Does It Matter Where You Come From? Vertical Spillovers from Foreign Direct Investment and the Origin of Investors

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Abstract: This study uses firm-level panel data from Romania to examine whether the origin of foreign investors affects the degree of vertical spillovers from FDI. Investors' origin may matter for spillovers to domestic producers supplying intermediate inputs in two ways. First, the share of intermediates sourced locally by multinationals is likely to increase with the distance between the host and the source economy. Second, the sourcing pattern is likely to be affected by preferential trade agreements. In this case, the Association Agreement between Romania and the European Union (EU) implies that inputs sourced from the EU are subject to a lower tariff than inputs sourced from the United States or Canada. This means that on average American investors may have a greater incentive than EU investors to source from Romania and hence present a greater potential for vertical spillovers. The empirical analysis produces evidence consistent with this hypothesis. The results show a positive association between the presence of American companies in downstream sectors and the productivity of Romanian firms in the supplying industries and no significant relationship in the case of European affiliates. The results also indicate that Romanian firms in sectors whose products are expensive to transport benefit more from downstream presence of American affiliates than Romanian firms in sectors with low shipping costs. No such pattern is found for European affiliates.

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Introduction

Many countries strive to attract foreign direct investment (FDI) by offering ever more generous incentive packages and justifying their actions with the expected knowledge externalities to be generated by foreign affiliates. While the empirical literature searching for FDI spillovers taking place within sectors has produced mixed results in a developing country context,[1] the emerging consensus is that spillovers are more likely to take place through contacts between domestic firms and their multinational customers operating in the same country. Javorcik (2004) and Blalock and Gertler (2008) provide evidence consistent with the presence of positive FDI spillovers working through this channel in Lithuania and Indonesia, respectively.[2] Despite being hugely important to public policy, factors affecting the existence of such externalities are rather poorly understood. In particular, relatively little attention has been paid to how characteristics of FDI projects matter for the extent of vertical spillovers.

This study uses a large panel data set on firms operating in Romania to examine a link between the origin of foreign investors and the degree of vertical spillovers associated with their investment projects. Such a link is likely to exist for three reasons. First, as the theoretical models of vertical linkages predict, the share of intermediate inputs sourced by multinationals in a host country is positively correlated with the distance between the headquarters and the production facilities in the host country (Rodriguez-Clare, 1996 and Markusen and Venables, 1999).[3] A larger share of local sourcing in turn implies more interactions between multinationals and local firms in upstream sectors and a greater potential for knowledge spillovers.[4] Therefore, in the context of Romania we would expect a higher degree of vertical spillovers to be associated

[1] Most of the existing firm-level studies, including Haddad and Harrison (1993) on Morocco, Aitken and Harrison (1999) on Venezuela, Djankov and Hoekman (2000) on the Czech Republic, Konings (2001) on Bulgaria, Poland and Romania, Javorcik (2004) on Lithuania, and Javorcik and Spatareanu (2008) on Romania cast doubt on the existence of intra-industry spillovers from FDI in developing and transition countries. They either fail to find a significant effect or produce evidence of a negative impact the presence of multinational corporations has on domestic firms in the same sector. For a literature review, see Görg and Strobl (2001) and Görg and Greenaway (2004).

[2] For other studies of vertical spillovers see the literature review by Görg and Greenaway (2004).

[3] This prediction is confirmed by empirical evidence. Hanson, Mataloni and Slaughter (2005) demonstrate that sales of intermediate inputs by US multinationals to their overseas affiliates decline with the trade costs. Local sourcing by Japanese investors in the US has been reported to be motivated by high transportation costs due to distance and potential shipping delays from Japan (Chung et al., 2003 and Martin and Swaminathan, 1995). In a recent survey of multinationals operating in the Czech Republic, when asked "Why did you choose to source inputs from a Czech supplier?" over half of the respondents mentioned the importance of proximity to suppliers and the savings on transportation costs while 44 percent of respondents pointed to savings on import duties (Javorcik and Spatareanu, 2005).

[4] See Pack and Saggi (2001) for a model of vertical technology transfer from multinationals to local suppliers.

with American investors than with European multinationals, since home countries of the former are located farther away from Romania.

Second, preferential trade agreements that cover some but not all investors' home countries are likely to affect the sourcing patterns of foreign affiliates. For example, as Romania signed the Association Agreement with the European Union (EU), its tariffs on imports from the EU are much lower than tariffs on imports from the US or Canada. In 1999, the average tariff applied by Romania to manufacturing imports from the US was 15.78 percent whereas the corresponding tariff on imports from the EU was only 4.88 percent.[5] Given this tariff differential, it is much more costly for American affiliates relative to their European counterparts to bring inputs from the home country.

Third, multinationals using Romania as an export platform can enjoy preferential (or even duty-free) access to the EU market provided that a sufficient share of value in their product was added within the area covered by the Agreement. This implies that while for European investors intermediate inputs purchased from home country suppliers comply with the rules of origin, this would not be the case for home country suppliers of American multinationals. Therefore, we expect that American investors would have a greater incentive to source locally and thus their presence would be associated with greater knowledge spillovers to Romanian firms in the supplying sectors.[6]

Anecdotal evidence also suggests that investors' origin may indeed affect the extent of local sourcing in Eastern Europe. For instance, when a US investor, General Electric, took over a Hungarian light-source producer, Tungsram, it retained local content of the production above 60% (Newton Holding, 2003). Likewise, Procter & Gamble Romania "has developed close relations with Romanian suppliers and has helped them grow and improve production quality"

[5] Source: WITS database. The figures in the text refer to simple averages which were calculated based on the tariff data for 8- (for EU) or 6-digit (for US) HS categories. Manufacturing sectors are defined as HS 25-97.

[6] This may not be true of all American investors as many of them may still choose to import their inputs from countries covered by the Agreement. Similarly, a certain number of European investors are likely to engage in local sourcing. Nevertheless, we would expect to observe a broad pattern along these lines. Overall, we expect that importing intermediate inputs would be more advantageous to European investors than to other multinationals as European investors may benefit from volume discounts by combining sourcing for their headquarters, Romanian plants and possibly sister companies in other Europe countries. As pointed out by UNCTAD (2001, p. 136), centralized or pooled group-sourcing arrangements may encourage affiliates to use foreign sources even when local suppliers are available. In a survey conducted in the Czech Republic, Javorcik and Spatareanu (2005) found that 46 percent of multinationals operating there imported their inputs in order to source from global suppliers of the parent company and 37 percent of respondents were obliged to do so by their parent company.

(Rompres, 21 October 2004).[7] On the other hand, after a German company, Volkswagen, invested in Skoda Motor Company in the Czech Republic, it drastically reduced the number of suppliers. The company explicitly stated that it wished to concentrate on only ten suppliers that would provide sub-assemblies (Martin, 1998). Similarly, when the French multinational, Renault, purchased an equity stake in Dacia, the Romanian car maker, in 1999, it promised to continue sourcing inputs from local suppliers provided they lived up to its expectations. This, however, does not seem to have been the case. In 2002, eleven foreign suppliers of the French group were expected to start operating in Romania, thus replacing the Romanian producers from whom Dacia used to source.[8]

To test our hypothesis we relate the total factor productivity (TFP) of Romanian manufacturing firms to proxies for the presence of foreign affiliates from different regions of the world in downstream industries. Our sample includes information on 13,389 Romanian firms with sufficiently complete information to allow us to estimate their TFP. These firms operate in 52 manufacturing industries. Our data is an unbalanced panel covering the period 1998-2003. The data are obtained from a commercial database Amadeus. TFP is derived from production functions estimated separately for each of the 52 manufacturing industries using two approaches: a log-linear Cobb-Douglass specification and the semi-parametric method suggested by Ackerberg, Caves and Frazer (2006) which corrects for the simultaneity between productivity shocks and input choices.

A unique feature of the Amadeus database is the availability of detailed information on firm ownership structure, including the country of origin of each shareholder. Thus we are able to calculate proxies for foreign presence in downstream sectors separately for European and American affiliates. These proxies are based on information about foreign affiliates in all sectors, not just manufacturing industries.

Our results can be summarized as follows. We find a statistically significant and positive association between the presence of American companies in downstream sectors and the productivity of Romanian firms in the supplying industries. There is no indication, however, that the productivity of Romanian firms is affected by operations of European investors in downstream industries. The difference between the two effects is statistically significant. These

[7] In this case, spillovers will take place only if the value of assistance extended to local suppliers is not reflected in lower prices of inputs obtained from them.
[8] Ziarul Financiar (Financial Newspaper) April 19, 2001.

results are robust to using different cut-offs to define foreign affiliates, to conducting the analysis at the regional level and to long differencing.

To eliminate the possibility that the results are driven by differences in sophistication levels between foreign affiliates of different origin, we show that the results are robust to controlling for the productivity level of foreign investors relative to their Romanian counterparts.[9] We also demonstrate that there is no statistically significant difference in productivity levels of American and European investors.

If the differences we find in the data are attributable to a greater involvement in local sourcing by American investors, then we should observe that vertical spillovers from American FDI are larger in sectors with higher transport costs. In other words, Romanian firms in sectors producing goods that are expensive to transport should benefit more from downstream presence of American affiliates. As we show in our analysis, this is indeed the case. Spillovers from American FDI are larger in the supplying industries whose products are more costly to transport. No such pattern is found for European FDI. This result is robust to using several measures of transport costs.

We conclude that the patterns observed in the data are consistent with our hypothesis that FDI inflows from far away source countries which are not part of the preferential trade agreement are more likely to be associated with local sourcing and thus lead to vertical productivity spillovers taking place through contacts with local suppliers of intermediate inputs. Although one may be tempted to advise the Romanian investment promotion agency to focus on attracting American FDI, we will stop short of doing so. Benefiting from knowledge spillovers is only of the reasons why countries wish to attract FDI (employment creation, tax revenues being among other potential reasons). Thus it would not be prudent to make policy recommendations without considering all of the effects FDI presence has on the host country.

This paper is structured as follows. In the next section, we briefly discuss FDI inflows into Romania. Then we present our data, estimation strategy and the empirical results. The last section concludes.

[9] On the one hand, it is possible that Romanian firms may find it difficult to supply foreign investors exhibiting higher productivity as they may require more sophisticated inputs. On the other hand, such investors may present a greater potential for knowledge transfer to their suppliers.

FDI in Romania

Compared to other Central and Eastern European countries Romania was a late bloomer as an FDI destination in the region. The Romanian government's cautious approach to privatization and to transition in general had led to relatively slow FDI inflows during the early 1990s. The situation changed dramatically in 1997 when substantial privatization efforts along with changes in the legislative framework provided new opportunities for foreign investors. As a result, the volume of FDI inflows in 1997 and 1998 was thirteen and twenty-one times larger, respectively, than the amount received in 1993. During the period covered by our study, 1998-2003, Romania received 8.3 billion dollars in FDI inflows which translated into 377 dollars of FDI inflows per capita (see Table 1).

According to the Romanian Agency for Foreign Investments, the Netherlands were the largest FDI source country, followed by France, Germany and the US. European and Turkish investors accounted for 71% of the investment value, while American investors were responsible for almost 7.4%. The share of Asian countries at 3.7% was quite small, with Korea, China and Syria being the largest investors. The remaining share of FDI originated in offshore tax havens, such as Netherlands Antilles, Cyprus or British Virgin Islands or it was not possible to make a determination.

Data Description

The data used in this study come from a commercial database Amadeus compiled by Bureau van Dijk, which contains comprehensive information on companies operating in 35 European countries, including Romania. In addition to standard financial statements, Amadeus includes detailed information on the ownership structure of firms which allows us to determine the amount and the country of origin of the foreign equity stake in each company. While information on the foreign equity share is not difficult to find, knowing the source country of the foreign capital is a unique feature of our data set. As each release of Amadeus contains only the latest available ownership data, we relied on multiple releases when constructing a panel of ownership information. In cases where it was not possible to infer from Amadeus the date of foreign investor’s entry, we obtained additional information from the Romanian Chamber of Commerce and Industry, which is the agency responsible for collecting such information in

Romania. We were able to construct ownership information for the period 1998-2003. A detailed description of the procedure used is presented in Appendix I.

In our analysis, we relate the total factor productivity of Romanian firms in manufacturing industries to foreign presence in downstream sectors. We start with a sample of 59,535 manufacturing firms, an unbalanced panel for years 1998-2003. We drop observations which are missing the information necessary to estimate TFP, and we remove outliers.[10] This leaves us with 13,389 Romanian firms, 3,421 foreign affiliates (defined as having foreign equity share of at least 10 percent) and 773 firms whose ownership is not known, or the total of 17,583 firms for which we can estimate TFP. This translates into 45,864 firm-year observations pertaining to Romanian firms or between 6,724 and 8,720 observations per year. Using a specification in which independent variables are lagged by one period gives us the final sample of 39,140 observations for Romanian firms.

When calculating proxies for vertical spillovers from FDI we want to use the most complete information possible. Thus we use all 105 sectors (rather than just 52 manufacturing industries). We drop observations with negative output figures, and we interpolate missing values of firm output. This allows us to employ information on output of 369,266 firms, 59,535 of which operate in manufacturing sectors. We define firms as foreign owned if the share of foreign capital is at least 10 percent. The sample includes 22,278 European affiliates, 1,662 American affiliates and 6,881 Asian affiliates.

We also employ annual input-output matrices provided by the Statistical Office of Romania. Each input-output matrix covers 105 sectors and each firm in our data set is matched with the IO sector classification based on its primary three-digit NACE code.

Empirical Analysis

Estimation strategy

To examine the effect of foreign presence on the productivity of domestic firms, we proceed in two steps. First, we estimate sector-specific production functions to obtain measures of the total factor productivity. Then, we relate the TFP to proxies for FDI spillovers. We obtain TFP by estimating a log-linear transformation of a Cobb-Douglas production function:

[10] Firms in the top and bottom one percentile of all firm-specific output and input variables were deleted from the sample.

$$\ln Y_{it} = \alpha + \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_M M_{it} + \varepsilon_{it} \quad (1)$$

where subscripts *i* and *t* refer to firm and year, respectively. Y_{it} stands for firm's output, M_{it}, K_{it}, L_{it} and represent production inputs: materials, capital and labor. We define firm's output as turnover deflated by industry-specific producer price indices at the two-digit NACE classification. Material inputs are deflated by a weighted average of the producer price indices of the supplying sectors. The weights are given by the annual input-output matrices and represent the proportion of inputs sourced from a given sector. We measure labor by the number of employees. Capital is proxied by the value of tangible fixed assets deflated using the GDP deflator. For each of the 52 manufacturing sectors (defined based on the classification used in the input-output matrices) a separate production function is estimated.

As an alternative way of estimating TFP, we employ the semi-parametric approach suggested by Ackerberg, Caves and Frazer (2006) who build on the work of Olley and Pakes (1996) and Levinsohn and Petrin (2003). Their approach addresses colinearity problems that may be affecting the latter methods. This approach allows us to take into account the possibility that a firm's private knowledge of its productivity (unobserved by the econometrician) may affect the input decisions. The method allows for firm-specific productivity differences that exhibit idiosyncratic changes over time and thus addresses the simultaneity bias between productivity shocks and input choices. Since our study relies on correctly measuring firm productivity, obtaining consistent estimates of the production function coefficients is crucial to our analysis. As recommended by Ackerberg et al., we apply their method to value added production functions specific to each of 52 manufacturing industries.[11]

In the second step, we relate the estimated TFP to the proxies for foreign presence in the same sector and in downstream industries. Since knowledge externalities from the foreign presence may take time to manifest themselves, we lag these variables one period. We control for the level of competition in industry *j* with a Herfindahl index. We estimate a specification in levels including firm (α_i) and time (α_t) fixed effects:

$$\ln TFP_{it} = \alpha_i + \beta_1 \text{Vertical\_European}_{jt-1} + \beta_2 \text{ Vertical\_American}_{jt-1} + \beta_3 \text{Horizontal}_{jt-1} + \beta_3 \text{Herfindhal}_{jt-1} + \alpha_t + u_{it} \quad (2)$$

as well as specifications in long differences. We correct standard errors for a correlation between observations belonging to the same industry in a given year.

[11] We are grateful to Caroline Villegas-Sanchez for sharing her code implementing Ackerberg et al.'s method.

The variable $Horizontal_{jt}$ is defined as the share of an industry *j*'s output produced by firms with at least 10 percent foreign equity where sectors *j* correspond to the classification used in Romanian input-output matrices. It is a sector-specific time-varying variable.

The variable $Vertical_{jt}$ is a proxy for the foreign presence in downstream sectors (i.e., sectors supplied by the industry *j*) and thus is intended to capture the effect multinational customers from a particular region of origin have on domestic suppliers. Following Javorcik (2004), it is defined in the following way:

$$\text{Vertical\_Origin}_{jt} = \Sigma_{k \neq j} \alpha_{jkt} \text{ Horizontal\_Origin}_{kt} \quad (3)$$

where α_{jkt} is the proportion of sector *j*'s output used by sector *k* taken from the input-output matrix pertaining to year *t*.[12] We calculate three measures of *Vertical* for three regions of origin of foreign investors: Europe, America and Asia.[13] Europe encompasses investors from all European countries (EU members, accession countries and non-members) as well as Turkey.[14] America includes both North and South America, but the grouping consists primarily (93%) of US and Canadian investors. In the baseline specification, we also include a proxy for Asian FDI but given the fact that Asian FDI primarily originates in developing countries and thus presents little potential for technology transfer we exclude it from the subsequent analysis.[15] In the baseline specification, we find no evidence of spillovers being associated with Asian FDI.

Foreign affiliates can be found in all of the sectors considered, accounting on average for 27 percent of sectoral output (29% in manufacturing). Foreign presence has been growing over time with the value of the *Horizontal* variable increasing from 16% in 1998 to 30% in 2000 and 33% in 2003. There is a large variation in foreign presence across sectors ranging from under one percent in several extractive industries to more than two-thirds of output in manufacturing of ceramic tiles, cement, domestic appliances and TV, radio and communications equipment as well as tele-communications.

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[12] In calculating α_{jk} sector *j*'s output sold for final consumption was excluded.

[13] We drop firms with foreign shareholders of multiple origins.

[14] Turkey has been classified as a European country because of its proximity and the fact that in 1995 it formed a Customs Union with the EU.

[15] The top source countries of Asian FDI are as follows: China (41% of Asian investors), Syria (13%), Iraq (11%), Lebanon (8.5%), Israel (7.7%), Iran (7.3%), Jordan (4.8%), Pakistan (2%), Vietnam (1%), India (0.6%). This group of source countries is a legacy of Romanian political and commercial ties during the Nicolae Ceausescu era. There are very few Asian investors originating in developed countries. This groups consists of Japanese investors (0.59% of Asian investors), Israelis (7.74%) and Koreans (0.25%).

As illustrated in summary statistics presented in Table 2, American and Asian affiliates tend to be less prevalent than European ones, which is not surprising given Romania's geographical location. The average values of the *Vertical_American* and *Vertical_European* variables are 0.014 and 0.147, respectively. The extent of Asian presence in downstream sectors is similar to that of American FDI.

In order to identify the effects of *Vertical_European* and *Vertical_American*, we rely on the variation in growth rates of European and American presence in downstream sectors. Therefore, we make sure that both variables are defined (i.e., non-missing) in all sectors considered and that they vary over time. As illustrated in Appendix II, which plots values of each variable across time for each sector, there are large differences in the evolution of both variables across sectors.

The model specified in equation (2) is estimated on the sample of Romanian firms, since we are primarily interested in the effect of foreign presence on domestic producers.[16] Restricting our attention to domestic establishments also allows us to avoid a potential bias stemming from the fact that foreign investors tend to acquire stakes in large and most successful domestic companies (see Arnold and Javorcik, 2009, for a literature review).

Baseline results

First, we present the results from the baseline specification with firm fixed effects, which uses the TFP from OLS estimations (see columns 1-4 in Table 3). The estimates lend support to our hypothesis. Consistent with our expectations, we find that the productivity of Romanian firms is positively correlated with the presence of American investors in downstream sectors. That is, a higher share of American companies among potential buyers of intermediate inputs is associated with a greater productivity of domestic producers of such inputs. The estimated coefficient is significant at the five percent level when entered alone as well as in the full specification. Further, as anticipated, the results indicate that there is no statistically significant relationship between the extent of operations of Asian firms in sectors purchasing intermediates and the productivity of Romanian firms in the supplying industries. Similarly, no statistically significant relationship is found for European affiliates in downstream industries. The difference

[16] Firms with foreign equity share below 10% are considered as Romanian.

between the effects associated with American and European investors is statistically significant at the five percent level. The same is true of the difference between the effects of American and Asian FDI. We find no evidence of positive spillovers taking place within industries, which is consistent with the conclusions of the existing literature.

Next, we take into account the simultaneity between productivity shocks and input choices by applying Ackerberg et al.'s approach to TFP estimation (hereafter referred to as the ACF TFP). The findings, presented in last four columns of Table 3, confirm our previous results. We find a positive correlation between the presence of American affiliates in downstream sectors and the productivity of Romanian firms in the supplying industries. No statistically significant effect is detected for Asian investors in downstream sectors. The proxy for spillovers from European FDI is statistically significant only when it enters alone, but not in the full specification. The difference between the effects associated with investors of American and European origin (and American and Asian origin) is statistically significant at the one percent level. As before, there is no evidence of productivity spillovers from foreign presence in the same sector.

The magnitudes of the estimated effects are economically meaningful. A one standard deviation increase in the presence of American FDI in downstream industries leads to a 2 percent (OLS TFP) or an 11 percent (ACF TFP) increase in the TFP of Romanian firms in the supplying sectors.[17] For comparison, Javorcik (2004) found that one standard deviation increase in the presence of FDI in downstream industries was associated with a 15 percent increase in the TFP of Lithuanian firms in the supplying sectors.

Given that Asian investors come from developing countries which are unlikely to be a source of technology transfer and the lack of evidence that they generate externalities to the supplying sectors, we exclude the proxy for Asian FDI from the analysis.[18] Including it would not change the results of the study. To save space in the subsequent analysis we also restrict our attention to the ACF TFP measure.

[17] These calculations correspond to columns 4 and 8 in Table 3.

[18] The limited potential of Asian affiliates for generating spillovers is also supported by the finding that Asian affiliates tend to exhibit on average 12 to 16 percent lower TFP than European or American investors (see Appendix III).

Robustness checks

In our analysis, foreign affiliates are defined as firms with at least 10 percent of foreign equity share. A potential concern is that a small ownership share gives a foreign investor little control over the firm and reduces incentives for technology transfer. Therefore, in the next exercise, we calculate proxies for foreign presence using a 50 percent and a 100 percent cut-off. As illustrated in Table 4, changing the cut-offs has little effect on the estimated coefficients. In all six specifications, we find evidence consistent with positive spillovers from American affiliates to the supplying industries. Only in one of six specification, the estimated effect of European FDI is positive and statistically significant. The difference between the coefficients on American and European proxies is statistically significant at the one percent level in all cases.

The size of Romania (the area of 92,043 square miles and 21.7 million inhabitants in 2002) allows us to exploit the geographic variation and conduct our analysis at the regional level. We use the Nomenclature of Territorial Units for Statistics (NUTS) classification which is a geocode standard for referencing the administrative division of countries for statistical purposes. This standard was developed by the EU and covers the member states as well as recent accession countries. There are 8 NUTS regions in Romania with an average population of 2.8 million inhabitants.[19] We compute each spillover proxy for the region where the firm operates as well as for the remaining regions. When considering the share of output produced by foreign firms in the same industry and the same region, we exclude the output of the Romanian firm in question from the denominator. To define foreign affiliates we use the baseline cut-off of 10 percent of equity as well as a 50 percent cut-off.

The results, presented in Table 5, support our earlier conclusions. We find strong evidence suggesting that the presence of American affiliates leads to productivity spillovers to Romanian firms in the supplying sectors. This effect does not appear to be confined to the region where foreign affiliates operate. We find very little evidence suggesting that similar spillovers originate in European affiliates. The difference between the coefficient on proxies for American and European presence in downstream sectors are statistically significant.[20]

In Table 6, we check the robustness of our results with respect to long differencing (1999-2003). Although long differencing severely reduces the size of our sample, it provides

[19] These are: Bucuresti-Ilfov, North East, South East, North West, South West, South, West and Center.

[20] A lower number of observations in the full specification reflects that fact that constructing the lagged value of *Horizontal_own_region* requires information on output of the firm in question in the previous period. This restriction leads to a decline in the sample size.

strong support for our hypothesis. The relationship between American FDI and the productivity of Romanian firms in the supplying industries is positive and statistically significant at the one percent level in all specifications. We find no evidence of similar spillover effects being associated with European FDI.

In regressions not reported to save space we also show that our conclusions are robust to dropping small Romanian firms from the sample. More specifically, we re-estimate our baseline specification with ACF TFP dropping firms with fewer than ten or fewer than twenty employees. Doing so does not change the signs or the significance pattern of the estimated coefficients and has very little effect on their magnitudes.

Finally, we also check (though do not report the estimates to save space) that our results are robust to narrowing the definition of vertical variables to foreign affiliates present only in manufacturing sectors.

Controlling for productivity of foreign affiliates

It is conceivable that our findings could be driven by differences in characteristics of European and American investors affecting their potential for knowledge spillovers. For instance, one could argue that foreign affiliates with more sophisticated technologies require more sophisticated inputs which Romanian firms may be unable to provide. If that's the case, the presence of such investors would not result in any spillovers to upstream industries. Alternatively, one could argue that if Romanian firms are able to supply foreign affiliates, affiliates with more sophisticated technologies present a greater potential for knowledge spillovers to upstream sectors.

A simple regression comparing the productivity levels of foreign affiliates of various origins does not reveal any statistically significant differences between American and European investors. In this exercise, presented in Appendix III, we regress the log TFP (either OLS or ACF TFP) on the dummy for American affiliates and a dummy for Asian affiliates controlling for industry, year and region fixed effects. European affiliates are the omitted category.[21] The exercise is conducted on the full sample as well as on subsamples of manufacturing and services

[21] The sample includes 14, 239 observations pertaining to European affiliates, 1,190 to American affiliates and 793 to Asian affiliates. The number of investors in the sample is reduced compared to the figures listed in the Data section due to missing values on variables required to estimate the TFP.

industries.[22] In none of the six specifications is the dummy for American affiliates statistically significant suggesting that there are no systematic differences in the performance of European and American investors. As discussed earlier, the results suggest that Asian affiliates tend to exhibit on average lower TFP than investors of other nationalities.

Nevertheless, to shed some light on the possibility that investor sophistication matters for the extent of spillovers we normalize the ACF TFP of each foreign affiliate by the median ACF TFP of Romanian firms operating in the same industry in the same year.[23] Then, we calculate the median value of the relative TFP for foreign investors in each industry and year. Finally, we weight the median value of the relative TFP of foreign investors in downstream sectors by the annual input-output coefficients:

$$Vertical\_TFP_{jt} = \Sigma_{k \neq j} \alpha_{jkt} (Median\_relative\_foreign\_TFP_{kt}) \quad (4)$$

Vertical_TFP thus captures the productivity advantage of foreign affiliates operating in downstream sectors relative to their median Romanian counterpart. We also use an alternative definition based on means instead of medians.

$Vertical\_TFP_{jt}$ enters the model as an additional regressor. While the variables *Vertical_European* and *Vertical_American* capture the extent to which each type of FDI is present in downstream sectors, *Vertical_TFP* is a proxy for the sophistication of foreign affiliates in downstream sectors (relative to Romanian firms in these industries) which may influence the affiliates' ability to find suitable inputs in Romania and/or their ability to transfer knowledge to local suppliers.

Adding this additional control variable, however, does not change our earlier results. As we can see in Table 7, *Vertical_TFP* never reaches conventional significance levels (regardless of whether its definition is based on medians or means). As before, we find a positive coefficient on the proxy for American presence in sectors purchasing intermediates. The coefficient is statistically significant in all specifications. The proxy for the presence of European investors in sourcing sectors or for FDI in the same industry never appear to be statistically significant. The difference between the effects associated with American and European investors is statistically significant in all cases.

[22] The sum of observations in the manufacturing and the services subsamples is smaller than the number of observations in the full sample because the full sample also includes extractive industries, agriculture, forestry, etc.
[23] More specifically, we take a log difference of the two values.

Are vertical spillovers affected by industry-specific transport costs?

The main hypothesis of our study is that American FDI leads to larger spillovers to Romanian firms in the supplying sectors (when compared to European FDI) because American firms have a greater incentive to source inputs locally due to the high cost of bringing such inputs from home. If this hypothesis is true, we should observe that vertical spillovers from American FDI are larger in sectors with higher transport costs (i.e., *ceteris paribus* Romanian firms in sectors producing goods that are expensive to transport should benefit more from downstream presence of US FDI).

To examine this issue, we add to our specification interaction terms between proxies for vertical spillovers and sector-specific transport costs. We use several measures of transport costs. The first measure pertains to US imports from 16 Eastern European countries. It is defined as the cost of all freight, insurance and other charges (excluding U.S. import duties) expressed as a percentage of the value of imports. The underlying assumption is that the cost of bringing goods from the US to Eastern Europe is the same as shipments in the opposite direction. The data are available from the US International Trade Commission in the six-digit NAICS classification, which we concord with four-digit NACE using the concordance from the US Census Bureau. We use the mean (or the median) cost for the period 1998-2003 for each three-digit NACE industry, which is the industry classification in our data set. As this measure is time invariant, it does not need to enter the specification alone because of the inclusion of firm fixed effects. As an alternative to using the continuous measure, we also define a dummy variable for sectors with transport costs above the median value.

The next set of proxies for transport costs comes from the data set assembled by Hummels (2007) pertaining to shipping costs incurred by US worldwide imports. We use figures on (i) costs of shipping consumer goods, (ii) costs of air shipments, and (iii) costs of ocean shipments. The figures are expressed as percentages of the shipment values. Again we use the average value for 1998-2003.[24]

The results for the first measure of transport costs based on US imports from Eastern Europe lend support to our hypothesis (see Table 8 columns 1-4 for the results based on the

[24] The original data are available for each exporting country. We take the mean for transport costs and shipment values for each five-digit SITC code over all countries. We calculate the ratio of transport costs to the value of shipments. We drop the top and bottom one percent of observations. We calculate the mean value for each five-digit SITC codes which we concord with the Romanian industry classification. Finally, we calculate the mean value for each industry for the 1998-2003 period.

mean transport cost and columns 5-8 for the results based on the median value). As expected, we find a positive and statistically significant coefficient on the interaction term between *Vertical_American* and the industry-specific transport cost in the most parsimonious as well as in the full specification. The coefficient on the stand alone *Vertical_American* is negative and statistically significant in 4 of 6 specifications. The model presented in the 4th column of the table suggests that the overall effect of American FDI in downstream sectors is positive for sectors with transport costs exceeding 6.54 percent of the shipment value or for about 70 percent of all observations in the sample.[25]

A strikingly different pattern is found for European FDI. In the specifications including just *Vertical_European* and its interaction term, the former bears a positive statistically significant coefficient while the interaction term is not statistically significant. This suggests that the extent of spillovers associated with European FDI in downstream sectors is not sensitive to transportation costs. The full specification suggests that spillovers from the presence of European FDI decrease with transportation costs.

In Table 9, the continuous variable is replaced with a dummy taking on the value of one in sectors with transport costs above the median, and zero otherwise. The estimation results suggests that spillovers from American FDI in downstream sectors are present only in industries with high transport costs, while the effect of European FDI is not robustly affected by transport charges. The F-test suggest that the difference between the effects of American and European affiliates on Romanian firms in the supplying industries with high transport costs is statistically significant. No significant difference is found for the American and European presence in general.

The results in Table 10 based on worldwide transport costs incurred by US imports lead to similar conclusions. Regardless whether transport costs are proxied by the overall transport charges, charges for air transport or charges for ocean transport, we find that Romanian firms in sectors whose products are expensive to transport benefit more from spillovers from American FDI in downstream industries than Romanian firms in sectors with low shipping costs. In the case of European FDI no statistically significant differences are detected for sectors with high and low transport costs.

[25] Negative spillovers may take place if foreign investors enter the country through acquisitions of Romanian firms and sever the linkages between the acquired firms and their local suppliers. This may cause a large drop in the demand faced by firms in the supplying industry and thus increase their average cost.

In sum, the results from Tables 8-10 lend support to our hypothesis that the differential effect of American and European FDI on the supplying sectors is driven by their incentives to source inputs locally due to differential transport costs that would need to be paid to obtain such inputs from the home country.

Conclusions

This study uses a firm-level panel data set from Romania to examine whether the origin of foreign investors affects the degree of vertical spillovers from FDI. Foreign investors' country of origin may matter for spillovers to domestic producers in upstream sectors (supplying intermediate inputs) in several ways. First, the share of intermediate inputs sourced by multinationals from a host country is likely to increase with the distance between the host and the source economy. Second, preferential trade agreements of which some but not other investors are members are also likely to affect the sourcing patterns of foreign affiliates. In our case, the Association Agreement signed between Romania and the EU implies that inputs sourced from the European Union are subject to lower tariffs than those purchased from the US or Canada. Further, while for European investors intermediate inputs sourced from home country suppliers comply with the rules of origin and thus products in which they are incorporated can be exported to the EU on preferential terms, this would not be the case for home country suppliers of American multinationals.

Therefore, while for European investors the benefits of volume discounts stemming from using parent company's suppliers in the home country are likely to outweigh the import costs, and the opposite is likely to be the case for American investors. For this reason, we expect that American investors have on average a greater incentive to source inputs in Romania than do European multinationals. A larger share of local sourcing implies more contacts between multinationals and Romanian firms in upstream sectors and thus a greater potential for knowledge spillovers. Thus our hypothesis is that (relative to European FDI) American investment is likely to be associated with greater knowledge spillovers to Romanian firms in the supplying industries.

Our empirical analysis produces evidence in support of this hypothesis. We find a statistically significant and positive association between the presence of American companies in downstream sectors and the productivity of Romanian firms in the supplying industries. The data

also indicate that operations of European investors in downstream sectors are not correlated with the productivity of Romanian firms in the supplying industries. The differences between the effects stemming from investors of different origin are statistically significant. More importantly, we find that the different extent of vertical spillovers associated with American and European FDI is systematically related to sector-specific transport costs. Romanian firms in sectors whose products are expensive to transport benefit more from downstream presence of American FDI than other firms. In the case of European FDI, the magnitude of spillovers to the supplying sectors is not systematically related to the shipping costs.

We conclude that the observed pattern is consistent with our hypothesis that FDI inflows from far away source countries are more likely to be associated with positive vertical spillovers. Thus in sum, the origin of foreign investors does seem to matter for FDI spillovers.

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Table 1. FDI Inflows into Central and Eastern European Countries 1998-2003

	FDI inflow (millions of US dollars)							FDI/ population (US$)
	1998	1999	2000	2001	2002	2003	1998-2003	1998-2003
Poland	6,365	7,270	9,343	5,714	4,131	4,123	36,946	957
Czech Republic	3,700	6,313	4,987	5,641	8,497	2,021	31,158	3,044
Hungary	3,343	3,308	2,770	3,944	3,013	2,202	18,580	1,830
Romania	2,031	1,041	1,037	1,157	1,144	1,844	8,254	377
Croatia	932	1,464	1,085	1,338	1,213	2,133	8,165	1,805
Bulgaria	537	819	1,002	813	905	1,419	5,495	701

Source: IMF International Financial Statistics

Table 2. Summary Statistics

Variable	Obs	Mean	Std. Dev.
ln(TFP OLS)	39,140	3.44	1.11
ln(TFP ACF)	39,140	6.75	1.32
Vertical European	39,140	0.147	0.054
Vertical American	39,140	0.014	0.008
Vertical Asian	39,140	0.016	0.008
Horizontal	39,140	0.289	0.155
Herfindahl	39,140	0.031	0.056
Vertical European 50%	39,140	0.126	0.048
Vertical American 50%	39,140	0.012	0.008
Horizontal 50%	39,140	0.252	0.157
Vertical European 100%	39,140	0.061	0.029
Vertical American 100%	39,140	0.009	0.007
Horizontal 100%	39,140	0.126	0.108
Transport cost (ITC mean)	32,591	8.53	3.19
Transport cost (ITC median)	32,591	8.32	3.17
Transport cost (consumer goods)	36,150	8.12	2.90
Transport cost (air)	36,150	17.09	7.78
Transport cost (maritime)	36,150	6.23	1.85

Table 3. Baseline Specification

	OLS TFP				ACF TFP			
Vertical European (lag 1)	0.377			0.145	2.341**			1.015
	[0.232]			[0.235]	[0.837]			[0.846]
Vertical American (lag 1)		2.773**		2.537**		15.587***		13.663***
		[1.040]		[1.106]		[3.717]		[4.084]
Vertical Asian (lag 1)			-0.201	-0.254			2.285	1.908
			[0.713]	[0.716]			[2.180]	[2.128]
Horizontal (lag 1)				0.016				0.407
				[0.072]				[0.304]
Herfindahl (lag1)				-0.291				-2.097*
				[0.364]				[1.182]
R-squared	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02
No. of observations	39140	39140	39140	39140	39140	39140	39140	39140
Vertical European = Vertical American	F-stat			3.91				7.95
	p-value			0.05				0.01
Vertical European = Vertical Asian	F-stat			0.28				0.15
	p-value			0.60				0.70
Vertical Asian = Vertical American	F-stat			4.37				7.24
	p-value			0.04				0.01

All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 4. Specification using different foreign ownership cut-offs to define linkages

	50% cut-off				100% cut-off			
Vertical European (lag 1)	2.105**		1.108	0.952	1.186		0.86	0.792
	[0.913]		[0.878]	[0.885]	[1.217]		[1.134]	[1.141]
Vertical American (lag 1)		16.147***	14.266***	14.973***		19.413***	19.153***	19.241***
		[3.969]	[4.181]	[4.082]		[4.614]	[4.700]	[4.666]
Horizontal (lag 1)				0.178				0.371
				[0.281]				[0.356]
Herfindahl (lag1)				-2.964				-2.083*
				[1.812]				[1.169]
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
No. of observations	39140	39140	39140	39140	39140	39140	39140	39140
Vertical European = Vertical American		F-stat	8.41	10.04			13.71	14.18
		p-value	0.00	0.00			0.00	0.00

The dependent variable is the ACF TFP.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 5. Exploiting geographic variation

	10% cut-off				50% cut-off			
Vertical European own region (lag 1)	0.095		-0.107	-0.324	0.041		-0.141	-0.465
	[0.298]		[0.297]	[0.283]	[0.316]		[0.314]	[0.290]
Vertical European other regions (lag 1)	2.021**		1.000	0.779	1.830**		0.976	0.755
	[0.680]		[0.676]	[0.674]	[0.754]		[0.699]	[0.714]
Vertical American own region (lag 1)		2.395*	2.175*	0.600		2.447*	2.242*	0.540
		[1.237]	[1.205]	[1.276]		[1.244]	[1.191]	[1.244]
Vertical American other regions (lag 1)		13.905***	11.976**	11.462**		14.486***	13.097***	12.363**
		[3.489]	[3.817]	[3.955]		[3.742]	[3.913]	[4.065]
Horizontal own region (lag 1)				-0.058				-0.056
				[0.089]				[0.090]
Horizontal other regions (lag 1)				-0.176				-0.175
				[0.259]				[0.262]
Herfindahl (lag1)				-0.913				-0.938
				[1.134]				[1.131]
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
No. of observations	39140	39140	39140	29598	39140	39140	39140	29598
Vertical European own region = Vertical	F-stat		3.10	0.47			3.49	0.60
American own region	p-value		0.08	0.50			0.06	0.44
Vertical European other regions =	F-stat		7.07	6.25			8.46	7.20
Vertical American other regions	p-value		0.01	0.01			0.00	0.01

The dependent variable is the ACF TFP.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 6. Specification in long differences

Δ Vertical European (lag 1)		1.993		-0.925	-1.032
		[1.369]		[0.779]	[0.774]
Δ Vertical American (lag 1)			19.496***	21.477***	22.194***
			[3.114]	[3.772]	[3.907]
Δ Horizontal (lag 1)					-0.492
					[0.459]
Δ Herfindahl (lag1)					-1.399
					[1.942]
R-squared		0.004	0.02	0.02	0.03
No. of observations		4723	4723	4723	4723
Δ Vertical European = Δ Vertical American	F-stat			29.61	28.90
	p-value			0.00	0.00

The dependent variable is the long difference (1999-2003) in ACF TFP. Independent variables are lagged one period (1998-2002).
Standard errors, corrected for clustering on industry, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 7. Controlling for the relative productivity of foreign affiliates in downstream sectors

Vertical European (lag 1)		1.398	1.292	1.157	1.044
		[0.956]	[0.943]	[0.867]	[0.859]
Vertical American (lag 1)		12.643**	13.171**	13.091**	13.633***
		[4.073]	[4.051]	[4.093]	[4.067]
Vertical TFP mean (lag 1)		-0.268	-0.278		
		[0.255]	[0.255]		
Vertical TFP median (lag 1)				-0.006	-0.015
				[0.255]	[0.256]
Horizontal (lag 1)			0.42		0.411
			[0.301]		[0.304]
Herfindahl (lag1)			-2.131*		-2.110*
			[1.177]		[1.185]
R-squared		0.02	0.02	0.02	0.02
No. of observations		39140	39140	39140	39140
Vertical European = Vertical American	F-stat	5.95	6.79	6.95	7.91
	p-value	0.02	0.01	0.01	0.01

The dependent variable is the ACF TFP. Vertical TFP is a proxy capturing the productivity of foreign affiliates in downstream sectors relative to the productivity of their Romanian competitors. The variable is constructed by weighting the mean (median) value of the relative TFP in each downstream industry by the relevant input-output coefficients. The productivity is estimated using the ACF method.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 8. Are vertical spillovers affected by industry-specific transport costs?

	mean transport cost 1998-03				median transport cost 1998-03			
Vertical European (lag 1)	2.442*		7.357***	7.197***	2.784**		6.935***	6.839***
	[1.288]		[1.820]	[1.829]	[1.217]		[1.756]	[1.760]
Vertical European (lag 1)*Transport cost	0.06		-0.626**	-0.608**	0.005		-0.588**	-0.577**
	[0.143]		[0.218]	[0.219]	[0.134]		[0.202]	[0.203]
Vertical American (lag 1)		-0.970	-47.791**	-46.683**		1.745	-43.111**	-42.206**
		[11.173]	[18.934]	[18.803]		[10.605]	[18.410]	[18.256]
Vertical American (lag 1)*Transport cost		2.342*	7.270***	7.139***		1.989#	6.615**	6.498**
		[1.255]	[2.113]	[2.097]		[1.208]	[2.034]	[2.019]
Horizontal (lag 1)				0.289				0.279
				[0.359]				[0.362]
Herfindahl (lag1)				-0.610				-0.469
				[1.559]				[1.562]
R-squared	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03
No. of observations	32591	32591	32591	32591	32591	32591	32591	32591

The dependent variable is the ACF TFP. Transport cost is defined as the cost of all freight, insurance and other charges (excluding U.S. import duties) expressed as a percentage of the value of imports. The data pertain to US imports from 16 Eastern European countries and are available from the US International Trade Commission.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level. # denotes a p-value of 0.101.

Table 9. Are vertical spillovers different in sectors with above-median transport costs?

Vertical European (lag 1)	2.562**		2.996**	2.905**
	[1.009]		[1.031]	[1.019]
Vertical European (lag 1)*High transport cost dummy	0.797		-1.673*	-1.515
	[0.755]		[0.961]	[0.978]
Vertical American (lag 1)		9.293	-3.326	-3.014
		[6.610]	[8.727]	[8.646]
Vertical American (lag 1)* High transport cost dummy		13.524**	26.433**	26.040**
		[6.721]	[10.315]	[10.291]
Horizontal (lag 1)				0.414
				[0.363]
Herfindahl (lag1)				-0.975
				[1.548]
R-squared	0.02	0.03	0.03	0.03
No. of observations	32591	32591	32591	32591
Vertical European = Vertical American			0.46	0.41
			0.50	0.52
Vertical European + Vertical European* High transport cost dummy		F-stat	12.99	13.42
= Vertical American + Vertical American* High transport cost dummy		p-value	0.00	0.00

The dependent variable is the ACF TFP.
High transport cost dummy is defined as dummy for sectors with transport costs above the median. Transport costs encompass all freight, insurance and other charges (excluding U.S. import duties) and are expressed as a percentage of the value of imports. The data pertain to US imports from 16 Eastern European countries and are available from the US International Trade Commission. The mean value for the 1998-2003 period is used.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.

Table 10. Alternative measures of transport costs

	Transport cost pertaining to					
	consumer goods imports		air transport		maritime transport	
Vertical European (lag 1)	2.83	2.654	2.885**	2.766**	2.890*	2.724*
	[1.726]	[1.729]	[1.221]	[1.214]	[1.520]	[1.505]
Vertical European (lag 1)*Transport cost	-0.171	-0.121	-0.067	-0.063	-0.144	-0.12
	[0.292]	[0.293]	[0.048]	[0.048]	[0.165]	[0.164]
Vertical American (lag 1)	-19.727	-24.801	-2.152	-1.24	-6.658	-7.584
	[17.053]	[17.028]	[9.333]	[9.347]	[13.944]	[13.759]
Vertical American (lag 1)* Transport cost	5.109*	5.905**	0.595*	0.571*	2.049#	2.188*
	[2.673]	[2.654]	[0.333]	[0.332]	[1.268]	[1.255]
Horizontal (lag 1)		0.785**		0.501		0.578
		[0.341]		[0.354]		[0.355]
Herfindahl (lag1)		-2.593**		-2.057		-2.129*
		[1.185]		[1.250]		[1.249]
R-squared	0.02	0.03	0.02	0.02	0.02	0.02
No. of observations	36150	36150	36150	36150	36150	36150

The dependent variable is the ACF TFP.
Transportation costs defined as: average shipping cost incurred by US imports of consumer products expressed as a percentage of the value of imports (columns 1-2); the average shipping cost incurred by US imports brought in by air (columns 3-4), and by ocean (columns 5-6). The mean value for the 1998-2003 period is used.
All specifications include firm and year fixed effects.
Standard errors, corrected for clustering for industry-year combinations, are reported in parentheses.
* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level. # denotes a p-value of 0.108.

Appendix I. **Data on Foreign Ownership**

The main source of information on foreign ownership shares is the Amadeus database. The database contains information on each company's ownership structure including the names of owners, their respective ownership shares, their countries of origin and the date when the information was updated. Each release of the database lists only the latest available ownership figures. Our effort to construct the ownership shares started with four releases of Amadeus: October 2001, January 2002, January 2005 and March 2005. Upon a closer inspection of the data we realized that the database provider made hardly any updates between the January 2002 and January 2005 release. Thus we decided to rely on three releases, which contained information pertaining mostly to March 2001 (October 2001 release), 2001 and 2002 (January 2005 release) and 2004 (March 2005 release). In 5,520 cases where it was not possible to infer the date of foreign investor's entry based on Amadeus, we obtained additional information from the Romanian Chamber of Commerce and Industry (which is the provider of data for Amadeus).

The construction of the ownership variable was done in three steps. In the first step, the date of the ownership information was assigned to each firm. In minority of cases, where a different date was associated with different owners, we generated the most recent as well as the second most recent ownership year. For firms with both domestic and foreign ownership, it was based only on the dates pertaining to foreign owners. The same procedure was followed for each release of Amadeus except for the 2001 data where we only used the earliest date. In addition, for the 2001 release, whenever the ownership date pertained to the first three months of the year, we considered it as pertaining to the previous year.[26]

In the second step, we generated foreign ownership *shares* for each company and each release of the database. We used only direct ownership figures. We dropped the small percentage of firms for which the sum of ownership shares was less than 90%. We considered any owner with missing ownership country as Romanian.[27]

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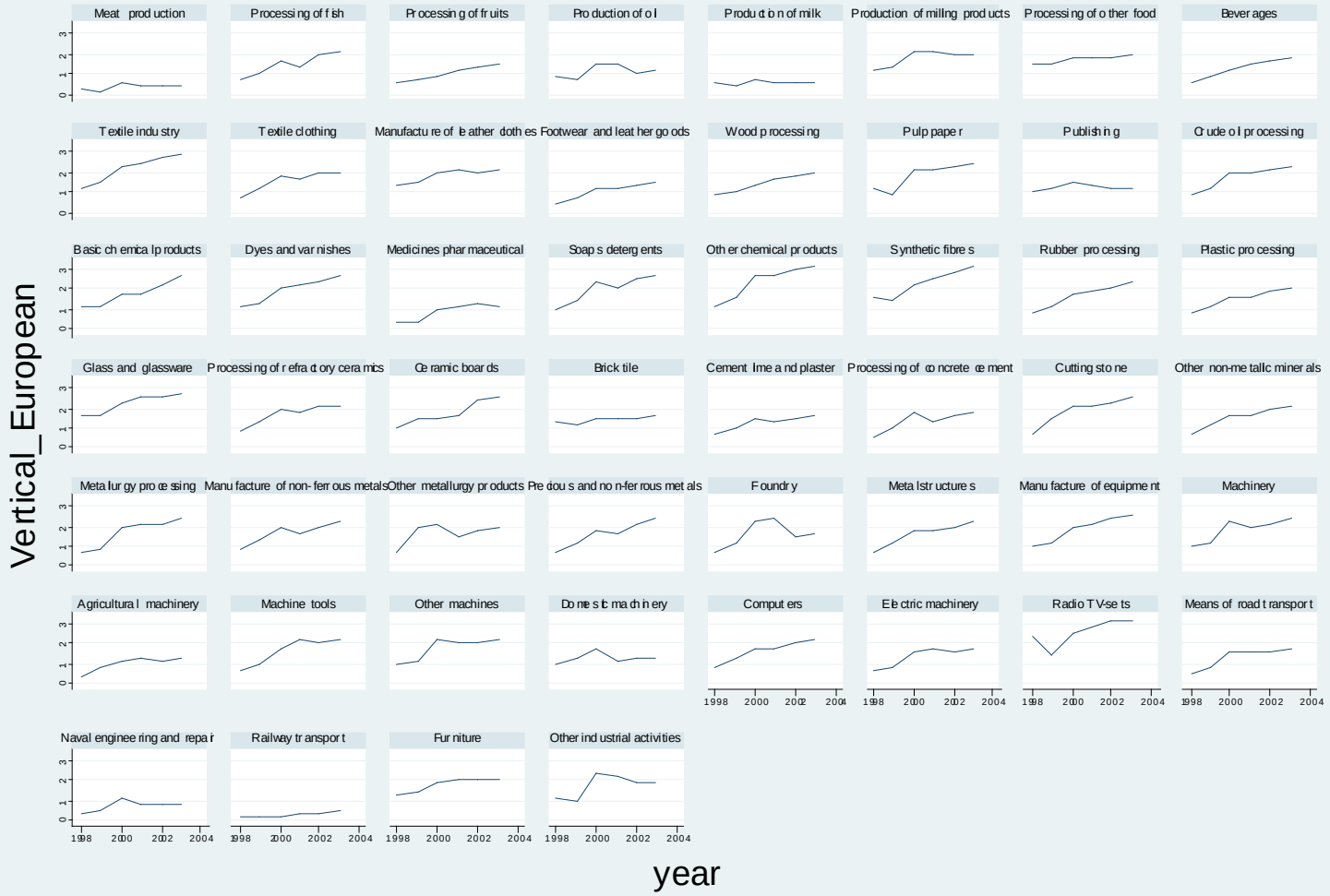
[26] This is reasonable assumption as there is most likely a delay between the actual change and its reporting to the Romanian Chamber of Commerce and Industry (RCCI), the RCCI transmitting the data to Bureau van Dijk (which is done every six months) and Bureau van Dijk incorporating the information into a new release of the Amadeus database.

[27] Nine percent of observations in January 2005 release were missing information on the owner's country. A close inspection of the data by one of the authors who is native speaker of Romanian revealed that in a vast majority of cases ownership with missing country information were actually Romanian owners.

In the third step, we used the information from the Romanian Chamber of Commerce and Industry as the base. If such information was not available to us, we defined our foreign ownership variable based on Amadeus starting with the earliest release. In each year, the ownership information was updated with the corresponding new information from Amadeus and carried over to future periods if no updates appeared in the database. If the Amadeus releases listed different ownership shares for the same year, the second most recent ownership date was used to assign the ownership information.

If a firm was listed as Romanian in a particular release but was missing ownership information for earlier periods, we assumed that in the earlier period it had been Romanian. In the case of foreign firms, we assumed the same ownership structure in an earlier period only if the available information pertained to no more than three years after the date of incorporation reported in Amadeus.

Appendix II. American and European Presence in Downstream Sectors



Graphs by sector

Appendix III. Comparing productivity of foreign affiliates of various nationalities

	All sectors		Services		Manufacturing	
	OLS TFP	**ACF TFP**	**OLS TFP**	**ACF TFP**	**OLS TFP**	**ACF TFP**
American MNCs	0.014	0.024	0.024	0.045	0.002	-0.005
	[0.016]	[0.033]	[0.028]	[0.048]	[0.019]	[0.045]
Asian MNCs	-0.113***	-0.155***	-0.146***	-0.207***	-0.073***	-0.081
	[0.019]	[0.040]	[0.036]	[0.063]	[0.022]	[0.052]
R-squared	0.88	0.41	0.86	0.44	0.88	0.39
No. of observations	16222	16222	5343	5343	10553	10553

The dependent variable is the total factor productivity.
Sample: American, European and Asian investors.
All specifications include industry fixed effects (defined following the classification used in the input-output matrix) as well as year and region fixed effects.
.* denotes significance at the 10% level; ** at the 5% level ; *** at the 1% level.