FOREIGN DIRECT INVESTMENT AND THE BUSINESS CYCLE: NEW INSIGHTS AFTER THE GREAT RECESSION

Carlos Rodríguez, Ricardo Bustillo[*]

Abstract:

In this paper we examine how business cycles in the home country affect outward flows of FDI (OFDI). We employ a panel data set of OFDI flows for a representative sample of countries from 1970 to 2011. The findings of the regression models that we have used are consistent with the hypothesis that OFDI flows behave pro-cyclically. This is the case for different country subsamples, for different business cycle specifications and for the inclusion of other control variables as well. Beyond this main conclusion, home country interest rate and exchange rates reveal a negative effect upon OFDI flows.

Keywords: foreign direct investment, real exchange rate, multinational firms, business cycles.
JEL Classification: F21, F23

1. Introduction

World FDI flows showed unprecedented growth during the past decade, surpassing the growth of trade flows and GDP, eventually reaching a historical maximum in 2007 (around 2,000 billion dollars, 4% of GDP) just before the outbreak of the financial crisis. The great recession seems to have had a remarkable impact on world FDI flows in 2008 and 2009, reducing that figure by almost half (-46%); but in 2010 flows started to recover and by 2011 they had regained much of their losses. These fluctuations were not, however, the first ones: world FDI data collected by UNCTAD since 1970 show world FDI declines in the early 1980s and again in the early 1990s and 2000s. These four negative periods seem to last only for a couple of years and flows subsequently recover their upward long-run trend. This increasing long-run trend has been the main focus of research into FDI. Despite their recurrence, cyclical trends in the short run have been downplayed or even ignored in theoretical and empirical studies about the determinants of FDI.

In fact the theory of the multinational enterprise, which explains how the determinants of FDI flows are derived, consists of a general equilibrium model. Empirical studies have mainly focused on the cross-country bilateral dimension of this phenomenon by looking at the long-run determinants that lead firms to invest abroad and become multinational (Brainard, 1997; Markusen *et al.* 1999; Carr *et al.* 2001). These studies have largely ignored time series fluctuations and look rather at persistent factors such as market size, distance, factor endowment similarity, institutional dimensions and trade costs.

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[*] University of the Basque Country, UPV/EHU, Avda, Bilbao, Spain (carlos.rodriguezg@ehu.es; ricardo.bustillo@ehu.es).

The principal aim of the research presented here is to focus on the short-run deter-minants of outward flows of FDI (OFDI). In other words, we attempt to shed some light on the relationship between business cycles and OFDI. Learning the effects of the busi-ness cycle on OFDI is a significant issue, especially during the ongoing recession that is affecting major investor countries. From the host countries' point of view, potential FDI flows may be a big help to them in exiting the crisis. Moreover, for investor countries this is a significant way to expand market opportunities and tap into opportunities for new technological upgrading. In this sense, it has been clearly accredited that multinational enterprises are able to stand better during bad times. On the other hand, although FDI flows might not be a large part of total capital inflows for major industrial countries, they are still a significant one, and this is even more true for emerging countries. A "sudden stop" in FDI outflows could cause a shock in the capital balance of a country. So in the context of this recession the cyclical behaviour of OFDI flows becomes an issue not only of academic but also of practical relevance.

As far as we are aware, there are only a few studies that deal partially with the issue of the cyclical behaviour of FDI flows, and they fall short of reaching a consensus as to how short-run GDP fluctuations (the business cycle) influence OFDI flows. Levi *et al.* (2007) examine how business cycles in developed countries affect FDI flows to devel-oping countries, and find that their results are consistent with the fact that FDI outflows tended to move in opposite directions (counter-cyclically) during the cycles in the USA and Europe throughout the eighties and nineties. Wang and Wong (2007), researching the effects of the business cycle on a country's direct investment outflows, find that volatility in economic growth has a significant negative impact on FDI outflows. They state that fluctuations in economic growth discourage OFDI only when countries are in a recession, but do not affect OFDI significantly in a boom. Cavallari (2013) analyses the role of real output volatility in driving OFDI and finds that it strongly deters foreign investment, especially for the decision to invest in a foreign country in the first place. Buch and Lipponer (2005), using industry data on German firms, find that German OFDI responds positively to positive cyclical development abroad and to a real depreciation of the source country currency.

Following this array of research, this paper seeks to contribute further to this issue. To avoid inconsistencies and confusion with previous literature, we focus mainly on how the home country's business cycle affects OFDI (while remaining aware of the possi-ble influence of host countries' business cycles), leaving aside the effect of uncertainty deriving from GDP volatility associated with business cycles. Our main country sample includes 22 OECD countries, which represent the bulk of world OFDI and for which data availability allows us to run a panel data regression model to test the main home country variables that affect these countries' OFDI in the short run. Our data set covers the period 1970–2011, including the recent recession and recovery, which is of major significance. The main findings of this paper can be summarised as follows: (i) the cyclical component of GDP exerts a positive impact on OFDI (it shows a pro-cyclical nature) even when different country samples, business cycle definitions and other possible control varia-bles are checked for; (ii) other variables such as exchange rates, interest rates, domestic investment, and the host countries' GDP cycle also exert an influence on OFDI.

The rest of the paper is organised as follows. Section 2 presents a brief theoretical discussion of the different channels through which business cycles can affect OFDI flows,

pointing out the different hypotheses to be tested. Section 3 deals with the empirical part, describing the data, specifying the econometric models and discussing the results. Section 4 summarizes the main findings and draws conclusions.

2. Theoretical Hypotheses

The model that can be applied to deduce some hypotheses about this issue is the model for a closed economy with financial restrictions, but extended for an open economy. This model links pro-cyclical investments to changes in the net worth of firms and the marginal cost of finance (Bernanke *et al.,* 2000). It is the usual financial accelerator hypothesis, but carried through in an international setting (Gilchrist and Himmelberg, 1995; Cavallari, 2010). As long as the net worth of multinational firms moves pro-cyclically foreign investments should increase during a cyclical expansion in the source country and decrease in a recession. Summarising the idea, in a boom when firms enjoy larger profits and cash flow (net worth in general) they have more internal funds for investment at home and abroad. On the other hand, whenever the bulk of a firm's investment is financed by its own funds (resulting from higher cash flows and profits), there would be a reduction in the external finance premium to be paid. According to this situation, agency problems for foreign investors would become an almost irrelevant issue (Buch and Lipponer, 2005). Therefore external financing costs decline and this encourages investments (at home and abroad).

Exchange rates fluctuations have been considered a relevant determinant to explain OFDI flows due to their effect on firms' access to financial resources (Cavallari, 2013; Froot and Stein, 1991). The relationship between exchange rates and financial resources is based on imperfect capital market model. These authors state that an appreciation of the domestic currency increases domestic firms' wealth (or cash flows) relative to foreign firms, which results in larger foreign investment flows from the domestic country, especially when FDI is directed towards the acquisition of firms as a way of entering a foreign market. This reasoning can be extended to the link between business cycles and OFDI by domestic firms as well. If GDP is reduced during a recession, the cash flow of firms shrinks, which makes OFDI more difficult. On the other hand, expansionary periods in GDP would have the opposite effect.

Finally, Levy *et al.* (2007) consider that there are different channels through which the business cycle could affect FDI outflows. They use the term "income effect" to refer to the positive influence of expansions (*i.e.* when the cyclical component of output is positive) on OFDI because of the higher earnings of firms to invest at home and abroad during the expansionary part of the cycle. Thus, OFDI should display the same pro-cyclical behaviour documented for domestic investment as in the financial accelerator hypothesis mentioned above. Additionally they refer to a "substitution effect" that would reduce OFDI. This negative effect may occur because in an upturn the marginal productivity of capital increases at home, making foreign investment less attractive, especially considering that OFDI is riskier than home investment. This substitution between foreign and domestic investment is an arbitrage between different investment options. Furthermore, if monetary policy is conducted in a counter-cyclical manner, raising interest rates in the source country during a boom, it increases financing costs of investment (at home and abroad). This substitution effect may generate counter-cyclical behaviour on the part of OFDI. Thus the *a priori* hypothesis that OFDI behaves pro-cyclically must be tested empirically.

3. Empirical Analysis

Illustrative Overview

As can be seen in Figures 1 and 2, there appears to be no clear common co-movement between OFDI and GDP in the short run. However, before a deeper analysis is made below to figure out this relationship in more detail, a brief outline of trends over time in world FDI outflows is provided OFDI worldwide and from developed countries show a growing long run trend, punctuated by four main peaks and troughs describing several complete cycles. Throughout the 1970s there was a slight upward tendency fed mostly by the access of US multinationals to world markets; however, increase in oil prices (1979) and the subsequent economic crisis coincided in time more or less with lower OFDI volumes in 1980 and 1981. The 1980s witnessed a steady, stronger rise in OFDI that continued into the early 1990s. During this period European and Japanese multinationals joined world FDI, encouraged by a process of increased capital market liberalisation and the ongoing trend towards globalisation. This expansionary period stopped at the end of the 1990s. The 1991 World Investment Report analysis of global OFDI trends starts by saying that volatility in FDI flows is closely related to cyclical fluctuations and that recession in the USA and the UK explain the world OFDI slowdown. However, commenting on the upward trend in these flows in 1992, even though this was a recessionary year, the report casts some doubts on the effect of economic growth on OFDI, stating that "this suggests that TNCs may become less influenced by cyclical fluctuations (or influenced by a time lag)" (pp. 14 and 15) and that TNCs seemed to give more importance to long-term goals.

Figure 1 | World GDP and OFDI in Ln Scale (GDP right Scale, OFDI left Scale)
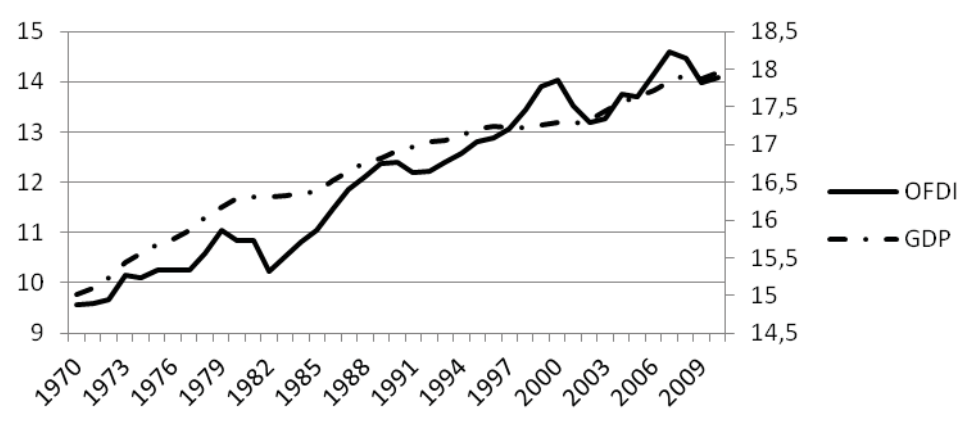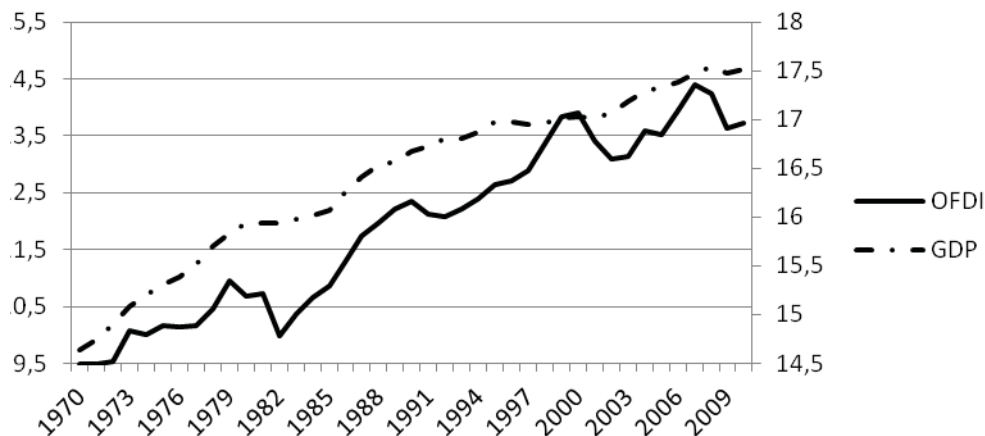
Figure 2 | GDP of Developed Countries and OFDI

The third expansion lasted until 2000. During the 1990s the OECD countries, which were still almost the only investors, enjoyed a period of moderate economic growth favoured by successful stabilising macroeconomic policies with low interest rates and abundant financial resources. Apart from macroeconomic stability factors, other relevant determinants of this growing trend that can be mentioned include structural changes in output that permitted firms in the manufacturing and service sectors also to outsource increasing parts of their production processes to lower-cost countries, in what is called vertical FDI strategies. Developments in information and communication technologies and transport undoubtedly favoured the international expansion of firms by reducing transaction, management and transport costs. Another important element was, of course, the process of liberalisation of foreign capital inflows that took place especially among developing countries. This was encouraged by the Washington Consensus, a parallel privatisation process in the latter countries, and by the transition to market economies among former Communist countries. This permitted OECD multinational companies to take advantage of their superior technology, management and market power to gain access to the markets of developing countries and to their cheap, unskilled labour and natural resources.

Referring to the unprecedented level of OFDI flows in 1995 UNCTADs WIR (96) comments that "given that FDI flows respond to cyclical fluctuations in economic growth with one or two-year lags, the 1995 surge is not surprising" and again argues that the underlying upward trend in OFDI flows over the 1980s and the fact that each cyclical upswing in economic activity has led to progressively higher peaks in FDI flows suggests that other factors are also at work. In the remaining reports until 2000 UNCTAD explains that world OFDI growth figures were not negatively affected by the backdrop of numerous unfavourable conditions affecting mostly Japan and emerging countries (financial instability).

At the beginning of the 21st century FDI outflows fell for two years in a row, 2001 and 2002. The reasons mentioned for this downturn were the slowing of growth in economic

activity in major industrial economies and a sharp decrease in their stock market activity, which caused a fall in stock market valuations. Lower corporate profitability, a slowdown in the pace of corporate restructuring in some industries and the winding down of privatisation in some nations also helped to explain this decrease in OFDI. In fact OFDI was severely damaged, apparently more than expected in view of the relatively slight deceleration in GDP growth.

After 2003 OFDI started to grow at an unprecedented rate, though this expansionary period ended abruptly in 2008 after reaching a historic record figure of 2.2 trillion dollars in 2007 (3.5% of world GDP and 15.7% of world gross capital formation). The main drivers behind this high growth in world OFDI were the same structural factors mentioned above plus some new ones, such as the new role that emerging countries started to play as investors in the global economic scenario. Other explanatory factors included the wave of international mega mergers and acquisitions that took place, especially between firms in OECD countries, in many industries (telecommunications, motor vehicles, chemicals and finance), a wave which was favoured by the boom in stock prices. Last but not least, a recovery in GDP growth occurred in the same period. Historically low interest rates and increasing financial integration led private equity firms to undertake direct investments abroad (WIR, 2005).

A sharp decrease in OFDI (by 12%) in 2008 was followed by an even sharper one (by 38%) in 2009. Although significant, this decrease was smaller than the accumulated decrease in 2001 and 2002 (39% and 29%, respectively). Moreover, world OFDI recovered even faster than in the previous period, clearly as a consequence of the fact that emerging countries continued to increase their investments abroad. To sum up, the overview and analysis by UNCTAD and an examination of trends over time reveal pro-cyclical behaviour on the part of OFDI, with some lags.

The model

Our large database covers gross OFDI flows from 100 countries, reported by UNCTAD. The data set has a panel structure and reports annual data from 1970 to 2011. Because of data availability and because in fact the bulk of world OFDI comes from a small group of advanced countries, most of the analysis focuses on a subset of 22 OECD countries, which represent more than 80% of world OFDI over the whole period. In the end we arrive at the 22 country sample panel data structure with a longer time series dimension than the cross sectional one (22x42, totalling 924 observations). Since we are interested in the impact of business cycles on the source country our research refrains from analysing pull factors (host country FDI inflow determinants). We therefore use total OFDI to the rest of the world regardless of the destination of investments. Including host country determinants would complicate the econometric specification without adding new insights into the main objective of the study.

$$OFDI_{it} = \beta_0 + \beta_1 LGDPTrend_{it} + \beta_2 GDPgap_{it} + \beta_3 rr_{it} + \beta_4 rer_{it} + Z_{it} + U_{it} \qquad (1)$$

OFDI data are deflated by the corresponding country GDP deflator. Since even for the subset sample UNCTAD does not distinguish between missing values and zeros in reporting OFDI data we have taken zeros as missing values, because the zeros reported seem to be unrealistic data for the countries in question which could bias the results.

Logs of FDI flows are usually taken to regress these data because this reduces skewness and provides a useful normalisation procedure, avoiding dimensional and outliers problems that may arise. This usually allows a better fit in gravity equations. However, such potential problems are not so relevant in this case, since we are employing a panel data specification with countries' fixed or random effects, capturing to some extent size differences among countries. Moreover, the transformations required to apply logs for negative observations –and there are many- are controversial (Levy *et al.*, 2007). We therefore decided not to transform the dependent variable, following Wang and Wong (2007).[1] This gives us a semi-logarithmic specification, which of course means that parameters, especially for GDPTrend, cannot be interpreted as elasticities. A "Z" term has been added to Equation 1; nevertheless, it must not be considered as a group of control variables, since there are components whose economic interpretation is relevant and hence will be explained later.

"L_GDP_Trend" stands for the log of the real GDP trend obtained by the decomposition of GDP between the long run trend and the cyclical component. There are several procedures for empirically observing the business cycle and testing for the effect of expansions and recessions on the dependent variable. Wang and Wong (2007) use the absolute value of the residual of a typical growth regression specification (Ramey and Ramey, 1995), Levy *et al.* (2007) use a dummy that takes the value of zero and one for recessions and expansions, respectively (obtained from the calculation of the GDP gap based on long-term GDP growth and alternatively using the official dating of recessions and expansions by the OECD). We decided to use the Hodrick Prescott (1997) HP filter because it is the most commonly used method and because we have a long annual time span in which to compute it properly. Furthermore, this procedure provides a continuous variable for the GDP trend and the GDP gap, allowing a better estimation of the parameters. Nevertheless, we alternatively employ dummies in some specifications to check robustness, as discussed below. "GDP gap" is the (negative or positive) value of the cyclical component of GDP. "rr" is the short run real rate of interest in the source country, used as a proxy for the cost of investment, and "rer" is the real exchange rate in terms of local currency *per* USD.

We expect a positive sign for "L_GDP_Trend" because larger countries would tend to invest more than smaller ones. Following the above-mentioned theoretical discussions, we cannot predict the sign for "GDP gap". It would be positive if the so-called income effect is larger than the substitution effect. However, we would intuitively expect the income effect to be larger (an idea that emerges from the discussion above and the general overview). The sign of the real interest rate is expected to be negative because, "*ceteris paribus*" higher interest rates would increase the cost of financing an investment project. In this regard, we find no positive correlation between the GDP Cycle and the interest rate implied in the above-mentioned argument about the counter-cyclical nature of monetary policy. This is probably because it was not until the mid eighties that monetary policy, in the framework of inflation targeting, started to be systematically implemented in a counter-cyclical manner, through short term interest rates as the main policy instrument. We would expect the sign of the exchange rate to be negative since, as already mentioned,

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1   However, in order to test for the existence of outliers, the baseline specification of Equation 1 (Specification 2, p. 11) has also been computed applying logs for OFDI. The signs and statistical significance of the parameters were quite similar to those obtained without logs for OFDI.

a depreciation of the domestic currency (an increase in the exchange rate) raises the cost of acquiring foreign assets and therefore discourages OFDI.

The Breusch and Pagan (1979) test reveals that dependant variable error variance is not heteroscedastic. We also perform the Hausman (1978) test to compare random/fixed effects and OLS estimations. The fixed effect estimation seems to be the most appropriate - except for Specification 6 - so we concentrate on it in what follows. However, in Table 1 we include for comparison the random effect estimation that produces similar results.

The corresponding regression results for Equation (1) are reported in the tables below, for the large country sample (Specification 1) and for the subsample of 22 OECD countries (Specification 2).

Table 1 | Regressions for OFDI – Large Sample and 22 OECD Country Subsample

Independent variable	Fixed Effects Large Country Sample Specification 1	Random Effects Large Country Sample Specification 1	Independent variable	Fixed Effects 22 OECD countries Specification 2	Random Effects 22 OECD countries Specification 2
	Coefficient	Coefficient		Coefficient	Coefficient
Const	-64.91***	-18.45***	const	-352.04***	-118.99***
l_GDP_Trend	17.72***	6.35***	l_GDP_Trend	65.87***	32.74***
GDP_Gap	0.078***	0.081***	GDP_Gap	0.095***	0.1057***
Real_interest_r	-0.0017	-0.0017	real_short_inte	-0.788**	-0.863*
Exchange_Rates	8.656e-05**	1.370e-05	REER	-0.355***	-0.595***
Observations	2,221	2,221		749	749
Time-series length	42	42		42	42
R²	0.49	0.35		0.52	0.43
Adjusted R²	0.46	0.35		0.51	0.43
Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0		Asymptotic test statistic: Chi-square(1) = 4,956.11 with p-value = 0			Asymptotic test statistic: Chi-square(1) = 356.237 with p-value = 1.85798e-079
Hausman test - Null hypothesis: GLS estimates are consistent		Asymptotic test statistic: Chi-square(4) = 86.2667 with p-value = 8.16922e-018			Asymptotic test statistic: Chi-square(4) = 90.6902 with p-value = 9.39436e-019

As can be observed in Table 1 the "GDP gap" parameter shows a positive, significant sign for both specifications, *i.e.* OFDI rises when output is above-trend and declines when output is below-trend. In other words, outward flows seem to behave pro-cyclically. For

"GDP trend" the sign is also positive and significant for the two samples of countries. As expected, the larger the GDP trend is the more countries invest abroad. Specifications 1 and 2 are not totally comparable because the variables for the interest rate and for the exchange rate are not exactly the same,[2] but as far as the effect of the business cycle on OFDI is concerned the results are similar.

The rest of the variables in Specification 2 (baseline specification) also have the expected signs and are statistically significant. An increase in home country interest and effective real exchange rate (*i.e.* a depreciation of the domestic currency) seems to reduce OFDI. So an increase in the costs of financing the acquisition of foreign assets, in terms of higher interest rates or lower purchasing power of the domestic currency, has a negative impact on outward investment projects.

Lagged effects on FDI of explanatory variables

As far as investment projects - especially if they are located abroad - are neither decided nor implemented instantaneously, it is reasonable to check for the repeatedly mentioned issue that the effect of business cycles or other key predictors on OFDI might occur not only contemporaneously but with some lag. Accordingly, the baseline specification has been computed including a one year lag for the GDP Gap (GDP_Gap_1) and for GDP trend (l_GAP_Trend_1).

As can be seen in the Table 2, results reveal that past year GDP trend and GDP cycle have a similar effect on OFDI comparing with the baseline Specification (2) without lagged predictors. However, the coefficient for GDP Gap is slightly lower, revealing that current business cycle has a larger effect than past business cycle. As a consequence of the slight differences between the parameters of lagged and non lagged explanatory variables, in what follows we keep on using the contemporaneous specification of Equation (1).

Country subsamples for OFDI

Since Levy *et al.* (2007) and Wang and Wong (2007) seem to detect different results regarding the effect of business cycles on OFDI depending on which home country samples are used[3], we further illustrate this issue by splitting our 22 OECD country sample into two further subsamples: one composed of the 12 initial euro area member countries (EA 12) and the other made up of the remaining 10 OECD countries.

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2   For the smaller country sample the data for the interest rate correspond to the real short interest rates (up to 3 months from AMECO and OECD) and the data for the exchange rate comprise the real effective exchange rate. The real effective exchange rate from IFS is the measure of the value of a currency against a weighted average of several foreign currencies divided by a price deflator. The latter data are better proxies and there are also more observations available. Moreover, those 22 OECD countries are the main world investor countries throughout the period studied. So for the rest of the analysis we take model 2 as the baseline model.

3   Wang and Wong (2007) find no significant relationship between OFDI and their measure of the business cycle for non OECD countries. Levy *et al.* (2007) find a significant (negative) result but only for the USA and Europe.

Table 2 | Regressions for OFDI – Lagged Predictors

Independent variable	Fixed Effects 22 OECD Specification 2	Fixed Effects 22 OECD Specification 3	Fixed Effects 22 OECD Specification 3
	Coefficient	*Coefficient*	
Const	-352.04***	**Const**	-350.874***
l_GDP_Trend	65.87***	**l_GDP_Trend_1**	65.809***
GDP_Gap	0.095***	**GDP_Gap _1**	0.054**
real_short_inte	-0.788**	**real_short_inte**	-0.775*
REER	-0.355***	**REER**	-0.350***
observations	749	**observations**	740
Time-series length	42	**Time-series length**	42
R²	0.52	**R²**	0.52
Adjusted R²	0.51	**Adjusted R²**	0.50
Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0	Asymptotic test statistic: Chi-square(1) = 356.237 with p-value = 1.85798e-079	**Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0**	Asymptotic test statistic: Chi-square(1) = 315.302 with p-value = 1.52865e-070
Hausman test - Null hypothesis: GLS estimates are consistent	Asymptotic test statistic: Chi-square(4) = 90.6902 with p-value = 9.39436e-019	**Hausman test - Null hypothesis: GLS estimates are consistent**	Asymptotic test statistic: Chi-square(4) = 88.3372 with p-value = 2.96934e-018

By contrast with the findings in Levy *et al.* (2007) and Wang and Wong (2007), we do not observe differences in behaviour in our country subsamples, which seems to imply that OFDI is always pro-cyclical. However, there is a minor difference in the results which has to do with the loss of significance of the real short term interest rate. Considering the absolute value of the "GDP gap" coefficient, it seems that OFDI in EA 12 countries reacts more strongly to the GDP gap than it does in the remaining 10 OECD countries. Taking into account that the 10 OECD country subsample includes countries such as the USA and the UK, which in the 1980s had already accumulated a large stock of OFDI, their lower response to the "GDP gap" might be explained by the fact that their high reinvested profits, which are included as OFDI, bear no relation to the business cycle in the source countries (proxied by "GDP gap").

Table 3 | Regressions for OFDI - OECD Country Subsamples

Independent variable	Fixed Effects EA 12: Specification 4	Random Effects EA 12: Specification 5	Fixed Effects 10 OECD : Specification 6
	Coefficient	*Coefficient*	*Coefficient*
const	-253.88***	-35.24	-523.02***
l_GDP_Trend	51.91***	13.18***	89.07***
GDP_Gap	0.333***	0.273***	0.068**
real_short_inte	-1.218***	0.207	0.372
REER	-0.378***	-0.352***	-0.348*
Euro_Dummy		29.18***	
observations	419	419	330
Time-series length	42	42	37
R²	0.47	0.51	0.56
Adjusted R²	0.45	0.49	0.55
Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0	Asymptotic test statistic: Chi-square(1) = 120.717 with p-value = 4.40656e-028	Asymptotic test statistic: Chi-square(1) = 165.191 with p-value = 8.30904e-038	Asymptotic test statistic: Chi-square(1) = 118.214 with p-value = 1.55631e-027
Hausman test - Null hypothesis: GLS estimates are consistent	Asymptotic test statistic: Chi-square(4) = 56.6333 with p-value = 1.47692e-011	Asymptotic test statistic: Chi-square(5) = 3.77095 with p-value = 0.593223	Asymptotic test statistic: Chi-square(4) = 50.5729 with p-value = 2.74132e-010

Finally, in order to test the effect of the introduction of the common currency and the single monetary policy in the euro area, a dummy variable has been included (with value 1 for data since 1999 and value 0 for data before 1999). A positive, significant coefficient is obtained, revealing a positive impact of the euro on OFDI. This result coincides with the much commented increase in intra euro area OFDI flows after the introduction of the single currency. Nevertheless, the real interest seems to lose the effect, probably as a consequence of the single monetary policy, which generated convergence in real short interest rates.

Discussing alternative specifications for the business cycle

There are other ways in which business cycles can be measured and dated. All have been extensively discussed in the relevant literature (a production function approach, a linear projection of the rate of growth in GDP, *etc.*). As mentioned above, the papers by Levy *et al.* (2007) and Wang and Wong (2007) use different measures and specifications for the

business cycles in their models, for example dummies for recessionary and expansionary periods. Three different econometric specifications are therefore presented below to compare our previous results for the subsample of 22 OECD countries using a business cycle measurement based on dummies instead of the "GDP gap" (HP filter). In the first one (Specification 7) we replace the variable "GDP gap" by a dummy for the GDP gap ("GDP gap dummy") that takes the value of 1 for expansionary years (*i.e.* when the GDP gap is positive) and 0 otherwise. Another possibility to provide further evidence that the variable for the business cycle ("GDP gap") that we use in the baseline specification (Specification 2) provides correct results for the effect of business cycles on OFDI, is to split the panel into two subsamples: one consisting of all the observations with a positive GDP gap ("GDP gap expansion", *i.e.* observations when countries are in expansion, Specification 8) and the other consisting of all the observations with a negative GDP gap ("GDP gap recession", Specification 9). Finally, following Wang and Wong (2007) we interact the GDP gap with the dummy variable ("Dummy*GDP gap", Specification 10).

Specification 7 offers almost the same results as the baseline specification (Specification 2) and the dummy for the GDP gap ("GDP gap dummy") is again positive, which means that OFDI behaves pro-cyclically. This is not a surprising result, but it helps to confirm the correctness of the previous estimation. As expected, when Specification 7 is run for expansions only, the sign of the parameter "GDP expansion" is positive and significant. Again, in those years when GDP is above potential OFDI increases. The rest of the variables maintain the correct sign, thus the cost of financing FDI projects abroad exerts a negative impact. Specification 9 exhibits a negative and significant coefficient for GDP gap recession. This confirms that recessions lead to lower OFDI levels. However, it is worth mentioning that this coefficient is lower in absolute terms than the one for expansions: this could be interpreted as meaning that OFDI is less sensitive to recessions than to expansions. This interpretation is at odds with the assertion by Wang and Wong (2007) that fluctuations in economic growth discourage OFDI but only when a country is in recession. Finally, Specification 10 is the only one where the business cycle, captured this time by the interaction of the "GDP gap" with the "GDP gap dummy" ("Dummy*GDP gap"), seems to exert a negative impact on OFDI. However, although this outcome seems to contradict the results that we have obtained so far, in fact it should not be interpreted as such, but purely as a consequence of the interaction term, which eliminates the positive GDP gap effect during expansions.

Table 4 | Regressions for OFDI –Different Specifications for the Business Cycle

Independent variable	Fixed Effects 22 OECD Specification 7	Fixed Effects 22 OECD Specification 8	Fixed Effects 22 OECD Specification 9	Fixed Effects 22 OECD Specification 10
	Coefficient	Coefficient	Coefficient	t-ratio
const	-352.79***	-396.75***	-275.86***	-332.68***
l_GDP_Trend	65.55***	69.23***	51.90***	60.66***
real_short_inte	-0.727*	-1.579**	-0.744*	-0.897**
REER	-0.357***	-0.153	-0.305**	-0.275***
GDP gap dummy	5.761**			
GDP gap expansion		0.409***		
GDP gap recession			-0.100**	
Dummy*GDP gap				0.515***
GDP gap				-0.159***
observations	749	362	387	749
Time-series length	42	22	23	42
R^2	0.53	0.56	0.58	0.55
Adjusted R^2	0.51	0.53	0.56	0.53
Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0	Asymptotic test statistic: Chi-square(1) = 345.277 with p-value = 4.52522e-077	Asymptotic test statistic: Chi-square(1) = 56.1743 with p-value = 6.63242e-014	Asymptotic test statistic: Chi-square(1) = 55.3983 with p-value = 9.84234e-014	Asymptotic test statistic: Chi-square(1) = 211.421 with p-value = 6.72864e-048
Hausman test - Null hypothesis: GLS estimates are consistent	Asymptotic test statistic: Chi-square(4) = 82.8381 with p-value = 4.36017e-017	Asymptotic test statistic: Chi-square(4) = 53.1923 with p-value = 7.76749e-011	Asymptotic test statistic: Chi-square(4) = 66.0702 with p-value = 1.53096e-013	Asymptotic test statistic: Chi-square(5) = 94.6893 with p-value = 6.94115e-019

Extended specification for domestic investment and host countries' business cycle

Theoretically, domestic investment might have an effect on OFDI. In the case of imperfect capital markets firms might be financially constrained and therefore a firm's decision to invest domestically would mean that there is less (or no) funding to invest abroad, which would have a negative effect on OFDI. This could be interpreted as an additional substitution effect over and above the one mentioned above (during expansions the marginal productivity of capital increases and makes OFDI less attractive). Following this argument, Wang and Wong (2007) assume that there must be a negative influence of home investment on OFDI. However, a different hypothesis can be put forward in this regard: for some companies and activities investment at home and abroad might be complementary. When multinational firms are vertically integrated an increase in capacity at home might require a rise in capacity abroad and thus lead to more OFDI. From that point of view, a rise in home investment could exert a positive effect on OFDI. In order to check for this effect we extend our baseline specification (Specification 2) to include an additional explanatory variable for home investment (Specification 11), namely the ratio of domestic investment to GDP ("GFCF_GDP").

Although we are mainly interested in short run OFDI push factors we cannot ignore a quite natural extension of the base line specification to analyse the effect on OFDI of the GDP gap, but also of host countries (Specification 12). It makes sense to argue that OFDI might increase when foreign markets are in expansion and *vice versa* because one of the reasons most widely cited in the literature for investing abroad is the FDI market-seeking hypothesis. Briefly: for a given size of the host market, the faster it grows the more foreign firms will invest there. In fact many empirical studies of FDI determinants have shown a positive relationship between inward FDI and GDP growth in the host country. As we do not have bilateral data, we have constructed a variable representing the weighted average of the business cycles of the other countries. Following Wang and Wong (2007), the weight is the share of each home country's GDP in the sum of all other countries' GDP in the sample. For the baseline specification (Specification 2) the 22 OECD countries included are not only the major investing countries but also the major receiving countries. We are not therefore losing a significant amount of OFDI directed towards countries in the rest of the world. For the variable "Host GDP gap" we would expect a positive sign: if the home country's business cycle holds constant an expansionary year in the host country would encourage OFDI and *vice versa*.

The results of Specification 11 are reassuring: the sign and significance of the control variables are maintained and the sign of the home investment ratio is positive and significant. Hence, it seems that there is a positive or complimentary effect between domestic and foreign investment, all the other explanatory variables being constant. So, in some sense there is a pro-cyclical behaviour of OFDI, to the extent that an expansion at home that tends to increase domestic investment would raise OFDI. However, we find no closed positive relationship between home GDP gap and domestic investment in our country sample that would support this indirect effect.

Table 5 | Regressions for OFDI - Extended Specifications

Independent variable	Fixed Effects 22 OECD Specification 2	Fixed Effects 22 OECD Specification 11	Fixed Effects 22 OECD Specification 12
	Coefficient	*Coefficient*	*Coefficient*
Const	-352.04***	-410.28***	-376.98***
l_GDP_Trend	65.87***	71.53***	67.98***
GDP_Gap	0.095***	0.079***	0.043*
real_short_inte	-0.788**	-0.586	-0.731*
REER	-0.355***	-0.380***	-0.352***
GFCF_GDP		1.095**	0.493
Host GDP_Gap			6.258***
observations	749	749	749
Time-series length	42	42	42
R²	0.52	0.53	0.54
Adjusted R²	0.51	0.51	0.52
Breusch-Pagan test - Null hypothesis: Variance of the unit-specific error = 0	Asymptotic test statistic: Chi-square(1) = 356.237 with p-value = 1.85798e-079	Asymptotic test statistic: Chi-square(1) = 186.436 with p-value = 1.62478e-038	Asymptotic test statistic: Chi-square(1) = 166.848 with p-value = 3.61176e-038
Hausman test - Null hypothesis: GLS estimates are consistent	Asymptotic test statistic: Chi-square(4) = 90.6902 with p-value = 9.39436e-019	Asymptotic test statistic: Chi-square(4) = 121.279 with p-value = 1.68219e-024	Asymptotic test statistic: Chi-square(4) = 104.781 with p-value = 2.51908e-020

In the most widely extended Specification (12), in line with our expectations, the average host country GDP gap exerts a positive influence over OFDI. The main variables give the same results even when the effect of these two variables is controlled for, thus supporting our main hypothesis, namely that OFDI is pro-cyclical.

This main result runs counter to the findings of Levy *et al.* (2007), and also partially contradicts Wang and Wong (2007). In any event, Levy *et al.* (2007) use a different procedure that employs bilateral OFDI flows towards developing countries: this different focus explains the opposing conclusions. Nevertheless, our results are not so divergent in comparison with Wang and Wong (2007), whose analysis finds pro-cyclical behaviour solely during recessions and no statistically significant effect during expansions, that is to say that OFDI decreases in recessions but does not increase during expansions.

4. Concluding Remarks

After examining the WIRs from 1991, in line with *a priori* expectations as to the effect of business cycles on OFDI flows and according to the investment accelerator principle, the main conclusion drawn from the analysis conducted here is that OFDI behaves pro-cyclically. This might be considered a trivial conclusion, but the scant empirical literature dealing with this issue does not reach a unanimous consensus.

Using a large sample of countries over a long time period (including the recent recessionary years) this research uses the output gap, derived from the HP filter, as the explanatory variable to capture cyclical disturbances in the economy. As a result we find that an economic expansion/recession has a positive/negative effect on OFDI.

Beyond this main conclusion, the study reveals that fluctuations in the financial cost in the source country for the acquisition of foreign capital (*i.e.* exchange rates and interest rates) are an important determinant of changes in OFDI flows when - as is usually the case - foreign operations are financed on the home capital markets, in local currency and require external sources of funding.

OFDI flows are the main way of integrating economies globally, and they seem to advance at a higher or lower rate depending on the cyclical performance of the home countries' economies and cost of financing fluctuations.

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Annex 1 | Summary of Variables Employed and Expected Signs

Name	Variable	Proxy	Unit of Measure	Source	Theoretical justification	Expected Sign
OFDI	Real OFDI world flows (dependent variable)		Constant US Dollars (billions)	UNCTAD		
GDP_Cycle	Home country GDP gap	Business cycle	Constant US Dollars (billions)	UNCTAD	Pro-cyclical Countercyclical	?
l_GDP_Trend	Natural log of home country GDP trend	Long-run GDP growth	Constant US Dollars (billions)	UNCTAD	Home country market size	+
real_short_inte	short real interest rate	Cost of investment	Annual percentage rate	IFS	Capital market imperfections	-
REER_IFS	Home country real exchange rate in terms of local currency per US $.	International average purchasing capacity	Annual average percentage rate	IFS	Influence of natural currency price on purchasing power	-
GFCF_GDP	Gross fixed capital formation: share of home country GDP	Home country's investment returns	Percentages	WDI	Substitutibility of domestic and foreign investments	-
Host GDP Cycle	Weighted average host countries average GDP cycle	Output gap in rest of world except home country	Constant US Dollars (millions)	UNCTAD	Business cycle in host countries	-

Annex 2 | Summary Statistics, using the observations

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
OFDI	22.4107	7.28267	-31.1370	370.363	42.9317
GDP_Cycle	-1.29870e-008	-0.115460	-467.048	381.610	44.5646
l_GDP_Trend_	5.97969	5.74446	2.25725	9.50958	1.40749
real_short_inte	2.37346	2.29180	-12.6134	21.8890	3.43948
REER_IFS	98.3854	98.9950	63.3382	143.727	11.6576
GFCF_GDP	22.9618	22.4000	9.00000	42.9000	4.26189
HostGDP_Cycle	-0.000751802	-0.0679657	-2.89102	2.95350	0.847081

Annex 3 | Correlation coefficients, using the observations

OFDI	GDP_gap	real_short_inte	REER_IFS	GFCF/GDP	Host GDP Gap	l_GDP_Trend	
1.000	**0.1012**	**-0.0877**	-0.0013	**-0.281**	**0.1576**	**0.5425**	**OFDI**
	1.000	0.0201	0.0252	**0.143**	**0.3827**	0.0027	**GDP_gap**
		1.000	**0.1079**	**-0.181**	0.011	-0.0214	**real_short_inte**
			1.000	-0.0553	0.0023	**0.1631**	**REER_IFS**
				1.000	**0.19**	**-0.1765**	**GFCF/GDP**
					1.000	0.0016	**Host GDP Gap**
						1.000	**l_GDP_Trend**

In bold: 5% critical value (two-tailed) = 0.0645 for n = 924