wealth effect occurs with strengthening purchasing

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16 A data reclassification by National Bureau of Statistics of People’s Republic of China may have contributed to the recent sharp divergence of private and SOE investment. See UBS (2016b), “Why Has Private Investment Plunged in China?”, Hong Kong. However, UBS (2016b) also highlights declining profits as the key determining factor for declining private investment expenditures.
power. The leverage ratios in Figure 14 suggest that monetary stimulus in China works differently. Due to the underdeveloped consumer credit market, corporate investment gains most from monetary easing. Such investment may stimulate GDP growth in the short-run, but the redundant capacity created in the process will weigh on growth in the long-run. Monetary easing measures will also hardly shore up PPI growth, since cost-insensitive SOEs will continue operating despite low producer prices and excess capacity, crowding the more efficient private firms out of the market. In other words, expansionary monetary policy may even undermine the corrective process and may lead to a persistent misallocation of capital. This phenomenon can be seen in the disaggregate pattern of PPI deflation with the biggest declines recorded in industries with a large share of SOEs (Figures 18 and 19). If that turns out to be true, injecting more liquidity meant to rebalance the economy may actually dig the economy deeper into deflationary pressure.

Is a devaluation of the effective RMB exchange rate welcome as a way to offset domestic deflationary pressures? No necessarily. Since 2010 global trade growth has slowed significantly. And, given that many Asian countries are highly open economies, the slowdown in world trade has weighed heavily on their exports. The post global financial crisis trade slowdown may be attributed to anemic advanced economy growth. It may also be attributed to the maturation of global value chains reducing the elasticity of trade flows to world GDP. During the 1990s, trade liberalization and a decline in shipping times and cost encouraged rapid fragmentation of production across countries. With maturing supply chains, this trade growth has lost momentum.\(^{17}\) As a result, trade has become less sensitive to world GDP and effective exchange rate changes. In a recent paper by Kee and Tang (2016), using China data, they showed that the domestic value added had increased substantially for Chinese firms and is insensitive to exchange rate changes. Furthermore, weakening the RMB’s purchasing power could put a dent in consumer confidence and domestic consumption. Having said the above, there could be some expenditure-switching effect if there is substantial currency depreciation of the RMB against its main trading partners.

\(^{17}\) Some supply chains may even have begun to shorten again as higher-value added activity moved to emerging markets.
Besides fiscal and monetary policies, another important area is a clear strategy from the government side. This involves both a clear economic plan and better communication strategy. Policy uncertainty has shown to be a key driving factor for the rapid decline in private investment (Wang et al., 2016).

The above analysis is consistent with PBoC analysis and communication. In their monetary policy reports, they had also consistently pointed out factors such as overcapacity, weak demand, declining global commodity prices as drivers of PPI deflation and the decline of CPI inflation.

6. Conclusions

Recent PPI deflation among Asian economies since 2012 is synchronous and protracted. The synchronous PPI growth is partly confirmed by the Diebold and Yilmaz (2009, 2012) spillover index, which our empirical results suggest account for a large portion of PPI growth (53% to 64%) among Asian economies. In particular, innovations to China’s PPI y-o-y growth are responsible for a major part of PPI growth in the rest of Asia.

The empirical results using the dynamic panel model suggest that recent PPI deflation in Asian economies can be explained by similar developments in local factors. Despite PPI growth being less sensitive to changes in exchange rates, exchange rate pass-through still plays a role in determining the PPI growth. A similar development in production growth and risk factors (stock prices), and common factors like a sharp drop commodity prices and spillover effects from China’s producer price deflation and are key determinants of recent Asian PPI deflation.

The empirical results confirm that China is at the heart of the region’s PPI deflation challenge. Despite protracted PPI deflation, CPI and core CPI inflation rates are still positive. With the fast deteriorating in Chinese economy growth, it is believed that policies should stabilize short-term growth as well as address medium and long-term structural problems. In the short run, the authority still has some room

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for expansionary fiscal policy and loosening monetary policy. However, injecting more liquidity meant to rebalance the economy may actually dig the economy deeper into deflationary pressures. Devaluing the exchange rate is not an effective tool as producer prices are insensitive to exchange rate changes.

The three fundamental problems of China, declining corporate profit, overcapacity and heavy debt burden could increase the risk of worsening PPI deflation and eventually lead to the CPI deflation, which in turn makes all three problems worse. These three fundamental problems are more serious for state-owned enterprises. Therefore, besides fiscal and monetary policies, supply side reforms such as tightening the overall credit growth, converting corporate debt into equity, and closing down non-profitable zombie firms, or any combination of these measures to reduce overcapacity and debt level, and improve the efficiency and profitability of state-own enterprises are required to avert a deflationary spiral. Since 1978, the reform of the state-owned enterprises has made a major contribution to China’s economic growth. The current problem is how the Chinese authorities can reinvigorate the dynamism of state-owned enterprises. However, the process of the supply side reform is not easy. In particular, the relocation of redundant workers and selection of which zombie firms to close down are key issues. In addition, the principal-agent problem could increase the difficulty in restructuring state-owned enterprises, and the corporate governance required to enhance structural reforms. Therefore, the Chinese authorities have to make a hard choice in restructuring state-owned enterprises and even shutting down some of them, with a trade-off between preserving order in the short-run and keeping the engine of growth running in the long-run.

Besides a new round of reforms to state-owned enterprises, other aspects of supply side reform to reduce distortions such as price, tax, credit supply distortions and create right incentives for the private sector to invest, especially in R&D are also required, so that they can help the economy to climb the technology ladder.

As CPI inflation has been consistently positive and quite stable and China’s PPI deflation has slowed for six consecutive months, the threat of huge deflationary pressures is not immediate. Nevertheless,
a comprehensive supply-side reform package combined with moderately expansionary demand policies is still needed to help China to avoid a hard landing, and prevent the threat of further deflation in other Asian economies.

References


Table 1: Correlations of PPI Inflation among Asian Economies

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Note: The correlations are calculated by using monthly PPI inflation (on year-on-year basis) within the sample period of 2000 – 2015.

Sources: Author’s calculations based on various national sources.

Table 2: Producer Price Spillovers Across Countries Based on 6-Step Ahead Forecasts

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Notes: The dataset covers the period from 2000M1 through 2015M12. The quarterly data for HK have been interpolated using the CPI index. The spillover index has been calculated for the PPI y-o-y growth rate. The optimal VAR lag length $p = 2$ has been determined using the AIC and BIC information criteria. With two lags there appears to be no significant autocorrelation in the residuals. Vietnam hasn’t been included because the sample period starts in 2006.
Table 3: Producer Price Spillovers Across Countries Based on 12-Step Ahead Forecasts

<table>
<thead>
<tr>
<th>To</th>
<th>CN</th>
<th>IN</th>
<th>ID</th>
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<th>PH</th>
<th>SG</th>
<th>TW</th>
<th>TH</th>
<th>HK</th>
<th>JP</th>
<th>From Others</th>
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<td>To Others</td>
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<td>21</td>
<td>23</td>
<td>36</td>
<td>21</td>
<td>11</td>
<td>TS = 64.3%</td>
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Notes: See Table 2.
Table 4: Dynamic Panel Regression for Year-on-Year growth of PPI; Jan 2000 – Dec 2015

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<th>Model</th>
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<td>0.889***</td>
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<td>0.898***</td>
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<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.010)</td>
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<tr>
<td>NEER,1</td>
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<td>-0.021</td>
<td>-0.024</td>
<td>-0.021</td>
<td>-0.027</td>
<td>-0.031</td>
<td>-0.036</td>
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<td>(0.016)</td>
<td>(0.014)</td>
<td>(0.005)</td>
<td>(0.004)</td>
<td>(0.015)</td>
<td>(0.013)</td>
<td>(0.005)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>NEER,1*(Dummy(Hard Pegs)),1</td>
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<td>0.035</td>
<td>0.037</td>
<td>0.030</td>
<td>0.044</td>
<td>0.045</td>
<td>0.039</td>
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<td>(0.023)</td>
<td>(0.021)</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.014)</td>
<td>(0.011)</td>
<td>(0.008)</td>
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<tr>
<td>NEER,1*(Dummy(Soft Pegs)),1</td>
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<td>-0.035</td>
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<td>-0.022</td>
<td>-0.026</td>
<td>-0.022</td>
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<tr>
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<td>(0.019)</td>
<td>(0.016)</td>
<td>(0.012)</td>
<td>(0.030)</td>
<td>(0.020)</td>
<td>(0.016)</td>
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<tr>
<td>NEER,1*(Dummy(Floating)),1</td>
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<td>0.024</td>
<td>0.026</td>
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<td>0.015</td>
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<td>(0.004)</td>
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<td>Commodity Price,1</td>
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<td>0.032***</td>
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<td>(0.004)</td>
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<td>(0.004)</td>
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<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Commodity Price,1*(Dummy(Hard Pegs)),1</td>
<td>-0.011***</td>
<td>-0.011***</td>
<td>-0.023***</td>
<td>-0.020***</td>
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<td>Commodity Price,1*(Dummy(Soft Pegs)),1</td>
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<td>(0.009)</td>
<td>(0.010)</td>
<td>(0.010)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Commodity Price,1*(Dummy(Floating)),1</td>
<td>-0.006</td>
<td>-0.006**</td>
<td>-0.001</td>
<td>0.001</td>
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</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>China PPI,1*Import share from China,1</td>
<td>-0.261***</td>
<td>-0.265***</td>
<td>-0.140***</td>
<td>-0.126***</td>
<td>-0.278***</td>
<td>-0.274***</td>
<td>-0.140***</td>
<td>-0.136***</td>
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</tr>
<tr>
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<td>(0.086)</td>
<td>(0.090)</td>
<td>(0.042)</td>
<td>(0.044)</td>
<td>(0.097)</td>
<td>(0.098)</td>
<td>(0.082)</td>
<td>(0.063)</td>
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<tr>
<td>China Policy Uncertainty Index,1*Import share from China,1</td>
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<td>-3.4E-05**</td>
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<td>(2.5E-05)</td>
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<td>Dummy for GFC</td>
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<td>-0.018***</td>
<td>-0.015***</td>
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<td>Stock Price,1</td>
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<td>0.007***</td>
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<td>(0.003)</td>
<td>(0.003)</td>
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</table>

No. of Countries: 11 11 11 11 11 11 11 11 11
No. of Observations: 2,112 2,112 2,112 2,112 2,112 2,112 2,112 2,112 2,112

Note: The dynamic panel regression is estimated by LSDV using Kiviet, K1 method. ***, **, and * respectively indicate significance at the 1%, 5%, and 10% level. Standard errors are given in the parenthesis underneath coefficient estimates. All variables are in year-on-year growth, except import share from China, China Policy Uncertainty Index, and Dummy for GFC. For the import share from China, the figure for China is using the import share of the remaining countries outside the estimation sample. China Policy Uncertainty Index is in level. Dummy for GFC: Dummy=1 if time during Sep 2008 to Mar 2009, 0 otherwise.
Table 5: Economic Indicators of Over-Capacity Industries

<table>
<thead>
<tr>
<th>Sector share (% of total, 2015)</th>
<th>Industrial employment</th>
<th>Non-farm employment</th>
<th>Industrial value added</th>
<th>GDP</th>
<th>FAI</th>
<th>Industrial profits</th>
<th>Industrial loss making</th>
<th>Industrial assets</th>
<th>Industrial liabilities</th>
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<tbody>
<tr>
<td>Overall industrial sector</td>
<td>100</td>
<td>29.4</td>
<td>100</td>
<td>33.8</td>
<td>39.9</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Coal mining &amp; dressing</td>
<td>4.7</td>
<td>1.4</td>
<td>3.7</td>
<td>1.3</td>
<td>0.7</td>
<td>0.7</td>
<td>10.7</td>
<td>5.4</td>
<td>6.6</td>
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<tr>
<td>Ferrous metal smelting &amp; pressing</td>
<td>3.9</td>
<td>1.1</td>
<td>6.6</td>
<td>2.2</td>
<td>0.8</td>
<td>0.8</td>
<td>15.3</td>
<td>6.6</td>
<td>7.8</td>
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<td>Cement production</td>
<td>0.9</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>0.4</td>
<td>2.5</td>
<td>1.4</td>
<td>1.6</td>
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<td>Flat glass production</td>
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<td>-</td>
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<td>0.4</td>
<td>0.1</td>
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<tr>
<td>Aluminum smelting</td>
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<td>0.1</td>
<td>-</td>
<td>-</td>
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<td>0.0</td>
<td>1.5</td>
<td>0.6</td>
<td>0.9</td>
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<tr>
<td>Ship building</td>
<td>0.6</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
<td>1.1</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Total 6 excess-capacity sectors</td>
<td>10.4</td>
<td>3.1</td>
<td>10.3</td>
<td>3.5</td>
<td>1.5</td>
<td>2.3</td>
<td>31.6</td>
<td>14.8</td>
<td>17.7</td>
</tr>
</tbody>
</table>

Notes: Table replicated from UBS report “The Economic and Financial Impacts of Excess Capacity Reduction”. Source: UBS (2016a), The Economic and Financial Impacts of Excess Capacity Reduction, Hong Kong.

Table 6: Financial Indicators of Selected Over-Capacity Industries

<table>
<thead>
<tr>
<th>(as 2015)</th>
<th>Assets (RMB trn)</th>
<th>Liabilities (RMB trn)</th>
<th>Debt (RMB trn)</th>
<th>Bank loan (RMB trn)</th>
<th>Liability-asset-ratio (%)</th>
<th>Profit margin (%)</th>
<th>Share of loss markers (%)</th>
<th>ROE (%)</th>
<th>ROA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall industrial sector</td>
<td>100</td>
<td>56.2</td>
<td>45.6</td>
<td>27.9</td>
<td>56.2</td>
<td>5.8</td>
<td>13.2</td>
<td>14.5</td>
<td>6.4</td>
</tr>
<tr>
<td>Coal mining &amp; dressing</td>
<td>5.4</td>
<td>3.7</td>
<td>3.2</td>
<td>1.8</td>
<td>67.9</td>
<td>1.8</td>
<td>31.5</td>
<td>2.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Ferrous metal smelting &amp; pressing</td>
<td>6.6</td>
<td>4.4</td>
<td>3.8</td>
<td>2.2</td>
<td>66.7</td>
<td>0.8</td>
<td>21.9</td>
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<tr>
<td>Total 6 excess-capacity sectors</td>
<td>14.8</td>
<td>10</td>
<td>8.7</td>
<td>4.9</td>
<td>67.3</td>
<td>1.3</td>
<td>26.5</td>
<td>3.0</td>
<td>1.0</td>
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</tbody>
</table>

Figure 1: PPI Inflation in Asian Economies

(A) PPI Level

(B) Year-on-year growth rates of PPI

Note: The charts show the monthly PPI index (2010=100) and PPI inflation (on year-on-year basis) of Asian countries from January 2000 to December 2015. Figures for Hong Kong’s PPI inflation are linear interpolated by using the quarterly PPI inflation.

Sources: Various national sources and IMF IFS.
Figure 2: PPI and NEER for Asian Economies

Sources: Various national sources, IMF International Financial Statistics and BIS.
Figure 3: PPI and Industrial Production for Asian Economies

Sources: Various national sources and IMF IFS.
Figure 4: PPI and Commodity Price for Asian Economies

Note: The commodity price is in local currency, which is calculated by the global commodity price index (in US Dollar) multiplied by exchange rate of country i, rebased to an index with the same base period (2005=100) as global commodity price index.

Sources: Various national sources and IMF IFS.
Figure 5: PPI and China’s Policy Uncertainty Index for Asian Economies

Note: The China Policy Uncertainty Index is adjusted by import share from China for each Asian economies.
Figure 6: PPI and Stock Price for Asian Economies

Note: The representative stock indices are used, specifically, China: Shanghai Composite Index; Hong Kong: Hang Send Index; Indonesia: Jakarta Composite Index (JCI); India: Sensex Index; Japan: Nikkei Index; Korea: Korea Composite Stock Price Index (KOSPI); Malaysia: Kuala Lumpur Composite Index (KLCI); Philippines: Philippine Stock Exchange (PSE) Composite Index; Singapore: Straits Times Index (STI); Thailand: Stock Exchange of Thailand (SET) Index; Taiwan: Taiwan Stock Exchange Weighted Index.

Sources: Various national sources, IMF IFS and Bloomberg.
Figure 7: CPI vs. PPI Dynamics in China, Jan 1997 – Jun 2016

![Graph showing CPI vs. PPI dynamics in China, Jan 1997 – Jun 2016]


Figure 8: PPI Dynamics and Profitability of Chinese Firms, Jan 2000 – May 2016

![Graph showing PPI dynamics and profitability of Chinese firms, Jan 2000 – May 2016]

Notes: Total profits refers to the operation results in a certain accounting period, and it is the balance of various incomes minus various spending in the course of operation, reflecting the total profits and losses of enterprises in reporting period (year-to-date figures in monthly basis). The enterprises included in the sample vary from time to time. From 2011, all enterprises with revenues of more than RMB 20 million from its main operating activities are included in the sample, while before 2011, the revenues was RMB 5 million. Source: National Bureau of Statistics of People’s Republic of China.
Figure 9: Profitability of Chinese Firms by Ownership, Jan 2004 – May 2016

Note: The profit figures are year-to-date figures in monthly basis.

Figure 10: Profitability of Chinese Firms in Overcapacity Sectors, Jan 2006 – May 2016

Note: The profit figures are year-to-date figures in monthly basis. For easier comparison, extreme figures (over 600%) are not shown.
Figure 11: Production Capacity Utilisation and PPI, Jan 1996 – May 2016

Note: Production capacity utilization is the diffusion index in 5000 Industrial Enterprises Survey conducted by People’s Bank of China, on quarterly basis. The latest available figure for production capacity utilization is the Sep 2015 figure.

Figure 12: Capacity Utilisation Rates in Selected Chinese Industries, 2008 vs. 2015

Notes: In the graph capacity is defined as the ratio of actual output to production capacity in percentage. Utilisation rate figures for refining and paper and paperboard are for 2014 instead of 2015.
Figure 13: Chinese Debt by Sectors, Q1 2006 – Q4 2015

Source: Bank for International Settlements.

Figure 14: Debt-to-Asset Ratio for SOE and Private Enterprise, 1996 - 2015

Figure 15: Declining Producer Prices in Industries with a High- and Medium-high- Technology, Jan 2011 – May 2016

Note: The classification of high/low technology is using the OECD classification of manufacturing industries based on R&D intensities.

Figure 16: Declining Producer Prices in Industries with a Low- and Medium-low- Technology, Jan 2011 – May 2016

Note: The classification of high/low technology is using the OECD classification of manufacturing industries based on R&D intensities.
Figure 17: Overall vs. Private fixed asset investment in China, Jan 2011 – May 2016


Figure 18: Declining Producer Prices in Industries with a High Share of SOEs, Jan 2011 – May 2016

Note: The classification of high/low share of SOEs is determined by using employment data. The industry with higher than 40% of SOE employees (percentage out of the sum of SOE employees and private employees, and the ratio is the average over 2005 - 2014) is classified as high share of SOE industry, while the industry with lower than 10% of SOE employees is classified as low share of SOE industry. Source: National Bureau of Statistics of People’s Republic of China.
Figure 19: Declining Producer Prices in Industries with a Low Share of SOEs, Jan 2011 – May 2016

Note: The classification of high/low share of SOEs is determined by using employment data. The industry with higher than 40% of SOE employees (percentage out of the sum of SOE employees and private employees, and the ratio is the average over 2005 - 2014) is classified as high share of SOE industry, while the industry with lower than 10% of SOE employees is classified as low share of SOE industry. Source: National Bureau of Statistics of People’s Republic of China.