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Economics Letters 100 (2008) 146 – 149
economics letters
www.elsevier.com/locate/econbase

The long-run relationship between outward FDI and domestic output: Evidence from panel data

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Received 6 September 2007; received in revised form 26 October 2007; accepted 3 December 2007
Available online 8 December 2007

Abstract

We find for 14 industrialized countries over the period 1971–2005 that outward FDI has positive long-run effects on domestic output. Our results suggest that increased outward FDI is both a cause and a consequence of increased domestic output.

Keywords: Outward FDI; Domestic output; Panel cointegration

JEL classification: F21; F23; C23

1. Introduction

The question of whether and how outward foreign direct investment (FDI) affects domestic output has been the subject of extensive public debate in the industrialized world. One argument is that when multinational firms relocate production facilities abroad, the associated outward investments necessarily reduce domestic output. Moreover, it is noted with respect to the financial side of the firm that investments in different locations generally compete for scarce funds because of costly external finance. Thus, the decision to invest fixed financial resources abroad reduces the likelihood of concurrent investments at home, implying that outward FDI inevitably substitutes foreign for domestic output (e.g., Stevens and Lipsey, 1992).

Against this, it is argued that multinational firms finance investment projects on world markets and make extensive use of their internal capital markets. Accordingly, the scenario of fixed financial resources is not typical for multinational enterprises. Furthermore, it is pointed out that outward FDI allows firms to enter new markets, to import intermediate goods from foreign affiliates at lower prices, to produce a greater volume of final goods abroad at lower cost, and to access foreign technology. From this point of view, outward-investing firms combine home production with foreign production to reduce costs and to increase their competitiveness both internationally and domestically, stimulating domestic factor demand and domestic output (e.g., Desai et al., 2005). As a result, the entire domestic economy benefits in the long run from outward FDI due to the increased competitiveness of the investing companies and associated spillovers to local firms.

Unfortunately, the evidence on the domestic output effects of outward FDI is limited. Previous studies have primarily examined the firm- and industry-level effects of outward FDI on employment, exports and investment in the home country. Only Barba Navaratti and Castellani (2004) have investigated the effects of outward FDI on domestic output. They apply propensity score matching estimators to a sample of Italian firms, and find that outward-investing firms experience higher growth in domestic output after investing abroad relative to a counterfactual of local firms. Certainly, the study by Barba Navaratti and Castellani (2004) provides valuable insights into the domestic output effects

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doi:10.1016/j.econlet.2007.12.004

of individual investing firms, but it does not indicate the long-run effects of outward FDI on the economy as a whole.[1]

This paper examines the long-run impact of aggregate outward FDI on total domestic output. To our knowledge, it is the first to examine this issue. To this end, we apply cointegration and causality analysis to a panel of 14 industrialized countries over the period 1971–2005. Our main findings are: (i) there is a *positive* long-run relationship between outward FDI and domestic output; (ii) the long-run causality is bidirectional, suggesting that increased outward FDI is both a cause and a consequence of increased domestic output.

The rest of the paper is organized as follows. Section 2 describes the estimating equation and the data. The empirical analysis is presented in Section 3. Section 4 concludes.

2. Model and data

Following common practice in panel cointegration studies, we consider a bivariate long-run relationship of the following form:

$$Y_{it} = a_i + \beta \mathrm{OFDI}_{it} + \varepsilon_{it}, \quad i = 1, 2, \ldots, N, \; t = 1, 2, \ldots, T \qquad (1)$$

where Y is the real GDP of country i in year t, OFDI stands for outward foreign direct investment, and ε_t is the usual error term.[2] GDP is measured in logarithms, while outward foreign direct investment is represented by the ratio of net FDI outflows to GDP. Note that we use net outward FDI and not gross outward FDI. The reason is that gross FDI figures reflect the sum of the absolute value of outflows and inflows in the balance of payments financial accounts and thus do not account for disinvestment. Given that net outflows have negative values in some years, it is, however, not possible to take logarithms. In order to derive economically interpretable estimates, we therefore use net FDI as a percentage of GDP, as is common practice in the FDI literature. Data on net FDI outflows as a percentage of GDP are from the UNCTAD FDI database. Real GDP data are taken from the World Development Indicators 2007 CD-ROM. The sample we use consists of 14 industrialized countries over the period 1971–2005. The countries are Australia, Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, UK and USA.

3. Results

We now estimate Eq. (1). Levin et al. (2002) and Im et al. (2003) panel unit root tests suggest that all our variables are integrated of order one (results not reported here to save space). Consequently, we use cointegration techniques for the purpose of estimation.

3.1. Testing for cointegration

We first test for cointegration using the Pedroni (1999) approach. This approach involves estimating the hypothesized cointegrating regression separately for each country. Then seven test statistics are employed to test the residuals for stationarity. Four of these test statistics pool the autoregressive coefficients across different countries during the unit root test and thus restrict the first-order autoregressive parameter to be the same for all countries. Pedroni (1999) refers to these statistics as *panel cointegration statistics*. The other three test statistics are based on averaging the individually estimated autoregressive coefficients for each country. Accordingly, these statistics allow the autoregressive coefficient to vary across countries and are referred to as *group-mean panel cointegration statistics*. The first of the *panel cointegration statistics* is a non-parametric variance ratio test. The second and the third are panel versions of the Phillips and Perron (PP) rho- and t-statistics, respectively. The fourth statistic is a panel ADF statistic analogous to the Levin et al. (2002) panel unit root test. Similarly, the first two of the *group-mean panel cointegration statistics* are panel versions of the Phillips and Perron rho- and t-statistics, respectively. The third is a group-mean ADF test analogous to the Im et al. (2003) panel unit root test.

As an additional test for cointegration, we use the Larsson et al. (2001) procedure, which is based on Johansen's (1995) maximum likelihood approach. Let LR denote the cross-section specific likelihood-ratio (trace) statistic of the hypothesis that there are at most r cointegrating vectors in the system. The standardized LR-bar statistic is given by

$$\Psi_{\overline{\mathrm{LR}}} = \frac{\sqrt{N}[\overline{\mathrm{LR}} - \mu]}{\sqrt{v}}, \qquad (2)$$

where $\overline{LR}$ is the average of the N cross-section LR statistics, μ is the mean and v is the variance of the asymptotic trace statistic. Asymptotic values of μ and v are provided by Breitung (2005) for the model we use (the model with constant but no trend in the cointegrating relationship).

Table 1
Panel cointegration tests

Pedroni (1999)	Panel cointegration statistics	Group-mean panel cointegration statistics
Variance ratio	3.08***	
PP rho-statistics	−3.69***	−5.35***
PP t-statistics	−6.66***	−4.73***
ADF statistics	−7.31***	−5.07***

Larsson et al. (2001)	Cointegration rank $r=0$	$r=1$
Ψ	5.30***	1.19

*** indicate a rejection of the null hypothesis of no cointegration at the 1% level. All test statistics are asymptotically normally distributed. The number of lags in the Larsson et al. (2001) test was determined using the Schwarz criterion.

[1] It is fair to say that there are now several micro studies on the more specific mechanisms between outward FDI and domestic economic activity. The overall picture that emerges from these studies suggests that the effects of outward FDI (at the firm or industry level) depend on several factors, such as the income level of the host country or the type of investment (e.g., Harrison et al., 2007).

[2] We use GDP as our measure of domestic output, because GDP, as opposed to GNP, reflects domestic production and does not include goods and services produces by national corporations in other countries. This ensures that our results are not driven by potential built-in correlations between our output measure and outward FDI.

Table 1 reports the results of these tests. As can be seen, all test statistics clearly indicate cointegration, implying that there exists a long-run relationship between domestic output and outward FDI.

3.2. Estimating the long-run relationship

Having tested for cointegration, the next step of the analysis is to estimate the parameter β. To this end, we use the between-dimension, group-mean panel DOLS estimator suggested by Pedroni (2001). The DOLS regression in our case is given by:

$$Y_{it} = a_i + \beta_i \,\mathrm{OFDI}_{it} + \sum_{j=-p_i}^{p_i} \Phi_{ij} \Delta \mathrm{OFDI}_{it-j} + \varepsilon_{it}, \tag{3}$$

where $\hat{\beta}_i$ is the conventional time series DOLS estimator applied to the ith country of the panel. Φ_{ij} are coefficients of lead and lag differences, which account for possible serial correlation and endogeneity of the regressor(s), thus yielding unbiased estimates. The group-mean panel DOLS estimator for the coefficient β is:

$$\hat{\beta} = N^{-1} \sum_{i=1}^{N} \hat{\beta}_i, \tag{4}$$

and the associated t-statistics is calculated as:

$$t_{\hat{\beta}} = N^{-1/2} \sum_{i=1}^{N} t_{\hat{\beta}_i}. \tag{5}$$

The DOLS parameter estimates for the individual countries as well as the group-mean panel DOLS estimates are reported in Table 2. Both the individual country estimates and the panel estimates show a statistically significant *positive* effect of outward FDI on domestic output. The group-mean estimator for the coefficient on OFDI is 0.221, implying that an increase in the outward FDI-to-GDP ratio by 1 percentage point increases domestic output by 0.221% (on average).

To evaluate the robustness of the positive relationship between outward FDI and domestic output, we also report the results of the fixed-effects DOLS estimator suggested by Kao and Chiang (2000). From the last line of Table 2, we see that the fixed-effects result is in agreement with the group-mean result. The estimated FDI coefficient is positive and highly significant. As expected, the fixed-effects estimator produces a lower estimate than the group-mean estimator, which is consistent with the findings of Pedroni (2001).

3.3. Testing for causality

The above interpretation of the estimation results is based on the assumption that long-run causality runs from OFDI to Y. A statistically significant positive coefficient on OFDI need not, however, necessarily be the result of an impact of outward FDI on domestic production. A positive and statistically significant $\hat{\beta}$ can equally be compatible with the possibility that outward FDI is determined by domestic output. The economic rationale is that establishing or acquiring foreign affiliates involves special costs of overcoming legal, cultural and social barriers. Accordingly, only firms of a certain size can cope with these fixed costs and thus engage in outward FDI. In this respect, increases in economy-wide output may allow firms to invest (more) abroad. Thus, the final step in the analysis is to investigate the direction of causality.

Our causality test involves estimating a panel vector error correction model given by:

$$\begin{bmatrix} \Delta Y_{it} \\ \Delta \mathrm{OFDI}_{it} \end{bmatrix} = \begin{bmatrix} c_{1i} \\ c_{2i} \end{bmatrix} + \sum_{j=1}^{p} \Gamma_j \begin{bmatrix} \Delta Y_{it-j} \\ \Delta \mathrm{OFDI}_{it-j} \end{bmatrix} + \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} \mathrm{ec}_{it-1} + \begin{bmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \end{bmatrix}, \tag{6}$$

where ec_{it} are the residuals of the individual DOLS long-run relations in Table 2. A significant error correction coefficient, $a_{1,2}$, indicates long-run Granger causality from the independent to the

Table 2
DOLS approach

	Leads and lags	Constant	Coefficient on OFDI
Country results			
Australia	1	26.012*** (394.05)	0.341*** (5.66)
Austria	2	25.507*** (859.20)	0.238*** (6.38)
Canada	2	26.541*** (561.51)	0.167*** (7.63)
Denmark	1	25.438*** (974.79)	0.054*** (6.57)
Finland	1	25.091*** (693.67)	0.051*** (5.62)
France	1	27.493*** (824.04)	0.074*** (6.68)
Germany	1	27.782*** (653.99)	0.182*** (6.42)
Italy	1	27.217*** (864.19)	0.461*** (9.68)
Japan	2	28.701*** (306.07)	0.754*** (4.45)
Netherlands	1	26.075*** (675.19)	0.052*** (8.65)
Spain	1	26.602*** (835.61)	0.098*** (7.80)
Sweden	1	25.779*** (1042.95)	0.056*** (9.79)
UK	1	27.467*** (580.26)	0.066*** (6.12)
US	2	29.097*** (344.69)	0.501*** (5.42)
Panel results			
Group-mean estimator (Pedroni, 2001)		26.776*** (2568.43)	0.221*** (25.90)
Fixed effects estimator (Kao and Chiang, 2000)	2	26.853*** (2323.57)	0.079*** (16.48)

*** indicate significance at the 1% level. t-statistics in parentheses.

Table 3
Weak exogeneity tests/long-run causality tests

Variable (Coefficient)	Y_t (α_1)	OFDI_t (α_2)
$\chi^2(1)$ (*p*-values)	15.89 (0.000)	18.69 (0.000)

The number of degrees of freedom υ in the $\chi^2(\upsilon)$ tests correspond to the number of zero restrictions.

dependent variables, where long-run Granger non-causality and weak exogeneity can be regarded as equivalent. Starting with four lags, we test for weak exogeneity by imposing zero restrictions on the insignificant short-run parameters. We then use a likelihood-ratio test of the null hypothesis $a_{1,2}=0$. Table 3 presents the results. As can be seen, the null hypothesis of weak exogeneity of both Y_t and OFDI_t is rejected at the 1% significance level. Thus, the long-run causality is bidirectional, suggesting that increased outward FDI is, in fact, both a consequence and a cause of increased domestic output.

4. Conclusion

This paper has examined the long-run relationship between outward FDI on domestic output using panel cointegration techniques. We found that outward FDI has positive long-run effects on domestic output. In addition, our results show that the long-run causality is bidirectional, suggesting that increases in domestic output in turn allow firms to invest more abroad. Consequently, increased outward FDI is both a cause and a consequence of increased domestic output.

Acknowledgement

I would like to thank an anonymous referee for helpful comments.

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