China in the World Economy: Dynamic Correlation Analysis of Business Cycles

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March 2011

Abstract

We analyze the business cycles in China and in selected OECD countries between 1992 and 2006. Nearly all OECD countries show positive correlations of the very short-run developments which may correspond to intensive supplier linkages. However, dynamic correlations at the business cycle frequencies are negative. Countries facing a comparably longer history of intensive trading links tend to show also slightly higher correlations of business cycles with China. Despite of this, trade and financial flows do not increase correlations of business cycles between China and OECD countries, but they lower the degree of business cycle synchronization within the OECD area.

JEL Classification: E32, F15, F41.

Keywords: Business cycles, synchronisation, trade, FDI, dynamic correlation.

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*We appreciate the research assistance by Yin Xia. We benefited also from comments by Katharina Fidrmuc-Helmstedt, Gerhard Illing, Tomasz Kozluk, Michael Funke, Tuuli Koivu, Aaron Mehrotra, Juraj Zeman, Pavol Brunovský, as well as Eiji Ogawa and seminar participants at the Hitotsubashi University Tokyo in 2007, and participants of the 6th Eurostat Colloquium on Modern Tools for Business Cycle Analysis in 2010.

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1 Introduction

In the last decade the structure of the world economy has become more complex. Before 1990, the economic development was clearly dominated by the USA, Japan and several European economies. There was also significant effort to achieve some degree of policy coordination through the Organisation for Economic Co-operation and Development (OECD), International Monetary Fund (IMF), and especially the European Union (EU). In general, the emerging countries were highly dependent on economic development in the OECD countries and followed to some extent also their policies.

Few events in the world economy match the emergence of China in recent decades. Predominantly agrarian before 1980, China today boasts an extensive modern industrial economy with booming urban regions. The country’s high trade growth is supported by large foreign direct investment (FDI) flows (Eichengreen and Tong, 2005). Not surprisingly, growth in the world’s most populous country has changed the distribution of economic activities across the world. Between 1980 and 2006, the share of Chinese GDP in the world economy valued at market exchange rates increased from 1.7% to 5.5% (this share is even higher if purchasing-power-adjusted prices are used).

The international redistribution of economic activities holds important implications for business cycles. Emerging countries, and particularly China, contribute significantly to global growth. Thus, global economic prospects are less dependent than earlier on the performance of large developed economies such as the US and Germany. This situation may make countries in a particular region less vulnerable to demand shocks (IMF, 2007).

The literature on business cycle synchronization stresses the importance of foreign trade and capital flows. Thus, the emergence of China as a large trading nation and a target for international investment may have a significant impact on the business cycles of its partner countries.

Even as China has opened up to the world economy, recent business cycle trends suggest differences among countries in their intensity of trade and financial relations with China. This seems especially important in the case of European countries. We observe a joint EU cycle up to the 1980s (see Artis and Zhang, 1997, Fatas, 1997) that essentially vanishes in the 1990s (see Artis, 2003). Moreover, the intensity of the trading and financial links with China has diverged among individual EU countries. For example, the UK, Germany, Finland, and the Netherlands have extensive links with China, while many other EU countries have quite modest economic ties with China.

Foreign trade and foreign direct investment (FDI) are generally seen as important factors of business cycles. However, their effects on correlation of international business cycles are ambiguous. Frankel and Rose (1998) find a robust positive relationship
between trade intensity and correlation of business cycles between OECD countries. This is reflected in high shares of intra-industry trade between these countries. Yet China's specific position in the international division of labor should result in increased specialization. Krugman (1993), for example, argues that this should cause business cycle divergence between countries. Moreover, FDI can be either a substitute or a complement to exports between a pair of countries.

In addition to the rich literature on trade between China and the developed countries (Bussière et al., 2008), there are also a range of authors (e.g. de Grauwe and Zhang, 2006) dealing with the determinants of the business cycles in Southeast Asia. Few papers deal specifically with the synchronization of business cycles in developed countries and China, so this study aims to help fill this gap in the literature.

Our study show three findings. First, the business cycle in China is quite different from OECD countries (with the exception of Korea). Second, trade flows between OECD countries and China have so far had rather limited effects on the comovements in China and OECD countries, although they have increased the comovement at the short-run frequencies. This stands in sharp contradiction to the positive relationship between trade and business cycle similarities between OECD countries extensively documented in the earlier literature (and confirmed here for OECD countries). Finally, trade and financial flows with China have lowered the degree of business cycle synchronization between OECD countries. To our knowledge, this result is novel to the literature.

The paper is structured as follows. The following section reviews the literature on international business cycles. Section 3 introduces the concept of dynamic correlation and discusses the stylized facts on business cycles in selected developed countries and China. Section 4 presents the stylized compares the business cycle of China and in OECD countries. Section 5 discusses cohesion analysis for selected world regions. Section 6 investigates the impact of China on the degree of business cycles synchronization between OECD countries. The last section concludes with suggestions on directions for future research.

2 Determinants of Business Cycle Synchronization

Economic development is determined by domestic factors (e.g. aggregate demand shocks and budgetary policy) and international factors (e.g. external demand and international prices for traded goods), as well as their interaction. In open economies, international factors play an important role, often driving the formulation of domestic policies designed to insulate the economy from adverse external economic shocks. Frankel and Rose (1998) argue that trade, and more generally economic integration
among countries, results in increased synchronization of individual business cycles. They contend trade links provide a channel for transmission of shocks across countries. In line with approach, Kenen (2000) shows that the correlation between two countries’ output changes increases with the intensity of trade links. Kose and Yi (2006) subsequently analyze this issue in an international real business cycle model. Although their model suggests a positive relation between trade and output comovement, only small qualitative effects are obtained.

The hypothesis of a positive relationship between trade and business cycles is not universally accepted, however. Krugman (1993), for example, argues that countries should be expected to increasingly specialize as they become more integrated. Thus, the importance of asymmetric or sector specific shocks should increase with the process of economic integration — a pattern perhaps more appropriate here to explaining Chinese business cycles.

The role of trade links has been studied extensively in the empirical literature. Despite the theoretical ambiguities, authors generally find that countries trading more intensively exhibit a higher degree of output comovement (e.g. Frankel and Rose, 1998, Otto et al., 2001, Baxter and Kouparitsas, 2005). It is not trade relations per se, however, that induce business cycle synchronization. Indeed, Frankel and Rose's hypothesis underscores the fact that bilateral trade is mainly intra-industry trade (although this indicator does not directly enter their analysis). Instead, they argue that specialization increases the exposure to sector-specific shocks transmitted via intra-industry trade. Fontagné (1999) discusses the relation between intra-industry trade and the symmetry of shocks in a monetary union. Fidrmuc (2004) demonstrates that intra-industry trade is a better indicator for business cycle symmetry than simple trade intensity.

Given China’s tendency to specialize vertically, this channel may not be particularly relevant for the Chinese business cycle. Instead, the specialization forces discussed by Krugman (1993) appear to dominate and drive the differences in business cycles of China and its various trading partners.

Financial integration between countries could also play an important role in synchronization of business cycles, but again, the impact of financial integration on business cycles is ambiguous. On the one hand, financial markets work similarly to trade links. Thus, business cycles in one country are likely to affect investment decisions and asset prices in other countries via financial flows. Conversely, FDI allows countries to specialize (Kalemli-Ozcan et al., 2001, Hoffmann, 2003, Imbs, 2004) such that a high degree of financial integration may reduce the extent of co-fluctuations. Empirical analysis here seems to indicate a less robust impact of financial integration on business cycle synchronization (see Artis et al., 2008).

In any case, the literature on business cycle correlation is concentrated on devel-
oped economies. Among the studies that look at business cycle correlation in Eastern Asia, we note the most relevant papers. Sato and Zhang (2006) find common business cycles for the East Asian region. Shin and Sohn (2006) show trade integration (and financial integration to a considerably lesser extent) enhances comovements of output in East Asia. Kumakura (2005) reports that the share of electronic products in foreign trade increases business cycle correlation for the countries around the Pacific. Finally, Shin and Wang (2004) observe that trade is a significant determinant of business cycle correlation for East Asian countries. Few, if any, papers directly examine the correlation of business cycles between China and other emerging Asian economies and those of the OECD countries.

3 Correlation and Dynamic Correlation Analysis

The correlation analysis is the most basic approach which has been applied in literature to study the degrees of synchronization between economic variables.

The most common measure of co-movement between time series is the classical correlation, which is also commonly used in literature on business cycle correlation. Unfortunately the classical correlation is associated with two main drawbacks: First, it does not allow for a separation of idiosyncratic components and common co-movements. Second, it is basically a static analysis that fails to capture any dynamics in the co-movement. An alternative measure of synchronization in the case of business cycles is the dynamic correlation, which was proposed by Croux et al. (1999).

Let \( x \) and \( y \) be zero-mean real stochastic processes. Let \( S_x(\lambda) \) and \( S_y(\lambda) \) be the spectral density functions of \( x \) and \( y \) and \( C_{xy}(\lambda) \) be the co-spectrum, \(-\pi \leq \lambda \leq \pi\). So the dynamic correlation equals

\[
\rho_{xy}(\lambda) = \frac{C_{xy}(\lambda)}{\sqrt{S_x(\lambda)S_y(\lambda)}}.
\]

(1)

The dynamic correlation lies between -1 and 1.

If two stochastic processes \( x \) and \( y \) are obtained by summing the waves of \( x_t \) and \( y_t \) within a given frequency interval, the dynamic correlation can be defined on frequency band. Set \( \Lambda_+ = [\lambda_1, \lambda_2) \) and \( \Lambda_- = (-\lambda_2, -\lambda_1) \), where \( 0 \leq \lambda_1 \leq \lambda_2 \leq \pi \). So the dynamic correlation within the frequency band \( \Lambda_+ \) is defined as

\[
\rho_{xy}(\Lambda_+) = \frac{\int_{\Lambda_+} C_{xy}(\lambda) d\lambda}{\sqrt{\int_{\Lambda_+} S_x(\lambda) d\lambda \int_{\Lambda_+} S_y(\lambda) d\lambda}}.
\]

(2)
In one particular case, if $\lambda_1 = 0$ and $\lambda_2 = \pi$, the $\rho_{xy}(\Lambda_\pi)$ is reduced to the static correlation between $x_t$ and $y_t$, $\text{corr}(x_t, y_t)$.

The dynamic correlation within the frequency band, which is defined in (2), can be used to measure the co-movement of seasonal components of two economic time series, because we can select the frequency band of our interest and to evaluate the dynamic correlation within this frequency band.

4 **Stylized Facts for the Business Cycle in China and Selected Countries**

We use quarterly GDP data taken from IMF International Financial Statistics. For developed countries, the time series start in the 1970s or 1980s. Where seasonal adjustment is required, we perform the US Census Bureau’s X12 ARIMA procedure for the entire available period.

For China, we use national quarterly data in current prices. Because the Chinese statistical authorities do not publish a quarterly real GDP series, we used published or implicit GDP deflator in order to convert nominal GDP to constant prices.

We have to keep in mind that average growth has been higher in China than in the OECD countries. During the analyzed period, China has been among the world's fastest-growing economies. Moreover, growth has remained remarkably stable before in 2007. Therefore, growth volatility in OECD countries has been higher than in China. We adjusted the time series for China using the same procedure as for other countries. In China’s case, the time series start from 1992. Moreover, we use data only until 2006 in order to avoid the effects of the global financial crisis (see Fidrmuc and Korhonen, 2010). This restricts our analysis to the period between 1992 and 2006.

Figure 1 presents dynamic correlations of business cycles in China and selected developed economies between 1992 and 2006. As in most cited studies, we distinguish among three components of the aggregate correlation. First, the long-run movements (over 8 years) correspond to the low frequency band below $\pi/16$. Second, the traditional business cycles (i.e. cycles with a period between 1.5 and 8 years) belong to the medium part of the figure (marked as a shadow area) between $\pi/16$ and $\pi/3$. Finally, the short-run movements are defined by frequencies over $\pi/3$. Although it is usual to neglect these developments in literature, we look at them here as the short-run dependences of economic development could potentially be important in China’s case.

We can see that business cycles in China and selected economies vary significantly over the frequencies. Only a handful of countries show comparably high positive cor-
relation with the long-run cycles of China. These countries include the non-European OECD countries (the US, Korea, Australia and Japan). To a lesser degree, we also see small positive correlations of the long-run development in Denmark, Italy, Norway, and perhaps the UK. In general, the non-European OECD countries trade more intensively with China than the remaining countries of our sample, which may help explain the extent of business cycle correlation. For European countries, however, this explanation is less credible.

We find a more homogenous picture for the traditional business cycle frequencies (between \( \pi/16 \approx 0.2 \) and \( \pi/3 \approx 1 \)). In general, negative correlations of business cycles in China and OECD countries dominate. Basically, only Korea, Denmark, and Spain show a positive correlation over the whole interval of business cycle frequencies. This confirms the earlier findings of Shin and Sohn (2006) and Sato and Zhang (2006). As before, the non-European OECD countries show a positive correlation at the lower range of the interval (close to eight years). Only Italy and Spain show positive correlation at frequencies close to 1.5 years.

Finally, we see large differences in short-run frequencies. In general, the dynamic correlations tend to increase at the right end of the spectrum (see Figure 1). This would correspond to strong business linkages between suppliers from China and final producers in developed countries. Among the European countries, short-term correlation appears to be high for Finland, the Netherlands, and Sweden. Short-run correlations are also high also for the US and Korea, but only marginally positive for Japan. All these countries can be characterized as having highly intensive relationships with China over a longer period.

Figure 2 compares average dynamic correlations at the business cycle and the short-run frequencies with the static correlations for the sample. We can see that the negative correlations dominate for nearly all countries especially for the business cycle frequencies. Only Korea, Denmark, Norway and Italy show a positive correlation of business cycles with China. At the same time, several countries show positive dynamic correlations for the short-run frequencies. This is especially strong for Korea, Netherlands, Sweden, and the USA. Thus, there could be also some signs of increasing similarities of business cycles. Cui and Syed (2007) find that China is moving away from traditional assembly operations in its processing activities and its exports have started to rely more on domestically sourced components.
5 Cohesion Analysis of Regional and Global Business Cycles

Standard correlation analysis cannot present a single measure of an overall synchronization of business cycles for a larger number of countries including for example selected world regions or the global economy. In order to illustrate the synchronization across the surveyed countries, we compute the cohesion, which provides a better measure of the dynamic co-movements between time series than alternative methods.

Cohesion, which is again defined in frequency domain, is a measure of dynamic co-movement between several time series. In a bivariate case, the measure is reduced to dynamic correlation, which we discussed above. We apply cohesion for the analysis of regional and global business cycles and their synchronization. Moreover, we discuss the short-run and long-run dynamic properties of time series on GDP of selected countries. Cohesion is an appropriate method to obtain the stylized facts on output co-movements at specified frequencies.

Let \( x_t = (x_{1t}, \ldots, x_{Nt})' \) be a vector of \( N \geq 2 \) variables and \( w = (w_1, \ldots, w_N)' \) be a vector of the non-normalized positive weights to the variables in \( x_t \). In particular, we use the national shares in global output. The cohesion of the variables in \( x_t \) is defined as the weighted average of dynamic correlation between all possible pairs of countries. Thus, the cohesion is defined as

\[
\text{coh}_x(\lambda) = \frac{\sum_{i \neq j} w_i w_j \rho_{x_i,x_j}(\lambda)}{\sum_{i \neq j} w_i w_j}.
\]

Similarly to dynamic correlation, cohesion is also defined between -1 and 1.

Figure 3 presents cohesion of selected regions of the world economy at all frequencies. The chart provides a comparison of cohesion of non-Asian OECD countries (Japan and Korea are involved in the Asian region), Asian countries and the members states of European Union (defined as 15 member states before 2004).

We can see that OECD countries show a high level of cohesion for all frequencies. In general, we can confirm a high degree of business cycles synchronization for the OECD countries. Not surprisingly, the highest values of cohesion are found for the European Union. Nevertheless, the addition of the oversee OECD countries (except Asia) does not change the picture significantly.

By contrast, the level of cohesion between China, Korea and Japan is close to zero at the business cycle frequencies. However, cohesion among Asian countries is higher for the shortest frequencies than cohesion reported for other regions. Low similarities of business cycles in OECD countries and in Asia results in a low level of cohesion.
reported for the global economy, although we reflect the different size of the countries already by output weights. For business cycle frequencies, we can see that the degree of cohesion drops approximately by a half. Moreover, cohesion is at relatively low levels also for the short-run movements. It follows that we can expect further declines of the worldwide level of cohesion in future as the weights of emerging countries will increase. The early evidence on business cycle decoupling between OECD countries and emerging economies indicates that this process will be counteracted only slowly with the convergence of business cycles in emerging countries with those in OECD countries (see Kose et al., 2006, Fidrmuc and Korhonen, 2010).

6 Exposure to a Globalization Shock and Business Cycles of OECD Countries

The stylised facts of the previous sections show that the business cycles in China and in the OECD countries are largely not synchronized. Furthermore, the intensity of economic links with China differs largely between the OECD countries. This can influence the business cycles of the individual OECD countries as shown partially in the previous section. In addition to increased synchronisation of movements at particular frequencies, the synchronisation between OECD countries may decline as a result of different exposure to the ‘globalization’ or ‘China’ shock. Alternatively, different specialization patterns achieved during the globalization period may lead also to increasing dissimilarities in business cycles of the OECD countries despite similar exposure to trade and financial integration with China and other emerging markets.

Therefore, we extend our analysis to the business cycles between the OECD countries (excluding Korea, Mexico and Israel from the previous sample because they are possibly more similar to emerging economies and due to data reasons). We start with the estimation of the traditional OCA endogeneity equation which follows Frankel and Rose (1998) for individual frequencies,

\[ \rho_{ij}(\lambda) = \beta_1(\lambda) + \beta_2(\lambda)b_{ij} + \epsilon_{ij}(\lambda). \]  

(4)

where \( \rho_{ij} \) is the bilateral dynamic correlation between countries \( i \) and \( j \) at frequency \( \lambda \) and \( b_{ij} \) stands for trade to GDP ratio of countries \( i \) and \( j \). Because estimating (4) by OLS may be inappropriate (see Imbs, 2004), we use two stage OLS. This reflects that bilateral trade flows might be influenced by exchange rate policies. Therefore, trade and FDI intensities have to be instrumented by exogenous determinants of bilateral trade and financial flows. Such instruments are provided by the so-called ‘gravity
model’ (Bussière et al., 2008) including the log of GDP and GDP per capita, log of distance between trading partners, a dummy for geographic adjacency, countries with a common language, and a dummy for the 15 earlier member states of the EU and the NAFTA.

Usually, equations similar to (4) are estimated for static correlation between OECD countries, which represents also the starting point of our analysis. The results are presented in the first column of Table 1. Similarly, other authors sometimes use the band-pass filter (BPF), which is also presented in the third column in Table 1. In addition, Table 1 presents results for all intervals of dynamic correlations for selected frequency intervals. As expected, we can see that the trade coefficient estimated for the average dynamic correlations over all frequencies is nearly equal to the results for the static correlation. The same is true for the average of dynamic correlations over the business cycle frequencies, while the results for the band-pass filter are much higher. We can see also that trade coefficient is nonsignificant for the average dynamic correlation over the short-run frequencies. This means that trade has mainly an effect on business cycle and long-run frequencies. This is an interesting extension of Frankel and Rose (1998) result.

The detailed results for individual frequencies are reported in Figure 4. We can see that the positive relationship between business cycle similarities and the degree of trade integration is fully confirmed for the business cycle frequencies as well as for the long-run frequencies in OECD countries. Somewhat surprisingly, the relationship is positive but no longer significant for the short-run frequencies.

In the next step, we extend equation (4) to

\[ \rho_{ij}(\lambda) = \beta_1(\lambda) + \beta_2(\lambda) b_{ij} + \delta(\lambda)x_i + \delta(\lambda)x_j + \epsilon_{ij}(\lambda). \]  

where \( x \) represents the measures of economic and financial integration with China, which enters for both countries \( i \) and \( j \). In particular, we take the ratio of bilateral trade, FDI stock, and flows (between 2001 and 2005) recorded between OECD countries and China to GDP of the analyzed OECD countries. This shows the importance of economic and financial links from the perspective of the OECD countries. We restrict the coefficient for economic and financial integration with China, \( \delta \), to be the same for both countries, as the differences between them are caused by different ordering of the countries in the data matrix. This reflects also that we use only one half of the all possible combinations of \( n \) countries, because the indicators are the same (except for possible errors in trade statistics) for the country pair \( i \) and \( j \) as well as for the pair \( j \) and \( i \).

The previous results for bilateral trade intensities of OECD countries remain un-
changed (see Table 1) if we include data for trade and financial links of OECD countries with China. Furthermore, we can see that the adjusted coefficients of determination improve as well. Actually, trade flows between OECD countries explain only 4 per cent of variance of our measure of similarity of comovements at the business cycle frequencies. The inclusion of trade intensity with China explains additional 15% of variance of business cycle similarities for the average of dynamic correlations for business cycle frequencies. The share of explained variance is even higher for static correlations, correlations using the band-pass filter and average dynamic correlations for the long-run frequencies.

In contradiction to trade integration between OECD countries, Figure 5 and Table 1 show that $x$ has negative sign and is highly significant especially at the longer-term business cycles frequencies. This pattern is the same for all indicators of economic and financial links between OECD countries and China. This confirms our hypothesis that high intensity of trade and financial links to China has a negative effect on country’s synchronisation with business cycles of other OECD countries. For the short-run frequencies, the estimated coefficients are insignificant and in few cases they have positive signs.

In all estimations, the effects of bilateral OECD trade intensity remains positive and significant for the business cycle frequencies (especially those at the right-hand spectrum). However, the size of the coefficients is slightly lower in all estimations when economic ties with China are included. This finding can be visible also for the individual frequencies in Figure 5.

7 Conclusions

The emergence of China as an important trading nation has been one of the major events in the world economy in the past two decades. During this gradual process, China gained in economic weights and influenced economic developments around the world. Thus, China has become an important factor of growth of the global economy. However, we are interested how much influence China has on business cycles in the developed OECD countries.

We show that the interdependence between the economic development in China and in developed economies is generally relatively small. However, many countries show a high correlation of the short-run fluctuations. Many transnational companies use China as a part of their production chain (see Dean et al., 2008), and this is especially true for the other Asian countries. In turn, most countries show a negative correlation with China for the traditional business cycles (cycles with periods between
1.5 and 8 years). It seems that countries, which have more intensive economic and financial relationships with China, have also higher dynamic correlation with Chinese economy. This seems to be especially true for the long-term developments.

In sum, our results confirm a special position of China in the world economy, although the countries having already intensive trading relationships with China (e.g. Korea, Japan, and the USA) have also more similar cycles with China over all frequencies. Despite the increased trade links between the countries, Chinese business cycle remains in general rather different from the rest of the world.

Finally, we show that countries engaged intensively in trade and investment in China tend to have a lesser degree of synchronisation of business cycles with the other OECD countries. At the same time, trade and financial integration between the OECD countries strengthen the similarity of business cycles in the OECD countries. Both effects are less important for the short-run comovements. Although these findings may be subject to data problems, our results confirm the dissynchronisation effects of trade specialization between China and OECD countries on their business cycles as described by Krugman (1993), while synchronization effects prevail between the OECD countries (Frankel and Rose, 1998).

References


Figure 1: Dynamic correlations between China and selected countries, 1992-2006.  
Note: Business cycle frequencies are marked by the shadow area.
Figure 2: Aggregate correlations of business cycles in China and selected countries, 1992-2006.
Figure 3: Cohesion of business cycles in selected regions, 1992-2006.

Note: Business cycle frequencies are marked by the shadow area.
Figure 4: Estimation results by frequencies: Bilateral OECD trade/GDP

Note: Confidence bands are constructed as 1.96 standard errors and business cycle frequencies are marked by the shadow area.
Figure 5: Estimation results by frequencies, determinants of business cycle of OECD countries.

Note: Each block of the table corresponds to a regression set, which includes the bilateral OECD trade and a proxy for countries' links to China. Confidence bands are constructed as 1.96 standard errors. Business cycle frequencies are marked by the shadow area. For better comparison, explanatory variables have been rescaled to yield coefficients of the same size.
<table>
<thead>
<tr>
<th></th>
<th>Static correlation</th>
<th>Average dynamic correlation</th>
<th>Static correlation for BPF</th>
<th>ADC: Bus. cycle frequencies</th>
<th>ADC: Short-run frequencies</th>
<th>ADC: Long-run frequencies</th>
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<tr>
<td>Basic equation (Only OECD bilateral data)</td>
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<td>1.264 ***</td>
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<td>(0.205)</td>
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<tr>
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<td>0.130 **</td>
<td>0.304 ***</td>
<td>0.226 ***</td>
<td>0.058 ***</td>
<td>0.295 ***</td>
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<td>(0.017)</td>
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<td>(0.022)</td>
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<td>OECD Trade</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>OECD Trade</td>
<td>0.930 ***</td>
<td>0.773 **</td>
<td>1.932 ***</td>
<td>1.075 ***</td>
<td>0.324</td>
<td>2.079 ***</td>
</tr>
<tr>
<td></td>
<td>(0.195)</td>
<td>(0.192)</td>
<td>(0.407)</td>
<td>(0.259)</td>
<td>(0.215)</td>
<td>(0.317)</td>
</tr>
<tr>
<td>FDI stocks in China</td>
<td>-0.134 ***</td>
<td>-0.147 ***</td>
<td>-0.122 ***</td>
<td>-0.144 ***</td>
<td>-0.110 ***</td>
<td>-0.278 ***</td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td>(0.037)</td>
<td>(0.078)</td>
<td>(0.049)</td>
<td>(0.041)</td>
<td>(0.060)</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.161 ***</td>
<td>0.163 **</td>
<td>0.298 ***</td>
<td>0.244 ***</td>
<td>0.089 ***</td>
<td>0.346 ***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.020)</td>
<td>(0.043)</td>
<td>(0.028)</td>
<td>(0.023)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>N</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.134</td>
<td>0.126</td>
<td>-0.060</td>
<td>0.047</td>
<td>0.059</td>
<td>0.090</td>
</tr>
<tr>
<td>Augmented equation 3 (Including OECD countries’ FDI flows to China)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>OECD Trade</td>
<td>0.843 ***</td>
<td>0.680 **</td>
<td>1.730 ***</td>
<td>0.836 ***</td>
<td>0.280</td>
<td>1.936 ***</td>
</tr>
<tr>
<td></td>
<td>(0.176)</td>
<td>(0.172)</td>
<td>(0.357)</td>
<td>(0.211)</td>
<td>(0.208)</td>
<td>(0.264)</td>
</tr>
<tr>
<td>FDI flows to China</td>
<td>-3.045 ***</td>
<td>-3.151 ***</td>
<td>-5.793 ***</td>
<td>-4.962 ***</td>
<td>-1.730 ***</td>
<td>-6.465 ***</td>
</tr>
<tr>
<td></td>
<td>(0.468)</td>
<td>(0.458)</td>
<td>(0.951)</td>
<td>(0.563)</td>
<td>(0.554)</td>
<td>(0.703)</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.269 ***</td>
<td>0.273 **</td>
<td>0.545 ***</td>
<td>0.447 ***</td>
<td>0.141 ***</td>
<td>0.575 ***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.026)</td>
<td>(0.054)</td>
<td>(0.032)</td>
<td>(0.031)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>N</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
<td>171</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.262</td>
<td>0.259</td>
<td>0.143</td>
<td>0.333</td>
<td>0.070</td>
<td>0.334</td>
</tr>
</tbody>
</table>

Note: BPF - band pass filter, ADC - average dynamic correlation over selected frequencies. Standard errors are in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively.

Table 1: Estimation results for static correlation, Band-Pass filter, and average dynamic correlation over selected frequency intervals.