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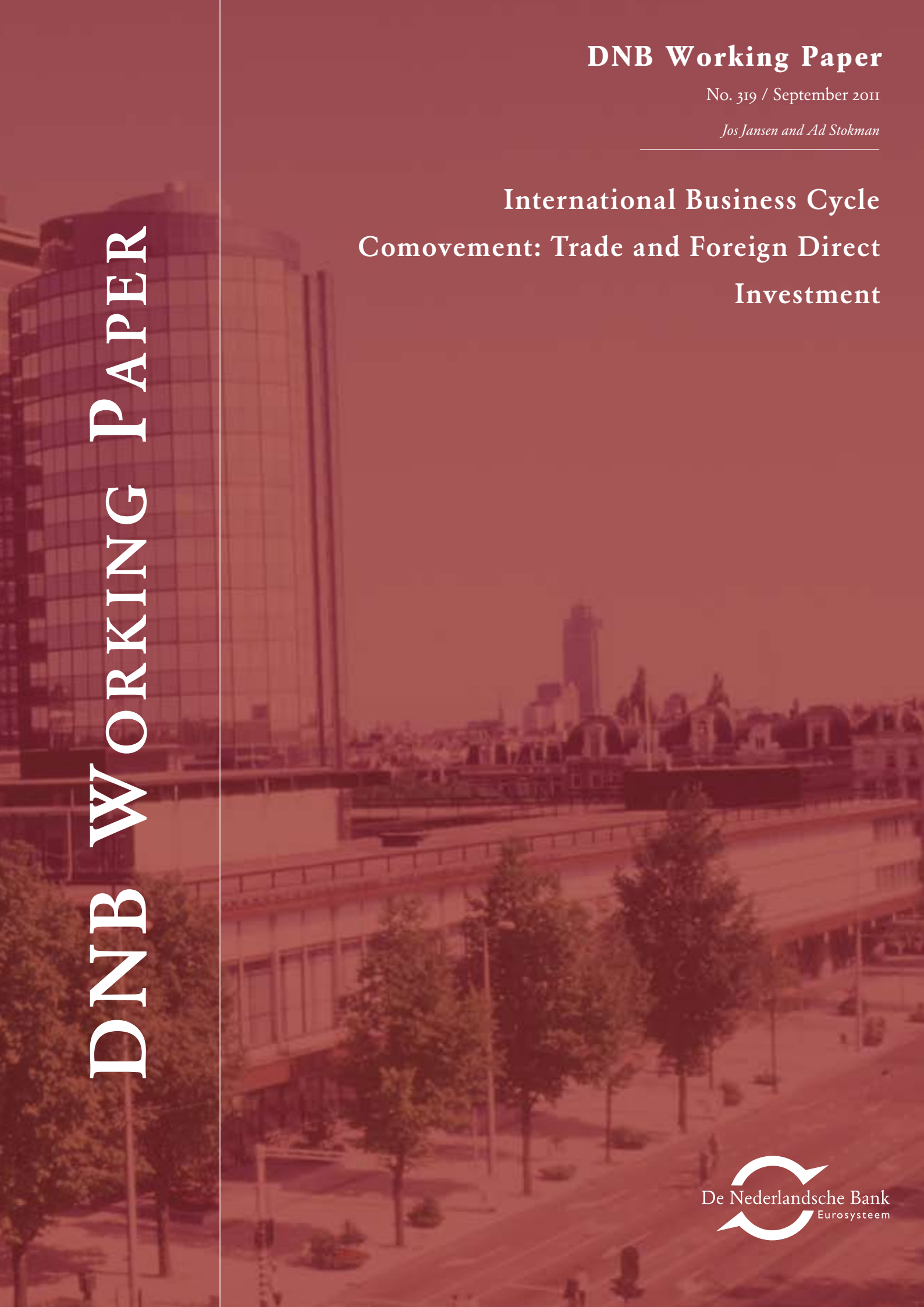

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Jos Jansen and Ad Stokman*

* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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De Nederlandsche Bank NV
P.O. Box 98
1000 AB AMSTERDAM
The Netherlands

International Business Cycle Comovement: Trade and Foreign Direct Investment

W. Jos Jansen*

Economic Policy and Research Department, De Nederlandsche Bank, Amsterdam, Netherlands

Ad C.J. Stokman

Economic Policy and Research Department, De Nederlandsche Bank, Amsterdam, Netherlands

Abstract
This paper investigates the relationship between foreign direct investment (FDI) and business cycle synchronization in the period 1982–2010 for eight industrialized countries. We find that more synchronized business cycles are associated with stronger FDI relations during 1995–2010, but that they are mainly associated with stronger trade linkages before 1995. More intensive FDI links are also associated with a greater vulnerability to lagged output spillovers from abroad, whereas trade links are not. Our findings suggest that FDI has become a separate channel through which economies may affect each other and that FDI stocks are now an essential aspect of economic interdependence.

Keywords: business cycle synchronization, international linkages, trade, FDI, vertical integration

JEL Code: F21, F44

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*Corresponding author: W. Jos Jansen, Economic Policy and Research Department, De Nederlandsche Bank, P.O. Box 98, 1000 AB Amsterdam, The Netherlands; email: w.j.jansen@dnb.nl; phone: 00-31-20-5243738; fax 31-20-5242529.

1. Introduction

Business cycles have on average behaved in relatively synchronized manner since the mid-nineties (Figure 1). The most dramatic example is provided by the aftermath of the Financial Crisis of 2008-2009. But in 2001-2002 the global economy also experienced a downturn that was unusually wide-spread across countries. Broadly speaking, the degree of output comovement reflects both the nature of the shocks, the similarity of economies and economic policies and the degree of economic interdependence. Output developments will be more correlated if common shocks happen to be predominant, while they will be more asymmetric if idiosyncratic shocks are most important. Because of economic relations among economies, country-specific shocks may get transmitted to other countries, enhancing output comovement indirectly. The higher degree of output comovement in recent years has partly been driven by common shocks, such as large-scale stress in financial markets, but deeper economic linkages may also have played a part.

The empirical literature on business cycle synchronization has focused on two dimensions of international economic interdependence. The first dimension is international trade in goods and services, including specialization patterns. The second dimension is international trade in financial assets, such as equity and bonds. Cross-border holdings of portfolio assets have mushroomed in recent years (Lane and Milesi-Ferretti 2008), while correlations among stock and bond markets of the major countries have greatly increased (Goetzmann et al. 2005; Berben and Jansen 2008). Financial markets have thus gained importance as a channel for the international transmission of shocks. All studies find that greater trade intensity is associated with more synchronized business cycles. Imbs (2004, 2006) and Schiavo (2007) find that correlations of output fluctuations increase with the degree of financial integration.

The literature has not explicitly analyzed a third important dimension of interdependence, namely the internationalization of production through foreign direct investment (FDI). Foreign direct investment has grown at rates far beyond those of international trade or output, especially since 1995 (Figure 2). The global stock of outward FDI increased from 5% to 12% of world GDP between 1980 and 1995, while it has grown three times as fast since 1995, reaching 32% of world GDP in 2010. At present, about 12% of world output is produced by foreign affiliates (UNCTAD 2011). It is conceivable that the larger presence of FDI capital is partly responsible for the observed increase in business cycle synchronization. However, the empirical literature on the effects of FDI is often based on firm-level data and mainly deals with supply-side effects on host economies in the longer run, focusing on the transfer of technology, management techniques and business models.

This paper is motivated by this gap in the literature. We use aggregate data on FDI stocks to examine the relationship between FDI and output comovement. The remainder of the paper is structured as follows. Section 2 briefly discusses a number of channels through which FDI may enhance business cycle synchronization. Section 3 presents our empirical analysis and Section 4 concludes.

2. Foreign direct investment and the international transmission of disturbances

Foreign direct investment aims at establishing a lasting, and often controlling, interest in companies located abroad. A stock of imported capital thus implies that part of domestic output is produced by firms controlled by foreigners. For example, Mataloni (2007) reports that in 2005 US majority-owned foreign affiliates accounted for 18.5% of Irish GDP, 9.5% of Canadian GDP and 6.2% of UK GDP. In Australia, Belgium and the Netherlands their output share was between 4 and 5%.

International supply chains

Production decisions become directly linked across countries via supply chains created by vertical FDI. If the parent company decides to cut output, output in foreign affiliates producing intermediate goods and parts will also fall. Vertical FDI arises when firms split up the production process, allocating the parts over different countries on the basis of cost efficiency or other considerations. The firm services its markets by exporting from a single location. Vertical FDI thus creates trade, both in intermediate and final goods. Recent empirical work suggests that the share of vertical FDI among industrial countries is much larger than used to be thought. Alfaro and Charlton (2009) conclude on the basis of a comprehensive firm-level database that over one half of FDI is vertical FDI, much of it relating to intra-industry subsidiaries producing highly specialized inputs for parent firms. Likewise, Badinger and Egger (2010) found that vertical motives are more important than horizontal ones for US multinationals for their FDI in developed countries. More evidence on the greater importance of vertical FDI is provided by Yeaple (2003), Braconier et al. (2005) and Petroulas (2007). Tanaka (2009) and Anderton and Tewolde (2011) argue that global production chains through vertical FDI are a crucial factor behind the collapse in international trade in late 2008 and early 2009.

International rent sharing

Within multinational corporations, firm-specific assets are a joint input, creating economics of scale at the company level. Global profits may be shared (with a lag) with affiliates and their workers. Due to the trend towards internationalization of production through FDI, domestic wages and employment may thus increasingly reflect international factors in addition to local economic conditions. Blanchflower et al. (1996), Budd and Slaughter (2004) and Budd et al. (2005) present evidence of cross-border profit sharing for US and European firms. Jansen and Stokman (2006) found for five

European countries that domestic labor market conditions are affected by the profitability of firms abroad, which points to a form of international rent sharing at the aggregate level.

Financial market frictions

The macroeconomic risks related to outward FDI stem from the fact that unfavorable developments in the host countries may reduce the value of the investment projects abroad, and thus the value of domestic (parent) firms. This reduction of net worth may lead to lower stock prices and greater difficulties for domestic firms in securing external finance for planned domestic investment projects, both in the capital market and with banks (Gilchrist et al. 2005). Domestic investment may thus be hurt via the balance sheet channel and the stock market channel (Tobin's q). The fall in stock prices, at home and abroad, may adversely affect domestic consumption via wealth effects, balance sheet effects and confidence effects (Poterba 2000). Regarding the risks related to inward FDI, a deterioration of the economic conditions in the foreign investor's home country may weaken its financial health, which in turn may lead to cutbacks in employment, wages and investment in the host countries, or even closure of affiliates.

Technology transfer

Since FDI operates as a channel for international transfer of technology and business practices, FDI tends to make economies more alike in structure (Keller 2004; Haskel et al. 2007). As a result, the response of economies to common shocks will be more similar, which will increase the degree of international output comovement in the long run.

The relevance of these four channels also depends on the type of FDI (horizontal or vertical). Vertical FDI potentially operates through all four channels. However, horizontal FDI does not create international supply chains. Instead, it is motivated by the desire to be close to customer markets due to high trade costs. The investing firm runs similar operations at different locations, producing and selling in the same country (or nearby countries). This type of FDI is thus a substitute for international trade. International rent sharing, financial market frictions and technology transfer are thus potentially relevant channels for horizontal FDI.

3. Empirical results

In this section we investigate the empirical relationship between business cycle comovement and FDI linkages. We draw on the experience of Australia, Canada, France, Germany, Italy, the Netherlands, the UK and the US. For these countries annual data on bilateral FDI stocks that are consistently measured across time are available for a long period (1982-2009). We will refer to these eight countries as the *reporting* countries, since the FDI data are taken from their statistical records. We

look at the bilateral linkages of the eight reporting countries among themselves and with Belgium, Japan, Sweden and Switzerland. These four countries are selected because of their size and their importance as an importer and exporter of FDI. Taken together, our 12 countries represent 73% of the outstanding stock of FDI at the end of 2010 (UNCTAD 2011). For each reporting country we thus distinguish bilateral links with 11 countries, which we will refer to as its partner countries.

3.1. Contemporaneous correlations

Our unit of observation is the country pair (r,p). For each reporting country r there are 11 consistently measured FDI links with partner countries p. This gives us 88 independent observations on FDI linkages.[1] As there are only 11 pairs per reporting country, we pool all pairs into a single pooled cross-section regression equation. Given the prominent role of trade in the literature we include bilateral trade links as a control variable. We thus estimate the following regression equation

$$\rho(r,p) = \sum_{r=1}^{8} \alpha_r D_r + \beta FDIX(r,p) + \gamma TRDX(r,p) \qquad (1)$$

where D_r indicate country-specific dummies, which are one if the observation refers to reporting country r, and zero otherwise. $\rho(r,p)$ denotes a measure of business cycle comovement between countries r and p over a certain time-span, while $FDIX(r,p)$ and $TRDX(r,p)$ refer to the average strength of the corresponding FDI and trade links. Eq. (1) assumes that intercepts differ across countries to take into account fixed differences across countries, including methodological differences between national FDI statistics. Moreover, if the sample period happens to have been dominated by common (idiosyncratic) shocks, all $\rho(r,p)$ will tend to be large (small), which will translate into large (small) estimates of the intercepts α_r. A similar argument applies if the sample period is characterized by overall strong or weak economic linkages. Hence, the parameters β and γ measure the sensitivity of cross-country output comovement to differences in the intensity of bilateral FDI relations and trade relations, respectively, conditional on the mixture and size of shocks and the overall (global) strength of FDI and trade links in the sample period. Due to the possible endogeneity of $FDIX(r,p)$ and $TRDX(r,p)$, we estimate eq. (1) by instrumental variables (Two Stage Least Squares). We employ as instruments gravity-type variables, EMU-membership and regulations on trade, FDI and the labor market.[2]

[1] In theory, the stock of inward FDI of Canada from Australia according to Canada's records should be the same as the stock of outward FDI of Australia in Canada according to Australia's records. However, in practice these numbers sometimes differ substantially.

[2] Many of the instruments we use have been used before in the literature. Our inclusion of labor market regulations is motivated by Nicoletti et al. (2003) and Dewit et al. (2009), EMU-membership by Petroulas (2007) and Schiavo (2007) and FDI regulations by Nicoletti et al. (2003).

We distinguish two measures of output comovement: (1) the correlation of the quarterly growth rates of real GDP and (2) the correlation of the quarterly output gaps estimated by the Baxter-King filter. Bilateral FDI linkages *FDIX*(*r,p*) are calculated as the sum of the inward and outward FDI stocks of country *r* vis-à-vis country *p* (using country *r*'s statistical records), as a percentage of GDP of countries *r* and *p*, respectively. We then average these two numbers, as a correlation is a symmetric concept. *FDIX*(*r,p*) is the period average of the annual observations over the time-span under consideration. Bilateral trade links *TRDX*(*r,p*) are calculated along the same lines, using data on commodity trade.

Our data set consists of 88 country pairs with observations on bilateral FDI positions and trade linkages and bilateral output correlations. However, only 60 of the correlations are unique. Country pairs relating to the eight reporting countries show up twice in the dataset: once with the links measured with country *r*'s statistical records and once with country *p*'s statistical records. To take account of this double-counting we report two sets of estimation results: the first one is based on TSLS (88 observations), the second one on weighted TSLS (WTSLS). In the latter case, observations on pairs consisting of reporting countries get a weight of ½ and all other observations a weight of 1, so that the effective number of observations is 60.

Table 1 reports the empirical results for the complete sample period 1982–2007 and two subperiods, 1982–1994 and 1995–2007.[3] This particular split-up of the sample is motivated by the large acceleration in the pace of FDI activity since 1995. For the full period 1982–2007 we do not find robust results for the relative importance of FDI and trade. Breaking up the sample in two halves, we find that trade relations are the dominant force in the period 1982–94. However, a remarkable change has occurred since 1995. Across estimation methods and correlation measures, FDI relations consistently are far more closely linked to output comovement patterns than trade relations in the period 1995–2007. In all cases, the estimate of β is high and statistically significant, while the estimate of γ is small and statistically insignificant.

Output correlation patterns during the Financial Crisis

Table 2 presents empirical evidence that our finding that FDI is superior to trade as a summary measure of economic interdependence also holds up during the Financial Crisis and its aftermath (2008-2010). Due to greater availability of FDI data, we can now use data from ten reporting countries

[3] We did a number of sensitivity checks. Schiavo (2007) and Inklaar et al. (2008) propose to use a transformation of the correlation [$c=\log((1+\rho)/(1-\rho))$] as the dependent variable, arguing that the fact that a correlation lies between -1 and 1 may complicate statistical inference. We have re-estimated eq. (1) using the transformed correlation, and also for comovement measures defined on annual data, for output gaps generated with the Hodrick-Prescott filter and for different sample split-ups, in each case obtaining similar results. In addition we verified that the fitted values for ρ were never greater than one in absolute value. All of these results and the details on the complete data set that we used are included in the Appendix.

(the previous eight plus Japan and Switzerland). The sample is 1995-2009/10, involving 110 observations on FDI and trade links and 65 unique output correlations. We restrict the analysis to the correlation of quarterly real GDP growth rates due to the difficulty of obtaining reliable estimates of the output gap in the years 2008-2010. Table 2 shows that trade linkages are never statistically significant in the period 1995-2010, while FDI linkages consistently are, including during the crisis episode of 2008-2010.[4]

Our finding that after 1995 trade linkages show up insignificantly in the regression is remarkable in view of the empirical literature on synchronization, which consistently finds a role for trade, but ignores FDI. We propose the following tentative explanation. For a start, if FDI linkages are a separate channel − reflecting international rent sharing, financial frictions and technology transfers − the emergence of FDI as a relevant factor should not have been at the expense of trade. Both types of economic linkages should have been significant. The interrelationship between FDI and trade is therefore the key issue.[5] Our results suggest the following causality pattern: FDI → trade → output correlation. A possible story is that vertical FDI may have changed the nature of international trade by increasing the importance of intermediate goods trade and intra-sectoral and intra-firm trade. A dollar of trade that occurs as part of a supply chain has a disproportionate effect on output comovement, but the size of that type of trade is tightly connected to the FDI stock that has created the supply chain. Consequently, to the extent bilateral FDI stocks are good proxies for the importance of cross-border supply chains and are strongly associated with that part of trade that has a large marginal effect on output comovement, they may be good explanatory variables for synchronization. At the same time, trade links may seem to be of little importance, as the FDI links take account of its most powerful part.[6]

3.2. Lagged spillovers

The discussion so far has concentrated on cross-country variations in contemporaneous correlations. This offers an incomplete picture as international spillovers may occur with some lags as well. For this reason, we next analyze the link between economic relations and the extent to which economies are affected with a lag by developments in other countries. Our measure of the lagged spillover is based

[4] We also did estimations with the sample period ending in 2009 and obtained similar results. See Table A2 in the Appendix.
[5] Note that if only trade enters eq. (1), it is highly significant for all time periods. Note also that our finding cannot be attributed to the steep increase in FDI stocks as such. Our estimation design focuses on differences between country pairs, conditional on the mixture and size of shocks and the overall (global) strength of the FDI and trade linkages in a certain period.
[6] Horizontal FDI cannot explain our finding. Horizontal FDI is a substitute for trade, reducing the size of the trade channel. However, it should still be true that country pairs that trade a lot exhibit greater output synchronization compared to pairs that do not, if FDI is included. Consequently, both FDI and trade should have been statistically significant.

on the concept of Granger causality. For each country pair (*r,p*) – 88 in total – we first estimate the following regression equation for various time-spans

$$y(r,t) = \alpha + \sum_{l=1}^{m} \gamma_l y(r,t-l) + \sum_{l=1}^{m} \lambda_l y(p,t-l) \qquad (2)$$

where *y* denotes the quarterly growth rate of real GDP or the output gap, and *m* stands for the maximum lag with which *y*(*p*) affects *y*(*r*). Granger causality from *y*(*p*) to *y*(*r*) obtains if some of the λ_l's are nonzero. In that case, conditions in partner country *p* influence those in reporting country *r* with a lag. We take the sum of the coefficients λ_l as our measure of the lagged spillover from country *p* to country *r*. Based on preliminary testing, we restrict our analysis to lagged spillover measures derived from eq. (2) with *m* set to either 1 or 2.

Table 3 reports the estimation results of eq. (1), with the left-hand side variable now being the lagged spillover measure.[8] As the focus is now on the vulnerability to lagged spillovers from partner countries, the FDI and trade linkages are expressed as a percentage of reporting country GDP. The main message of Table 3 is that trade linkages are never associated with lagged macroeconomic spillovers, while FDI linkages consistently are in the period 1995-2007. Again, FDI appears to be the more complete measure of international economic interdependence. Our finding also suggests that the various transmission channels of FDI may be working for a longer time than the international trade channel.

[8] Note that there is no double-counting issue in case of lagged spillovers. Consequently, we only apply unweighted estimation.

4. Summary and conclusions

This paper examines the relationship between bilateral FDI positions (stocks) and cross-country business cycle patterns. Do countries that have comparatively intensive FDI ties also exhibit a relatively large degree of business cycle comovement? We analyze the experience in the years 1982–2010 of Australia, Canada, France, Germany, Italy, the Netherlands, the UK and the US, looking at the bilateral linkages of these eight countries among themselves and with four other countries (Belgium, Japan, Sweden and Switzerland), employing two measures of international output comovement. We find that more synchronized business cycles are associated with stronger FDI relations during 1995–2010, but that they are mainly associated with stronger trade linkages before 1995. We also find that more intensive FDI links are associated with a greater vulnerability to lagged output spillovers from abroad, whereas trade links are not.

Taken at face value, our findings suggest that FDI stocks are now a more complete summary measure of international economic interdependence than international trade flows. At the very least, they imply that FDI stocks have become an essential aspect of international economic interdependence and that FDI constitutes a separate channel through which economies may affect each other, even with some time lag. Moreover, our macroeconomic analysis provides some tentative support for the emerging view based on micro-data that much of FDI is vertical in nature. Clearly, more research into the role of FDI and its relation to trade is needed. In a follow-up paper we plan to carry out a structural analysis as pioneered by Imbs (2004) to explore the relationships between foreign trade, FDI, financial integration, specialization and similarity of economic structure and policies.

Our research has two policy implications. The first one is that the trend towards greater economic interdependence through FDI implies an underlying tendency for business cycles to display a more synchronized behavior than in the past. This is not to say that we will actually observe greater output comovement in the future all the time, however. As the experience of the early 1990s teaches, the effects of large asymmetric shocks may overshadow the upward influence on account of increasing interdependence. The second lesson is that policy makers should pay more attention to FDI as a channel for the international transmission of disturbances, both in monitoring current developments and as a mechanism in their models.

Appendix

A.1. Data

Data on bilateral FDI stocks (positions) for the US, Germany and Canada are available for the years 1982–2009, for Australia and Italy for 1985–2009, for France for 1987–2009, for the Netherlands for 1984–2009, and for the UK for 1984 and 1987–2009. Missing observations have been estimated on the basis of bilateral FDI flows (when available) or interpolation. Positions are reported in the currency of the reporting country. The main source of the data is the *International Direct Investment Statistics* database maintained by the OECD on its website. We have also used old editions of *La balance des paiements et la position extérieur de la France* (Banque de France) and *Kapitalverflechtung mit dem Ausland* (Deutsche Bundesbank). The most recent data for Australia and Germany were taken from *International Investment Position 2010* (Supplementary Statistics, Tables 2 and 5) and *Kapitalverflechtung mit dem Ausland 2010* (Tables I.2.a and II.2.a), available on the websites of the Australian Bureau of Statistics and the Deutsche Bundesbank, respectively.

Source of the GDP data and the PPP exchange rates is the *National Accounts* published by the OECD. Data on bilateral imports and exports of goods are from the *International Trade in Commodities Statistics* database published by the OECD. Both databases are available on the OECD's website.

We used nine instruments: (1) DISTANCE, the log of the great circle distance between the geographical centers of the two countries of the pair; (2) BORDER, an indicator variable which is one if the two countries share a border and zero otherwise; (3) GDPPC, the log of the pairwise product of real GDP per capita in PPP dollars; (4) FDIRES, the pairwise sum of an index measuring restrictions on inward FDI; (5) TRDBAR, the pairwise sum of a composite index measuring the intensity of barriers to international trade in an economy; (6) FTA, an indicator variable which is one if the pair is a member of a free trade area and zero otherwise; (7) EPL, the pairwise sum of the OECD index of employment protection legislation; (8) LABREG, the pairwise sum of an index measuring the degree of regulation of the labor market in an economy; and (9) EMU, an indicator variable which is one if the pair is a member of the European Economic and Monetary Union and zero otherwise.

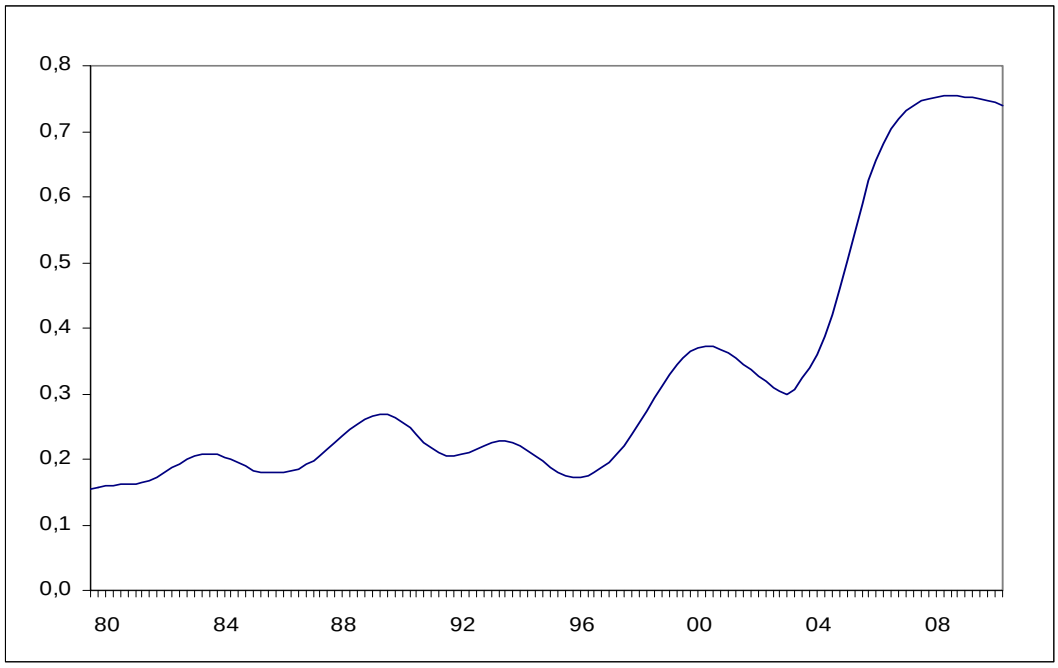
Regarding the sources, DISTANCE, BORDER and FTA are available on the website of Andrew Rose (faculty.haas.berkeley.edu/arose). GDPPC was calculated using the database maintained by the Groningen Growth and Development Centre (www.eco.rug.nl/ggdc). FDIRES is taken from Golub (2003) and extrapolated. TRDBAR and LABREG are based on indices available on the website of the Fraser Institute in Vancouver (www.fraserinstitute.ca/economicfreedom). The data are published in the annual report *Economic Freedom of the World*. EPL (version 1) is taken from the OECD website.

A.2. Sensitivity analysis

Table A1 reports alternative estimation results, described in footnote 3. Panel (a) reports results for output gaps based on the Hodrick-Prescott filter. Panels (b) and (c) report results for transformed correlations as advocated by Schiavo (2007) and Inklaar et al. (2008). Panels (d) and (e) report results for correlations based on annual data. Panels (f) and (g) report results for different break-ups of the sample period 1982-2007 (1993 and 1997 instead of 1995).

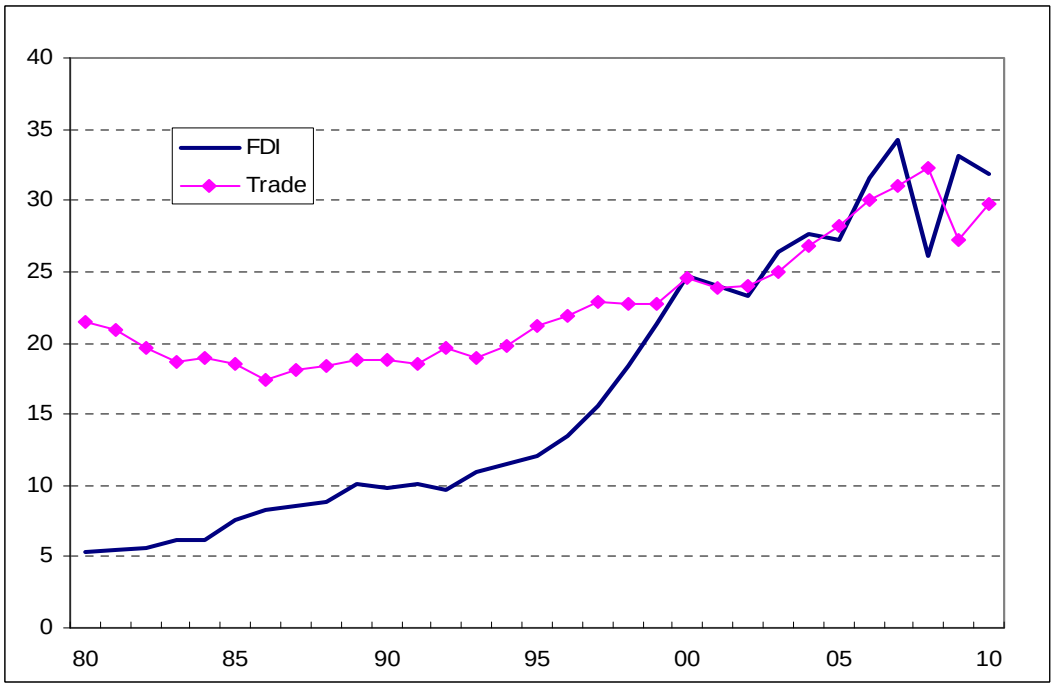
Table A2 repeats the estimations reported in Table 2, using data from 1995-2009 (see footnote 4).

Figure 1. Average output comovement among 12 industrialized countries, 1980-2010



Unweighted average of the bilateral correlations of the quarterly real GDP growth rates for all possible pairs among Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States. Before averaging across the 66 country pairs, correlations were smoothed using a symmetric rolling 40-quarter window based on a Gaussian kernel.

Figure 2. Global stock of foreign direct investment and world trade, 1980-2010



Source: *World Investment Report 2011* published by the United Nations. Expressed as a percentage of global GDP. Data refer to outward foreign direct investment and world exports, respectively.

Table 1. Pooled cross-section regression of output comovement measures on FDI and foreign trade linkages, 1982-2007

	TSLS				weighted TSLS			
Period average	FDI	*t* -stat	Trade	*t* -stat	FDI	*t* -stat	Trade	*t* -stat
				(a) quarterly growth rate of real GDP				
1982-2007	-0.001	(-0.21)	0.022***	(4.50)	0.012**	(2.05)	0.007	(0.89)
1982-1994	0.007	(0.74)	0.022***	(3.97)	0.023**	(2.28)	0.010*	(1.86)
1995-2007	0.011***	(3.11)	0.008	(1.45)	0.016***	(3.68)	-0.001	(-0.06)
				(b) quarterly output gap (Baxter-King filter)				
1982-2007	0.006	(0.84)	0.024***	(3.40)	0.013*	(1.73)	0.01	(1.07)
1982-1994	-0.003	(-0.24)	0.03***	(3.60)	0.006	(0.47)	0.014*	(1.71)
1995-2007	0.022***	(3.84)	0.009	(1.11)	0.023***	(3.29)	-0.001	(-0.06)

Based on eight reporting countries (see main text). Estimation method Two Stage Least Squares (88 observations) and weighted TSLS (effectively 60 observations). See main text for list of instruments. *t*-statistics based on heteroskedasticity consistent standard errors. *,**,*** denotes significance at 10%, 5% and 1% respectively.

Table 2. Pooled cross-section regression of real GDP growth rate correlations on FDI and foreign trade linkages, 1995-2010

	TSLS				weighted TSLS			
Period average	FDI	*t* -stat	Trade	*t* -stat	FDI	*t* -stat	Trade	*t* -stat
1995-2010*	0.007***	(3.08)	0.003	(1.07)	0.007***	(3.43)	0.000	(0.13)
1995-2007	0.012***	(3.43)	0.007	(1.40)	0.013***	(3.87)	0.000	(0.02)
2008-2010*	0.004**	(2.33)	0.004	(1.02)	0.005***	(2.97)	-0.001	(-0.20)

*Explanatory variables refer to 1995-2009 and 2007-2009 respectively.
Based on ten reporting countries (see main text). Estimation method Two Stage Least Squares (110 observations) and weighted TSLS (effectively 65 observations). See main text for list of instruments. *t*-statistics based on heteroskedasticity consistent standard errors. *,**,*** denotes significance at 10%, 5% and 1% respectively.

Table 3. Pooled cross-section regression of lagged output spillovers on FDI positions and foreign trade flows, 1982-2007

	lag of one quarter				lag of two quarters			
Period average	FDI	*t* -stat	Trade	*t* -stat	FDI	*t* -stat	Trade	*t* -stat
	(a) quarterly growth rate of real GDP							
1982-2007	0,008	(0.98)	0,005	(0.60)	0,015*	(1.80)	0,005	(0.59)
1982-1994	0,013	(1.02)	0,009	(0.89)	0,017	(1.24)	0,014	(1.23)
1995-2007	0,022**	(2.52)	-0,008	(-0.94)	0,024***	(3.88)	-0,008	(-1.14)
	(b) quarterly output gap (Baxter-King filter)							
1982-2007	0,018***	(2.98)	-0,007	(-1.15)	0,001	(0.70)	0,000	(0.11)
1982-1994	0,026**	(2.31)	-0,007	(-1.13)	0,004	(1.16)	-0,001	(-0.64)
1995-2007	0,013**	(2.57)	-0,003	(-0.45)	0,001	(0.41)	-0,000	(-0.18)

Based on eight reporting countries (see main text). Estimation method Two Stage Least Squares (88 observations) and weighted TSLS (effectively 60 observations). See main text for list of instruments. *t*-statistics based on heteroskedasticity consistent standard errors. *,**,*** denotes significance at 10%, 5% and 1% respectively.

Table A1. Pooled cross-section regression of output comovement measures on FDI and foreign trade linkages, 1982-2007 (alternative estimations)

	TSLS				weighted TSLS			
Period average	FDI	*t* -stat	Trade	*t* -stat	FDI	*t* -stat	Trade	*t* -stat
	(a) correlation quarterly output gap (Hodrick-Prescott filter)							
1982-2007	0.004	(0.62)	0.025***	(3.40)	0.013*	(1.70)	0.01	(1.09)
1982-1994	-0.003	(-0.22)	0.03***	(3.55)	0.008	(0.60)	0.015*	(1.87)
1995-2007	0.022***	(4.16)	0.006	(0.79)	0.023***	(3.60)	-0.002	(-0.15)
	(b) transformed correlation quarterly growth rate of real GDP							
1982-2007	-0.004	(-0.41)	0.055***	(4.82)	0.024*	(1.88)	0.02	(1.16)
1982-1994	0.014	(0.72)	0.053***	(3.98)	0.049**	(2.24)	0.025**	(2.01)
1995-2007	0.024***	(3.00)	0.019	(1.53)	0.035***	(3.67)	0.001	(0.06)
	(c) transformed correlation quarterly output gap (Baxter-King filter)							
1982-2007	0.008	(0.43)	0.076***	(3.98)	0.032	(1.50)	0.039	(1.41)
1982-1994	-0.010	(-0.27)	0.088***	(3.73)	0.013	(0.39)	0.051**	(2.01)
1995-2007	0.061***	(4.20)	0.017	(0.77)	0.067***	(3.63)	-0.007	(-0.20)
	(d) correlation annual growth rate of real GDP							
1982-2007	0.009	(1.19)	0.027***	(3.35)	0.020**	(2.16)	0.010	(0.93)
1982-1994	0.006	(0.42)	0.036***	(4.06)	0.020	(1.35)	0.020**	(2.23)
1995-2007	0.024***	(3.88)	0.009	(1.14)	0.025***	(3.10)	0.004	(0.31)
	(e) correlation annual output gap (Baxter-King filter)							
1982-2007	0.004	(0.43)	0.033***	(3.02)	0.012	(1.16)	0.020*	(1.72)
1982-1994	0.000	(0.02)	0.044***	(3.63)	0.008	(0.41)	0.026**	(2.34)
1995-2007	0.029***	(3.60)	0.006	(0.66)	0.039***	(3.40)	-0.006	(-0.34)
	(f) correlation quarterly growth rate of real GDP, different sample split-up							
1982-1996	0.006	(0.76)	0.022***	(4.16)	0.021**	(2.37)	0.010**	(2.04)
1997-2007	0.011***	(3.06)	0.007	(1.37)	0.016***	(3.37)	-0.003	(-0.33)
1982-1992	0.010	(1.02)	0.020***	(3.61)	0.028**	(2.48)	0.007	(1.41)
1993-2007	0.008**	(2.23)	0.011*	(1.97)	0.012***	(2.80)	0.007	(1.05)
	(g) correlation quarterly output gap (Baxter-King filter), different sample split-up							
1982-1996	0.001	(0.04)	0.028***	(3.43)	0.012	(0.89)	0.013	(1.58)
1997-2007	0.019***	(3.75)	0.009	(1.24)	0.018***	(3.24)	0.002	(0.19)
1982-1990	-0.002	(-0.13)	0.028***	(3.37)	0.004	(0.30)	0.014*	(1.69)
1991-1999	0.017***	(3.17)	0.011	(1.46)	0.020***	(2.79)	0.002	(0.23)

Based on eight reporting countries (see main text). Estimation method Two Stage Least Squares (88 observations) and weighted TSLS (effectively 60 observations). See main text for list of instruments. *t*-statistics based on heteroskedasticity consistent standard errors. *,**,*** denotes significance at 10%, 5% and 1% respectively.

Table A2. Pooled cross-section regression of real GDP growth rate correlations on FDI and foreign trade linkages, 1995-2009

	TSLS				weighted TSLS			
Period average	FDI	*t* -stat	Trade	*t* -stat	FDI	*t* -stat	Trade	*t* -stat
1995-2009	0.007***	(3.01)	0.003	(0.99)	0.006***	(3.11)	0.000	(0.09)
1995-2006	0.013***	(3.63)	0.006	(1.11)	0.019***	(4.01)	-0.002	(0.21)
2007-2009	0.003**	(2.19)	0.002	(0.51)	0.004***	(2.86)	-0.003	(-0.75)

Based on ten reporting countries (see main text). Estimation method Two Stage Least Squares (110 observations) and weighted TSLS (effectively 65 observations). See main text for list of instruments. *t*-statistics based on heteroskedasticity consistent standard errors. *,**,*** denotes significance at 10%, 5% and 1% respectively.

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