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Symmetry of shocks across China: a VAR approach

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Abstract

This paper examines how similar shocks are across Chinese regions from 1978 to 2009. Using a SVAR with GDP growth and inflation as dependent variables, we identify the model assuming demand shocks have no long-run effect upon output. We find that both supply and demand shocks are more correlated within China than are their counterparts within Europe or the U.S. as reported in similar studies. Moreover, demand shocks are more strongly correlated than are supply shocks. Output and prices also respond similarly to shocks.

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1 Introduction

China has become one of the largest economies in the world and China's per capita GDP has more than quadruped in the last 30 years. Of course, not all parts of China have grown equally resulting in increasing regional disparity. Kanbur and Zhang (2001) analyze regional inequality in China from 1949 to 2000. They argue that regional inequity is explained by three key variables: the ratio of heavy industry to gross output value, the degree of centralization, and the degree of openness. Demurger et al. (2002) estimate the effects of geography and the preferential policy on provincial growth rates in 1996-99. They find both factors are important for provincial growth by using simple cross-section regressions. Fleisher et al. (2005) find that FDI is an important factor of regional disparity in China.

These studies compare income levels across regions and then attempt to find explanations for divergence. However, one can also consider a different concept of "similarity" across regions by comparing business cycle dynamics across regions. To what extent do regions X and Y within China face similar business cycle shocks? Of course, these two concepts of similarity need not be entirely distinct. Consider a region of China that is not developing as quickly as others but remains more dependent upon agriculture. Weather induced supply shocks would then have bigger effects on this region than on others. Or, as coastal regions quickly grow and become more integrated with the global economy, global trade and financial shocks could have bigger effects on these regions than on other parts of China. The focus of this study is upon the similarity of business cycle shocks across Chinese regions.

Such a study can provide several benefits. For one, to what extent are centralized fiscal policies appropriate? One element of Chinese reforms has been to give provincial governments more fiscal autonomy (see Lan and Sylwester (2010)). The benefits of such a policy presumably increase to the extent that different provinces face different business cycle conditions. Likewise, the appropriateness of a common monetary policy depends upon the similarity of business cycle conditions across countries. Although we recognize that even in the absence of similar business cycle shocks China will retain a single currency, this study can help Chinese policy makers better recognize potential shortcomings of a single monetary policy for the country.

However, this study can still hold implications for the appropriateness of a common currency area. Several studies have compared the degree of symmetry of shocks across European countries to that in the US, a large region already having a common currency[1]. Likewise, a reason to consider the symmetry of shocks within China is to provide a basis of comparison for other emerging market areas in forming their own currency union. Many developing areas have been considered for possible currency unions, especially after the launch of the Euro in 2002. For example, the Asian Monetary Fund and Chiang Mai Initiative were considered as a basis for regional monetary integration. Similar proposals have been discussed in Africa, the Gulf Arab countries, and the east Caribbean (e.g., Bayoumi and Eichengreen (1996), Darrat and Al-Shamsi (2005), and Morshed et al. (2005)).

[1] See Boltho (1989), Bayoumi and Eichengreen (1994), Dibooglu and Horvath (1997) and Monfort et al. (2003).

Currency unions across developing and emerging market regions are also receiving a great deal of academic attention. Xu (2006) is skeptical of the feasibility of a currency union between mainland China and Hong Kong. However, Zhang and Sato (2008) do find increasing integration within the "Greater China" which is becoming a better candidate for currency union. Ward and Jayaraman (2006) also cast doubt on the appropriateness of a currency union among several Pacific island countries. Buiget and Valev (2005) do not favor a currency union among East African countries. Chaplygin et al. (2006) report a lack of symmetry across former Soviet countries and so do not support a currency union among them. Other studies consider to what extent peripheral European countries should also join the Euro. Mikek (2009) finds that shocks remain sufficiently asymmetric so that peripheral countries should not join. Horvath and Ratfai (2004) also question the wisdom of expanding the Euro region. Bergman (1999) even considers whether the Scandinavian Currency Union of 1873 to 1913 was an appropriate currency union.

Since many of the countries in the above studies are at income levels far below that of the U.S. or Europe, one might wonder if comparing associations among such countries to those in the U.S. is appropriate. Thus, policy makers in these countries as well as researchers examining this issue can use China as a benchmark to determine if shocks and their dynamics are sufficiently similar to form a currency union. China is a functioning monetary union and is the biggest developing country in terms of geography and population. However, there is also variability in production and development levels across provinces in China just as there are in regions containing several developing countries. Therefore, just as the United States often serves as a benchmark when considering greater European integration, perhaps China can serve as a measuring stick when developing countries consider currency unions.

The rest of the paper is organized as follows. Section 2 describes the methodology and section 3 presents results. Concluding comments follow in section 4.

2 Methodology

2.1 Econometric Model

We divide China into five regions, analogous to the eight census regions of the U.S., where each region contains multiple provinces. These regions are: Center, East, Northeast, Northwest, and Southwest. The appendix lists what provinces are in each region. For each region, we consider a structural vector autoregression (SVAR) with the growth rate of GDP and the inflation rate as the endogenous variables. Given sufficient identifying assumptions (see below) we can uncover the structural supply and demand shocks for that region. We can then repeat this procedure for the four remaining regions, uncovering their respective supply and demand shocks. By comparing these shocks across regions, we can then gauge to what extent different regions are hit by similar or disparate supply and demand shocks. We can also compare how output and prices respond to these shocks in each of the five regions.

This procedure is taken from Bayoumi and Eichengreen (1994) who analyze data on output and prices in 11 European countries in order to extract information on aggregate supply and demand shocks. They employ a SVAR to distinguish aggregate supply shocks and aggregate demand shocks across regions in the U.S. and European countries. The coherence of the underlying shocks in Europe is then compared to the results from US regional data. To motivate the restrictions necessary to identify the structural shocks, we continue to follow Bayoumi and Eichengreen (1994) and use an AD-AS model. The AD curve slopes downward. The long-run AS curve is vertical. A short run AS curve has positive but finite slope. In the short run, wages are sticky by assumption. A positive demand shock raises prices and so lowers real wages. Firms hire and produce more and so "move up" the (short-run) aggregate supply curve. But since nominal wages adjust to changes in prices in the long run to restore real wages to their initial level, output also returns to its initial level but with higher prices. Therefore, a positive shock to AD raises output and price in the short run but has no long run effect upon output. This is the key restriction we employ to identify the model: demand shocks have no long run effect upon output.

More specifically, consider the following VAR containing the growth rates of output and prices as the dependent variables:

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \begin{bmatrix} a_{11}(L) & a_{12}(L) \\ a_{21}(L) & a_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{st} \\ \varepsilon_{dt} \end{bmatrix} = \sum_{i=0}^{\infty} A_i \varepsilon_{t-i} = \mathrm{A}\,(\mathrm{L})\,\varepsilon_t \tag{1}$$

where $a_{ij}(L)$ are polynomials and A are matrices in the lag operator L. The coefficients of the polynomials $a_{ij}(L)$ give the time path of the effect of shock j on variable i. Let $\Delta x_t \equiv [\Delta y_t \quad \Delta p_t]'$ and $\varepsilon_t \equiv [\varepsilon_{st} \quad \varepsilon_{dt}]'$, where Δ denotes the first-difference operator, y_t is real output and p_t is the price level. All variables are in log form. ε_{st} is the supply shock, and ε_{dt} is the demand shock.

One can estimate the following reduced-form VAR:

$$\Delta x_t = B(L)\,\Delta x_{t-1} + \mu_t$$

where μ_t is a vector reduced-form disturbance. An MA representation is:

$$\Delta x_t = C(L)\,\mu_t \tag{2}$$

By comparing equation (1) and (2), the relation between the structural and reduced-form disturbances is obtained:

$$\mu_t = A_0 \varepsilon_t \tag{3}$$

The variance of the supply shock and demand shock are normalized to one. And structural shocks are assumed to be mutually orthogonal. Thus, one additional restriction is required to recover the elements of A_0.

As stated, this restriction is from the AD-AS model. Demand shocks have no long run effects upon output. Once A_0 is identified, the structural shocks can be recovered using equation (3).

2.2 Data

China has 31 provincial level localities. From these 31, we exclude Xizang (Tibet), Hainan, and Chongqing provinces due to a lack of data. We then divide the remaining 28 provinces into five regions: Northeast, East, Center, Northwest, and Southwest. The appendix lists the provinces in each region.

Annual data from 1978 to 2009 for real Gross Regional Product (GRP) and the CPI for these 28 provinces are collected from www.chinadataonline.com. All these data are provided by National Bureau of Statistics of China. We then aggregate the data to the regional level and then take natural logarithms. Output growth and inflation are calculated as the first differences of the logged series. Summary statistics of this data are provided in the appendix.

Before proceeding we test each series to see if the first differences are stationary, thereby allowing their use in the VAR. Table 1 presents the results of these ADF tests. For all series, the null of a unit root cannot be rejected for the series in levels whereas this null is rejected when considering first differences for most series. Only in two cases is the null not rejected at conventional levels (and in both cases the p-value is 0.11). The null of stationarity is never rejected for the first differences when using a KPSS test (not reported but available upon request). Taking the generality of these findings, we proceed with the aforementioned empirical methodology taking the first differences to be stationary.

Table 1: Unit root tests

	Levels			First Differences		
	t-statistic	p-value	# lags	t-statistic	p-value	# lags
GDP						
Center	0.70	0.99	2	-3.54	0.014	1
East	1.65	0.99	6	-3.25	0.028	3
Northeast	3.024	0.99	6	-3.41	0.019	2
Northwest	1.19	0.99	1	-2.80	0.070	2
Southwest	0.833	0.99	1	-3.97	0.005	0
CPI						
Center	-1.82	0.36	5	-2.94	0.05	1
East	-1.50	0.52	1	-2.58	0.11	1
Northeast	-1.47	0.53	2	-2.55	0.11	2
Northwest	-1.26	0.63	2	-2.80	0.07	1
Southwest	-1.22	0.65	2	-3.14	0.03	1

3 Empirical Results

3.1 Correlations

Figures 1 and 2 present the structural supply and demand shocks for each of the five regions. Table 2 provides correlations across regions. Correlations of supply shocks are given above the main diagonal and those for demand shocks are provided below the main diagonal (and are also written in italics). Demand shocks are highly correlated across regions, more so than are supply shocks. The mean correlation for demand shocks is 0.80 versus 0.56 for supply shocks. Moreover, the range of correlations for demand shocks is relatively narrow, spanning 0.73 to 0.83. No region appears to exhibit many large, idiosyncratic demand shocks. On the other hand, supply shock correlations range from 0.38 to 0.75 and so the potential for large, idiosyncratic supply shocks to hit a specific region appear greater.

One can also see common shocks on the figures. The 1980 economic reforms creating greater private incentives could have spurred greater work effort resulting in a countrywide supply shock in the early 1980's. For example, the "household-responsibility system" decollectivized agriculture, allowing farmers to retain more of what they grew. Production managers at factories were also given more autonomy to make decisions and were allowed to sell production above their quota. The dual price system also created more incentives for production, allowing producers to sell at market prices once a certain amount of output was sold at the government-set price. [2] The 1992 positive supply shock could have resulted from China's decision to extend its open door policy to all of the country after Deng Xiaoping's southern inspection trip (*nanxun*) that year, signaling that reform was still ongoing and had not terminated. A large negative supply shock hit the southwest region in 2001 but did not directly affect other parts of China. This was possibly caused by a series of earthquakes that hit Sichuan province in February of that year. Two large demand shocks hit all regions, the first in 1988 and the second in 1994. The latter might have been caused by an increase in confidence as the U.S. renewed Most Favored Nation Status with China that year. Chong (1988) attributes the former to loose monetary policy by the Chinese monetary authority early in the year and to a buying spurt across China as many feared that price controls would soon be lifted on a wide variety of goods.

[2] See Qian (2003) and Jin et al. (2005) for surveys of economic and fiscal reforms in China.

Figure 1: Supply Shocks for all Five Regions

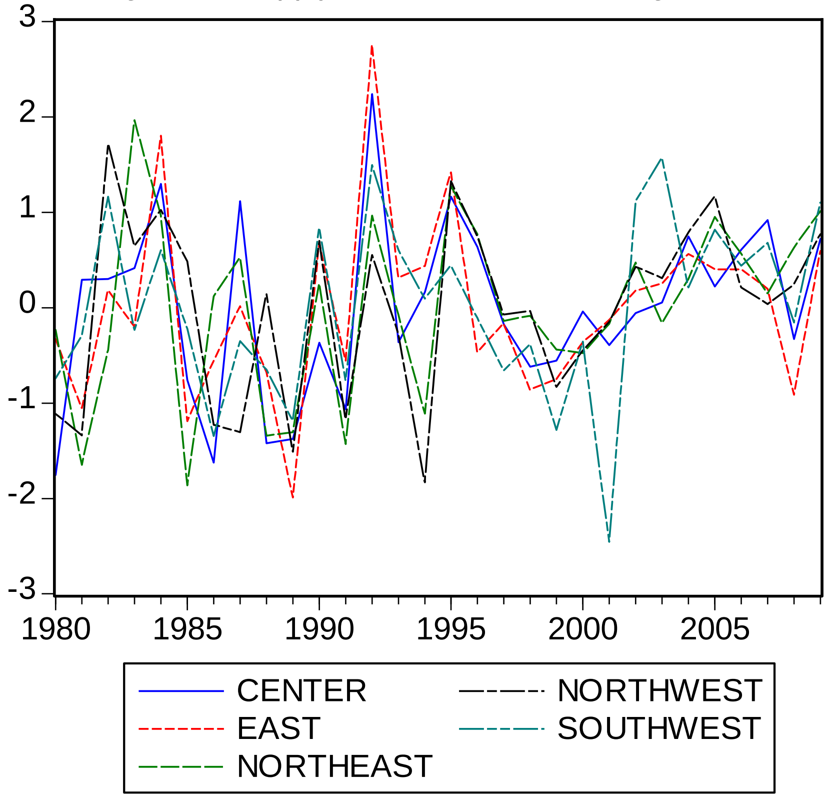
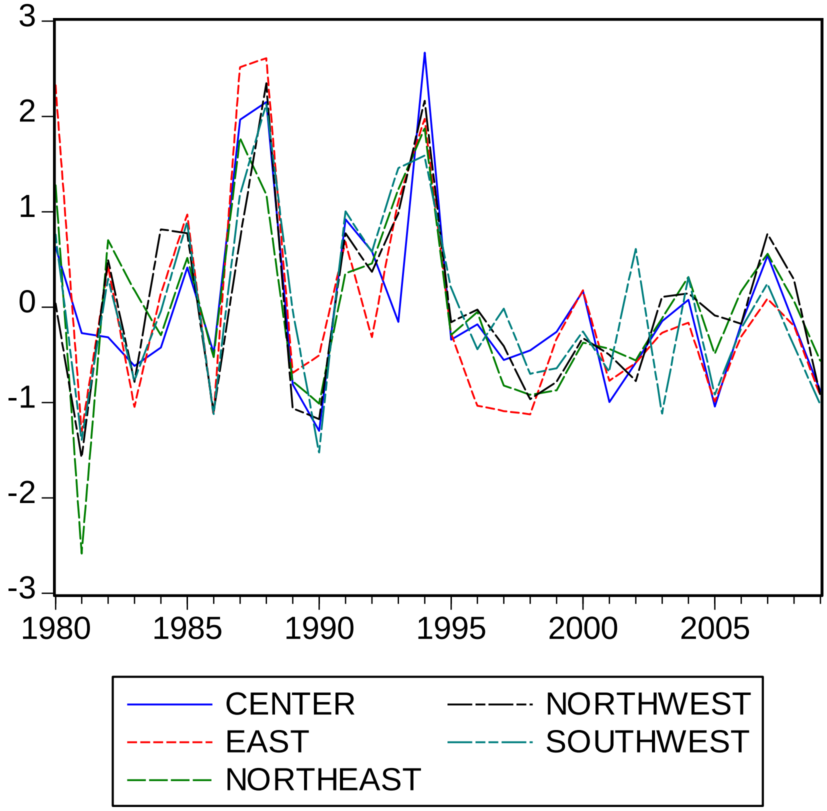


Figure 2: Demand Shocks for all Five Regions



When examining Europe, Bayoumi and Eichengreen compared countries to Germany. They found that Belgium's supply shocks were most correlated with Germany's (0.61) whereas Ireland's were least correlated (-0.06). Obviously, our findings show greater correlations than these, possibly due to the presence of a single national economic policy that affects incentives similarly across the country in regards to supplying labor (as well as labor effort). Comparing our results with those for the U.S. from Bayoumi and Eichengreen (1994) produce mixed results. The correlation between New England and the Mid-Atlantic states was 0.81, higher than what we find for any of our correlations. On the other hand, the correlation between the Mid-Atlantic states and the (American) Southwest was -0.12. As stated, the lowest correlation we find is 0.38. This result is somewhat surprising. Both countries are large and so different regions of the country could undergo vastly different "weather shocks". But since agriculture is a much larger share of the Chinese economy, one would have thought that disparate weather shocks in China would have a greater potential to affect regional aggregate supply. We do not find this to be the case. Instead, other factors appear to be more important. Perhaps a lower degree of specialization across China lowers the potential for sector-specific supply shocks to affect one region disparately than others. Or, perhaps the continued presence of state owned enterprises and production quotas (before selling to the market can begin) create greater similarities across regions.

Regarding demand shocks, one can also use results from Bayoumi and Eichengreen (1994) to compare. The correlations found here are much larger than those found in Europe. This is not surprising given the potential for diverse fiscal policies across sovereign governments. However, the demand shock correlations found here are also greater than those Bayoumi and Eichengreen (1994) found for the U.S. ranging from -0.28 to 0.8. One reason could arise from a greater autonomy in conducting fiscal policy for U.S. states relative to Chinese provinces.[3] Government consumption is also a higher fraction of GDP in China. To the extent that this consumption is similar across regions, then this is another reason why demand shocks are more strongly correlated within China. Another possibility again stems from the greater degree of regional specialization in the U.S. Changing demand for specific types of products would then affect specific U.S. regions more so than similar sector-specific demand shocks in China.

Table 2: Correlations of Structural Shocks

	CENTER	EAST	NORTHEAST	NORTHWEST	SOUTHWEST
CENTER		0.75	0.58	0.47	0.60
EAST	*0.83*		0.59	0.49	0.63
NORTHEAST	*0.73*	*0.83*		0.56	0.38
NORTHWEST	*0.79*	*0.79*	*0.82*		0.58
SOUTHWEST	*0.78*	*0.82*	*0.79*	*0.82*	

Note: Correlations of supply shocks are above the main diagonal, and correlations of demand shocks are below the diagonal, written *in italics*.

3.2 Variance decomposition

Variance decompositions attribute the percentage of forecast error stemming from each type of structural shock and so can describe the relative importance of each shock in driving future output and prices. Tables 3 and 4 provide the variance decompositions of output and prices for several years into the future. With only one exception in the table, supply shocks explain the majority of output movements, the lone exception being a one-year horizon for the Northeast. Supply shocks are clearly dominant in the center region. As the region most reliant upon agriculture, annual fluctuations in weather or other factors that affect agricultural productivity could be one reason why supply shocks are so important. Supply shocks are somewhat less important in the Northeast and Northwest regions. One possible explanation is that state owned enterprises (SOEs) are more prevalent in these two regions than in the three others. SOE employment constituted 36% and 25% of employment in 1994 in the Northeast and Northwest regions, respectively. It was only 17% (East), 16% (Center), and 12% in the Southwest. Perhaps such enterprises are less prone to supply shocks than are privately owned enterprises (and so relatively more prone to demand shocks). Another possibility is that mining is also a

[3] However, Chinese provinces have increasingly been allowed greater autonomy with regard to fiscal policy decisions, especially after 1993. See Jin et al. (2005).

greater share of GDP in both these regions. If fluctuations in mining industries are mostly driven by changing demand for these resources, then this is another reason why demand shocks could contribute more to output fluctuations in the north than in the other three regions. On the other hand, demand shocks are more important for price movements in all five regions. Only in the Northwest and Northeast do supply shocks provide any meaningful contribution to price movements (and their contribution is still under 20%).

Table 3: Variance Decomposition of Output

	Supply Shocks					Demand Shocks				
	1	2	3	4	10	1	2	3	4	10
Center	96.57	98.23	97.74	97.10	96.90	3.43	1.77	2.26	2.90	3.10
East	77.70	86.24	81.19	80.80	80.60	22.30	13.76	18.81	19.20	19.40
Northeast	46.00	62.81	61.80	60.50	61.30	54.40	37.19	38.20	39.50	38.70
Northwest	57.90	67.40	69.96	70.80	73.00	42.10	32.60	30.04	29.20	27.00
Southwest	85.20	82.31	82.74	83.10	83.90	14.80	17.69	17.26	16.90	16.10

Table 4: Variance Decomposition of Price

	Supply Shocks					Demand Shocks				
	1	2	3	4	10	1	2	3	4	10
Center	2.43	3.91	5.00	5.60	14.60	97.57	96.09	95.00	94.40	85.60
East	0.70	9.80	14.80	14.70	14.10	99.30	90.20	95.20	85.30	85.90
Northeast	25.10	14.89	13.83	15.00	18.50	74.90	15.11	86.17	85.00	81.50
Northwest	17.80	13.34	14.18	15.40	17.50	82.20	86.66	85.82	84.60	82.50
Southwest	0.11	0.63	0.91	1.05	1.09	99.89	99.37	99.09	98.95	98.91

3.3 Impulse responses

We compute impulse responses of output and prices to both types of shocks for all five regions. Results are provided in figures 3 – 6. Of note is the similarity of responses for all five regions. The lone exception is the response of prices to supply shocks. For the Center, East, and Southwest regions, a positive supply shocks raises prices. This contrasts the AD-AS model where a positive supply shock lowers prices although Bayoumi and Eichengreen (1994) also find instances for U.S. regions where positive supply shocks raise price. Nevertheless, the variance decomposition results suggest that supply shocks contribute little to price fluctuations so perhaps these anomalies are not that prevalent. Where supply shocks play a larger role in explaining price movements such as in the Northeast and Northwest regions, supply shocks are predicted to initially lower prices.

Also of note in the figures are the similarities in timing. The effects of demand shocks upon price for all regions dissipate between years four and five. With a slight exception for the Center region, the effect of supply shocks upon output also seems to die off at similar rates. These findings reinforce the sense that differing Chinese regions respond to shocks similarly.

Table 5 provides the speed of adjustment for output following a supply shock and for price following a demand shock. This value denotes the change in a variable in year three (following a shock) relative to the long-run change. A value of 0.7, for example, means that 70% of the long-run effect happens by year three. All of these values are greater than 50%. For all regions, at least two-thirds of the long-run price effect of a demand shock is complete three years following the shock. Therefore, these speeds of adjustment seem large suggesting that much of the force of these shocks in all regions is felt soon after they occur.

Table 5: Speed of Adjustment (Fraction of effect by year 3 to the long-run effect)

	Supply Shock upon Output	Demand Shock upon Price
Center	0.91	0.91
East	0.86	0.66
Northeast	0.70	0.78
Northwest	0.52	0.94
Southwest	0.63	0.92

Figure 3: Impulse Responses of output to supply shocks

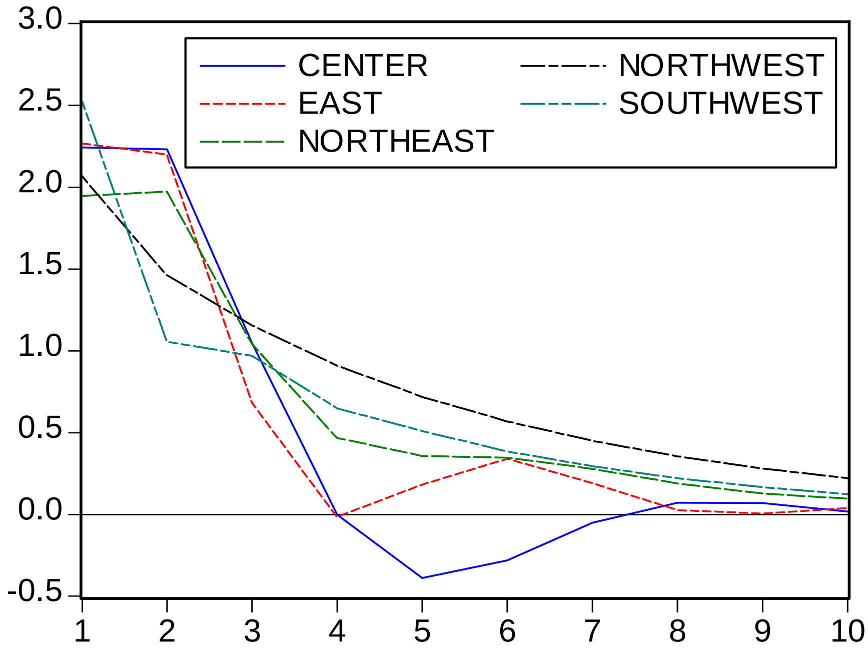


Figure 4: Impulse Responses of output to demand shocks

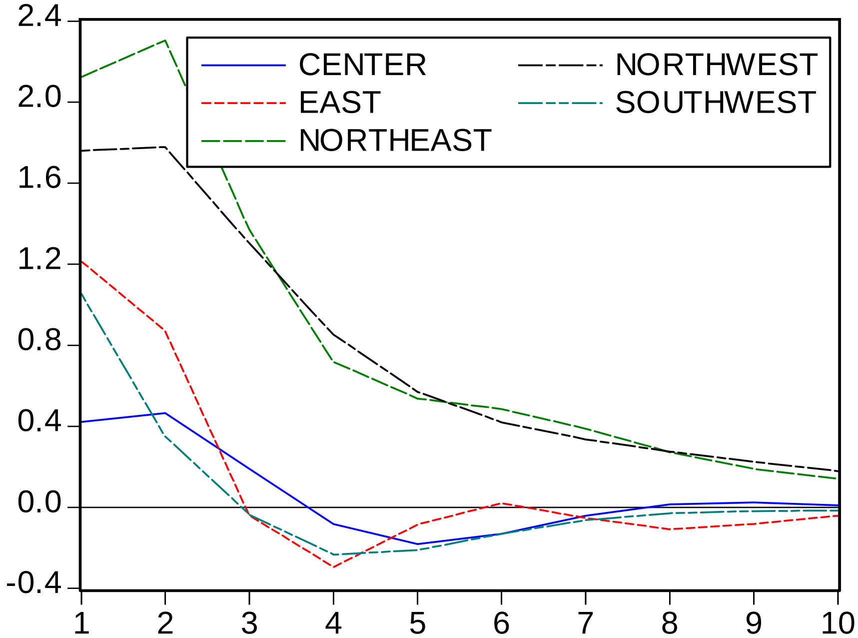


Figure 5: Impulse Responses of price to supply shocks

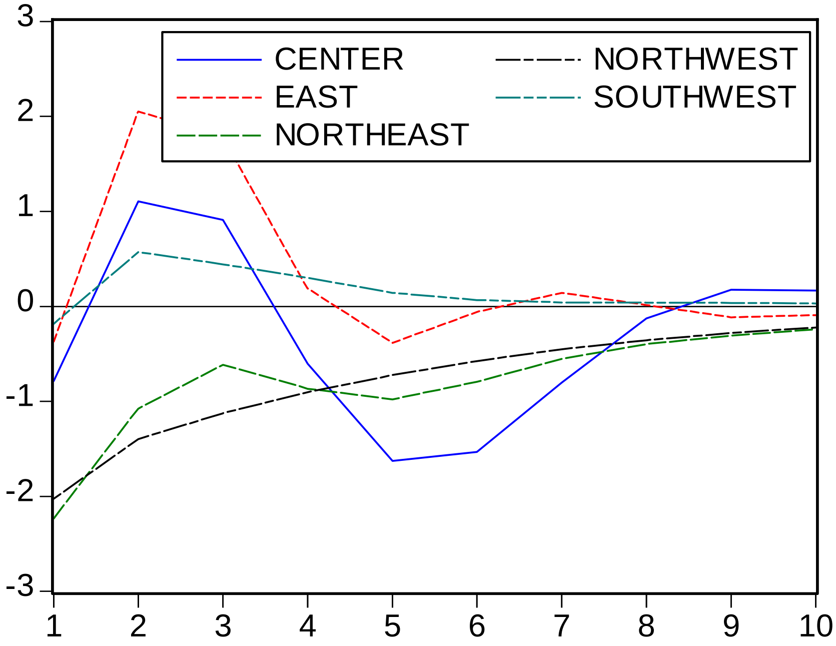
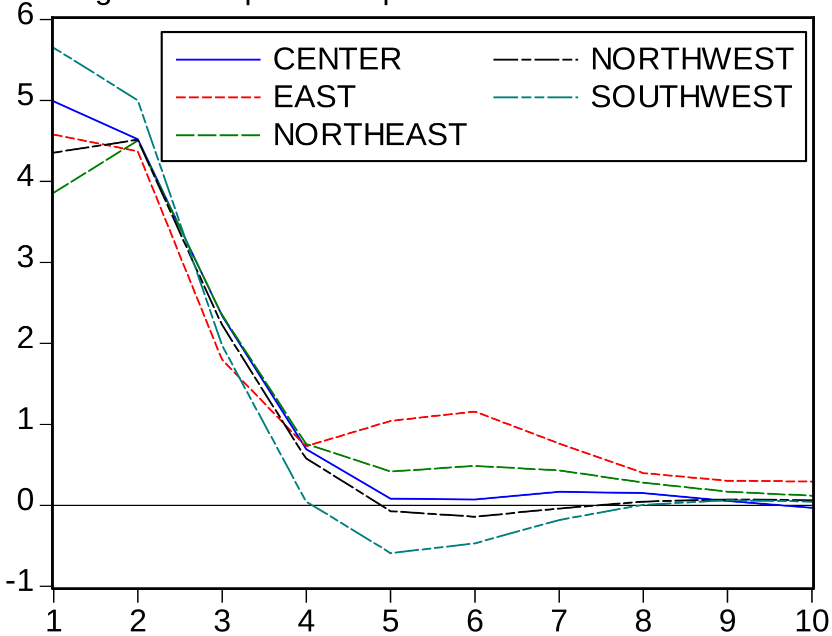


Figure 6: Impulse Responses of Price to demand shocks



4 Conclusion

In this paper, we used a structural VAR to identify the aggregate supply and demand shocks in Chinese regions. We find that demand shocks are highly correlated across regions, more so than are supply shocks. In fact, we find a greater extent of symmetry than Bayoumi and Eichengreen (1994) found in a similar study for Europe or the U.S. Another characteristic is the low degree of variability across demand shocks. No one region appears to be an aberration. The reason for this high correlation of demand shocks is likely due to a centralized monetary and fiscal policy. Variance decomposition results indicate that in general, supply shocks are important in explaining output variability and demand shocks play an important role in explaining price movements at the regional level. Our impulse response functions show that regional output and price levels generally respond similarly to these shocks.

What are the policy implications of this analysis? The finding of fast adjustment of shocks across regions indicates that the factors of production are fairly mobile across regions. This fast adjustment of shocks across regions reflects that the Chinese internal market is integrated, not segmented. This finding also supports that labor market reforms and other reforms in China have been successful, at least to some degree, in better integrating the Chinese economy. Perhaps additional reforms would speed adjustment even more.

Moreover, these results can provide a benchmark for other regions contemplating currency union. To the extent that results for other regions mirror ours, then we suggest that continued consideration be given to that area as a currency union. Of course, if associations across shocks are less similar that need not eliminate such consideration since shocks could become more symmetric as policies converge across regions.

Finally, this study offered several explanations for why demand shocks are so correlated within China and to why demand shocks seem to be more important in the northern regions than they are in other parts of China. However, we did not formally examine these explanations. We leave such pursuits for future work.

Appendix:

The classification of the five regions is similar to the one used in Demurger et al. [2004]. A difference, however, between these two classifications is that the metropolises of Beijing, Tianjin, and Shanghai are placed in the East region instead of grouping these metropolises as a separate entity.

Center: Anhui, Henan, Hubei, Hunan, Jiangxi, and Shanxi. This region is the agricultural heartland of China.

East: Beijing, Fujian, Guangdong, Hebei, Jiangsu, Shandong, Shanghai, Tianjin, and Zhejiang. These coastal provinces have grown the fastest of these five groupings during the reform period. FDI and export industries are concentrated in this region.

Northeast: Heilongjiang, Jilin, and Liaoning. These provinces were the industrial heartland of China in 1949. From 1949 to 1978, their early start in industrialization was consolidated, making these provinces the part of China that most resembled the Soviet Union in industrial organization and production structure.

Northwest: Gansu, Inner Mongolia, Ningxia, Qinghai, Shaanxi, and Xinjiang. This region is far away from the coast and a large number of residents are minorities. This is a poor region.

Southwest: Guangxi, Guizhou, Sichuan, and Yunnan. This region is similar to the Northwest. A large part of its residents are minorities. This region had the lowest GDP per capita in 1978 and has had (relatively) low growth rates during the reform period.

Table 6: Descriptive Statistics

	Avg. GRP	Avg. Growth of GRP	Avg. Inflation
Center	3311	10.64%	5.87%
East	11625	11.84%	5.78%
Northeast	2417	9.71%	5.75%
Northwest	1539	10.48%	5.84%
Southwest	1628	9.89%	6.09%

References:

Bayoumi, T. and Eichengreen, B. (1994) Shocking Aspects of European Monetary Integration.In: *Adjustment and growth in The European Monetary Union.*(Ed.) F. Torres, and F. Giavazzi, Cambridge University Press, New York.

Bayoumi, T. and Eichengreen, B. (1996) *Is Asia an optimal currency area? Can it Become one? Regional, global and historical perspectives on Asia monetary relations*. Center for International and Development Economic Research Paper No. C96-081.

Bergman, M.U. (1999) Do Monetary Unions Make Economic Sense? Evidence from the Scandinavian Currency Union, 1873-1913, *Scandinavian Journal of Economics*, **101**, 363-377.

Boltho, A. (1989) Europe and United States Regional Differentials: A Note, *Oxford Review of Economic Policy* **5**, 105-115.

Buigut, S.K. and Valev, N.T. (2005) Is the Proposed East African Monetary Union an Optimal Currency Area? A Structural Vector Autoregression Analysis, *World Development*, **33**, 2113-2133.

Chaplygin, V., Hughes-Hallett, A. and Richter, C. (2006) Monetary Integration in the Ex-Soviet Union: a 'Union of Four'? *Economics of Transition*, **14**, 47-68.

Chong, W.L. (1988) Price Reform in China: the Heated Summer 1988 Debates, *China Information* 3 (September), 1-11.

Darrat, A. and Al-Shamsi, F. (2005) On the path to integration in the Gulf Region, *Applied Economics*, **37**, 1055-1062.

Demurger, S., Sachs, J.D., Woo, W.T., Bao, S.M., Chang, G. and Mellinger, A. (2002) Geography, Economic Policy, and Regional Development in China, *Asian Economic Papers*, **1**, 146-197.

Dibooglu, S. and Horvath, J. (1997) Optimum Currency Areas and European Monetary Unification, *Contemporary Economic Policy*, **15**, 37-49.

Fleisher, B., Li, H.Z. and Zhao M.Q. (2005) *Regional Inequality and Productivity Growth in China: The Role of Foreign Direct Investment, Infrastructure, and Human Capital*, the Ohio State University, Working Paper.

Horvath, J. and Ratfai, A. (2004) Supply and Demand Shocks in Accession Countries to Economic and Monetary Union, *Journal of Comparative Economics*, **32**, 202-211.

Jin, H., Qian, Y., Weingast, B.R. (2005) Regional Decentralization and Fiscal Incentives: Federalism, Chinese Style, *Journal of Public Economics* 89, 1719-1742.

Kanbur, R. and Zhang, X.B. (2004) *Fifty Years of Regional Inequality in China: A Journey through Revolution, reform and Openness*, World Institute for Development Economics Research Paper No. 2004/50.

Lan, S. and Sylwester, K. (2010) Provincial Fiscal Positions and Business Cycle Synchronization Across China, *Journal of Asian Economics*, **21**, 355-364.

Mikek, P. (2009) Shocks to New and Old Europe: How Symmetric? *Journal of Common Market Studies*, **47**, 811-830.

Monfort, A., Renne, J., R. Ruffer, and Vitale, G. (2003) Is Economic Activity in the G7 Synchronized? Common Shocks Versus Spillover Effects, CEPR Discussion Papers #4119.

Morshed, A., Ahn, S. and Lee, M.S. (2006) Price Convergence among Indian cities: A Cointegration Approach, *Journal of Asian Economics*, **17**, 1030-1043.

Qian, Y. (2003) How Reform Worked in China, In Rodrik D. (Ed.) *In Search of Prosperity: Analytic Narratives of Economic Growth*. Princeton: Princeton University Press, 297-333.

Ward, B. and Jayaraman, T.K. (2006) A Single Currency for Pacific Island Countries? An SVAR Analysis, *International Economics*, **59**, 83-111.

Xu, X. (2006) A Currency Union for Hong Kong and Mainland China? *Journal of International Money and Finance*, **25**, 894-911.

Zhang, Z. and Sato, K. (2008) Whither a Currency Union in Greater China, *Open Economies Review*, **19**, 355-370.