Whither China? Reform and Economic Integration among Chinese Regions

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CESifo Working Paper No. 4220
Category 6: Fiscal Policy, Macroeconomics and Growth
April 2013

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Abstract

This paper investigates the changing nature of economic integration in China. Specifically, we consider business-cycle synchronization (correlation of demand and supply shocks) among Chinese provinces during the period 1955-2007. We find that the symmetry of supply shocks has declined after the liberalization initiated in 1978. In contrast, the correlation of demand shocks has increased during the same period. We then seek to explain these correlations by relating them to factors that proxy for interprovincial trade and vulnerability of regions to idiosyncratic shocks. Interprovincial trade and similarity in factor endowments tend to make shocks more symmetric. Surprisingly, foreign trade and inward FDI have little effect on the symmetry of shocks.

JEL-Code: E320, F150, H770.

Keywords: VAR model, business cycle synchronization, China, reform.

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March 27, 2013

1 Introduction

Since 1978, China has been undertaking a gradual and largely steady liberalization. The changes were especially profound in the economic sphere although, lately, they have extended also to the political domain. The three decades of economic liberalization have had far-reaching effects on the Chinese economy and society. Most of the changes have been for the better: China has been able to maintain a high rate of growth, recently becoming the second largest economy in the world. Yet, the benefits of this expansion have not been universally shared. Most notably, the coastal provinces of Eastern and South-Eastern China have charged ahead while the inland provinces lag behind. There is a similar, though less pronounced, disparity between urban centers and their rural hinterlands throughout China. These regional disparities reflect not only differentiated economic regional development but are further reinforced by the continued implementation of the *hukou* system of household registration which restricts labor and residential mobility.[1]

The large regional economic differentials appear on the background of a high degree of economic decentralization. This is highlighted by Xu (2010) who describes China as a 'regionally decentralized authoritarian system'. He points out that while the central government controls key political appointments at all levels, it allows regional governments to run their economic affairs largely unimpeded. This, he argues, is the product of political upheavals and purges during the Great Leap Forward and, especially, in the course of the Cultural Revolution. During these upheavals, the Soviet-inspired centralized model was abandoned and instead the regions were encouraged to compete with each other. The inter-regional competition was aimed primarily at maximizing output but it also fostered experimentation with respect to production arrangements and policies (such as the creation of different commune set-ups). The result was a small (though politically powerful) central government and relatively strong regional governments. The decentralization continued and was even reinforced during the reform period. Arguably, a particularly dramatic step in this direction was the creation of special

[1] More precisely, the hukou system divides the population into urban and rural residents, and restricts the access of rural residents to public services including healthcare, education, pension insurance and unemployment insurance in case they move to urban regions.

economic zones in the early years of liberalization.[2] This effectively introduced a two-speed system, allowing selected regions to charge ahead in economic liberalization while the rest of the Chinese economy proceeded more cautiously. This appears to have laid the foundations of the subsequent economic gaps between the coastal areas and the rest of the country.[3]

In this paper, we document the depth of economic integration among Chinese provinces and analyze the factors that foster such integration. Our analysis proceeds in two steps. First, we use a structural VAR model to identify province-specific shocks between 1955 and 2007.[4] Our methodology allows us to distinguish between shocks that have a temporary and permanent effect on output, typically referred to as demand and supply shocks, respectively, in the relevant literature. We compute the correlations between these shocks for all possible pairs of provinces for four sub-periods: two before and two after the 1978 liberalization. These correlations capture the intensity of integration, and the changes therein, among China's provinces, over a period during which the country gradually abandoned central planning, state ownership as well as Maoism and embraced economic liberalization. Second, we analyze the determinants of these correlations using a stylized version of the gravity model (broadly in line with Artis and Okubo, 2008, although they use a different methodology for estimating the business-cycle correlations). In particular, we seek to explain the correlations of shocks by relating them to factors that proxy for the vulnerability of regions to idiosyncratic developments as well as factors that can facilitate inter-regional transmission of shocks. The latter include the endowments of physical and human capital, transport infrastructure, structure of the economic

[2] On the history of SEZs and the role they have played in Chinese economic development, see Chen et al. (2011), and the references therein.

[3] An especially poignant example of the fruits of this policy is Shenzhen, a city in Guandong, whose population exploded from around 300,000 to its current 14 million since it became the first special economic zone more than 30 years ago.

[4] The use of structural VARs to assess the nature of economic integration between countries or regions was pioneered by Bayoumi and Eichengreen (1993) whose work was in turn motivated by the Theory of Optimum Currency Areas (henceforth OCA; Mundell, 1961). Bayoumi and Eichengreen applied this methodology to assess the merits of adopting the common currency in the European Union. They sought to identify which European countries tend to encounter shocks that are predominantly symmetric or asymmetric in nature.(the OCA theory suggests that monetary integration is less costly if it involves countries that are subject to symmetric shocks). Since their seminal contribution, this method has become accepted as the workhorse for assessing the depth of integration in other regions as well, see Fidrmuc and Korhonen (2006), de Haan et al. (2008a), and the references therein.

activity, openness to foreign trade, foreign direct investment, geography, and economic policy. We also include variables used in gravity models of trade – distance between the regions and their economic size – which we interpret as proxies for inter-provincial trade. This analysis is carried out for the same four sub-periods so as to capture the determinants of economic integration in the various periods, and the changes therein.

Our main findings are the following. First, the demand and supply shocks have evolved differently in the course of the Chinese reforms: demand shocks appear to become more synchronized over time while supply shocks grow more dissimilar. Second, we find that factors that proxy for interprovincial trade and similarity in factor endowments tend to make shocks more symmetric. Rather surprisingly, foreign trade and inward FDI have had little effect on the symmetry of shocks.

The remainder of the paper is structured as follows. The next section briefly discusses what we know about economic integration and decentralization in China. Section 3 describes the data and empirical methodology. Section 4 reports the main empirical finding. Section 5 states the conclusions.

2 China's Economics Integration

2.1 Economic Decentralization in China

During the period from the communist takeover in 1949 until 1978, the Chinese economy was tightly regulated: output quotas, resource allocations and prices were set centrally according to a plan formulated by the central government. This reflected the initial desire of Mao Zedong's government to follow the Soviet model of organizing the economy. However, as argued by Xu (2010), China started to deviate from the Soviet model during the economic and political upheavals of the Great Leap Forward (1958-61) and Cultural Revolution (1966-76). Rather than plan and regulate the economic activity from the center, the central government granted wide-ranging economic autonomy to the provincial governments. This was to encourage the regions to compete with each other in order to deliver or exceed their quota of output. As a result, China became a collection of regional economies rather than a single centrally-planned

Soviet-type economy, with the central government in Beijing retaining control over political appointments and decisions while devolving much of economic policy making to the provinces.

The decentralization accelerated further after Mao's death in 1976.[5] The objective was to reinvigorate the stagnant economy by improving incentives and encouraging local initiative in production (Tang, 1998). The fiscal and economic decentralization has been widely acknowledged as one of the key drivers of the fast growth of the Chinese economy in the last three decades. However, the decentralization has allowed some locals governments also to implement protectionist policies, ostensibly with the objective to develop their local economies (Bai, 1981).

Another important change that took place after Mao's death was the liberalization of the economy. The liberalization initiated by Deng in 1978 was gradual not only with respect to time but also in space. In particular, the liberalization favored the development of the coastal regions. Most notably, the central government initially directed all foreign investment to a handful of *special economic zones (SEZs)*, all of which were located in the costal regions (the best well-know of which is Shenzhen, close to Hong Kong, the first SEZ to be established in China). In effect, the SEZs were allowed to be increasingly driven by market forces while central planning continued in the rest of the country. Following the success of the first zones, liberal policies were gradually extended beyond the SEZs, first throughout the coastal provinces and then later also throughout China. This helped stimulate the rapid development of the coastal regions and increased their competitiveness compared to the interior (Poncet, 2005). At the same time, the inland provinces continued to export raw materials to the coastal areas at fixed (low) prices, which translated to a net transfer of resources from the interior regions to the manufacturing provinces on the coast. The less developed regions responded by pursuing a policy of industrialization through import substitution, as decentralization combined with the fact that most of tax revenue accrued from industrial production made them keen to develop their industrial base (Lee, 1998, cited in Poncet, 2005).

An important element of the Maoist regime is the household registration (*hukou*) system,

[5] The central government's share of expenditures declined from 51 percent in 1978 to 28 percent in 1993 (Ma and Norregaard, 1998, as cited in Poncet and Barthélemy, 2008, p.899)

which severely restricts the ability of Chinese citizens to move and even travel within China. Under this system, each person was tied to a particular area and could move to a different area only with a permission of the authorities of both origin and destination regions. Despite progressively accelerating economic liberalization, the hukou system has remained in place even after 1978. Unlike during the Maoist period, rural workers now can move to and take up jobs in the urban areas. However, changing their registration to the destination region is difficult. This means that they can only benefit from many public services in their region of origin: health care eligibility, children's education and pension claims, most notably, are not portable. Despite this, labor mobility has been steadily increasing, especially from the inland rural to coastal urban regions (Tang, 1998).

In all, China is an economy with a single currency but capital or labor are not perfectly mobile. Its provinces are subject to centralized political rule but are growing more and more decentralized on the economic front.

2.2 Asymmetric Shocks in China

How well integrated is the Chinese economy? A common approach for assessing the intensity of integration is based on examining the similarity of business cycles. Compared with other approaches to assessing economic integration, the business-cycle approach has several advantages. It not only provides a comprehensive measure of the various factors that contribute to economic integration but it can reveal also whether there are any regional groups of the provincial economies that are highly integrated (Tang, 1998).

A number of approaches have been utilized to assess the degree of asymmetry of shocks across economies – whether these are countries or regions within countries. One method is based on cross-country correlation of growth rates, inflation rates, exchange rates, interest rates and stock prices. The weakness of this method is that it does not allow one to distinguish between the shocks themselves and the reactions to them. For example, Poncet and Barthélemy (2008) investigate business cycles and their determinants by identifying the cyclical component of monthly provincial gross output over 1991-2004. They find that despite a cleavage existing between the coastal and interior regions, business-cycle synchronization increased from a rather low level at the beginning of the 1990s to a level comparable to that of the US at the beginning of the 2000s. Furthermore, they argue that international trade and local economic policy foster synchronization. However, Carsten et al. (2010) argue that this finding may be attributable to the specific macroeconomic environment during the period analyzed and as such it cannot be generalized into the future.

Another popular method is to identify shocks using the structural vector auto-regressive (SVAR) model formulated by Blachard and Quah (1989). An SVAR model allows one to identify shocks and the economic responses to them. This method has became a popular tool for identifying asymmetric shocks since it was applied by Bayoumi and Eichengreen (1993) to assess the similarities of economic cycles in Europe in the run-up to the formation of the European Economic and Monetary Union (Babetskii, 2005). The SVAR methodology allows us to distinguish between shocks that affect both output and price level permanently (usually denoted as supply shocks) and those affecting output only temporarily while having a permanent price-level effect (demand shocks). The literature studying the business-cycle synchronization of the Chinese economy using the SVAR method remains very limited, however. Tang (1998) adopts an SVAR model to gauge the degree of economic integration within China using data on industrial output and the retail price index. He argues that a high degree of integration prevails in Eastern China only. This finding is also replicated by Poncet and Barthélemy (2008).

Gerlach-Kristen (2009) uses a different methodology: she identifies the common component in output gap fluctuations at the provincial level by using principal component analysis. She finds that the degree of synchronization varies over time: it is high during the 1960s, declines during the 1970s and 1980s and then rises again. Her results indicate, furthermore, that business cycles in the inland provinces in Northern and Northeastern China tend to be less influenced by the national business cycle.

In summary, the evidence so far, as limited as it is, suggest that the Chinese provincial business cycles have become more synchronized over time but this process has not been uniform. In particular, a gap may be emerging between the coastal and interior regions.

2.3 Determinants of Business-cycle Co-movements

There is no consensus as to which determinants of business-cycle co-movement are important. There are instead many potential candidate explanations of business-cycle synchronization or the lack thereof.

One leading candidate is trade. Frankel and Rose (1998) present empirical evidence that higher bilateral trade between two countries leads to greater correlation of business cycles between them. An opposite view is put forward by Krugman (1993) who argues that international trade increases specialization, making shocks more asymmetric. Frankel and Rose (1998) argue that inter-industry and intra-industry trade play different roles in this respect. The former reflects specialization and therefore may cause asymmetries. The latter implies that the country simultaneously exports and imports products of the same category. The total effect of trade intensity on business-cycle correlation is therefore theoretically ambiguous and the question can only be answered empirically. Fidrmuc (2004) adopts the specification of Frankel and Rose (1998) and applies it to a cross section of OECD countries over the last ten years with quarterly data, controlling for intra-industry trade in his analysis. His findings confirm the Frankel and Rose view. Baxter and Kouparitas (2005), similarly, argue that trade is the only factor with a robust effect on business cycle synchronization. In contrast, de Haan et al. (2008b) argue that the role of trade is less important than suggested by this literature.

Empirical evidence of the positive relationship between similarity in structure of output and business-cycle synchronization has been stressed in a series of papers by Imbs (1998, 2003, 2004) and is found also in analyses using regional data by Kalemi-Ozcan et al.(2001) and Clark and Wincoop (2001). Kalmemi-Ozcan et al. (2001), in particular, find that U.S. states that are more specialized in turn display a lower correlation of business cycles with the aggregate U.S. growth.

Another approach, related to the trade-based link discussed above, is motivated by the gravity model of trade. The gravity model relates bilateral trade flows to variables such as distance between regions, common language, common border, and so on. Therefore, gravity-model variables can be, in turn, used as proxies for trade and therefore can be used as determinants of business-cycle synchronization: see, among others, Clark and van Wincoop (2001), Calderon et al. (2007) and Fidrmuc (2004).

Fatás (1997) argues that the coordination of monetary and fiscal policies is also a key determinant of business-cycle synchronization. Meanwhile, he points out it has an ambiguous impact on business cycles since it depends on the type of shocks driving economic fluctuations and the ability of governments to stabilize output. If macroeconomic policies are the source of business cycles, more coordinated policy could lead to higher synchronization. Darvas et al. (2007) and Artis et al.(2008) investigate and confirm this based on the European Union data while Poncet and Barthélemy (2008) and Lan and Sylwester (2010) obtain similar findings with Chinese regional data.

Furthermore, factor endowments are also drew attention of scholars. Most theories, such as the Heckscher-Ohlin model, Ricardian theories and models with differentiated products, predict a significant relationship among factor endowments and business-cycle co-movement.

3 Supply and Demand Shocks

3.1 Chinese Provincial Data

China is administratively divided into 31 regions: 22 provinces, 5 minority autonomous regions (Tibet, Xinjiang, Guanxi, Ningxia and Inner Mongolia)[6] and 4 metropolitan provinces (Beijing, Shanghai, Tianjin and Chongqing). For simplicity, we refer to all of them as *provinces* in the remainder of the paper. Our sample covers 28 provinces for which data are available.[7] Annual data are available for the period from 1952 to 2007. Provincial real GDP growth data and the GDP deflator are obtained from nominal and real GDP indexes published by the Bureau of National Statistics of China[8]. We further subdivide the sample into three geographical regions:

[6] Autonomous regions are those with a high share of a particular ethnic minority: Tibetans (Tibet), Uyghurs (Xinjiang), Zhuangs (Guangxi), Huis (Ningxia) and Mongols (Inner Mongolia). According to the Chinese constitution, autonomous regions should enjoy more legal autonomy although this is hardly the case in practice.

[7] Tibet, Hainan and Chongqing are excluded due to missing data. Only very incomplete data are available for Tibet. The data for Chongqing start only in 1997 which is when this city was split apart from Sichuan to become the fourth metropolitan province. For the same reason, data for Sichuan consistent with its current borders are are available only from 1978; unlike Chongqing, we include Sichuan in our analysis from 1978 onwards.

[8] We used the following publications: 'Comprehensive Statistical Data and Materials 50 years of New China', China Labour Statistical Yearbook and provincial statistical books.

East, *Center* and *West*; besides reflecting geography, this categorization also broadly captures the differences in the degree of economic development. During the early transition period, the coastal areas in the East were the main beneficiaries of the open door policy, developing much more quickly than the interior areas in the Center and West. Furthermore, we divide the 53 years[9] covered by the data into four sub-periods: 1955-1965, 1966-1977, 1978-1991 and 1992-2007. This break-down reflects the main phases of China's economic and political development. The first two sub-periods correspond to the early and late Maoism. The early Maoist period includes the Great Leap Forward (1958-1961) while the late Maoist period overlaps with the Cultural Revolution (1966-1976). Chinese economic reform was initiated in 1978 and this lead to a dramatic economic improvement: China maintained a real GDP growth of 8-10% during the following three decades (Xu, 2007). The reform momentum was not evenly paced, however. Market reforms accelerated following Deng Xiaoping's 'Southern Tour' in 1992. We therefore treat this year as the start of a new phase of China's reform process (see also Fleisher et al., 2009, and Xu, 2007).

3.2 Identification of Shocks

In this subsection, we present the methodology used to identify province-specific shocks. We use a SVAR model with two variables: the log of output (annual real GDP) and the log of prices (annual GDP deflator). It is assumed that the fluctuations in these two variables result from two types of disturbances: supply and demand shocks. This terminology is motivated by the standard AS-AD analytical framework. Supply shocks, which are associated with the shifts of the aggregate supply curve, lead to changes in both real output and prices in the short and long-term. Demand shocks also have short-term effects on both output and prices. However, since the long-term aggregate supply curve is vertical, demand shocks do not have any long-term effect on the level of output and become fully absorbed by price-level adjustments.

Following Blanchard and Quah (1989), Bayoumi and Eichengreen (1993) and Babetskii (2005), we estimate the following SVAR model involving real output growth and price-level growth:

[9] The sample that we analyze is shorter than the period covered by the data (56 years) since we use lags.

$$
\begin{aligned}
y_t &= b_{01} + \sum_{k=1}^{K} b_{11k} y_{t-k} + \sum_{k=1}^{K} b_{12k} p_{t-k} + e_t^y \\
p_t &= b_{02} + \sum_{k=1}^{K} b_{21k} y_{t-k} + \sum_{k=1}^{K} b_{22k} p_{t-k} + e_t^p
\end{aligned} \tag{1}
$$

Output and price-level are in log-differences: $y = logGDP_t - logGDP_{t-1}$ and $p_t = logP_t - logP_{t-1}$. b_{ijk} are coefficients, and k is the lag length. e_t^y and e_t^p are disturbances which are assumed to be serially uncorrelated and take the following form:

$$
\begin{aligned}
e_t^y &= c_{11}\varepsilon_t^D + c_{12}\varepsilon_t^S \\
e_t^p &= c_{21}\varepsilon_t^D + c_{22}\varepsilon_t^S
\end{aligned} \tag{2}
$$

where ε_t^D and ε_t^S are demand and supply disturbances, respectively. These equations state that the unexplainable components of output growth and inflation are linear combinations of supply and demand shocks. The vector of structural disturbances, ε_t, can be obtained under the following restrictions:

1. $c_{11}^2 + c_{12}^2 = Var(e^y) = 1$
2. $c_{21}^2 + c_{22}^2 = Var(e^p) = 1$
3. $c_{11}c_{21} + c_{12}c_{22} = Cov(e^y, e^p)$
4. $\sum_{k=0}^{\infty} c_{11}\varepsilon_{t-k}^D = 0$

The first three restrictions on the coefficients of Equation (2) follow from the normalization conditions and from the assumption that temporary and permanent shocks are orthogonal ($Cov(\varepsilon^D, \varepsilon^S) = 0$). The fourth restriction on coefficients c_{ij} states that demand shocks have no long-term impact on the level of output.

3.3 Correlations of Supply and Demand Shocks

Having estimated the demand and supply shocks affecting the individual provinces, we calculate $\rho_{ij\tau}^S$ and $\rho_{ij\tau}^D$, the correlation of supply/demand shocks between any two provinces i and j during period τ. If the correlation of shocks is positive, the shocks are considered to be symmetric and if it is negative, they are considered asymmetric. Table 1 and Table 2 give the weighted-average (with GDP used as weights) correlations of supply and demand shocks for each province and for each sub-period, respectively. Figures 1-4 depict the distribution of bilateral cross correlations of supply shocks for the sub-periods 1955-65, 1966-77, 1978-91 and 1992-07. Figures 5-8 provide the same information for demand shocks. It is clear that the nature of shocks is changing over time. However, the change is not the same for the two kinds of shocks. The correlations of supply shocks computed for the more recent periods suggest a lower degree of business-cycle synchronization. In contrast, the development of demand shocks suggest a greater degree of synchronization in the later periods. Hence, depending on which type of shocks we look at, Chinese provinces either appear to have become more closely integrated or have grown increasingly apart since the reforms have been implemented.

The focus on the symmetry of shocks is at the core of the optimum currency area (OCA) theory (Mundell, 1961). Indeed, Bayoumi and Eichengreen's article pioneering the use of SVAR to analyze business-cycle synchronization was motivated by Mundell's theory. If shocks are sufficiently symmetric, the argument goes, the regions/countries sharing the same currency will have little need for independent monetary policy. With asymmetric shocks, policy preferences can diverge: a region hit by a negative shock would prefer loose monetary policy while another affected by a positive shock would be in favor of a monetary tightening. The OCA theory, however, considers only the overall symmetry of shocks, without distinguishing between demand and supply shocks. Therefore, it gives us little guidance as to how to evaluate cases such as China's where falling correlation of supply shocks seems counter-balanced by increasing symmetry of demand shocks.

Fidrmuc (2012), in contrast, formulates a model of fiscal integration that emphasizes the qualitative difference between permanent and temporary output shocks (recall that supply shocks affect output permanently while demand shocks only have a temporary effect). He argues that symmetry of permanent shocks is more important for the stability of integration than symmetry of temporary shocks: both kinds of shocks give rise to divergent policy preferences but the impact of temporary shocks is (by definition) short lived while permanent shocks can fundamentally undermine the stability of integration. In this context, the fact that China is experiencing falling correlation of supply (permanent) shocks may come across as worrying, despite the movement in the opposite direction by the correlation demand (temporary) shocks.

4 Determinants of Business Cycle Co-movement in China

4.1 Methodology

So far, we have explored the changing nature of business-cycle synchronization during the last five decades of China's history. In this section, we investigate the determinants of business cycle co-movements and, thereby, shed some light on the factors behind the different development of supply and demand shocks discussed in the preceding section.

The dependent variables are the correlations of supply and demand shocks, $\rho^S_{ij\tau}$ and $\rho^D_{ij\tau}$, estimated for provinces i and j during period τ, with the unit of observation thus being pairs of provinces. The correlation coefficients, by construction, are bound between -1 and $+1$. Besides using the simple correlations, we therefore apply the Fisher-z transformation, which results in figures that are not bound from above or below:

$$z_\rho = \frac{1}{2} \log \frac{1 + \rho_{ij\tau}}{1 - \rho_{ij\tau}}$$

Since we consider a rather large number of explanatory variables, we start by including all variables in a broad multivariate regression. As our discussion of the determinants of business-cycle co-movements makes clear, bilateral trade intensity, in turn, is likely to increase the synchronization of business cycles between provinces. Data on internal trade flows in any country, however, are notoriously difficult to obtain: unlike foreign trade, internal trade flows attract little official scrutiny and may also be difficult to measure (for instance, intra-firm deliveries crossing provincial borders would often fail to appear in official statistics). There is abundant evidence in the existing literature that gravity variables explain bilateral trade very well (see, for example, Frankel and Rose, 1998, Baldwin and Taglioni, 2006, and de Haan et al., 2008b). We therefore include some standard and commonly-used gravity variables:

- dummy for a common border: equal to 1 for adjacent provinces,
- same–region dummy: equal to 1 when both provinces belong to the same region,[10]

[10] As discussed above, the sample is divided to three regions, East, Center and West.

- coast and interior-coast dummies: equal to 1 when both provinces are located in the coastal region and when one province is on the coast while the other lies in the interior, respectively,[11]

- bilateral distance calculated as the shortest distance for freight transportation by railway in kilometers, and

- economic size, measured as the sum of the two provincial GDPs.

Regions specializing in producing similar products are likely to be exposed to similar shocks. There is, however, no standard measure of similarity in the production structure. Following Clark and van Wincoop (2001), Imb (2004) and Poncet and Barthélemy (2008), we compute Krugman's (1991) absolute value index. Let S_{ni} and S_{nj} denote the GDP shares for industry n in provinces i and j. Then, the dissimilarity of the two provinces' production structures is measured as

$$\frac{1}{N}\sum_{n=1}^{N}|S_{ni}-S_{nj}|$$

To compute the index, we consider 5 broad sectors of the Chinese economy: primary sector (comprising agriculture, hunting, forestry, fishing, and mining and quarrying); construction; manufacturing; infrastructure services (transportation, post and telecommunications); and trade services (wholesale, retail and catering).[12]

Another potential source of asymmetric shocks is represented by local policy making. Dissimilarity of local policies is measured by means of two indicators. One captures the provincial divergence of fiscal policy while the other investigates heterogeneity in terms of inflation. Similar to Clark and van Wincoop (2001) and Poncet and Barthélemy (2008), we use the standard deviation of provincial budget deficit differentials to measure the dissimilarity of fiscal policy (with annual budget deficits expressed as a percentages of GDP). We capture provincial

[11] These two dummies should reveal up whether business cycles are more closely synchronized among coast provinces (captured by the coast dummy), between coast and interior provinces (coast-interior dummy), or among interior provinces (omitted category).

[12] The data are taken from the Chinese national statistic year book.

divergence in inflation as

$$\frac{1}{T}\sum_{t}|GPI_{i,t}-GPI_{j,t}|$$

(see also Boyreau-Debray, 2000; and Poncet and Barthélemy, 2008), where $GPI_{i,t}$ is the general price index of the province i during the period t and T is the sub-period time span.

A major source of divergence of business cycles can be the exposure to foreign trade and foreign direct investment. We measure the foreign trade dissimilarity as

$$\frac{1}{T}\sum_{t}|Trade_{i,t}-Trade_{j,t}|$$

where $Trade_{i,t}$ correspond to the percentage share of foreign trade in GDP of province i during period t and T is the sub-period time span. An analogous formula is used for FDI dissimilarity.

Finally, differences in factor endowments can also play a role in explaining the degree of business-cycle synchronization. We consider two factors of production: investments in human capital and fixed-assets. Investment in human capital is measured as secondary and higher education enrolment rates (i.e. the ratio of the total secondary and higher education enrolment to the population). Investment in physical capital is expressed as a percentage of GDP. For the pre-1978 period, we only have public investment (private investment during this period is likely to be very low or zero). After 1978, the data distinguish between total investment in physical capital (including public investment) and public investment only. For the general regressions, we include only total investment, whereas we use both types of investment in the univariate regressions. Both investments (human and physical capital) are entered as dissimilarity indexes computed in the same way as those for production structures, inflation and trade discussed above.

Thus, we estimate the following regressions for correlation of supply or demand shocks between the regions

$$\rho_{ij\tau}^{k,f}=\mathbf{X}_{ij\tau}\mathbf{\Phi}^{k,f}+\mu_{ij\tau}^{k,f} \tag{3}$$

The dependent variable is either the standard correlation of supply and demand shocks ($k=S,D$) or its Fisher-z transformation (superscript $f=c,z$, denoting the two alternative definitions of business cycle synchronization). $\mathbf{X}$ is the vector of all explanatory variables discussed above with the corresponding coefficient vector, $\mathbf{\Phi}$. We estimate four cross-sectional regressions for business cycle similarity between regions i and j in sub-period τ identified in the previous section. We start by including all variables in a broad multivariate regression. Alternatively, we consider separate relationships between correlation of shocks and the various potential determinants, one single explanatory variable at a time. We report robust standard errors using the White (1980) correction for heteroscedasticity of the residuals, μ.

4.2 Empirical Results

Tables 4 to 7 present the general regression results (with all variables) for each sub-period. For comparison, regression results are reported both for the correlations of shocks and their Fisher-z transformations. Table 4 reports on the correlations of supply shocks during the Maoist period while Table 5 covers the reform period.

The main finding concerning supply shocks during the Maoist period (Table 4) is that hardly any of the variables explain the interprovincial correlations of supply shocks in China. The overall explanatory power of the regressions estimated for this period is extremely low and, in fact, only the second regression (with Fisher z transformation for 1955-65) is significant (with the joint F test just barely significant at the 5% level). The only gravity variable that appears to play any role is the dummy for coastal regions in 1955-65 and its sign goes against our expectations: provinces located along the coast display lower symmetry of shocks. The dissimilarity in investment in physical capital lowers the correlation of supply shocks, significantly so during the early part of the Maoist period. Overall, economic determinants seem to matter little for business cycle synchronization during the Maoist era.

The picture becomes clearer during the reform period (Table 5). Adjacent regions and those located on the coast display higher correlations of supply shocks (however, the common-border dummy is only significant during the 1992-07 period). The dissimilarity in investment in physical capital continues to lower the correlation of supply shocks during both sub-periods, in line with expectations: regions with different patterns of investment have their business cycles less closely synchronized.

The regressions results for the correlations of demand shocks are presented in Tables 6-7. Again, essentially none of the included variables explain the correlations of shocks during the early Maoist period (and again, the regressions for this period are not jointly significant). During the later Maoist period, 1966-77, we see that the correlation of shocks falls with distance and also with dissimilarity in investment in physical capital. Much clearer picture again emerges during the reform period, especially the early sub-period, 1978-91. The degree of correlation of demand shocks again falls with distance (more so during the early reform period). Regions located on the coast tend to encounter similar shocks during the early reform period. However, this is counterbalanced by the negative coefficient estimated for the same-region dummy during the same period. This surprising result may reflect a dichotomy between the regional centers and their surrounding rural areas. Economic size appears to lower the symmetry of shocks during the early reform period: two relatively large provinces would be expected to display a lower degree of symmetry of demand shocks than two small provinces. Dissimilarity of investment in physical capital, counterintuitively, reverses sign for the late reform period, 1992-07, so that regions that have dissimilar investments appear to encounter shocks that are more similar.

Several variables are notable for being consistently insignificant: dissimilarity indexes with respect to the output structures, exposure to trade and incoming FDI apparent to have no impact on the symmetry of supply or demand shocks. This is somewhat surprising, especially for trade and FDI, given the extraordinary importance of external economic relations for the post-1978 economic development (Huang, 2011, for example, finds that exposure to FDI is an important determinant of economic growth of Chinese regions). A possible explanation of this absence is that the shocks attributable to foreign trade and FDI affect much of China in much the same way (or else that their effects quickly spillover across regions).

Some of the variables included in the preceding regressions are likely to be collinear with each other and this could explain their low significance. Therefore, in Tables 8-11, we report the results of univariate regressions between the correlations of supply and demand shocks, respectively, and each variable considered in our study. Few explanatory variables appear significant during the Maoist period again: for supply shocks during both sub-periods and during the early Maoist period for demand shocks. Nevertheless, common border, distance and output size shape the correlation of demand shocks during the late Maoist period: demand shocks become less symmetric with distance while their similarity is higher for adjacent and for larger provinces. Provinces sharing a border, located in the same region and those on the coast also appear more similar during the reform period (though the coefficients are not always significant). The effect of distance is similarly negative but not always significantly so. Economic size is not a significant determinant of supply shocks whereas it appears negatively related to the correlation of demand shocks during the reform period.

5 Conclusion

The Chinese society has experienced numerous dramatic changes during the last five decades: the communist take-over, the upheavals of the Great Leap Forward and Cultural Revolution, and finally economic liberalization and opening up to the outside world and the rapid growth that this has generated. In this paper, we document the impact of these changes on the Chinese regional economies and on the degree of economic integration among them. The picture that our results paint is mixed: as the reforms progress, Chinese provinces encounter increasingly symmetric demand shocks but also increasingly asymmetric supply shocks. This is potentially worrying: supply shocks lead to permanent economic differentials, unlike demand shocks, and therefore their falling similarity may undermine the stability of Chinese economic integration in the future. This may translate into growing economic and political tensions in the future, especially if appropriate adjustment channels are not introduced (for example, greater liberalization of migration between provinces). The experience of countries such as Belgium, Spain or Czechoslovakia demonstrates the dangers that growing economic divergence can pose serious danger for political unity of countries, especially ethnically diverse ones.

We relate the interprovincial correlations of supply and demand shocks to a broad range of economic variables but we again obtain at best mixed results. Little explain the synchronization of business cycles during the Maoist period, especially during its early part, 1955-65. The limited explanatory power of economic factors should perhaps not be surprising, given that the Maoist period was dominated by politically-induced shocks of the Great Leap Forward and Cultural Revolution. During the reform period, factors typically associated with bilateral (interprovincial) trade matter, although their importance is not overwhelming. In particular, we find that the symmetry of both demand and supply shocks tends to fall with the distance between provinces and rises when provinces share a border or are located in the same region. We find also that provinces that experience similar patterns of investment in physical capital tend to encounter similar supply shocks. In contrast, similar patterns of investment in physical capital tends to make demand shocks less similar, possibly because investment behavior is itself driven by demand shocks. Hence, interprovincial trade increases the symmetry of both demand and supply shocks while investment in physical capital has opposite effects on supply and demand shocks. Finally, and rather surprisingly, we find little evidence that inward FDI and foreign trade affect the synchronization of demand or supply shocks, even though these are among the main factors highlighted as drivers of the recent Chinese growth,.

Clearly, our analysis fails to account for a number of factors that can also contribute to the on-going divergence of permanent shocks in China. Chinese provinces may specialize in relatively narrow range of products but our data only distinguish very coarse categories of output structure. Migration is an important channel mitigating asymmetric shocks but we do not have any (reliable) data on this. Moreover, migration in China is still highly constrained by the continued enforcement of the *hukou* system of household registration which limits mobility of workers and their entitlement to public goods. Finally, the role of the special economic zones may deserve closer attention as the SEZs have effectively enjoyed a substantial head start over rest of China. This, however, might require more disaggregate data than those that we have: the SEZs typically account only for a relatively small portion of the province in which they are located. Finally, future will show whether supply shocks affecting Chinese regions will continue to diverge or whether this trend will be reversed.

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Table 1: Weighted average supply shocks's correlation by province

Region	Province name	1955-1965	1966-1977	1978-1991	1992-2007
EAST	Beijing	0.61	0.54	0.41	0.26
	Tianjin	0.77	0.37	0.48	0.34
	Shanghai	0.68	0.35	0.49	0.33
	Liaoning	0.78	0.27	0.38	-0.35
	Shandong	0.63	0.38	0.46	0.29
	Jiangsu	0.39	0.53	0.37	0.27
	Zhejiang	0.68	0.10	0.53	0.35
	Fujian	0.69	0.35	0.49	0.37
	Guangdong	0.65	0.35	0.38	0.41
CENTRAL	Hebei	0.71	0.42	0.50	0.25
	Shanxi	0.78	0.50	0.23	0.03
	Inner-Mongolia	0.65	0.46	0.18	0.10
	Jilin	0.73	0.49	0.35	0.33
	Heilongjian	0.78	0.40	0.37	0.09
	Anhui	0.48	-0.09	-0.21	0.09
	Jiangxi	0.43	0.45	0.39	0.36
	Henan	0.71	0.34	0.19	-0.12
	Hunan	0.78	0.52	0.36	0.38
	Hubei	0.72	0.48	0.37	0.16
WEST	Guangxi	0.76	0.24	0.42	0.43
	Sichuan	-	-	0.46	0.32
	Guizhou	0.82	0.35	0.29	0.08
	Yunnan	0.58	0.38	0.35	0.32
	Shaanxi	0.78	0.36	0.39	-0.04
	Gansu	0.61	0.19	0.33	0.20
	Ningxia	0.56	0.32	0.25	-0.26
	Qinghai	0.69	0.23	0.39	0.11
	Xinjiang	0.59	0.51	0.29	0.27

Table 2: Weighted average Demand shocks's correlation by province

Region	Province name	1955-1965	1966-1977	1978-1991	1992-2007
	Beijing	0.01	0.05	0.43	0.60
	Tianjin	0.20	0.23	0.47	0.66
EAST	Shanghai	0.18	0.16	0.34	0.73
	Liaoning	-0.18	0.17	0.17	0.50
	Shandong	0.21	0.07	0.19	0.51
	Jiangsu	-0.07	0.18	0.37	0.76
	Zhejiang	0.26	0.08	0.41	0.75
	Fujian	0.18	-0.13	0.48	0.74
	Guangdong	0.18	0.10	0.37	0.66
	Hebei	0.17	0.09	0.49	0.71
	Shanxi	0.05	0.20	0.38	0.66
CENTRAL	Inner-Mongolia	0.05	-0.02	0.44	0.79
	Jilin	0.19	0.03	0.10	0.60
	Heilongjian	0.11	0.30	0.20	0.75
	Anhui	-0.18	0.29	0.40	0.66
	Jiangxi	0.21	0.14	0.45	0.66
	Henan	-0.07	0.29	0.37	0.72
	Hunan	0.18	-0.17	0.38	0.78
	Hubei	0.08	0.10	0.39	0.75
	Guangxi	0.14	0.02	0.53	0.70
	Sichuan	-	-	0.32	0.68
	Guizhou	0.23	0.16	0.53	0.77
WEST	Yunnan	0.16	-0.18	0.28	0.58
	Shaanxi	0.14	0.22	0.26	0.67
	Gansu	0.14	-0.24	0.21	0.36
	Ningxia	0.16	-0.04	0.49	0.73
	Qinghai	0.12	-0.10	0.37	0.71
	Xinjiang	-0.08	-0.15	0.38	0.68

Table 3: Sub-groups

Sample	Observations
East	Beijing, Tianjin, Shanghai, Liaoning, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan
Central	Hebei, Shanxi, Inner-Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hunan, Hubei
West	Guangxi, Guizhou, Yunan, Sichuan, Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang

Table 4: Determinants of interprovince correlation of supply shocks: 1955-65 and 1966-77

	1955-65		1966-77	
	ols	*z*	*ols*	*z*
common border dummy	0.045 (0.043)	0.082 (0.084)	0.014 (0.061)	0.021 (0.077)
coast dummy	-0.107 (0.047)*	-0.228 (0.092)*	-0.053 (0.067)	-0.084 (0.085)
same region dummy	0.041 (0.032)	0.068 (0.062)	0.063 (0.049)	0.102 (0.061)
coast-interior dummy	-0.038 (0.067)	-0.109 (0.132)	0.042 (0.096)	0.047 (0.121)
distance/1000	0.019 (0.013)	0.024 (0.025)	0.007 (0.019)	0.014 (0.024)
$LogY_i + LogY_j$	0.011 (0.016)	0.021 (0.031)	-0.002 (0.022)	0.007 (0.028)
dissimilarity of physical capital	-0.488 (0.237)*	-0.945 (0.464)*	-0.117 (0.336)	-0.023 (0.421)
dissimilarity of human capital	0.024 (0.017)	0.038 (0.034)	0.017 (0.048)	0.014 (0.060)
dissimilarity of inflation	-0.001 (0.002)	-0.002 (0.003)	-0.003 (0.002)	-0.003 (0.003)
std dev of fiscal deficit	0.482 (0.210)*	1.069 (0.412)**	-0.858 (0.563)	-1.395 (0.706)*
constant	0.544 (0.125)**	0.695 (0.246)**	0.416 (0.210)*	0.41 (0.263)
observations	325	325	324	324
R^2	0.05	0.06	0.02	0.03

Figures in ( ) are standard errors. Significance levels: ** 1%, *5%.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Table 5: Determinants of interprovince correlation of supply shocks: 1978-91 and 1992-07

	1978-91		1992-07	
	ols	*z*	*ols*	*z*
common border dummy	0.031	0.045	0.226	0.276
	(0.048)	(0.057)	(0.068)**	(0.082)**
coast dummy	0.203	0.26	0.279	0.356
	(0.060)**	(0.073)**	(0.089)**	(0.107)**
same region dummy	-0.026	-0.030	-0.019	-0.031
	(0.037)	(0.045)	(0.056)	(0.067)
coast-interior dummy	0.005	0.009	-0.224	-0.275
	(0.080)	(0.097)	(0.115)	(0.137)*
distance/1000	-0.022	-0.031	0.027	0.035
	(0.019)	(0.022)	(0.024)	(0.029)
$LogY_i + LogY_j$	0.003	-0.004	-0.027	-0.030
	(0.017)	(0.020)	(0.023)	(0.027)
dissimilarity of physical capital	-1.844	-2.225	-1.381	-1.616
	(0.392)**	(0.474)**	(0.401)**	(0.479)**
dissimilarity of human capital	5.009	5.338	-2.974	-3.399
	(2.393)*	(2.887)	(4.031)	(4.821)
dissimilarity of inflation	0.024	0.030	0.039	0.047
	(0.014)	(0.017)	(0.027)	(0.033)
std dev of fiscal deficit	0.844	1.005	0.542	0.277
	(0.528)	(0.637)	(1.392)	(1.664)
dissimilarity of trade	0.122	0.121	0.068	0.075
	(0.188)	(0.226)	(0.077)	(0.092)
dissimilarity of fdi	-5.742	-6.587	-0.364	-0.317
	(4.189)	(5.054)	(1.187)	(1.420)
dissimilarity of output structure	-0.081	-0.060	0.522	0.618
	(0.123)	(0.148)	(0.254)*	(0.303)*
constant	0.326	0.457	0.413	0.460
	(0.185)	(0.223)*	(0.339)	(0.406)
observations	378	378	378	378
R^2	0.14	0.14	0.10	0.11

Figures in ( ) are standard errors. Significance levels: ** 1%, *5%.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Table 6: Determinants of interprovince correlation of demand shocks: 1955-65 and 1966-77

	1955-65		1966-77	
	ols	*z*	*ols*	*z*
common border dummy	0.020	0.018	0.061	0.064
	(0.080)	(0.092)	(0.071)	(0.080)
coast dummy	0.116	0.140	-0.045	-0.061
	(0.087)	(0.100)	(0.078)	(0.089)
same region dummy	-0.047	-0.055	0.011	0.019
	(0.059)	(0.068)	(0.056)	(0.064)
coast-interior dummy	-0.021	-0.033	-0.159	-0.177
	(0.125)	(0.144)	(0.111)	(0.126)
distance/1000	0.005	0.006	-0.089	-0.096
	(0.024)	(0.028)	(0.022)**	(0.025)**
$LogY_i + LogY_j$	-0.053	-0.061	0.009	0.011
	(0.029)	(0.034)	(0.026)	(0.029)
dissimilarity of physical capital	-0.604	-0.729	-0.775	-0.859
	(0.440)	(0.509)	(0.387)*	(0.441)
dissimilarity of human capital	-0.004	-0.006	0.050	0.052
	(0.032)	(0.037)	(0.055)	(0.063)
dissimilarity of inflation	-0.004	-0.004	-0.003	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)
std dev of fiscal deficit	0.331	0.350	-0.029	-0.126
	(0.391)	(0.452)	(0.649)	(0.739)
constant	0.514	0.599	0.211	0.232
	(0.233)*	(0.269)*	(0.242)	(0.275)
observations	325	325	324	324
R^2	0.02	0.02	0.13	0.12

Robust standard errors in parentheses. Significance levels: ** 1%, * 5%.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Table 7: Determinants of interprovince correlation of demand shocks: 1978-91 and 1992-07

	1978-91		1992-07	
	ols	*z*	*ols*	*z*
common border dummy	-0.032 (0.047)	-0.032 (0.059)	0.020 (0.031)	0.035 (0.056)
coast dummy	0.160 (0.059)**	0.202 (0.075)**	-0.058 (0.040)	-0.088 (0.074)
same region dummy	-0.103 (0.036)**	-0.136 (0.046)**	0.006 (0.025)	0.013 (0.046)
coast-interior dummy	0.026 (0.079)	0.058 (0.099)	-0.098 (0.052)	-0.201 (0.095)*
distance/1000	-0.073 (0.018)**	-0.101 (0.023)**	-0.023 (0.011)*	-0.043 (0.020)*
$LogY_i + LogY_j$	-0.068 (0.016)**	-0.085 (0.020)**	0.008 (0.010)	0.010 (0.019)
dissimilarity of physical capital	0.583 (0.384)	0.695 (0.485)	0.493 (0.180)**	0.954 (0.331)**
dissimilarity of human capital	0.797 (2.343)	2.267 (2.958)	-2.621 (1.814)	-5.880 (3.324)
dissimilarity of inflation	0.069 (0.014)**	0.092 (0.017)**	0.024 (0.012)*	0.032 (0.023)
std dev of fiscal deficit	-0.489 (0.517)	-0.577 (0.653)	0.646 (0.626)	1.015 (1.148)
dissimilarity of trade	-0.183 (0.184)	-0.196 (0.232)	-0.064 (0.035)	-0.141 (0.064)*
dissimilarity of fdi	-1.550 (4.101)	-3.083 (5.179)	0.338 (0.534)	0.934 (0.979)
dissimilarity of output structure	-0.072 (0.120)	-0.123 (0.152)	-0.155 (0.114)	-0.261 (0.209)
constant	1.127 (0.181)**	1.374 (0.229)**	0.593 (0.153)**	0.804 (0.280)**
observations	378	378	378	378
R^2	0.16	0.17	0.08	0.08

Robust standard errors in parentheses. Significance levels: ** 1%, * 5%.

o: results based on original data, z: results based on Fisher ”z” tranformation and log(variables) .

Table 8: Univariate determinants of interprovince correlation of supply shocks, 1955-77

variables	1955 − 1965		1966 − 1977	
	o	z	o	z
common border	0.028157	0.048582	0.040173	0.047516
	(0.031775)	(0.062398)	(0.044468)	(0.055910)
	[0.002425]	[0.001873]	[0.002520]	[0.002231]
distance/1000	0.00207	−0.00280	−0.00670	−0.00736
	(0.0110)	(0.02152)	(0.0153)	(0.01928)
	[0.000110]	[0.0001]	[0.0005]	[0.0005]
$LogY_i + LogY_j$	0.0134862	0.0257442	0.0000835	0.0024802
	(0.0113243)	(0.0222346)	(0.0157296)	(0.0197739)
	[0.0044]	[0.0041]	[0.00]	[0.00]
dissimilarity of capital investment	−0.336200**	−0.037162	−0.268362	0.008314
	(0.169711)	(0.030349)	(0.241338)	(0.024251)
	[0.012004]	[0.004621]	[0.003814]	[0.000364]
dissimilarity of human capital	0.018180	0.032628*	0.015472	−0.009189
	(0.017182)	(0.018441)	(0.047604)	(0.021297)
	[0.003454]	[0.009599]	[0.000328]	[0.000578]
dissimilarity of GPI	−0.000604	0.040185	−0.002502	−0.038544*
	(0.001503)	(0.041364)	(0.002149)	(0.022564)
	[0.000500]	[0.002913]	[0.004181]	[0.008953]
dissimilarity of standard deviation of fisical deficit	0.221947	0.049456	−0.810108	−0.087079**
	(0.187832)	(0.037616)	(0.535593)	(0.041178)
	[0.004304]	[0.005323]	[0.007033]	[0.013656]
number of observations:	325	325	325	325

Robust standard errors in parentheses. Significance levels: *** 1%, ** 5%, * 10%.

R^2 in parentheses. in square brackets.

o: results based on original data, z: results based on Fisher ”z” tranformation and log(variables)

Table 9: Univariate determinants of interprovince correlation of supply shocks, 1978-07

variables	1978 − 1991		1992 − 2007	
	o	*z*	*o*	*z*
common border	0.023345	0.044330	0.130154***	0.154216***
	(0.037581)	(0.045354)	(0.051851)	(0.062148)
	[0.001025]	[0.002534]	[0.016482]	[0.016112]
same region	0.039198	0.056307	0.084523**	0.100917**
	(0.029714)	(0.035853)	(0.041183)	(0.049355)
	[0.004607]	[0.006517]	[0.011079]	[0.010997]
coast_intra	0.221088***	0.276857***	0.195236***	0.257427***
	(0.046338)	(0.055838)	(0.065587)	(0.078403)
	[0.057088]	[0.061369]	[0.023024]	[0.027873]
coast_interior border	0.054391	0.076551	−0.039507	−0.048638
	(0.070802)	(0.085488)	(0.098507)	(0.118047)
	[0.001567]	[0.002128]	[0.000428]	[0.000451]
distance/1000	−0.02130	−0.03301**	0.001098	0.00068
	(0.01363)	(0.01643)	(0.01902)	(0.02279)
	[0.0065]	[0.0106]	[0.000009]	[0.0000]
$LogY_i + LogY_j$	0.0521871***	0.0594767***	0.0207678	0.0301462
	(0.0132161)	(0.0159982)	(0.0160028)	(0.0191573)
	[0.0398]	[0.0355]	[0.0045]	[0.0065]
dissimilarity of capital investment	−0.202189	−0.013527	−1.327728***	−0.101748***
	(0.242573)	(0.020732)	(0.384416)	(0.036837)
	[0.001844]	[0.001131]	[0.030751]	[0.019888]
dissimilarity of fixed asset investment	−1.831116***	−0.148670***	−0.897178	−0.080585**
	(0.348473)	(0.029156)	(0.330894)	(0.040774)
	[0.068412]	[0.064679]	[0.019177]	[0.010282]
dissimilarity of human capital	0.503795	0.015454	−4.272693	−0.051782
	(1.877101)	(0.027268)	(3.910434)	(0.045384)
	[0.000192]	[0.000853]	[0.003165]	[0.003450]
dissimilarity of GPI	0.016084	0.042656	0.041759*	0.086882
	(0.012270)	(0.033941)	(0.025354)	(0.055054)
	[0.004549]	[0.004183]	[0.007163]	[0.006580]
dissimilarity of standard deviation of fisical deficit	0.517423	0.021295	−0.731659	−0.054555
	(0.352769)	(0.022140)	(1.128675)	(0.037963)
	[0.005689]	[0.002454]	[0.001116]	[0.005462]
dissimilarity of production structure	0.101360	0.037248	0.211801	0.025112
	(0.076309)	(0.027723)	(0.207825)	(0.052348)
	[0.004670]	[0.004778]	[0.002755]	[0.000612]
dissimilarity of FDI	2.892671	0.026751	0.179763	0.005275
	(2.466734)	(0.011721)	(0.721279)	(0.024454)
	[0.003644]	[0.013664]	[0.000165]	[0.000124]
dissimilarity of international trade	0.205564*	0.038594***	0.046245	−0.005189
	(0.106799)	(0.012968)	(0.046314)	(0.015493)
	[0.009757]	[0.023013]	[0.002645]	[0.000298]
number of observations:	378	378	378	378

Robust standard errors in parentheses. Significance levels: ** 1%, * 5%.

R^2 in parentheses. in square brackets.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Table 10: Univariate determinants of interprovince correlation of demand shocks, 1955-77

variables	1955 − 1965		1966 − 1977	
	o	z	o	z
common border	0.016038 (0.058028) [0.000236]	0.012693 (0.067104) [0.000111]	0.167365*** (0.053691) [0.029205]	0.179765*** (0.060920) [0.026251]
distance/1000	0.00005 (0.01999) [0.0000]	0.000539 (0.02312) [0.0000]	−0.10486*** (0.017844) [0.0966]	−0.113886*** (0.020304) [0.0888]
$LogY_i + LogY_j$	−0.0162104 (0.0206834) [0.0019]	−0.0168501 (0.0239214) [0.0015]	0.055078*** (0.0190059) [0.0253]	0.059864*** (0.0215544) [0.0233]
dissimilarity of capital investment	−0.103934 (0.311406) [0.000345]	−0.027562 (0.032648) [0.002202]	−1.208475*** (0.288197) [0.051627]	−0.101415*** (0.026151) [0.044490]
dissimilarity of human capital	0.004045 (0.031397) [0.000051]	0.003724 (0.019909) [0.000108]	0.055264 (0.058134) [0.002799]	−0.003252 (0.023473) [0.000060]
dissimilarity of GPI	−0.003036 (0.002737) [0.003793]	−0.068216 (0.044347) [0.007272]	−0.002924 (0.002630) [0.003810]	−0.041937* (0.024890) [0.008713]
dissimilarity of standard deviation of fisical deficit	0.150066 (0.343279) [0.000591]	−0.010881 (0.040521) [0.000223]	−0.732635 (0.656563) [0.003840]	−0.064897 (0.045588) [0.006235]
number of observations:	325	325	325	325

Robust standard errors in parentheses. Significance levels: *** 1%, ** 5%, * 10%.

R^2 in parentheses. in square brackets.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Table 11: Univariate determinants of interprovince correlation of demand shocks, 1978-07

variables	1978 − 1991		1992 − 2007	
	o	*z*	*o*	*z*
common border	0.023834	0.046782	0.020040	0.037709
	(0.037145)	(0.047124)	(0.023144)	(0.042607)
	[0.001094]	[0.002614]	[0.001990]	[0.002079]
same region	−0.023149	−0.031228	0.011592	0.031778
	(0.029414)	(0.037340)	(0.018341)	(0.033743)
	[0.001645]	[0.001857]	[0.001061]	[0.002353]
coast_intra	−0.012962	−0.017831	−0.039961	−0.057588
	(0.047163)	(0.059879)	(0.029331)	(0.054049)
	[]	[0.000236]	[0.004912]	[0.003010]
coast_interior border	0.041835	0.092028	−0.068357	−0.146728*
	(0.070004)	(0.088795)	(0.043516)	(0.080019)
	[0.000949]	[0.002849]	[0.006520]	[0.008863]
distance/1000	−0.023941*	−0.035316**	−0.011298	−0.02251
	(0.013464)	(0.017068)	(0.008408)	(0.015472)
	[0.0083]	[0.0390]	[0.0048]	[0.0056]
$LogY_i + LogY_j$	−0.0490265***	−0.0596692***	−0.0119099*	−0.0240455*
	(0.0130894)	(0.0166438)	(0.0070803)	(0.0130245)
	[0.0360]	[0.0331]	[0.0934]	[0.0090]
dissimilarity of capital investment	0.238076	0.008761	0.389290**	0.025987
	(0.239674)	(0.021549)	(0.171852)	(0.025293)
	[0.002617]	[0.000439]	[0.013464]	[0.002800]
dissimilarity of fixed asset investment	0.728007**	0.031695	0.327238**	0.050676*
	(0.354885)	(0.031282)	(0.147085)	(0.027777)
	[0.011068]	[0.002723]	[0.012993]	[0.008774]
dissimilarity of human capital	−1.064335	−0.010069	−2.411289	−0.057103*
	(1.854753)	(0.028341)	(1.731047)	(0.030807)
	[0.000875]	[0.000336]	[0.005134]	[0.009055]
dissimilarity of GPI	0.040543***	0.107509***	0.007895	0.000705
	(0.011975)	(0.034903)	(0.011268)	(0.037600)
	[0.029585]	[0.024612]	[0.001304]	[0.000001]
dissimilarity of standard deviation of fisical deficit	−0.786255**	−0.057348***	0.478487	0.021793
	(0.347326)	(0.022843)	(0.499800)	(0.025889)
	[0.013446]	[0.016487]	[0.002432]	[0.001881]
dissimilarity of production structure	−0.155250	−0.077501***	−0.115586	−0.057319*
	(0.075178)	(0.028596)	(0.092024)	(0.035523)
	[0.011215]	[0.019160]	[0.004178]	[0.006877]
dissimilarity of FDI	0.493072	0.001729	−0.446336	−0.024001
	(2.442522)	(0.012263)	(0.318804)	(0.016601)
	[0.000108]	[0.000053]	[0.005186]	[0.005528]
dissimilarity of international trade	−0.152044	−0.019970	−0.045081***	−0.030514***
	(0.105792)	(0.013594)	(0.020417)	(0.010430)
	[0.005463]	[0.005707]	[0.012800]	[0.022259]
number of observations:	378	378	378	378

Robust standard errors in parentheses. Significance levels: *** 1%, ** 5%, * 10%.

R^2 in parentheses. in square brackets.

o: results based on original data, z: results based on Fisher "z" tranformation and log(variables)

Figure 1: Interprovince correlation of supply shocks 1955-1965

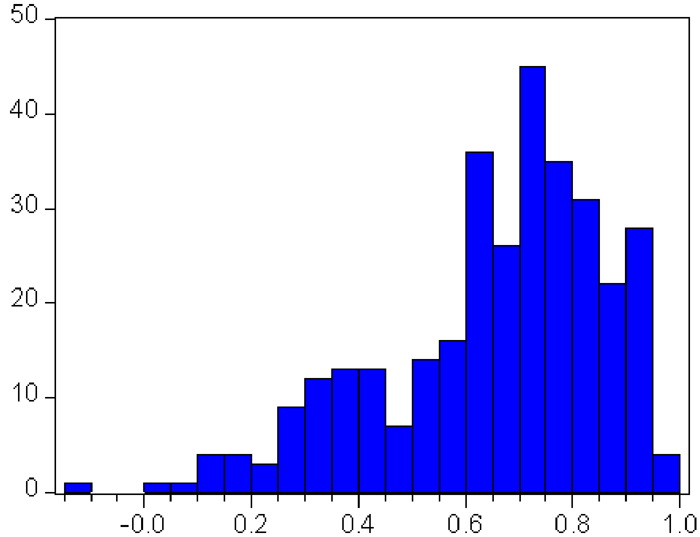

Figure 2: Interprovince correlation of supply shocks 1966-1977

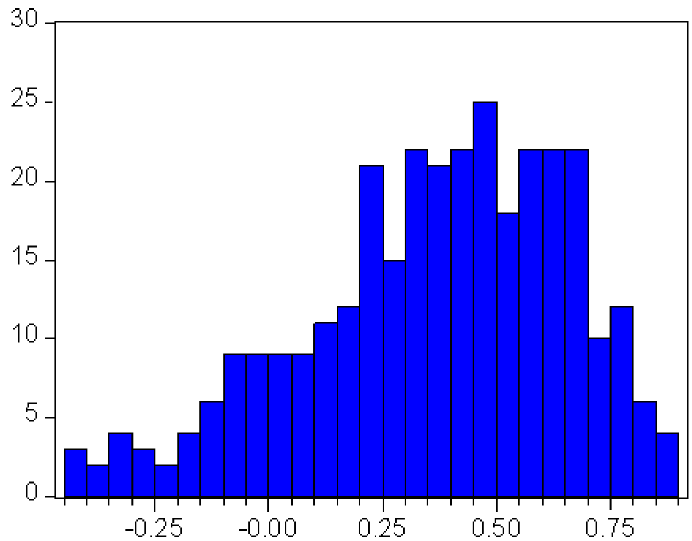

Figure 3: Interprovince correlation of supply shocks 1978-1991

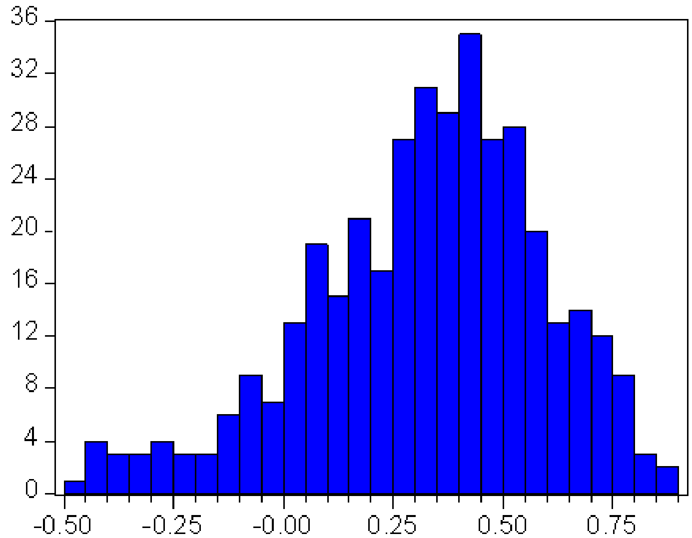

Figure 4: Interprovince correlation of supply shocks 1992-2007

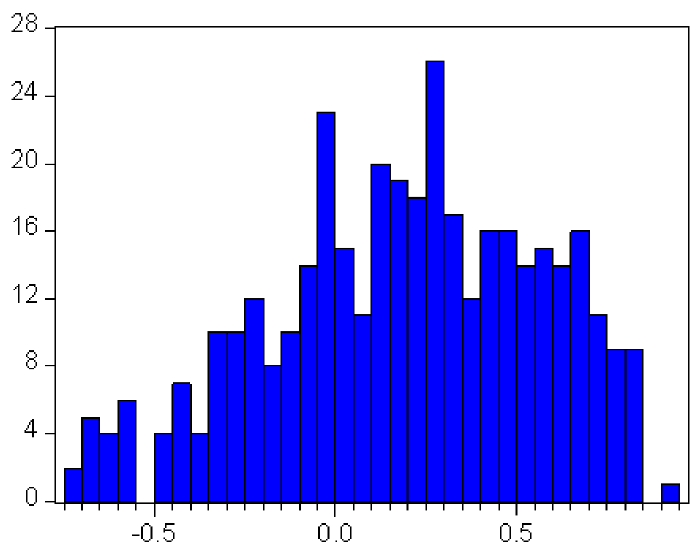

Figure 5: Interprovince correlation of demand shocks 1955-1965

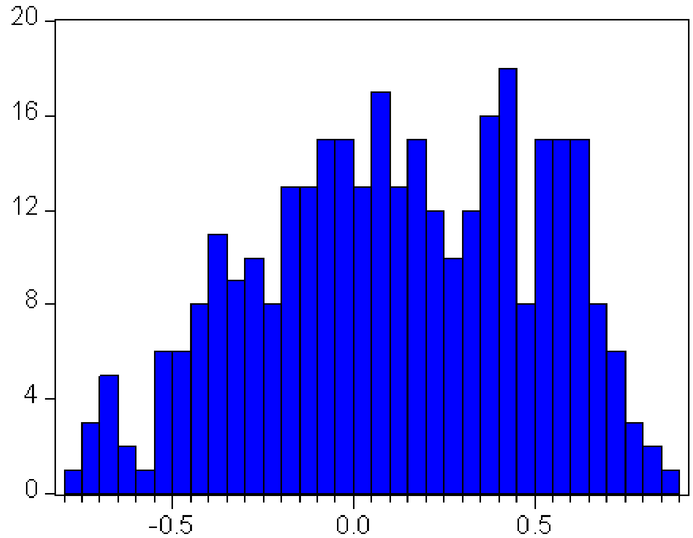

Figure 6: Interprovince correlation of demand shocks 1966-1977

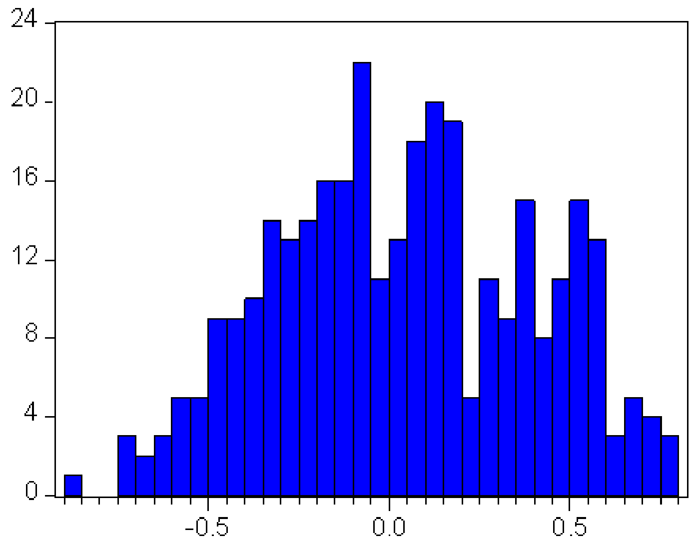

Figure 7: Interprovince correlation of demand shocks 1978-1991

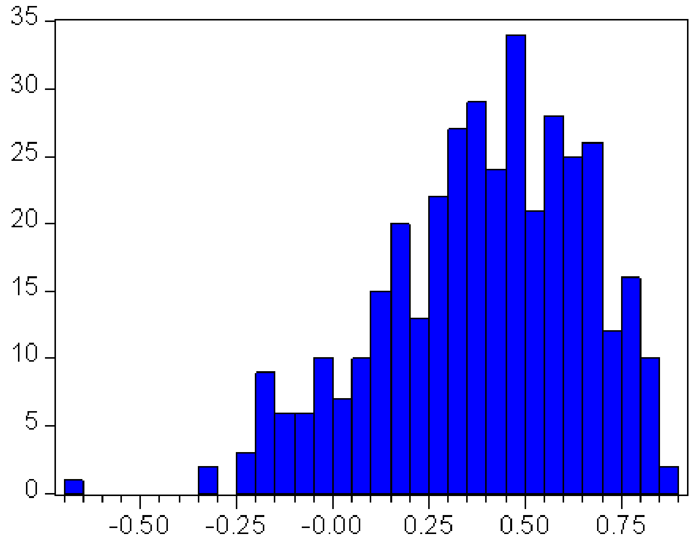

Figure 8: Interprovince correlation of demand shocks 1992-2007