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## Article

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Cogent Economics & Finance

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*Suggested Citation:* Liu, Hai Yue; Chen, Xiao Lan (2017) : The imported price, inflation and exchange rate pass-through in China, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 5, Iss. 1, pp. 1-13,  
<https://doi.org/10.1080/23322039.2017.1279814>

This Version is available at:

<https://hdl.handle.net/10419/194641>

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Received: 23 October 2016  
Accepted: 03 January 2017  
Published: 02 February 2017

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Reviewing editor:  
Caroline Elliott, Huddersfield University,  
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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# The imported price, inflation and exchange rate pass-through in China

Hai Yue Liu<sup>1</sup> and Xiao Lan Chen<sup>2\*</sup>

**Abstract:** This paper considers the effect of exchange rate (ER) level on China's domestic prices during the period of 2003–2012. We examine China's consumer price index (CPI), import price index (IPI) and producer price index (PPI) by using time series vector error correction analysis. The main finding of the paper is that ER pass-through has had a limited but growing effect on domestic prices and will continue to do so. ER regime change that was announced by Chinese government in 2005 led to an increased sensitivity of ER pass-through to domestic prices.

**Subjects:** Economic Theory & Philosophy; Monetary Economics; International Finance

**Keywords:** CPI; PPI; IPI; exchange rate

**JEL classification:** F31; F41; E31

## 1. Introduction

As China has been further embracing globalization, exchange rate becomes an important economic index to reflect the status of the macro economy. It is a key factor linking international trade and capital flow. Over the past twenty years, China has been moving from a managed exchange rate toward a fully floating exchange rate. Since 2005, China has reformed the exchange rate regime to a managed floating system referring to a basket of currencies. At present, China is urging further reform to improve exchange rate flexibility as part of plans to liberate China's capital account. In the lead up to establishing a fully floating exchange rate, the fluctuation of the RMB will have more impacts on China's economy, such as on the price levels in China.

## ABOUT THE AUTHORS

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## PUBLIC INTEREST STATEMENT

How does exchange rate pass-through affect domestic price level? It has long been a topic of interest in academia. In China, Scholars uses multiple theories and empirical methods only to prove that the imperfections of exchange rate pass-through channels. While in our research, we find that a shock on nominal effective exchange rate (NEER) has negative effect on CPI which depicts that RMB appreciation will cause CPI decrease. Exchange rate pass-through also proved to have limited but growing impact on domestic inflation since the foreign exchange rate regime reform in 2005. In light of these findings, China's inflation can't only be explained as "domestic economic imbalance". More flexible exchange rate regime brings stronger transmission effect from exchange rate and imported prices to domestic inflation in China.

The fluctuation of exchange rate will cause changes on the imported price and then pass on to the producer price index (*PPI*) and consumer price index (*CPI*) of a country. Traditional theory states that the appreciation of a country's currency will relieve the pressure on the inflation in that country. Since 2003, the RMB has appreciated over 24% and this appreciation didn't help bring down the price level while China was facing the high pressure of inflation (Yue, Qiang, & Kai, 2015). The real effective exchange rate (REER) increased 17% from 2003 to 2008, while *CPI* increased over 8% during that same time. It raised an interesting point regarding how effective the exchange rate pass-through is to the imported price and price level in China. This paper tries to study the effects of the exchange rate fluctuation on the price levels in China. Using monthly data from 2003 to 2012, the sensitivity of the imported price and consumer price in China responding to the exchange rate fluctuation was examined through the vector error correction (VEC) model.

The rest of the paper is organized as follows: Section 2 reviews the relevant theoretical and empirical literature. Section 3 describes the theoretical background. Section 4 sets up the empirical model and explains the results. Section 5 concludes the paper.

## 2. Literature review

Although exchange rate pass-through has long been of interest, the focus of this interest has evolved considerably over time. Beginning in the late 1980s, after a long debate over the law of one price and convergence across countries, exchange rate pass-through studies emphasized industrial organization theories. The role of segmentation and price discrimination across geographically distinct product markets was also heavily studied. More recently, pass-through issues have played a central role in heated debates over appropriate monetary policies and an optimal exchange rate regime in general equilibrium models. These debates have broad implications for the conduct of monetary policy, for macroeconomic stability, for international transmission of shocks, and for efforts to contain large imbalances in trade and international capital flows.

### 2.1. Explanations from theories of industrial organization

Substantial work, both theoretical and empirical, has drawn on models of industrial organization to explain the links between exchange rates and prices in terms of market concentration, import penetration, the substitutability of foreign and domestic products, and the nature of oligopolistic competition. Dohner (1984) developed a dynamic model of pricing by forward-looking competitive profit-maximizing exporters in which consumers adjust slowly to price changes. The level of pass-through is determined by the speed of consumer adjustment and expectations of the duration of exchange-rate changes. Mann (1986) and Kreinin, Martin, and Sheehey (1987) all present some evidence suggesting that industry characteristics influence the extent to which exchange-rate movements are passed on to the dollar price of foreign goods. Krugman (1986) pointed out that the reason for incomplete exchange rate transmission to the imported price is the pricing-to-market (PTM) behavior of firms. Feinberg (1986, 1989) found that market concentration and import penetration, differing by industry, influenced the pass-through of changes in exchange rates to prices of West German domestic goods from 1977 to 1983. He also explained the pass-through into domestic prices for the United States over the 1974–1987. Froot and Klemperer (1989) provide both theory and evidence suggesting that expectations of exchange rates play a dominant role in price determination. Dornbusch (1987) developed several static models to explain pass-through with reference to the nature of competition between firms and the relative number of home and foreign firms. The results showed that incomplete pass-through can occur even in the case of perfect substitutes. Baldwin (1988) presented a model, with sunk market-entry costs, in which temporary exchange-rate fluctuations alter domestic market structure sufficiently to influence the pass-through from real exchange rates to real import prices. Fisher (1989) laid out a partial equilibrium model in which domestic and foreign firms set prices based on expected exchange rates; he showed that exchange-rate changes could imply changes in import prices, but the degree of pass-through depended on domestic and foreign market structures. As surveyed by Goldberg and Knetter (1997), most of the available evidence is from very narrowly defined export industries, with an emphasis often placed on the pricing-to-market behavior of exporters. Marston (1990), Knetter (1992, 1993) and Goldberg and Knetter

(1997) used export prices or export unit values from specific countries to multiple destinations with the intent of identifying price discrimination or pricing-to-market activity. Whereas import prices are by definition just the local-currency value of another producer's export prices, the import price series aggregate across producers from all source countries and across a broader array of prices.

## **2.2. Explanations from monetary theories**

Most notably, theoretical works argue that volatility in monetary aggregates and exchange rates of countries should influence the choice of invoice currencies in trade (Devereux & Engel, 2001). In equilibrium, countries with low relative exchange rate variability or stable monetary policies would have their currencies chosen for transaction invoicing. The low-exchange-rate-variability countries would also be those with lower exchange rate pass-through. Taylor (2000) also has noted the potential complementarity between monetary stability and monetary effectiveness as a policy instrument. The idea is that if pass-through rates are endogenous to a country's relative monetary stability, periods of more stable inflation and monetary performance will also be periods when monetary policy may be more effective as a stabilization instrument. For the purpose of the relevant macroeconomic debate, import price series with aggregation are the appropriate units for analysis. Taylor (2000) and Goldfajn and Werlang (2000), among others, have argued that pass-through rates may have been declining over time.

## **2.3. Some evidence found in Chinese literature**

Recent empirical research by some Chinese scholars has drawn controversial conclusions on the exchange pass-through to China's inflation. Jixiang, Yancheng, Liping, and Yuanfeng (2011) found that RMB appreciation would increase the domestic price level through a Granger causality test by using monthly data of 2005–2010. Zhu and Liu (2012) studied the exchange rate pass-through and its relationship with aggregate domestic demand and world commodity price from the year 1980 to 2010. The result shows a positive relationship with RMB appreciation and domestic inflation by using an ARDL model. They drew a conclusion that China's domestic inflation is a "domestic issue" rather than an "imported" one. Ha (2008) argued that RMB appreciation would restrain the domestic inflation. Shi, Fu, and Xu (2008) found the negative relationship between RMB appreciation and inflation by using quarterly data from 1994 to 2007. They also found that the exchange rate pass-through is imperfect in China. Jiang and Kim (2013) further proved their results. Bei and Zhu (2008) research showed that there is no direct relationship between exchange rate and domestic price. This conclusion is similar to that of Li and He (2007).

This paper looks at China's ER pass-through to domestic price levels by focusing on the exchange rate regime reform. Although many existed literature concluded that China does not have a strong exchange rate pass-through channel. We argue that a short-term pass-through channel from exchange rate to *IPI* and *PPI* and then to *CPI* is proved to be effective and smooth. Further the exchange rate reform in 2005 strengthened the sensibility of domestic price levels responding to exchange rate fluctuations.

## **3. Exchange rate pass-through and domestic price level**

According to Svensson (2000)'s inflation targeting model, exchange rate can affect domestic price level through direct and indirect channels hence having further impact on monetary policy. Firstly, exchange rate volatility affects the imported price level which is a part of the *CPI* calculation basket. Secondly, exchange rate volatility affects the relative price level of the importing and exporting countries, which in turn changes the demand level of the imported and exported products. Thirdly, taking foreign exchange rate as an asset, the fluctuation of the exchange rate expectations affects the domestic price level. Finally, the macroeconomic conditions of foreign countries would also affect the domestic price level. Built on Svensson's framework, this paper set up a VAR model for the dynamic exchange rate pass-through to domestic price level taking Chinese economic reality into consideration.

The transmission started from the foreign supply shocks which we use IM (China's total import) as a proxy variable.

$$T_t^{IM} = E_{t+1}(T_t^{IM}) + E_t^S \quad (1)$$

$$M_t = E_{t+1}(M_t) + \alpha_1 E_t^S + E_t^M \quad (2)$$

$$\gamma_t^{GDP} = E_{t+1}(\gamma_t^{GDP}) + \beta_1 E_t^S + \beta_2 E_t^M + E_t^D \quad (3)$$

$$NEER_t = E_{t+1}(\gamma_t^{GDP}) + \gamma_1 E_t^S + \gamma_2 E_t^M + \gamma_3 E_t^D + E_t^E \quad (4)$$

$T_t^{IM}$  represents the foreign supply. We use IM as a proxy variable.  $M_t$  is the broad money. We take M2 as a proxy variable.  $NEER_t$  is the nominal effective exchange rate.  $E_t^S$ ,  $E_t^M$ ,  $E_t^D$  and  $E_t^E$  represent the impact from shocks other than to the supply level, the money supply, domestic demand or the exchange rate.

We assume that the IPI, PPI and CPI have positive transmission relationships with each other. Expressed as flows:

$$P_t^{IPI} = E_{t-1}(P_{t-1}^{IPI}) + \delta_1 E_t^S + \delta_2 E_t^M + \delta_3 E_t^D + \delta_4 E_t^E + E_t^{IPI} \quad (5)$$

$$P_t^{PPI} = E_{t-1}(P_{t-1}^{PPI}) + \theta_1 E_t^S + \theta_2 E_t^M + \theta_3 E_t^D + \theta_4 E_t^E + \theta_5 E_t^{IPI} + E_t^{PPI} \quad (6)$$

$$P_t^{CPI} = E_{t-1}(P_{t-1}^{CPI}) + \eta_1 E_t^S + \eta_2 E_t^M + \eta_3 E_t^D + \eta_4 E_t^E + \eta_5 E_t^{IPI} + \eta_6 E_t^{PPI} + E_t^{CPI} \quad (7)$$

$P_t^{IPI}$ ,  $P_t^{PPI}$  and  $P_t^{CPI}$  represent the imported price index, producer's price index and consumer's price index, respectively. These three variables reflect the price level of a country.  $E_t^{IPI}$ ,  $E_t^{PPI}$  and  $E_t^{CPI}$  represent the impact from shocks to IPI, PPI, and CPI, respectively. We take these seven impacts as variables of the VAR model to evaluate their effect on inflation.

#### 4. Empirical analysis

Basically, the analysis starts from the reduced form of an unrestricted VAR model with k lags that can be written down as:

$$Z_t = a_0 D_t + \sum_{i=1}^k A_i Z_{t-i} + u_t \quad (8)$$

where  $D_t$  is a  $(n \times 1)$  vector of all deterministic variables such as intercepts, trends, dummies etc.,  $A_1, \dots, A_k$  are  $(n \times n)$  matrix of coefficients,  $Z_t = (Z_{1t}, Z_{2t}, \dots, Z_{nt})'$  is a vector of  $n$  variables,  $u_t$  is a  $(n \times 1)$  column vector of innovations, that is, serially uncorrelated disturbances that have zero mean and a variance-covariance matrix variance-covariance matrix  $E(u_t, u_t') = \Sigma$ , i.e.  $u_t \sim N(0, \Sigma)$ .

The estimation of  $a, A_1, \dots, A_k$  are obtained by applying ordinary least squares (OLS) to each part of Equation (8) separately, and the estimate of  $\Sigma$  is given by the sample covariance matrix of the OLS residuals.

If co-integration between the variables exists, the VAR model can be rewritten in a VEC (vector error correction) model as:

$$\Delta Z_t = a_0 D_t + \sum_{i=1}^k \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-k} + u_t \quad (9)$$

where  $\Delta$  is a difference operator,  $\Gamma$  is a  $(n \times n)$  matrix of long-run multipliers and  $[\Gamma_i]_{i=1}^{k-1}$  is a  $(n \times n)$  matrix of coefficients that contain the short-run responses among variables.

In this study,  $Z_t = (LCPI, LIPI, LPPI, LM2, LIM, LNEER, LGDP)'$ , a  $(7 \times 1)$  vector of  $I(1)$  variables are considered as endogenous.

The data employed for the study are monthly series of *CPI*, *IPI*, *PPI*, *NEER*, *M2*, *GDP*, and *IM*, representing inflation, import price index, producer's price index, nominal effective exchange rate, money supply, domestic demand and foreign supply, respectively.

The time span chosen for analysis is from 2003 to 2012. Three major inflations happened during this period. The data sources of variables are listed in Table 1. Unless otherwise stated, all variables have been adjusted seasonally using X12 method and adopted the natural logarithm in order to eliminate the influence of seasonal interruptions and heteroscedasticity (Findley, Monsell, Bell, Otto, & Chen, 1998). Table 2 presents summary statistics on the key variables used in this analysis.

The estimation process is organized as follows: firstly, it presents the unit root test result for the stability of all variables. Secondly, it shows the co-integration relationship examined by the Johansen co-integration test. At last, a VEC model will be set up to analyze the impulse response and variance decomposition.

#### 4.1. Unit root test

To determine the appropriate specification for the VAR estimate, the variables must be tested for the stationary process. The presence of non-stationary behavior in the autoregressive representation of the variable, i.e. the order of integration for each variable is determined using the Augmented Dickey-Fuller (ADF) unit root test. The results of the ADF tests for six key variables reveal that *GDP*, *IPI*, *IM* and *PPI* are stationary at level ( $I(1)$  process), while *CPI*, *M2* and *NEER* are first difference stationary ( $I(2)$  process) at 10% critical value (Table 3).

**Table 1. Variable description and data source**

Variables	Description	Representation	Source
<i>CPI</i>	Consumer price index (2005 = 100)	Domestic inflation	National Bureau of Statistics
<i>IPI</i>	Import price index (2005 = 100)	Price levels of imported products	National Bureau of Statistics
<i>PPI</i>	Producer price index (2005 = 100)	Producer's manufacturing cost	National Bureau of Statistics
<i>NEER</i>	Nominal effective exchange rate (2005 = 100)	Exchange rate level	IMF International Finance Statistics
<i>M2</i>	Broad money (in million US dollars)	Domestic money supply	National Bureau of Statistics
<i>GDP</i>	Gross domestic product (using industrial value-added as proxy variable)	Aggregate domestic demand	National Bureau of Statistics
<i>IM</i>	China's total import from the world (in million US dollars)	Foreign supply	National Bureau of Statistics

**Table 2. Summary statistics of key variables**

Variables	Observation	Mean	Std. dev.	Minimum	Maximum
<i>LCPI</i>	120	4.6347	0.0227	4.5870	4.6886
<i>LIPI</i>	120	4.6642	0.0955	4.3770	4.8097
<i>LPPI</i>	120	4.6346	0.0407	4.5196	4.7014
<i>LNEER</i>	120	4.5521	0.0708	4.4308	4.6818
<i>LM2</i>	120	12.961	0.4929	12.155	13.789
<i>LGDP</i>	120	2.6473	0.2928	1.6864	3.1442
<i>LIM</i>	120	6.6628	0.4805	5.4714	7.4242

**Table 3. ADF unit root test results**

Variables	At level		1st difference	
	t-value (constant and trend)	p-value (constant and trend)	t-value (constant and trend)	p-value (constant and trend)
LCPI	-2.3969	0.3793		
LGDP	-3.6875**	0.027		
LIPI	-4.2898*	0.0046		
LPPI	-2.5369**	0.0101		
LM2	-2.5369	0.3101		
LNEER	-3.1075	0.1094		
LIM	-5.6911*	0.0000		
LCPI			-12.3134*	0.0000
LM2			-5.5843*	0.0000
LNEER			-7.4046*	0.0000

Note: Lag length selection is automatically based on Schwarz info Criterion (SIC), maxlag = 13.

\*Rejection of the null hypothesis (a variable has a unit root) at 1% significance level.

\*\*Rejection of the null hypothesis (a variable has a unit root) at 5% significance level.

## 4.2. Co-integration test and VEC model setup

Considering this study is to analyze the pass-through of the variables related to exchange rate volatility to the domestic price level, all these macro-economic variables might share the same long-run trend and affect each other in a certain way, or while they exhibit short run fluctuations around a long run equilibrium. The ADF test indicates that all the time series are not stationary at the same level. A Johansen co-integration test was employed in order to prove there is co-integration relationship between these variables. Table 4 shows that there are at least two co-integrating equations at the 5% level for both trace test and maximum eigenvalue test. Therefore, *CPI*, *GDP*, *IPI*, *PPI*, *NEER*, *M2*, and *IM* were included to establish a VEC model. The result shows that all the inverse roots are less than one, i.e. all the model roots are located in a unit circle (see Figure 1), and the optimal lag period is 2 according to AIC result (Table 5). The model is stable so that we can proceed to impulse response and variance decomposition analysis.

## 4.3. The dynamic behavior of the VEC model

The dynamic behavior of the VEC model is analyzed using the impulse response function and variance decomposition.

### 4.3.1. Impulse response functions

The impulse response function (IRF) traces the effect of a one-standard-deviation shock in a variable on current and future values of others in the system. It indicates the size and characteristics of the shock's effects. It is well known that the results of the IRF and variance decomposition based on Cholesky's decomposition are sensitive to the order of the variables and the lag length. A VEC model

**Table 4. Johansen co-integration test result**

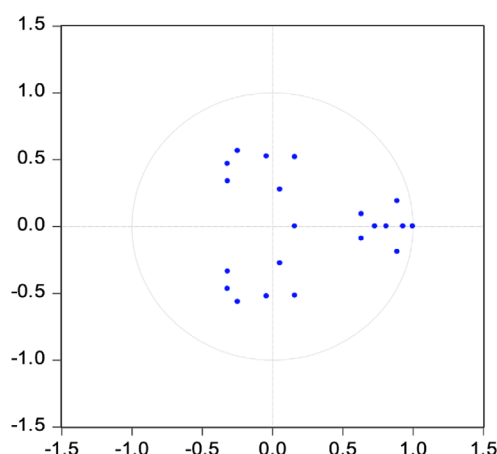
Unrestricted co-integration rank test (trace)					Unrestricted co-integration rank test (maximum eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.	Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.
None*	0.4239	166.6119	125.6154	0.0000	None*	0.4239	62.3116	46.2314	0.0005
At most 1*	0.3087	104.3002	95.7537	0.0113	At most 1*	0.3086	41.7067	40.0776	0.0325

Notes: Trace test indicates 2 co-integrating equation(s) at the 0.05 level. Maximum eigenvalue test indicates 2 co-integrating equation(s) at the 0.05 level.

\*Rejection of the hypothesis at the 0.05 level.



**Figure 1. Inverse roots of AR characteristic polynomial.**



**Table 5. VAR lag order selection criteria**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1,006.884	NA	4.15E-17	-17.855	-17.685	-17.786
1	1,870.569	1,603.985	2.00E-23	-32.403	-31.044*	-31.852
2	1,962.539	159.305	9.37E-24*	-33.170*	-30.622	-32.136*
3	1,996.708	54.914	1.25E-23	-32.905	-29.168	-31.389
4	2,044.992	71.565*	1.33E-23	-32.893	-27.965	-30.894
5	2,081.281	49.250	1.81E-23	-32.666	-26.549	-30.184
6	2,124.255	52.949	2.29E-23	-32.558	-25.252	-29.594

Notes: FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

\*Lag order selected by the criterion: LR: sequential modified LR test statistic (each test at 5% level).

can be used to test the Granger causality among variables of the model, i.e. to ascertain the direction of causality. Granger's definition of causality is a widely used concept of causality (Granger, 1969). In order to analyze the causal relationships between *CPI* and the other variables, a Granger causality test within a VEC framework is used. The test estimates the  $\chi^2$  value of the coefficient on the lagged endogenous variables. The null hypothesis is that the lagged explanatory variables of the model and also their joint significance do not Granger-cause the dependent variable. Table 6 reports *p*-values for *F*-statistics at lag three for the VEC Granger causality test results.

The results presented in Table 6 indicate that among six variables, except *dLM2* others do "cause" *CPI* individually and the six variables influence *CPI* jointly. Combined with the Granger Causality Test results and the economic reality, we can decide the Cholesky order as follows: *GDP*, *M2*, *NEER*, *IM*, *PPI*, *IPI*, *CPI*.

Figure 2 shows a shock on *NEER* has negative effect on *CPI*. The impact from exchange rate to the *CPI* added up gradually and reached the highest point of 0.36% around the seventh month. A shock on *PPI* has positive effect on *CPI*. The effect is quick (reaches the highest point in the first months at about 0.36%) and then faded out to 0.1% after 12 months. A shock from imported price also has positive effect on *CPI*. It reaches the highest point after 3 month to 0.18% and slowly fades out. The results show a short-term pass-through channel from exchange rate to the *CPI* through imported price and *PPI*. This is the first empirical evidence that our hypothesis conforms to real-world trends.



**Table 6. VEC granger causality/block exogeneity wald test results-probabilities**

Dependent variables	Excluded variables ( $df = 3$ )							Block exogeneity ( $df = 10$ )
	dLCPI	dLNEER	dLIPI	dLPPI	dLM2	dLGDP	dLIM	
dLCPI		0.01*	0.01*	0.01*	0.34	0.00*	0.07*	0.00*
dLNEER	0.48		0.63	0.01*	0.75	0.65	0.26	0.21
dLIPI	0.86	0.44		0.00*	0.64	0.84	0.35	0.00*
dLPPI	0.03**	0.00**	0.14		0.77	0.05**	0.48	0.00
dLM2	0.02**	0.36	0.26	0.20		0.62	0.40	0.18
dLGDP	0.60	0.55	0.63	0.92	0.18		0.56	0.29
dLIM	0.25	0.77	0.13	0.23	0.00*	0.86		0.00*

\*Rejection of the null hypothesis (a variable has a unit root) at 1% significance level.

\*\*Rejection of the null hypothesis (a variable has a unit root) at 5% significance level.

**Figure 2. Response of LCPI to Cholesky one S.D innovations.**

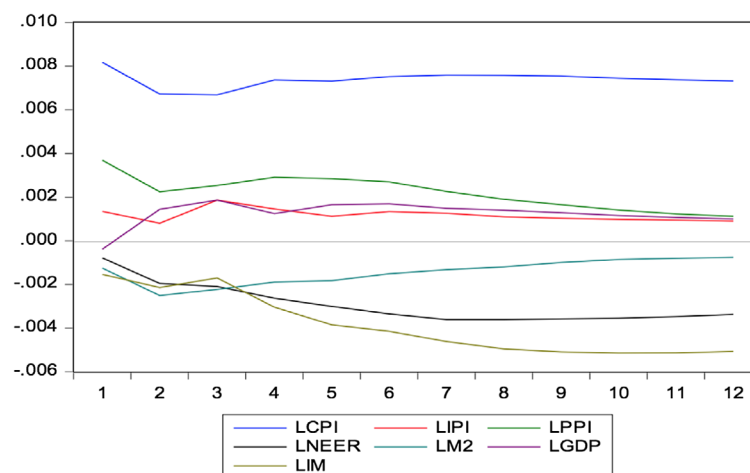


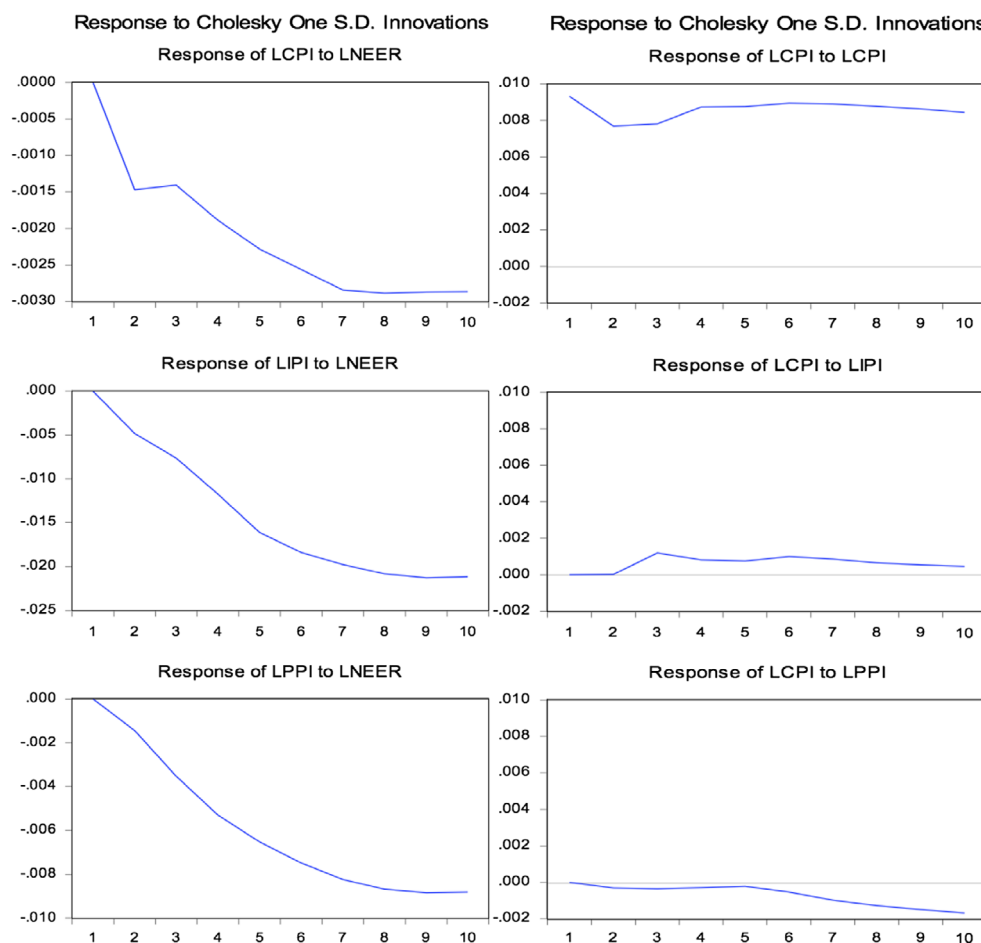
Figure 3 shows that a shock on *NEER* has negative effect on *CPI*, *IPI*, and *PPI*. The imported price index has been most affected by the changes in the exchange rate compared with the other two price indices. The effect increases gradually and reaches the highest point after 7 months (2.2%). It indicates the pass-through effect from exchange rate to imported price levels is relatively smooth. The *NEER* has the smallest impact on the *CPI* (0.27% at the highest). It explains the exchange rate pass-through to domestic inflation is imperfect and lagged-behind.

#### 4.3.2. Variance decomposition

Variance decomposition measures the percentage of the forecast variance in inflation. This variance can be attributed to shocks or changes to each explanatory variable over a series of time horizons. In addition, it shows how this proportion changes over time. The variance decomposition in *CPI* of the VEC model by using the Cholesky decomposition method is reported in Table 6 (the Cholesky order has been discussed earlier).

The variance decomposition results support the empirical findings from the impulse response functions (Table 7). *CPI* itself caused 60% of its variability. Then outside supply shocks (IM) accounts for almost 16% of the *CPI*'s variance after ten lags, which is the highest among all these explainable variables. Exchange rate (*NEER*) claims 9.6% of the *CPI*'s variance at the end of 10 months which is supported by the IRF test as well. *PPI* has a significant contribution to *CPI*'s variance in the beginning (15.6%) but the percentage decreases gradually. *IPI* makes up 2% of *CPI*'s variance in the first month and keeps a steady percentage of 1.75% after 10 lags. M2 has immediate influence in the second

**Figure 3. Impulse response results of *LNEER*, *LCPI*, *LPPI*, *LIPI*.**



**Table 7. Variance decomposition of *LCPI* (2003–2012)**

Period	<i>LCPI</i>	<i>LIPI</i>	<i>LPPI</i>	<i>LNEER</i>	<i>LM2</i>	<i>LGDP</i>	<i>LIM</i>
1	76.8626	2.0954	15.6378	0.7013	1.8015	0.1725	2.7289
2	72.4874	1.5911	12.0459	2.8677	5.0687	1.4390	4.5002
3	69.7082	2.6442	11.1323	3.9167	5.6905	2.5283	4.3797
4	67.8416	2.5975	10.7640	5.0585	5.2640	2.3297	6.1446
5	65.4888	2.3137	10.3033	6.1358	4.8835	2.4680	8.4069
6	63.8135	2.2138	9.7183	7.1594	4.3727	2.5505	10.1718
7	62.5182	2.1014	8.9135	8.0964	3.9198	2.4845	11.9664
8	61.5244	1.9660	8.1235	8.7553	3.5511	2.3987	13.6810
9	60.8041	1.8483	7.4375	9.2293	3.2257	2.2997	15.1554
10	60.2459	1.7519	6.8424	9.6031	2.9530	2.1973	16.4064

Note: Cholesky ordering: *LGDP*, *LM2*, *LNEER*, *LIM*, *LPPI*, *LIPI* and *LCPI*.

month, about 5%, after which the influence decreases month by month to only 2.95% at the end. GDP has a steady increase to *CPI*'s variance at about 2%.

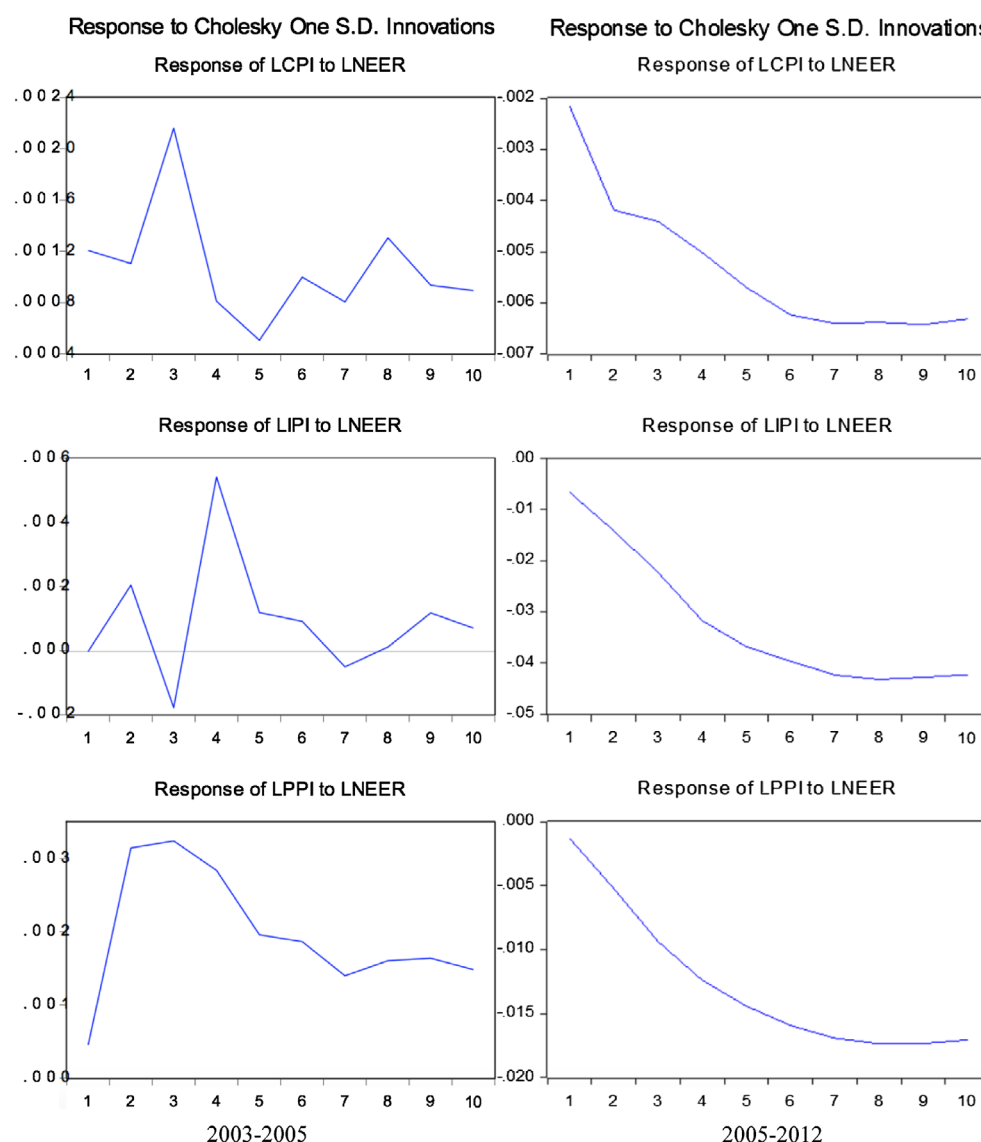
#### 4.4. Further discussion—Does exchange rate reform in China change the sensitivity of the pass-through effect?

In July 2005, to reform the formation mechanism of the RMB exchange rate, the rate was no longer pegged to the US Dollar, but instead determined by a currency basket. A managed floating exchange rate system was implemented which was based on the market supply and demand and was regulated referring to the currency basket.

The foreign exchange rate reform in 2005 has made the RMB exchange rate more floating compared with the regime of pegging-dollar during 1994–2005. After 2005, the RMB REER appreciated almost 30%. We try to analyze if foreign exchange regime would make a difference when it comes to the pass-through effect on inflation. We separate the time span to before the reform (2003–2005) and after the reform (2005–2012). The major finding through impulse response and variance decomposition is presented in Figure 4 and Table 8.

Through Figure 4, it is obvious that the exchange rate pass-through to the *IPI*, *PPI* and *CPI* is more effective after the 2005 reform. It explains that before 2005, the effect of exchange rate to the price levels are not stable or significant. It depicts that after 2005, the appreciation of RMB helped bring

**Figure 4. Comparisons of impulse responses of price levels to *LNEER*.**



**Table 8. Comparison of variance decomposition of ICPI to LNEER**

Period	LNEER (2003–2005)	LNEER (2005–2012)
1	5.1358	4.7350
2	2.3576	12.9269
3	2.9319	16.3130
4	2.3346	17.6952
5	1.9319	19.9580
6	1.8114	21.8478
7	1.6588	22.9393
8	1.6475	23.6693
9	1.5446	24.2306
10	1.4635	24.5914

Note: Cholesky ordering: LGDP, LM2, LNEER, LIM, LPPI, LIPI and LCPI.

down the price levels. 1% of RMB appreciation helped the *IPI* to decrease 4%, *PPI* to decrease 1.7% and *CPI* to 0.6%. Through variable decomposition (Table 8) we can see the explanation power of *NEER* to *CPI* increased from 1.46 (2003–2005) to 24% (2005–2012) (after 10 lags). The domestic price levels are more sensitive to the changes of exchange rate under the more flexible exchange rate regime in China. We can draw a conclusion that imported factors are becoming more and more influencing and that the 2005 exchange rate regime reform has made the pass-through more effective than the pegging-dollar regime.

#### 4.5. Robustness test

The US Dollar is the key currency in China's exchange rate "currency basket". It is also the major settlement currency in trade and investment practice in China. Consequently, we use RMB per US dollars (US) as the replacement to *NEER* to build up our robustness test. Table 9 show similar results. The variance decomposition shows that LUS explains 7% of *LCPI*.

#### 5. Conclusions

This paper sets up VEC model to analyze the pass-through effect of exchange rate to domestic price levels using monthly data from 2003–2012. The major findings are: (1) A shock on *NEER* has negative effect on *CPI* which depicts that RMB appreciation will cause *CPI* decrease. Exchange rate pass-through also proved to have limited but growing impact on domestic inflation. (2) A shock on *PPI* and *IPI* has positive effect on *CPI*. The effect is quick and significant. A short-term pass-through channel from exchange rate to *IPI* and *PPI* and then to *CPI* is proved to be effective and smooth. (3) The exchange rate regime reform in 2005 has rather important effect on the pass-through channel. The

**Table 9. Variance decomposition of LCPI (Robustness test)**

Period	LGDP	LM2	LUS	LIM	LPPI	LIPI	LCPI
1	0.2685	3.6813	2.0883	6.1708	16.9622	1.2932	69.5357
2	1.2406	7.6886	4.8023	9.0617	12.9625	1.0084	63.2360
3	2.2235	8.3741	7.1753	8.5784	12.8996	2.2806	58.4686
4	2.0923	7.4132	7.8577	10.5343	13.42397	2.2648	56.4138
5	2.3229	6.7400	8.4939	12.9375	13.5236	2.0880	53.8946
6	2.4165	6.0523	8.5596	14.954	13.4686	2.1898	52.3587
7	2.3562	5.4784	8.3273	17.0189	13.0865	2.2132	51.5196
8	2.2706	5.0539	7.9823	19.1130	12.5463	2.1805	50.8535
9	2.1597	4.6783	7.5468	21.0366	12.0005	2.1560	50.4181
10	2.0410	4.3645	7.0751	22.7668	11.4616	2.1388	50.1523

Note: Cholesky ordering: LGDP, LM2, LUS, LIM, LPPI, LIPI and LCPI.

result shows that after 2005, the appreciation of RMB did help bring down the price levels. The 2005 exchange rate regime reform has made the pass-through more effective than the pegging-dollar regime. In light of these findings, China's inflation can't only be explained as "domestic economic imbalance". More flexible exchange rate regime brings stronger transmission effect from exchange rate and imported prices to domestic inflation in China.

#### Funding

This paper was supported by the High-level Young Scholars Team-Building Fund of Sichuan University [grant numbers SKGT20130, SKQY201520]; Soft Science Fund of Department of Science and Technology of Sichuan Province [grant numbers 2015ZR0106, 2016ZR0017].

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#### Citation information

Cite this article as: The imported price, inflation and exchange rate pass-through in China, Hai Yue Liu & Xiao Lan Chen, *Cogent Economics & Finance* (2017), 5: 1279814.

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