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Inward FDI, Value Added and Employment in US States: A Panel Cointegration Approach

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This study investigates the long-run relationships between inward FDI and economic outcomes in terms of value added and employment at the level of the US states. JOHANSEN's (1988) co-integration technique and TODA and YAMAMOTO's (1995) Granger causality tests are applied to data for the period of 1977 to 2001. We find cointegration as well as two-directional causality between FDI and outcome variables. This holds for both measures of FDI (stocks and employment in foreign affiliates) and independently of whether we consider the states' overall economy or their manufacturing sector.

JEL codes: F23, O18, O51
Keywords: FDI stocks, FDI-related employment, gross state product, manufacturing, Granger causality

1 Introduction

The economic impact of inward FDI in the United States has received scant attention in the literature. This is in striking contrast to the repercussions on US output and employment of outward FDI in less advanced host countries such as China, India and Mexico. This gap is all the more surprising once it is taken into account that inward FDI stocks in the US in 2005 were only 20 percent less than the FDI stocks the US held abroad (UNCTAD 2006, p. 303).

US policymakers obviously expect FDI inflows to help improve income and employment prospects. US states compete aggressively for FDI (GRAHAM and KRUGMAN 1995; CASEY 1998; HEAD, RIES and SWENSON 1999; TORAU and GOSS 2004). For instance, the state of Alabama is reported to have spent US$ 150,000 per job created to attract a new Mercedes plant in 1994 (KELLER and YEAPLE 2003, p. 3). According to the earlier verdict of GLICKMAN and WOODWARD (1989), this is just "a mad scramble for the crumbs."

We perform Granger causality tests within a panel cointegration framework to assess the output and employment effects of FDI at the level of US states.

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This approach appears well suited to address some of the theoretical ambiguities surrounding inward FDI in advanced host countries such as the US, including the direction of causation. Empirically, our analysis complements the regression analysis of MULLEN and WILLIAMS (2005) and the Markov chain approach of BODE and NUNNENKAMP (2007). We find fairly strong evidence of favourable FDI effects on output and employment at the level of US states. At the same time feedback effects play an important role.

2 Analytical Background and Previous Findings

It is for several reasons that positive output and employment effects of FDI in advanced host countries cannot be taken for granted. According to LIPSEY (2002, p. 34), "the benefits to the host country, if they exist, stem mainly from the superior efficiency of the foreign-owned operations." Likewise, GIRMA and WAKELIN (2001, p. 2) stress that the firm-specific assets that multinational companies are supposed to have, provide the theoretical basis for the expectation of spillovers from foreign affiliates. However, the assumption that foreign-owned firms possess superior technology is less compelling, when the host country is among the world's technological leaders.

Technologically advanced countries such as the US should attract a different type of FDI than less developed host countries, namely, an asset seeking rather than an asset exploiting type (DUNNING 1999). Asset seeking FDI, which has also been termed "technology or knowledge seeking FDI" (CANTWELL 1989) is motivated by the investing company's search for knowledge and technologies that are not available in its home country. In other words, the investing company seeks to draw on superior knowledge and technologies, rather than transferring knowledge and technologies from which the host country may benefit through spillovers.

Theoretical predictions become even more ambiguous when assessing the role of FDI at the regional level of highly developed countries. The capital-augmenting effect of FDI should be less relevant than in a developing country context. Capital mobility is considerably higher within the US than across countries, as US financial markets are well developed and the home bias of investors plays a minor role compared to cross-border capital flows.[1]

1 BARRO, MANKIW and SALA-I-MARTIN (1995) point to substantial borrowing and lending across US state borders. The assumption of a closed economy would thus be difficult to justify for US states (see also MULLEN and WILLIAMS 2005). However, FRANCIS, HASAN and WASIMAN (2007) report evidence of a home bias of investments in the US, which is primarily due to a lower effectiveness of external monitoring across larger geographical distances.

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Furthermore, FDI in the US comes largely in the form of mergers and acquisitions (M&As) which, unlike greenfield FDI, amount to a change in ownership of existing production capacity.[2]

Yet, KELLER and YEAPLE (2003) find FDI-related spillovers to be important for the US – even though the productivity of firms in the US is supposed to be higher than in any other country of the world. The explanation offered by KELLER and YEAPLE is that high average productivity of US firms masks substantial heterogeneity across US firms. Heterogeneity may also be relevant with respect to the regional dimension of inward FDI. GIRMA and WAKELIN (2001) offer several arguments why FDI should have a regional dimension. FDI-related spillovers, including demonstration effects, the acquisition of skills as well as technology transfers, are expected to benefit primarily the region where FDI is located. For the United Kingdom, GIRMA and WAKELIN (2001) find indeed that FDI-induced spillovers in the electronics industry are mostly confined to the region where FDI is located (possibly due to lower transport and communication costs within regions).

Concerning economic performance of US states, CRAIN and LEE (1999) employ extreme-bounds analysis to assess the sensitivity of "numerous control variables" identified in earlier studies as potentially relevant: FDI is not considered at all! Two recent exceptions are Mullen and Williams (2005) and BODE and NUNNENKAMP (2007). The former study estimates a neoclassical model of conditional convergence, augmented by FDI as an additional determinant of the steady state income. Employing fixed effects panel regressions, MULLEN and WILLIAMS find FDI to have a significantly positive impact on state income growth. The latter study takes a Markov chain approach to show that (i) both quantitative and qualitative FDI characteristics affect per-capita income and growth, and (ii) FDI has tended to slow down income convergence among US states.

3 Approach and Data

In the following, we subject state-wise FDI measures and economic outcome variables to Granger causality tests within a panel cointegration framework. Given the unit root characteristics of time series variables in general, results based on panel regression analysis are subject to spurious correlation.

2 BOBONIS and SHATZ (2007) note that almost 80 per cent of FDI in the US involved M&As in the period 1980–1996.

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Therefore, a better understanding of FDI-outcome relationships requires complementary analyses that rigorously explore the issue of cointegration as well as the causal relationships between FDI and outcome variables.

Our empirical investigation regarding the association between FDI measures and economic outcomes follows the three step procedure suggested in BASU, CHAKRABORTY and REAGLE (2003). We begin by testing for non-stationarity of our FDI measures and outcome variables in the panel of 48 contiguous US states plus Washington, D.C. Prompted by the existence of unit roots in the time series, we proceed by testing for long-run cointegrated relationships between FDI measures and outcome variables in the second step of our analysis. Given our data properties and the evidence of cointegration in the long-run FDI-outcome relationship across the panel, we employ TODA and YAMAMOTO's (1995) test to uncover Granger causality in the final step of our analysis.

Our approach is restricted to the bivariate relationship between FDI measures and outcome variables. This limitation is fairly common in the relevant literature. The bivariate approach has been used in several recent studies on the causal links between FDI and growth, including CHOWDHURY and MAVROTAS (2006), HANSEN and RAND (2006), HERZER, KLASEN and NOWAK-LEHMANN (2006), and CHAKRABORTY and NUNNENKAMP (2008).[3] The preference for bivariate approaches in the relevant literature is to avoid the complications resulting from indirect causality once so-called auxiliary variables are accounted for in a multivariate framework (DUFOUR and RENAULT 1998). Moreover, the usable sample size tends to shrink considerably when testing for causality in a multivariate system (KÓNYA 2004). Hence, we follow the standard bivariate approach. Our contribution to the existing literature is that we identify the precise direction of causality, for example, between FDI and state income, rather than identifying the relative importance of various possible determinants of state income.

We measure FDI located in the US states in two alternative ways. The first measure, the stock of inward FDI (FDIST), emphasises the monetary dimension of FDI, given by the value of gross property, plant and equipment owned by foreign affiliates in constant prices. FDI stocks are widely used as a measure of inward FDI in the literature (for example, LEICHENKO and ERICKSON 1997; BOBONIS and SHATZ 2007). The second measure, FDI-re-

3 The same applies to related fields. For recent bivariate approaches with respect to causality between exports and growth, see SHARMA and PANAGIOTIDIS (2005) and KÓNYA (2006).

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lated employment (FDIEMP), emphasises the real dimension of FDI, given by the number of employees in foreign affiliates. Both FDI measures are employed for (i) all sectors in US states (FDIST-TOT and FDIEMP-TOT, respectively) and (ii) the manufacturing sector in US states (FDIST-MAN and FDIEMP-MAN, respectively). In this way, we check at least tentatively whether cointegration and causality differ across sectors.[4] The reason for considering two alternative measures of FDI is that measurement is likely to matter for FDI effects (KELLER and YEAPLE 2003). Measurement problems may concern FDI stocks in the first place, even though FDI stocks have been used extensively in the empirical literature on FDI effects. Gross book values of FDI on a historical cost basis may be a flawed indicator of FDI-related activities such as production, sales, value added or employment that may have favourable effects in the host economy.[5]

In the case of FDI stocks, we consider the gross state product of US states in constant prices (GSP) and the value added in manufacturing in constant prices (VAMAN) as outcome variables. Correspondingly, total employment (EMP-TOT) and, respectively, manufacturing employment (EMP-MAN) in US states are employed as outcome variables in our models with FDIEMP-TOT and FDIEMP-MAN. As a result, we estimate two "monetary" models with FDI stocks and value added in either the total state economy or its manufacturing sectors, as well as two "real" models with FDI-related employment and state-wise (total or manufacturing) employment. The question of major interest is how the FDI measure affects the corresponding outcome variable, taking into account that causality may run both ways.

The time series for all variables used range from 1977 to 2001. In line with the relevant literature (for example, MULLEN and WILLIAMS 2005; BOBONIS and SHATZ 2007), we exclude Alaska, Hawaii and Puerto Rico. For these states, the data are deficient due to many outlying and missing observations. We obtain a balanced panel by interpolating and extrapolating some 20 missing (out of 1225) observations for the remaining 48 US states and Washington, DC. All data are drawn from the Bureau of Economic Analysis and the Bureau of Labor Statistics. FDI stock data as well as GSP and value ad-

4 Note that the data situation does not allow for isolating specific sectors other than manufacturing from totals.

5 There is at least some empirical evidence suggesting that FDI is not properly measured by stock data. MAYER-FOULKES and NUNNENKAMP (2005) employ various measures of outward US FDI, including FDI stocks and employment of US affiliates, in a large number of host countries. They find that the growth effects of FDI tend to be understated, compared to almost all alternative measures of FDI, when using stock data. By contrast, the growth effects turn out to be particularly strong when using the employment data of affiliates.

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ded are in constant US$ (million). Employment data refer to the number of persons employed. Appendix 1 provides exact definitions of the variables as well as data sources.

Table 1: IM, PESARAN and SHIN (2003) (IPS) Unit Root Tests

Variable	Levels	N	1st Differences	N
GSP	14.054 (1.000)	1127	-7.464*** (0.000)	1078
VAMAN	7.500 (1.000)	1127	-12.257*** (0.000)	1078
FDIST-TOT	13.441 (1.000)	1127	-7.095*** (0.000)	1078
FDIST-MAN	12.987 (1.000)	1127	-12.750*** (0.000)	1078
EMP-TOT	10.220 (1.000)	1127	-8.566*** (0.000)	1078
EMP-MAN	0.454 (0.675)	1127	-13.278*** (0.000)	1078
FDIEMP-TOT	4.515 (1.000)	1127	-12.998*** (0.000)	1078
FDIEMP-MAN	0.860 (0.805)	1127	-11.449*** (0.000)	1078

H0: unit root. Significance levels: * = 10%, ** = 5%, *** = 1%
IPS w-stats, p-values in parentheses, N = observations

As mentioned before, we first have to check whether our panel is suitable for the cointegration analysis performed below. The variables of interest must be integrated of order one, that is, they are to be ~I(1). Traditionally, the Augmented Dickey Fuller (ADF) test has been employed to test for stationarity of the first differences of the variables under consideration. However, the ADF test was originally meant for single time series and may suffer from low statistical power in panels and small samples like ours. Therefore, we apply the test proposed by IM, PESARAN and SHIN (2003) which is based on the ADF test but overcomes its weaknesses. IM, PESARAN and SHIN's (IPS) test rejects the null of non-stationarity if at least a fraction

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of the series are stationary, thus allowing for individual unit roots and individual intercepts. In our setting with GSP and other outcome variables varying considerably in magnitude across US states, the IPS test is appropriate.

With annual data, the last period is most likely to influence the current period. We include one lag plus a constant to allow for first order serial correlation. The results of the unit- root tests are reported in Table 1. All variables clearly turn out to be ~I(1), that is, they are integrated of order one. With this precondition being met, we proceed with cointegration analysis in the subsequent section.

4 Cointegration and Causality Analysis

Table 2: JOHANSEN (1988) (Trace) Cointegration Tests

Series	coint. relations	trace stats.	N	lags
GSP, FDIST-TOT	0	157.104 (0.000)	980	1-4
	≤1	0.499** (0.480)		
VAMAN, FDIST-MAN	0	129.107 (0.000)	980	1-4
	≤1	0.284** (0.594)		
EMP-TOT, FDIEMP-TOT	0	195.799 (0.000)	980	1-4
	≤1	0.955** (0.328)		
EMP-MAN, FDIEMP-MAN	0	131.721 (0.000)	980	1-4
	≤1	0.239** (0.625)		

Significance levels: * = 10%, ** = 5%, *** = 1%
MacKinnon, Haug and Michelis' (1999) p-values in parentheses, lags in 1st differences

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Next, we aim at uncovering long-run relations between FDI measures and outcome variables, that is, cointegration between the pairs of outcome and FDI variables introduced in Section 3. We employ JOHANSEN's (1988) Trace test to assess whether our (monetary and real) FDI measures reveal stable long-run relations with value added and, respectively, employment in US states' overall economy and/ or their manufacturing sector. The results are reported in Table 2.

The null of no cointegrated relationship is clearly rejected. All pairs of FDI and outcome variables are cointegrated at the five percent significance level. Both FDI measures and the corresponding outcome variables reveal stable long-run relations, irrespectively of whether we regard the economy of US states as a whole or only their manufacturing sector. The finding that cointegration is similarly strong for both FDI measures speaks against the above mentioned concerns that FDI stocks, in particular, may be prone to measurement problems.

While cointegration indicates that our variables of interest are moving together over time, it remains open to question whether FDI actually drives value added and adds to employment. According to GRANGER (1988), cointegration implies causality in least one direction.[6] Consequently, we now turn to Granger causality analysis to detect the direction of impulses. We are interested in the driving forces underlying the long-run relations reported in Table 2. Therefore, we focus on long-run Granger-causality analysis and employ the test suggested by TODA and YAMAMOTO (1995). These authors show that vector autoregressive models (VAR) can be estimated in levels to perform WALD tests even if the time series are non-stationary.

Following TODA and YAMAMOTO (1995), we estimate VAR(p) systems that are asymptotically X^2 distributed to employ WALD tests for k linear restrictions. The lag length p is the sum of k, the lag length indicated by SCHWARZ' information criteria (SBC) and d_{max}, that is, the maximum order of integration, so $p = k+d_{max}$. SBC are reported in Table 3, indicating that k is optimally four for most of our VARs (with one exception of five lags). As discussed above, the maximum order of integration is one (Table 1). Therefore, p equals five and six respectively.

6 Causality in the sense of Granger is defined as an event *b* which precedes event *a*, such that forecasting *a* based on a set of information containing *b* yields better predictors than forecasting without that information contained in *b* (HAMILTON 1994).

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Table 3: SCHWARZ' (1978) Information Criteria (SBC)

VAR	lags	SBC	N
1. GSP, FDIST-TOT	1	20.302	980
	2	20.135	1029
	3	20.150	1078
	4	20.104*	1127
	5	20.128	1176
2. VAMAN, FDIST-MAN	1	17.806	980
	2	17.837	1029
	3	17.871	1078
	4	17.645*	1127
	5	17.801	1176
3. EMP-TOT, FDIEMP-TOT	1	25.098	980
	2	24.743	1029
	3	24.709	1078
	4	24.614*	1127
	5	24.644	1176
4. EMP-MAN, FDIEMP-MAN	1	22.655	980
	2	22.451	1029
	3	22.438	1078
	4	22.231	1127
	5	22.227*	1176

* = smallest value

We include individual, state-specific effects (μ_i) and common time effects (υ_t), following CHAKRABORTY and NUNNENKAMP (2008) in this respect. Hence, our VAR(p)s have the following form:

$$Y = c_0 + \sum_{j=1}^{k+d} Y_{t-j} + \sum_{j=1}^{k+d} X_{t-j} + u_i + \upsilon_t + \varepsilon_{yt}$$

$$X = c_0 + \sum_{j=1}^{k+d} X_{t-j} + \sum_{j=1}^{k+d} Y_{t-j} + u_i + \upsilon_t + \varepsilon_{xt}$$

where Y represents our outcome variables, X the corresponding FDI variables; ε_{yt} and ε_{xt} denote the residuals. OLS may appear to be the "natural estimator" for this specification (MÁTYÁS and SEVESTRE 1996). However, GSP varies considerably across states and over time.[7] Consequently, the as-

7 See also the summary statistics in Appendix 2.

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sumption underlying OLS estimations that the variances remain constant is unlikely to hold. Heteroskedasticity might invalidate OLS results and calls for a robust estimator as an alternative to OLS. We employ a feasible GLS estimator which accounts for heteroskedasticity through adequate transformations. Common time effects are included in order to account for macroeconomic shocks affecting all US states alike.[8]

In line with the above noted SBC and given that $d_{max} = 1$, we estimate VAR(5) and VAR(6) to compute LM~χ^2(p) test statistics which we compare to critical values. The results obtained are reported in Table 4. Most importantly, it turns out that the null of no causality running from FDI to economic outcomes in US states in 1977–2001 is rejected at the one percent level for all four VARs. More specifically, total FDI stocks Granger-cause the GSP of US states to rise (VAR1), and FDI stocks in the manufacturing sector Granger-cause higher value-added in this sector (VAR2). Likewise, total and manufacturing employment in US states is driven by the number of persons employed by foreign affiliates (VAR3 and VAR4).

Table 4: TODA and YAMAMOTO (1995) Causality Tests

VAR	W~χ^2(p)		p	N
1	GSP←FDIST-TOT 29.228*** (15.1)	GSP→FDIST-TOT 19.260*** (15.1)	5	980
2	VAMAN←FDIST-MAN 16.775*** (15.1)	VAMAN→FDIST-MAN 9.893* (9.24)	5	980
3	EMP-TOT←FDIEMP-TOT 28.544*** (15.1)	EMP-TOT→FDIEMP-TOT 30.563*** (15.1)	5	980
4	EMP-MAN←FDIEMP-MAN 26.911*** (16.8)	EMP-MAN →FDIEMP-MAN 15.997** (12.6)	6	931

H0: no causality. Significance levels: * = 10%, ** = 5%, *** = 1%
Critical values in parenthesis, p = restrictions, N = observations

8 Note that US states can reasonably be assumed to share a common level of technology. In other words, production techniques employed in California can be employed in, say, New Hampshire as well. In this respect, our analysis across US states differs from cross-country studies on the output and employment effects of FDI in which technological heterogeneity has to be accounted for.

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Reverse causality is also observed in all VARs. Consequently, bi-directional causality exists for FDI stocks and our monetary outcome-variables, as well as for FDI-related employment and the overall employment situation in US states. Even though all four models reveal essentially the same result of bi-directional causality, the results for the two models of the manufacturing sector differ to some extent: While the feedback relations are highly significant with respect to employment (VAR4), they are relatively weak with respect to value added (VAR2). We return to this issue in Section 5.

5 Interpretation of Major Results

Our central finding that FDI in US states Granger-causes better economic outcomes is strikingly robust throughout all VARs. In some respects, we corroborate the (few) earlier studies on FDI effects at the level of US states, even though these studies take alternative routes with respect to methodology. Most notably, our result of Granger causality running from FDI stocks to the GSP of US states is consistent with MULLEN and WILLIAMS' (2005) regression results. We support the Markov approach of BODE and NUNNENKAMP (2007) in that FDI Granger-causes value added not only for US state economies as a whole but also in their manufacturing sectors.

At the same time, we provide evidence that is complementary to MULLEN and WILLIAMS (2005) as well as BODE and NUNNENKAMP (2007) in one important respect. As reported above, FDI Granger-causes not only value added but also employment – and again in state economies as a whole and in their manufacturing sectors. Finally, it turns out that measurement of FDI hardly matters for Granger causality running to economic outcomes. This is in some conflict with the Markov chain approach of BODE and NUNNENKAMP (2007), who find more favourable FDI effects when measuring FDI by the employment of foreign affiliates operating in US states, rather than FDI stocks located there.

The robust evidence on Granger causality from FDI to economic outcomes in US states may be surprising in the light of the highly ambiguous findings for other host countries reported in studies employing cointegration techniques. HERZER, KLASEN and NOWAK-LEHMANN (2006) estimate vector error correction models for 28 developing countries on a country-by-country basis, and conclude: "In the vast majority of countries, there exits neither a long-term nor a short-term effect of FDI on growth." In a panel cointegration framework, BASU, CHAKRABORTY and REAGLE (2003) find

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bi-directional causality between FDI and GDP for more open developing economies, but no long-run causality from FDI to GDP in more closed developing economies. Likewise, NAIR-REICHERT and WEINHOLD (2001) as well as CHOWDHURY and MAVROTAS (2006) conclude that the causal relationship between FDI and economic growth in developing countries is characterised by a considerable degree of heterogeneity.

One could have expected the opposite pattern, that is, weaker rather than stronger evidence of Granger causality from FDI to economic outcomes for the United States, compared to less advanced host countries. As discussed in Section 2, the motive of foreign companies investing in US states may be drawing on superior technology and knowledge available there, rather than transferring technology and knowledge to US states. Moreover, inward FDI in the United States largely takes place in the context of M&As (BOBONIS and SHATZ 2007). It is often feared that this form of FDI results in replacement effects and labour shedding. Such concerns appear to be unjustified, according to our result that FDI Granger-causes both value added and employment.

In contrast to the United States, however, many less advanced host countries may lack the absorptive capacity to benefit from FDI-related spillovers. The large pool of sufficiently qualified labour that foreign investors can tap in advanced host countries such as the United States rather helps imitation and the acquisition of additional skills, two channels through which host countries may achieve FDI-related productivity gains.[9] Furthermore, as argued by KELLER and YEAPLE (2003), there is substantial heterogeneity across US firms with respect to productivity and, thus, the potential to benefit from technology transfers.[10] According to DOMS and JENSEN (1998), foreign affiliates even tend to have a higher productivity than US firms in the same industry.

Granger causality running from FDI to economic outcomes is clearly of major interest from a policy perspective. But feedback relations are relevant, too. For instance, feedbacks may reveal which US states have better chances to attract FDI in the first place. It generally appears that FDI tends to concentrate in larger and more advanced US states, indicated by GSP and overall labour availability Granger-causing FDI at the one percent level of significance. This finding corroborates earlier studies according to which

9 For a detailed discussion of FDI-related spillovers, see GÖRG and GREENAWAY (2004).

10 On the other hand, KELLER and YEAPLE (2003) share the view that "perhaps a relatively high productivity is required for a firm to acquire FDI related spillovers".

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FDI located in relatively advanced states and where agglomeration economies could be reaped (COUGHLIN, TERZA and ARROMDEE 1991; HEAD, RIES and SWENSON 1995; HEAD, RIES and SWENSON 1999; BOBONIS and SHATZ 2007); it is also in line with BODE and NUNNENKAMP (2007) who concluded that FDI has tended to slow down, rather than fostered income convergence among US states.

Feedback effects are relatively weak, however, in the manufacturing sector of US states. This applies especially to VAR2 in Table 4; feedback effects of value added in manufacturing on FDI in this sector can be observed at the ten percent level of significance only. In other words, FDI in manufacturing appears to be less focused on larger and richer states than FDI in all sectors taken together. This is in some contrast to BODE and NUNNENKAMP (2007), according to whom it does not make much of a difference whether or not the analysis is restricted to FDI in manufacturing. But the weaker feedbacks in manufacturing appear to be in line with CASEY (1998) who observed that foreign investors in manufacturing shifted their attention from large industrial states (California, New York, Texas, New Jersey and Illinois) towards south-eastern states (notably, North Carolina, Georgia and Tennessee) in the 1980s.

The automobile industry in the United States offers an interesting example that helps explain why feedback effects remained weak with respect to value added and FDI (VAR2), even compared to labour availability and FDI in manufacturing (VAR4). Traditionally, the US automobile industry has been strongly concentrated in the Midwestern states of Indiana, Michigan and Ohio (FEDERAL RESERVE BANK OF CHICAGO 2008).[11] While the degree of geographical clustering continues to be high, foreign-owned car assemblers and their suppliers gravitated south and located in states such as Alabama, South Carolina and Tennessee. Greenfield FDI by BMW and Mercedes in Spartanburg (South Carolina) and Tuscaloosa (Alabama), respectively, provided cases in point in the early 1990s.[12] Wages were considerably lower at the southern end of the "auto corridor" (KLIER 1998). For instance, average annual wages of US$ 35,600 in the manufacturing sector of Michigan in 1990 compare with around US$ 23,000 in Alabama, South Carolina and

11 Especially the "Detroit Three" (Chrysler, Ford and General Motors) plus their suppliers contributed to the fact that about half of US automotive employment was still in these three states at the turn of the century.

12 Location choices by Japanese car producers were more ambiguous. For example, frontrunner Honda built its first production facility in Marysville, Ohio, in 1979. The company shifted south to Alabama, North and South Carolina when deciding on additional production facilities about 20 years later. In June 2006, however, Honda announced to build yet another assembly plant in Greensburg, Indiana.

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Tennessee.[13] It appears that foreign investors in the automobile industry made use of agglomeration benefits (for example, in terms of spillovers and relatively low transportation costs) available in the "auto corridor" and, at the same time, exploited labour cost advantages offered by US states at the southern end of the corridor.[14] The preference for lower-cost locations could have weakened the feedback effects from value added to FDI.

6 Summary and Conclusions

Our analysis provides a sharp contrast to the verdict of GLICKMAN and WOODWARD (1989), according to whom the competition for FDI among US states is a "mad scramble for the crumbs." This is even though one would have to figure in the costs involved in competing for FDI, in terms of foregone government revenue and outright subsidies, in order to come up with clear-cut conclusions on the (net) benefits of FDI at the level of US states. The lack of transparency that characterises FDI subsidies renders it almost impossible to account for such costs.

Keeping this caveat in mind, we find fairly strong evidence of favourable FDI effects on output and employment in US states. Applying JOHANSEN's (1988) cointegration technique and TODA and YAMAMOTO's (1995) Granger causality tests to the panel of US states and the years 1977–2001, it turns out that FDI consistently Granger-causes outcome variables. This finding is robust to the measurement of FDI (stocks or employment by foreign affiliates). Likewise, FDI effects are essentially the same when restricting the analysis to the manufacturing sector of US states. It is only with respect to the feedback effects running from outcome variables to FDI that it matters somewhat whether the analysis is performed for all sectors taken together or the manufacturing sector.

Additional insights may be gained by taking the following routes in future research. First, the direction of causality between FDI and outcome variables may be re-assessed in a multivariate framework. Extending the present analysis in this way might offer insights on indirect causality running from FDI through auxiliary variables to economic outcomes, but would

13 Data on wages in the manufacturing sector of US states are available from BEA, Internet: http://www.bea.gov/bea/regional/spi/action.cfm (as of 1 April 2008).

14 This fits into the picture provided by FELICIANO and LIPSEY (1999): Using state and industry-wise data, these authors show that foreign-owned subsidiaries generally pay higher wages than US firms – but not so in manufacturing.

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also raise complex data and methodological issues. Second, it remains open to question what sort of FDI-related spillovers drives the macroeconomic effects of FDI in technologically leading host economies. A more detailed account might start from KELLER and YEAPLE's (2003) observation of considerable heterogeneity in productivity across US firms and should, to the extent possible, differentiate between major types of FDI. Third and most obviously, it would be desirable to replicate the present analysis for other developed host countries of FDI. Again, however, data constraints typically loom large when it comes to the regional distribution of FDI.

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Appendix 1: Definition of Variables and Data Sources

Variable	Definition	Source
GSP	Gross state product; millions of $, deflated by the price index for GDP (2000 =1)	Bureau of Economic Analysis (www.bea.gov)
VAMAN	Value added in manufacturing; millions of $, deflated by US PPI for machinery and equipment (series ID WPU 11 from BLS)	Bureau of Economic Analysis Bureau of Labor Statistics (www.bls.gov)
FDIST-TOT	Gross book value of property, plant and equipment of affiliates in all industries of US states; millions of $, deflated by US PPI for machinery and equipment (series ID WPU 11 from BLS)	Bureau of Economic Analysis
FDIST-MAN	Gross book value of property, plant and equipment of affiliates in the manufacturing sector of US states; millions of $, deflated by US PPI for machinery and equipment (series ID WPU 11 from BLS)	Bureau of Economic Analysis Bureau of Labor Statistics
EMP-TOT	Number of jobs in all industries of US states, full-time plus part-time	Bureau of Economic Analysis
EMP-MAN	Number of jobs in the manufacturing sector of US states, SIC definition	Bureau of Economic Analysis
FDIEMP-TOT	Employment of foreign affiliates in all industries of US states	Bureau of Economic Analysis
FDIEMP-MAN	Employment of foreign affiliates in the manufacturing sector of US states	Bureau of Economic Analysis

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Appendix 2: Summary Statistics

	mean	std. dev.	min.	max.	obs.
GSP	139525	167107.2	7746.46	1287145	1225
VAMAN	17532.43	19394.41	173.81	147574.2	1225
EMP-TOT	2739018	2913541	230589	19700000	1225
EMP-MAN	399014	413015.9	9003	2225545	1225
FDIST-TOT	10174.42	15252.5	49.45	121040	1225
FDIST-MAN	4524.19	6578.66	5.3	60816.9	1225
FDIEMP-TOT	78265	97628.73	730	749400	1225
FDIEMP-MAN	36984	41842	0	248000	1225

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Artikel – Articles

Inward FDI, Value Added and Employment in US States: A Panel Cointegration Approach
Elias Ajaga and Peter Nunnenkamp 347

This study investigates the long-run relationships between inward FDI and economic outcomes in terms of value added and employment at the level of the US states. JOHANSEN's (1988) co-integration technique and TODA and YAMAMOTO's (1995) Granger causality tests are applied to data for the period of 1977 to 2001. We find cointegration as well as two-directional causality between FDI and outcome variables. This holds for both measures of FDI (stocks and employment in foreign affiliates) and independently of whether we consider the states' overall economy or their manufacturing sector.

Wir analysieren in diesem Beitrag die langfristigen Kausalitätsbeziehungen zwischen den ausländischen Direktinvestitionen in den US-amerikanischen Bundesstaaten und der dortigen wirtschaftlichen Performance in Form von Wertschöpfung und Beschäftigung. Wir wenden das Kointegrationsverfahren von JOHANSEN (1988) und die Granger-Kausalitätstests von TODA und YAMAMOTO (1995) auf Daten für den Zeitraum 1977–2001 an. Es zeigt sich Kointegration sowie eine zweiseitige Kausalität zwischen den Direktinvestitionen und den Performance Variablen. Dies gilt für beide Maße der Direktinvestitionen (Kapitalbestände und Beschäftigung in den US-Töchtern der Auslandsunternehmen) und auch unabhängig davon, ob man die gesamte Wirtschaft oder nur das Verarbeitende Gewerbe der US-Staaten betrachtet.

The Significance of Switzerland's Enormous Current Account Surplus
Peter Jarrett and Céline Letremy 369

Switzerland has had a long standing surplus on its current account. But over the past 15 years that surplus has surged to levels unmatched by nearly any other OECD country at any point. This paper looks at the surplus from a balance of payments vantage point as well as from the optic of the excess of national saving over domestic investment. It then seeks possible explanations for the uptrend and assesses whether it results to any extent from market, institutional or policy failures that could call for reforms. A number of important measurement issues are raised. But the key recommendation is that the authorities should prepare for a possible sharp increase in the value of the Swiss franc if and when investors engaged in the "carry trade" unwind their positions. To that end they should examine labor, capital and product markets with a view to ensuring they are as flexible as possible and that factors

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