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***FDI and Domestic Capital Stock in US Manufacturing  
Industries: Crowding-Out and Displacement Effects***

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## **ABSTRACT**

The global financial crisis has witnessed a dramatic slowdown in FDI flows, yet concerns over its possible impacts on investment and employment in home and host economies have actually intensified. Although weakened national economies may be a source of many such concerns, research has yet to clarify many of the consequences of bi-directional FDI flows. Inward FDI is often prized by policymakers based on the belief that it results in job creation and technology transfer, but unresolved issues remain. For example, its role as a catalyst in local investment is unsettled, despite the general positive effect it has on domestic productivity. Evidence on the “crowding-in” vs. “crowding-out” hypothesis concerning FDI’s impact on domestic investment remains scarce. A common view of outward FDI is that it displaces local investment; however, some researchers note that the underlying motivation for this investment ultimately will determine its impact on source economies, with the possibility that favourable employment and investment effects could materialize. The present research provides empirical evidence on the crowding-out and displacement effects of bi-directional FDI, relying on disaggregated industry-level data for U.S. manufacturing industries from 1997 to 2007.

## I. INTRODUCTION

Despite its recent slowdown in the wake of the financial crises, foreign direct investment (FDI) continues to attract the scrutiny of economists as it represents a primary manifestation of economic globalization. At the same time, owing to its potential impacts on both home and host economies, it has frequently captivated unfavorable attention by the public and the punditry. Despite a wealth of research on the general impacts of FDI, there remains a void of evidence and consensus about the specific impacts of FDI on fixed capital formation within the home economy. For example, although some research finds that *inward* FDI may stimulate investment (and employment) in the home market, additional empirical inquiry is needed to bolster this evidence. Further the role of *outward* FDI on domestic capital remains largely speculative, with available studies generally limited to the use of aggregate, economy-wide data. Clearly, further work is needed to determine how firms within specific industries respond to capital outflows, as the implications for domestic production and employment are paramount. The present research provides some empirical evidence on the relationship between bi-directional foreign investment and domestic capital stocks and flows. The analysis relies on a theory-based empirical model that is tested by using both pooled and panel data at the disaggregated industry level within US manufacturing. The findings and implications of this research may be suggestive to governments in adopting policies towards foreign investment that do not compromise national economic performance.

The next section of the paper reviews the pertinent empirical literature in this area. This is followed, in section III, by the development of an empirical methodology that provides an appropriate experimental design. Next, the data sources are described and

identified, and the results of the analysis are discussed in detail. A final section (V) offers summary and future directions.

## II. BACKGROUND LITERATURE

A number of empirical studies have examined the relationship between outward FDI and domestic investment. These studies generally follow two alternative strands, the first of which is based largely on aggregate analyses using macro-type variables. Feldstein's (1995) early study focused on the general relationship between outward FDI and domestic investment. Using aggregate data for the US economy, he regresses domestic investment on domestic savings and outward FDI. After accounting for the endogeneity of FDI by using instrumental variables, his findings imply that domestic investment suffers as FDI expands. Desai, et al (2005a) use a similar approach based on data from OECD countries over the 1986-1994 period; they also find a negative relationship between outward FDI stocks and domestic capital. However, they then proceed to examine this relationship by limiting the aggregated investment stocks to those of US multinationals; here they find a positive relationship between outward investment and domestic capital. Herzer and Schrooten (2007), examining the long-run relationship between domestic capital formation and FDI outflows, find it to be positive for the US but negative for Germany. This pattern of contradictory findings probably reflects the likelihood that this relationship varies over time, between countries, and across industries. As such, empirical evidence that is relevant to a particular setting is necessary for policy formation purposes.

The evidence drawn from firm-level analyses is similarly inconclusive. Desai, Foley and Hines (2005b) find some evidence that outward FDI has a positive impact on domestic investment, although this result is not based on a multivariate regression model. Harrison and McMillan (2006), analyzing the same firm-level data, show that the complementary relationship between foreign and domestic investment disappears once a distinction is made between high and low-income countries. Of course, the interpretation here is that when outward FDI is primarily vertically-motivated, investment in domestic operations suffers. Some earlier work, also based on firm-level analysis, found this not to be necessarily true. For example, Stevens and Lipsey (1992) find a positive relationship between outward FDI and domestic investment, drawing on a unique sample of multinational firms over a 16 year period. Also, Rao, et al (1994), report some mild evidence that this relationship is positive, based on data for Canadian multinationals.

There are just a few studies in this area that have been based on industry-level data. Most notably, Hejazi and Pauly (2003) use data on 15 Canadian industries from 1984 to 1995 in order to examine the impact of multinational activity on domestic investment. In general, their results suggest that outward FDI has no statistically significant impact on such investment; however, they do find inward FDI to have a stimulative effect on gross fixed capital formation in Canada. Driffield and Hughes (2003) also find a positive relationship between inward FDI and domestic investment, based on an analysis of UK data that is stratified by region, industry and time. They interpret their findings as offering support for the hypothesis of Markusen and Venables (1999), and others, that agglomeration economies from such inward investment are an important source of complementarities

with local industry. Yet their analysis does not explicitly consider the impact of outward FDI on domestic capital.

### III. EMPIRICAL METHODOLOGY

As previous research concerning the impact of outward FDI on domestic capital is both scant and inconclusive, we seek to augment the empirical evidence on this issue. The specific approach employed herein is one based on an industry-level analysis. Such an approach is beneficial if one seeks to avoid the disadvantages associated with the use of either aggregate or firm-level data. Some clarification is warranted here. The use of aggregated data ignores the variation in adjustments patterns that take place at the firm-level, as their response is dependent upon industry-affiliation and other characteristics. Alternatively, focusing on firm-level data ignores any general equilibrium effects that are likely to be quite important. For example, firms that do not engage in FDI will still be impacted by sometimes dramatic changes in both product and factor markets. Accordingly, an analysis based on industries at a high level of disaggregation should provide useful empirical insight; this is especially true in light of the paucity of reliable evidence on the industry level.

Previous research efforts in this and related areas have typically employed an ad hoc empirical model in order to test the relationship between foreign and domestic capital formation. Of course, it is preferable to utilize an empirical approach that is broadly grounded in underlying economic theory, even if the empirical specifications are not specifically derived from an underlying structural model. In what follows, we extend a model of domestic capital formation used by Driffield and Hughes (2003).

Adhering to a standard model based on an underlying production technology, the optimal demand for capital stock is taken as being dependent on output, labor inputs, and the price (cost) of capital services. On the supply side, domestic capital stock is assumed to be driven by profit expectations (Nickell, 1979) and, in turn, exogenously-determined levels of both inward and outward foreign capital (FKI, FKO). Thus the required rate of return ( $r$ ) for suppliers of finance for domestic capital (DK), to a specific industry, is given by:

$$(1) r = DK^{\eta} Q^{\rho} FKI^{\psi} FKO^{\phi}.$$

Ultimately, the effects of inward and outward FDI on domestic capital are empirical issues. Regarding inward foreign capital, agglomeration and spillover effects may dominate, with positive implications for capital supply. These effects may be related to productivity gains experienced by domestic firms (Barrell and Pain, 1997) and/or agglomeration economies that stem from intra-industry spillovers (Markusen and Venables, 1999). Alternatively, supply of domestic capital may be subject to a crowding-out phenomenon as more-productive foreign firms are willing to pay more for capital services, increasing the cost of domestic capital. As far as outward foreign capital (FKO) is concerned, the relative strength of two opposite influences will also determine its final impact on domestic capital. Outbound FDI may displace the need for domestic stocks if vertically-motivated FDI causes a resultant decline in home production (and investment) as firms attempt to exploit lower foreign labor costs. Alternatively, a larger stock of domestic capital may emerge from outbound FDI, especially if this is largely an attempt to broaden market access for these firms. Indeed, the knowledge capital theory of foreign investment would be consistent with a positive supply response of domestic capital. So a structural model of domestic capital supply is used to generate the following reduced-form solution:

$$(2) DK_{it} = \alpha + \beta_1 \pi_{it} + \beta_2 L_{it} + \beta_3 Q_{it} + \beta_4 FKI_{it} + \beta_5 FKO_{it} + \varepsilon_{it} ,$$

where  $DK_{it}$  is domestic capital (industry  $i$  at time  $t$ ),  $\pi$  represents expected profitability,  $L$  is labor input,  $Q$  is industry output, and  $KFI$  and  $KFO$  are inward and outward stocks of foreign capital.<sup>1</sup> The signs of  $\beta_4$  and  $\beta_5$  are unknown a priori, so the empirical exercise will reveal the nature of this relationship at the industry level. This relationship will depend on a number of factors including the motivation for FDI within a specific industry, the input and output linkages between industries, the relative importance of multinationals vs. domestic firms within each industry, etc.

This type of model is amenable to estimation within a dynamic framework; such an approach is more realistic because the current level of the capital stock is likely dependent upon previous levels. This type of inertia in adjusting to an optimal capital stock is a reflection of firms interactions with imperfect capital markets. Moreover, it is unlikely that the investment decisions of firms are truly independent of financing choices, as is typically assumed in financial models of the firm. Differences between the timing of optimal investment and the availability of funds make it more likely that the capital stock at time  $t$  will be influenced by previous levels of this variable. Accordingly, the empirical specification that we employ here is:

$$(3) DK_{it} = \alpha + \beta_0 DK_{i,t-x} + \beta_1 \pi_{it} + \beta_2 L_{it} + \beta_3 Q_{it} + \beta_4 FKI_{it} + \beta_5 FKO_{it} + \varepsilon_{it} .$$

The new term  $DK_{i,t-x}$  represents the lagged ( $x$  period) value of domestic capital stock within the industry. Although it is common to specify a one-period lag in many dynamic models, longer or numerous lags may be appropriate if warranted by the nature of the relationship

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<sup>1</sup> This specification is in broad agreement with one described in Arndt, et al (2007); similar specifications have been used in attempts to link domestic employment to multinational activities (e.g., see Yamashita and Fukao, 2009 and Hanson, et al, 2003).

between variables in the model. We now turn to a description of a dataset which would allow for testing the relationship represented by an empirical specification such as (3).

#### IV. DATA AND PRELIMINARY FINDINGS

##### Data Sources

The primary source of data for our analysis comes from the US Bureau of Economic Analysis (Department of the Census) in the form of their survey of multinational corporations. The Bureau (BEA) conducts an annual survey of both inward direct investment (FDIUS) by foreign multinationals and Direct Investment Abroad (USDIA) by US multinationals. These surveys compile an array of detailed financial and operating data; when aggregated by industry group, the data reveal inward and outward FDI stocks as well as annual capital expenditure. These data can be combined with other BEA data that reveal the principal operating statistics on the same disaggregated industry basis. (The data and analysis are restricted to the manufacturing sector because it is the only sector where the required operating data is available.) Our analysis is based on the 4-digit industry level for a number of reasons. First, this level of disaggregation is sufficiently fine that it should avoid problems inherent in aggregate data, yet still capture the general pattern of response to capital stocks within an industry as its firms elect to invest in foreign operations. Second, any further disaggregation would result in elimination of a majority of the possible observations because of confidentiality concerns.<sup>2</sup> There exist approximately 86 industries at the 4-digit level, although this number varies slightly across the sample years owing to

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<sup>2</sup> For example, the 6-digit level of industry detail often reflects the activity of one (or one predominant) firm in that industry group, in which case these data are not revealed for confidentiality purposes.

changes in industry classifications. To illustrate the detail at the 4-digit level, our data set includes information on the animal food manufacturing industry (NAICS code 3111), hardware manufacturing (3325), and audio/video equipment manufacturing (3343). We specifically use 1997, 2002, and 2007 in the analysis because the required operating statistics are only available in these benchmark years (the Census of Manufactures is published in 5-year intervals). We restrict the data to 1997 and more recent years, as industry classifications changed dramatically in 1997 with the switchover from the old SIC to the NAICS system. In fact, some difficulties remain in efforts to attain comparability between data for 1997 and later years, resulting in the elimination of certain 4-digit industries from the analysis. By way of illustration, we have 61 industries at this level for 2002, although a number of these observations are unusable because information on all of the required variables is not available.

### Preliminary Results

The initial empirical exercise here involves estimating Eq. (3), using OLS regression analysis, from the available sample of a cross-section of industries for 2002. These results are presented in Table 1. Note that, in advance of construction of the ideal data set, the current analysis employs a five year lag for the domestic capital stock variable. Indeed, the issue of selecting an appropriate lag is ignored here; the intention is to use a one-year lag specification when the required capital stock series is completed. Thus for the present results, the 1997 values of the domestic capital stock are used as lagged values for this variable, and are hypothesized as influencing 2002 levels of the domestic stock. Note that there are 44 usable industry-level observations for this initial exercise.

The regression results are generally consistent with a priori expectations. The high F-value and adjusted R-square reflect the validity of the overall relationship, although the inclusion of the lagged capital stock as an explanatory variable accounts much of the variation in the dependent variable. Our primary interest rests on the signs and significance levels of the foreign capital stock variables. Note that these preliminary results indicate that inward FDI stocks have a positive and statistically significant effect on domestic stocks, while outward FDI has the opposite effect. So the interpretation is that inward foreign investment, rather than crowding-out domestic capital, actually stimulates investment in the home economy. This finding is not unique to our study, and suggests that there may be knowledge spillovers and productivity improvements that favourably impact the productivity of domestic stocks. Regarding outbound FDI, the result here implies that much of this investment displaces domestic capital stock. This finding may be explained by a number of (non-competing) contributory factors. First, this might reflect the influence of displaced exports in the wake of horizontally-motivated FDI. Also, to the extent that firms acquire or establish production facilities abroad to take advantage of lower factor costs, vertically-motivated FDI may result in a reduced need to invest in domestic facilities.

The remaining explanatory variables are generally consistent with a priori expectations. Higher profit levels are seen as stimulating investment in the domestic industry. The positive and statistically significant coefficient for the labor variable captures the anticipated complementarity between inputs. Finally, the output variable, although correctly signed, is not statistically significant. This result could be due to the use of “value added output” in lieu of information on the value of intermediate inputs. Overall, however,

the findings suggest that inward FDI stocks may prove beneficial to domestic capital, whereas outbound FDI may have the opposite effect.

In what follows, we extend the analysis by estimating a relationship where domestic investment spending (flows) has replaced domestic capital (stocks). We employ an identical specification otherwise, where lagged (one-year) investment expenditure is now employed as an explanatory variable. Of course, both inward and outward FDI stocks remain as right-hand side variables. Results from this empirical specification are displayed in Tables 2 and 3. Note that these separate tables represent estimates based on 2002 data, followed by results derived from the pooled (2002 & 2007) sample.<sup>3</sup>

Generally, the estimates from these investment equations are strongly supportive of the findings for the capital stock specifications. The coefficients for the inward stock of FDI continue to be positive and statistically significant; this is true for both 2002 sample and the pooled data alike. Note that the magnitudes of the coefficients are very close, with only a slight drop in the significance level for the pooled sample. Also, outward FDI performs in the same manner as it did in the capital stock equation. Here we find that outbound FDI has a negative and statistically significant effect on domestic capital; in the pooled sample, the size of the coefficient and its significance level are both reduced however. Yet overall, the interpretation is that inward foreign investment stimulates domestic capital formation, whereas outward investment has a displacement effect.

The performance of the other explanatory variables in the model is generally robust across specifications and data sets. Not surprisingly, lagged investment is found to have a strong significant impact on current capital spending, and this generally would be expected

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<sup>3</sup> Recall that the original data source contains information on domestic investment expenditure at the appropriate industry level.

in the presence of imperfect capital markets. Note that, for the investment equation using 2002 data (Table 2), the coefficient on the output variable is positive, as expected, but now statistically significant; however, now we find that the labor input variable loses its statistical significance. Generally, the performance of these other variables is worse when using the pooled data; now we find that output, labor and profit rate have no statistically significant effect on investment expenditure. Again, note the robust performance of the variables that capture both the inward and outward stocks of FDI.

## V. SUMMARY AND FUTURE DIRECTIONS

This research has offered some additional, though preliminary, findings concerning the impact of bi-directional FDI stocks on domestic capital formation. More specifically, we utilize 4-digit industry data to examine the relationship between FDI stocks and domestic capital stocks and flows. The results are based on an econometric specification that would ideally be suited to a panel data analysis. In anticipation of these data, we offer some tentative results based on cross-sectional data alone. Generally, the variables posited as influencing gross domestic capital formation perform in accordance with theoretical expectations. The performance of the FDI variables, of course, is our principal interest. We find that inward FDI has a stimulative impact on both domestic capital stocks and investment expenditures within the same industry. On the other hand, outward FDI stocks are associated with a reduction in both domestic capital stocks and flows in a particular industry. This result seems to imply that vertically-driven FDI may be more important than previously thought, thus reducing the need for domestic operations. Indeed, some recent

evidence has suggested a larger role for vertical FDI compared to earlier studies (see Davies, 2008; also, Alfaro and Charlton, 2009).

The direction for one part of the future work with this database is straightforward. Further analysis, based on a larger pooled sample, should be informative. Ultimately, the goal is to estimate our empirical specification through the analysis of panel data. This would be conducted for a consistent sample of industries over a time horizon of ten years, but as captured by only three data years (conforming to the data benchmark years: 1997, 2002 and 2007). Recall that the specification entails the use of lagged values for our dependent variable, so that an appropriate capital stock series is required. Issues pertaining to the use of appropriate panel data techniques loom large, and must be addressed to add validity to our preliminary findings.

Table 1<sup>§</sup>(2002 data; dependent variable= $\ln DK_i$ )

VARIABLE	PARAMETER ESTIMATE
CONSTANT	-0.42139 (0.60)
$\ln DK_{t-5}$	0.83872* (17.76)
$\ln L$	0.16075*** (1.87)
$\ln Q$	0.01113 (0.11)
$\ln \pi$	0.41248*** (1.75)
$\ln FKI$	0.06598** (2.62)
$\ln FKO$	-0.05409*** (2.01)

F-value = 264.43\*

(adjusted) R-square=0.974

N=44

<sup>§</sup>Statistical significance at the 1%, 5% and 10% level represented, respectively, by \*, \*\*, and \*\*\*.

Table 2<sup>§</sup>(2002 data; dependent variable= $\ln KX_i$ )

VARIABLE	PARAMETER ESTIMATE
CONSTANT	-1.78119 <sup>**</sup> (2.11)
$\ln KX_{t-5}$	0.51302 <sup>*</sup> (7.60)
$\ln L$	0.16732 (1.49)
$\ln Q$	0.39683 <sup>*</sup> (2.84)
$\ln \pi$	0.58748 <sup>***</sup> (1.83)
$\ln FKI$	0.1099 <sup>*</sup> (3.69)
$\ln FKO$	-0.10848 <sup>*</sup> (3.27)

F-value = 221.06<sup>\*</sup>

(adjusted) R-square=0.965

N=49

<sup>§</sup>Statistical significance at the 1%, 5% and 10% level represented, respectively, by \*, \*\*, and \*\*\*.

Table 3<sup>§</sup>(2002 & 2007 data; dependent variable= $\ln KX_i$ )

VARIABLE	PARAMETER ESTIMATE
CONSTANT	-0.43003 (0.39)
$\ln KX_{t-5}$	0.57608* (6.19)
$\ln L$	0.21479 (1.43)
$\ln Q$	0.21435 (1.19)
$\ln \pi$	0.50239 (1.05)
$\ln FKI$	0.09487** (2.35)
$\ln FKO$	-0.05899*** (1.66)

F-value = 104.20\*

(adjusted) R-square=0.855

N=106

<sup>§</sup>Statistical significance at the 1%, 5% and 10% level represented, respectively, by \*, \*\*, and \*\*\*.

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