Bournemouth University

BAFES –
Bournemouth Accounting, Finance & Economic Series

NO 02 / 2016

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Draft: July 2016

INWARD FDI AND INNOVATION IN TRANSITIONAL COUNTRIES

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ABSTRACT

This study empirically examines the relationship between innovation and foreign ownership for a large sample of firms in 29 transitional countries, taken from the 2013 BEEPS survey. The analysis is based on two different aspects of FDI theory – technology transfer and strategic asset seeking (with respect to R&D). It finds that firms who innovate with respect to new products, new processes and new management techniques have, on balance, more foreign ownership than those who do not. The evidence supports a view that strategic asset seeking is associated with inward FDI. It also supports the view that technology transfer is also an important feature of the relationship between innovation and FDI in transitional countries. Of the two effects the technology transfer effect is of more consequence than the strategic asset seeking effect.

Key words: FDI, innovation, transition, firm, technology transfer, strategic asset seeking.

JEL: F23, O30, P20.

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1. Introduction

There is a sense in a number of transitional countries that inward FDI has focused on cheap but highly educated labour. This is not without foundation in the academic literature but is far from being a complete picture. This study focuses on the links between inward direct investment or, more precisely, foreign ownership of firms and innovation in transitional economies. The focus is upon two theoretical links between FDI and innovation – technology transfer and strategic asset seeking investment.

There have been a number of previous studies of transitional and other economies which have considered the spillovers arising from technology transfer – see, for example, Damijan et al (2003). Spillovers are the diffusion of knowledge from affiliates of MNEs to other firms in the same location. The focus of this paper is different. Its interest is in the diffusion of knowledge from parent to affiliate (technology transfer) and from affiliate to parent (strategic asset seeking).

Using data on approximately 9000 firms from the 2013 BEEPS survey the paper finds that there is a statistically significant link between innovation and foreign ownership in transitional countries. It also finds that this is linked to the employment of a high proportion of workers with university degrees. The study examines the relationship between indicators of technology transfer and of strategic asset seeking. It finds evidence that both technology transfer and strategic asset seeking are associated with foreign ownership.

Section 2 presents a review of the relevant literature and section 3 sets out the hypotheses derived from this literature. The data used for the study is discussed in section 4 and the methodology in section 5. Propensity score matching analysis is covered in section 6 and the findings are further developed by inverse probability weighted regression adjustment estimates in section 7. Conclusions are provided in section 8.

2. Review of Literature

The conceptual foundation of this paper, as with much empirical analysis of FDI, is the OLI paradigm – see Dunning (2001) for an exposition. The analysis presented here is not some

much concerned with the ownership (O) or internalisation (I) aspects as the locational (L) aspects of the paradigm. Dunning (2000) categorises the different motives involved in the locational decision as market seeking, efficiency seeking, resource seeking and strategic asset seeking. This paper is focused on examining the evidence for strategic asset seeking in transitional countries. Dunning (1998) defines strategic assets in this context as: "technical knowledge, learning experiences, management expertise and organizational competence .."

The growth of outward investment from emerging markets, particularly China, has put the original OLI paradigm under question. One of the early papers to do so was the influential paper by Buckley et al (2007). Undoubtedly, outward investment from emerging markets requires at least some re-thinking of aspects of OLI. These concerns are mostly addressed to ownership or internalization issues. Since this paper is concerned with locational aspects and, in particular, strategic asset seeking concerns with other aspects of the OLI paradigm are not discussed further. Strategic asset seeking as a motive for inward investment remains a prominent issue in the literature relating to the investment decision. As Monteiro (2015) has pointed out the view of key drivers of the location of direct investment has shifted from the traditional view of exploiting firm specific advantages. A much greater emphasis is now placed on global knowledge sourcing in which local subsidiaries are embedded in local networks and provide access to local knowledge for the MNE.

One consequence of the development of, in particular, outward investment from China has been increased attention in the literature to strategic asset seeking motives for direct investment. Cui et al (2014), in a study of Chinese firms, found strategic asset seeking behavior by those firms pursuing competitive catch-up, to aggressively catch up with world leaders. Chinese firms with more focus on short term profitability were found to focus more on efficiency seeking investment. Deng (2007) found strategic asset seeking to the primary motive behind Chinese investment in industrial economies. In a similar vein Deng (2009) found acquisition of foreign subsidiaries by Chinese firms to be dominated by strategic asset seeking considerations.

Existing studies of FDI in transitional countries have produced mixed conclusions with respect to strategic asset seeking. Gauselmann et al (2011) conducted a study of five Central and Eastern European countries (Czech Republic, Hungary, Poland, Romania and Slovakia) in 2009 using firm level data for foreign affiliates. They found low wage costs (for relatively well educated workers) to be the dominant motive for inward investment. They also found

the local economic community to be more engaged with domestic than foreign firms. Gorodnichenko el (2013) used firm level data from the BEEPS surveys of 2002 and 2005 (combined with input-output data) to analyse efficiency and spillover effecs of foreign subsidiaries in 17 transitional countries. They find evidence of significant spillover effects on backward linkages from technology transfer effects of FDI. Javorcik and Saggi (2010) found evidence from firms in Eastern Europe and the former Soviet Union that investors with greater technological and marketing sophistication tended to prefer ownership of subsidiaries to joint ventures

It is not just strategic asset seeking motives for choosing a particular location that link FDI to innovation. The ownership (O) component of the OLI paradigm stresses know-how and its transfer to a host country by means of FDI. Simona and Axele (2012) conducted a survey of foreign affiliates in the Polish automotive industry. An important finding was that foreign firms contribute to the knowledge base of local firms but they also found that knowledge acquired from foreign firms was not significantly related to innovation. Campos and Kinoshita (2002) in a panel econometric analysis of transitional countries between 1990 and 1998 find evidence of technology transfer providing a contribution to economic growth. Damijan et al (2003), in a firm level study of 10 transitional countries, found significant and substantial positive effects of technology transfer through FDI on the productivity of firms.

A substantial volume of literature deals with the spill-over effects of technology transfer through inward FDI on the rest of the economy. For example, Giroud et al (2012), in a study of transitional economies find evidence of technology transfer by foreign affiliates through backward linkages. Another example is the study by Damijan et al (2003) which finds significant spillover effects arising from technology transfer and FDI in a sample of 10 transition countries. These spillover effects are clearly of importance but are not the focus of this paper, which investigates the evidence for technology transfer on innovation in the first place rather than its consequences for the wider economy.

The existence of both strategic asset seeking and technology transfer predict a relationship between innovation and foreign ownership. Both suggest that we should observe more innovation in foreign owned firms or joint ventures than in wholly domestic firms. An observation that foreign owned firms are associated with more innovation is a necessary condition for concluding that this is a result of strategic asset seeking but it is not a sufficient condition. Technology transfer (from foreign to local innovation) may just as well be the

reason for such an association as strategic asset seeking (from local innovation to foreign). These two effects are not mutually exclusive so both could co-exist. A further task of empirical analysis is to assess which effect dominates or whether neither does – to assess whether any observed association between foreign ownership and innovation is, on balance, attributable to strategic asset seeking or to inward technology transfer or both.

The available evidence also suggests that access to skilled labour may be important in the locational decision. Becker et al (2005) found evidence that locations in Central and Eastern Europe with available skilled labour strongly attracts investment from German but not Swedish firms. Bijsterbosch and Kolasa, (2010) found evidence that FDI played an important role in productivity catch-up in Central and Eastern European member states of the EU and that human capital was of importance in this process. Gao (2005) finds inward investment in different regions of China to be dependent on the quality of labour.

3. Hypotheses

Hypothesis 1: there should be an observable relationship between innovation (as measured by different indicators) and foreign ownership.

OLI theory predicts that strategic asset seeking investment will seek out innovative firms and that technology transfer will bring new products, processes or management techniques to domestic markets.

Hypothesis 2: both foreign ownership and innovation should be associated with more educated, more highly skilled workers.

The literature suggests that technology transfer is more effective with skilled and educated workers. The creation of the knowledge that attracts strategic asset seeking investment also requires such workers.

Hypothesis 3: foreign owned firms (or joint ventures) are more likely to undertake R & D locally than wholly domestic firms

If strategic asset seeking behavior is present then there must be local knowledge creation. R & D is not the only possible way to create knowledge or the only form of relevant knowledge but its existence does imply local knowledge creation.

Hypothesis 4: as a consequence of technology transfer certain characteristics (licensing of foreign technology and training of workers) are more prevalent in foreign owned firms than domestic.

A transfer of technology would normally involve some kind of payment from the local affiliate to the parent company. Likewise technology transfer would require more local training than firms not receiving an inward transfer of knowledge.

4. Data

The study uses firm level data from the 2013 BEEPS survey, which covers a total of 29 countries in Eastern Europe and Central Asia. A full list of the countries is provided in Appendix 1. Further details of the survey can be found at: http://ebrd-beeps.com/

The foreign ownership variable ***foreign*** is given by the response to the following question: "What percentage of the firm is owned by … private foreign individuals, companies or organisations".

From this variable two further (0,1) variables were defined. ***Foreign1*** is defined as 1 for any foreign ownership, 0 otherwise. ***Foreign2*** is defined as 1 where foreign ownership is 50% or greater and 0 otherwise. A (0,1) variable ***joint*** for a joint venture was defined as 1 for those firms who indicated the option "joint venture with foreign partner(s)" in response to the following question: "How was this firm established ?"

The survey includes several innovation questions on which variables are based. The variable ***newprod*** (0,1) was defined by a positive response to the question: "During the last three years, has this establishment introduced new or significantly improved products or services? Please exclude the simple resale of new goods purchased from others and changes of a solely aesthetic nature."

The variable ***newproc*** (0,1) was defined by a positive response to the question: "During the last three years, has this establishment introduced any new or significantly improved methods for the production or supply of products or services?" Likewise the variable ***newman*** (0,1) was defined by the following question: "During the last three years, has this establishment introduced any new or significantly improved organizational or management practices or structures?"

The variable for research and development expenditure, ***rdexp***, also (0,1), was defined by a positive response to the question: "During the last three years, did this establishment spend on research and development activities, either in-house or contracted with other companies (outsourced)?" The variable for licensed technology***, license*** (0,1), captures the response to the question: "Does this establishment at present use technology licensed from a foreign-owned company, excluding office software?".

The remaining variables of core interest concern labour. The variable ***degree*** was the reported percentage of the firm's employees with a university degree and ***degree2*** a (0,1) variable defined to take on the value of 1 when 60% or more of the firm's employees had a university degree. The variable ***train*** (0,1) was defined by a positive response to the question: "Over the last fiscal year, did this establishment have formal training programs for its permanent, full-time employees?".

The methodological approach also requires a number of control variables. Some of these were firm level variables, also taken from the BEEPS survey and some were country level variables taken from the World Bank's *World Development Indicators* database. The firm level control variables include a number that are more or less standard in the empirical literature on the determinants on inward FDI – see Blonigen (2005). These comprised:

- ***Age;*** the age of the firm in years, a proxy for the experience of the firm.
- ***Mgrexp;*** the number of years of experience of the firm's senior manager.
- ***Size1***; the size class of the firm from micro (0) to large (3), a proxy for economies of scale.
- ***Export***; the share of exports in total sales, included as a proxy for firm efficiency, since exporting firms are typically more competitive.
- ***Loan3***; a (0,1) variable taking on the value of 1 if the firm received a loan, intended to capture the effects of access to finance.
- ***Infra;*** the mean score of the firms response to the perceived severity of constraints arising from (a) electricity (b) telecommunications and (c) transport all ranked from 0 (no obstacle) to 4 (very severe obstacle).
- ***Burcy***; the mean score of the firm's response to the severity of constraints arising from (a) tax administration, (b) business licensing, (c) customs procedures and (d) labour regulations, each similarly ranked from 0 (no obstacle) to 4 (very severe obstacle).

- ***Rdexp and degree;*** as previously defined but used as control variables only when they are not treatment variables.

In addition to these firm level variables two country level variables were used as proxies intended to capture the technological environment in each country. These were;

- ***Hitechexp2***; high technology exports as a percentage of total exports of manufactures.
- ***Internet2***; percentage of population that are internet users.

5. Methodology

The analysis uses, firstly, a propensity score matching approach. A matching approach focuses on the relationship between a (0,1) "treatment" variable (for example, whether or not a firm trains its workers) and an "outcome" variable (say, productivity). In this study we look at the relationship between several different "treatment" variables related to innovation and use the percentage share of foreign ownership as an outcome variable. A simple but naïve approach would be to divide the sample into two sub-samples – those who innovate and those who do not - and to use a t test for the difference between two means to see if those firms who innovate have a higher share of foreign ownership than those that do not. Since the data that are available are observational not experimental such a procedure would almost certainly be biased since it is unlikely that the two groups would share common characteristics. For example, it is unlikely that many micro firms undertake R&D expenditure. It is also unlikely that many micro firms will be foreign owned. This means that non-innovation sub-sample would, most likely, comprise many more micro firms than the innovating sub-sample.

The propensity score matching approach seeks to ensure that the "treated" sub-sample is compared to a carefully constructed control group that, as far as possible, matches the "treated" firms in all key respects other than the treatment itself. In this way it tries to replicate experimental random sampling using observational data. The process of matching is conducted by creating a "propensity score" which is, in essence, is the creation of a model of the key features of the treatment variable. In this study, as in many others a Probit model was used to estimate the relationship between each treatment variable and the relevant control variables. Once the propensity score was created (probit model) the control group was created by matching with the treatment group. This matching was conducted using a kernel density approach and bootstrapped standard errors used for the resulting t tests between the

mean of the treated and control groups. For a more complete exposition of the propensity score matching approach readers are referred to Leuven and Sianesi (2015), Peikes, Moreno, and Orzol (2008), Dehejia (2005) and Dehejia and Wahba (2002).

At the heart of the propensity score matching approach are three parameters:

- ATE – the average treatment effect in the population (all treated and untreated firms).
- ATT – the average treatment effect for treated firms (for example, those which undertook innovation)
- ATNT – the average treatment for those that were not treated (firms with no innovation).

These parameters are defined as follows:

$$ATE = E(Y_{1i} - Y_{0i}) \equiv E(\beta_i) \quad (1)$$

$$ATT = E(Y_{1i} - Y_{0i} | D_i = 1) \equiv E(\beta_i | D_i = 1) \quad (2)$$

$$ATNT = E(Y_{1i} - Y_{0i} | D_i = 0) \equiv E(\beta_i | D_i = 0) \quad (3)$$

Where Y is the outcome and where subscript 1 denotes firms that are "treated" and subscript 0 denotes those that are not. D indicates whether or not "treatment2 was received (1 for treated and 0 for untreated).

As previously argued a simple t test for a difference in means between treated and untreated firms would be biased. In the propensity score matching literature it is common to distinguish between two types of bias: bias from selection on observables and bias from selection on unobservables. Bias for selection on unobservables is essentially the counterpart of omitted variable bias in a regression model or of a confounding in other techniques. If an important variable affecting both the treatment and the outcome has been excluded then the results will be biased. As with other estimators it is simply impossible to ensure that the risk of bias on unobservables is eliminated but this risk can be reduced by including as many relevant control variables as possible.

The propensity score matching approach, given the risk of bias on unobservables, is to, as far as possible, create a control group which eliminates differences in the control variables between the treated and untreated control group – bias in observables. For estimation of ATT we need to assume that all relevant characteristics are captured in the observed attributes of the treated and untreated firms (that there is no bias from selection on unobservables) . It is also necessary to assume that we observe both treated and untreated firms with common support (shared attributes). To select the control group a propensity score p(x) is used where:

$$p(x) \equiv P(D=1|X=x) = E(D|X=x) \quad (4)$$

As previously noted a probit model was used for this purpose. This probit model is not and is not intended to be a model of causality. Its function is to identify and summarise the key characteristics of the treated group. The next step is to use the propensity score for matching – to create a control group in which firms share common features. There are a significant number of different ways of conducting this matching process. The procedure adopted in this study was to conduct matching by kernel density, using bootstrapped standard errors. The final step in the propensity score matching approach is to check the process of selection on observables – to check that the treated group and the control group are indeed well matched with respect to all of the observable characteristics.

One limitation of the propensity score matching approach is that the treatment is assumed to be exogenous. This may be problematic. For example, one of the treatment variables is product innovation. Product innovation itself may be determined by a number of variables which also influence the outcome variable (foreign ownership). To include potential endogeneity of the treatment variable this study used Inverse Probability Weighted Regression Adjustment (IPWRA) analysis. For an exposition of this technique see Cattaneo (2010) and Cattaneo et al (2013).

IPWRA analysis is, in essence, an extension of the standard matching approach. This approach has possible limitations where the members of both groups might choose whether to be treated or not – for example if the decision to innovate is related to the foreign ownership decision. "Regression adjustment" produces an estimator which includes a deterministic model which assigns each firm to the treated and untreated groups (for example, whether they are an innovator or not). The technique is similar to estimating a counter-factual – how would foreign ownership have been affected if firms had not innovated?

There are a number of different methods by which regression adjustment can be undertaken. "Inverse probability weighting" directly models the decision to undergo "treatment" (to innovate or not). This is undertaken by means of a logit model of the probability that a firm innovates, using a number of explanatory variables. The resulting estimated probabilities are used to weight each observation. The final extension to the IPWRA model is that both outcome and treatment are adjusted by using weighted inverse probabilities.

Further attractions of the IPWRA approach (in addition to the statistical properties described) are, firstly, that it offers a "doubly robust" approach. That is, it estimates the effect of adding treatment compared to no treatment and the effect of removing treatment from treated firms. This provides a robustness check on either set of estimates. Secondly, the IPWRA approach allows for more than one treatment effect. This is of particular importance in this study where the focus is, in part, on how

indicators of both technology transfer and strategic asset seeking (both different treatment variables) interact with each other and with foreign ownership (the outcome variable).

6. Propensity Score Matching Analysis

Table 1 presents propensity score matching tests for all the hypotheses. Checks on bias on observables for each of these tests are presented in Appendix 2. For each of these the outcome variable is foreign (the percentage share of the firm that is foreign owned). Hypothesis 1 (that inward FDI is associated with innovation) is tested with three different indicators of innovation – new products, new processes and new management techniques. Hypothesis 2 (that foreign ownership is associated with skilled or educated labour) is tested using ***Degree2*** (1, if 60% or more of employees have university degrees, 0 otherwise). Hypothesis 3 (foreign ownership is associated with R and D expenditure) is tested using the (0,1) variable ***rdexp*** as the treatment variable. Finally, hypothesis 4 (that foreign ownership is associated with both training and licensing of foreign technology) is tested separately using two (0,1) variables – ***train*** and ***license***.

TABLE 1: PROPENSITY SCORE MATCHING TESTS (kernel density matching, bootstrapped standard errors)

Outcome		Treated		Controls			Standard	
Variable	Sample	Mean	Obsevations	Mean	Obsevations	Difference	Error	t statistic
Treatment = new product innovation (newprod)								
foreign	Unmatched	7.973	2537	4.275	6692	3.697	0.481	7.680
	ATT	7.973		5.734		2.238	0.671	3.337
Treatment = new process innovation (newproc)								
foreign	Unmatched	7.268	2096	4.678	7131	2.590	0.513	5.050
	ATT	7.268		6.095		1.173	0.685	1.711
Treatment = new management innovation (newman)								
foreign	Unmatched	8.378	2215	4.307	7015	4.071	0.503	8.100
	ATT	8.378		5.575		2.802	0.715	3.921
Treatment = 60% or more of employees with university degrees (degree2)								
foreign	Unmatched	5.814	2635	5.141	6947	0.673	0.476	1.410
	ATT	5.814		4.702		1.112	0.479	2.318
Treatment = expenditure on R & D in the last 3 years (rdexp)								
foreign	Unmatched	9.614	1099	4.770	8483	4.844	0.666	7.280
	ATT	9.614		5.955		3.659	0.870	4.206
Treatment = training provided in the most recent fiscal year (train)								
foreign	Unmatched	8.152	3727	3.510	5788	4.642	0.435	10.670
	ATT	8.152		4.134		4.017	0.478	8.412
Treatment = uses technology licensed from foreign firm (license)								
foreign	Unmatched	13.093	1177	4.200	8325	8.894	0.641	13.880
	ATT	13.093		5.555		7.538	0.867	8.692

The results show that new product innovation in transitional countries is associated with a statistically significantly (at 99% confidence) higher foreign ownership. New product innovation is more likely in foreign owned firms than domestic. New management innovations are likewise statistically significantly (at 99% confidence) associated with higher foreign ownership. New process innovation is also statistically more significantly associated with foreign ownership but only at 90% confidence. Collectively these three findings support the view that foreign ownership and innovation are associated in transitional countries (hypothesis 1). Note that this does not necessarily imply that foreign ownership causes innovation (technology transfer) nor does it imply that innovation causes foreign ownership (strategic asset seeking). It does imply that at least one of these effects is relevant.

The results also suggest that there is a statistically significant (at 95%) association between foreign ownership and the proportion of employees with university degrees. Those firms with 60% or more of their workforce with university degrees are significantly more likely to have a higher share of foreign ownership. This supports hypothesis 2 (that foreign ownership is associated with highly educated labour). There is also a statistically significant difference, at 99% confidence, between firms who undertake expenditure on R & D. Firms undertaking R & D expenditure typically have a significantly and substantially higher foreign ownership than firms who do not. Firms who undertake R & D expenditure, on average, have a foreign shareholding which is about 3.6% (of the total shareholding) higher than firms in the (carefully selected) control group who do not undertake R & D. This provides evidence to support Hypothesis 3 – that foreign ownership is significantly higher in the presence of knowledge creation through R & D.

Both training of workers and licensing of foreign technology both exhibit statistically significantly (at 99% confidence) are associated with higher levels of foreign ownership. Firms who used licensed foreign technology, on average, have a 7.5% (of the total ownership) greater share of foreign ownership compared to a suitably matched control group. A similar comparison for firms who train their production workers shows that the share of foreign ownership is about 4% (of the total value of the firm) higher for firms who train their workers than comparable firms who do not..

The main conclusions are that the evidence supports a positive relationship between innovation and foreign ownership in transitional countries in 2013. It supports the view that

this is in part strategic asset seeking since foreign ownership is associated with knowledge creation through R & D. Foreign ownership is also substantially higher where firms have a high proportion of workers with university degrees. The evidence supports the view that technology transfer is also important since foreign ownership is significantly higher for firms who use licensed foreign technology and who train their workers.

7. Inverse Probability Weighted Regression Adjustment (IPWRA)

The preceding propensity score matching analysis provides clear evidence and conclusions with respect to the relationship between innovation and foreign ownership in the sample of firms from transitional countries but this analysis can be further strengthened. Firstly, it is possible that any two influences may interact. For example, it may be the case that R & D expenditure (strategic asset seeking) complements technology transfer activities such as licensing foreign technology or training. Certainly, the existing literature is clear that both strategic asset seeking and technology transfer should be positively related to educated workers. IPWRA techniques allow the matching analysis to, in effect, be repeated with two treatment variables. That is, they allow interactions between two variables to be captured.

A second advantage is that IPWRA explicitly models endogeneity of the treatment variable. For example, training is treated as exogenous or pre-determined in the basic propensity score matching analysis. The IPWRA technique estimates determinants of the treatment variables and makes each treatment variable endogenous.

The following analysis continues to use the outcome variable as foreign ownership but considers the effect of two treatment variables. Table 2 presents the IPWRA analysis of foreign ownership with two treatment variables – ***innovation*** and ***degree2***. ***Degree2*** is, as before, a (0,1) variable which is 1 if 60% or more of employees have a university degree. ***Innovation*** , also (0,1), is a composite variable which takes on a value of 1 if any of the following take place – product, process or management innovation.

Table 2: IPWRA Analysis with Innovation and Educated Workers as Treatments				
	Treatment Group			
Control Group	None	Innovation	Degrees (60%)	Both
None	-	2.291029***	3.703826***	3.685372***
		(0.7760443)	(1.026906)	(0.9719749)
Innovation	-1.756373***	-	-1.098035	1.259422
	(0.5210473)		(0.6943617)	(0.9290968)
60% or more of staff	-1.264926*	1.483817	-	2.774714**
with degrees	(0.6823984)	(1.394005)		(1.346042)
Both	-3.289616***	-0.3074254	-2.862825***	-
	(1.044283)	(0.9428174)	(1.091317)	

Coefficients marked with *** are statistically significant at 99% confidence, ** at 95% confidence and * at 90% confidence.

The results (reading across the first row) show that both innovation and educated labour individually are statistically significantly and positively related to foreign ownership. Jointly their combined effect on foreign ownership is also positive and statistically significant. The first row shows, in essence, the difference between firms where these variables are included compared to their exclusion. It leads to the conclusion that innovation and educated workers are both individually and jointly significantly associated with more foreign ownership.

A further advantage of the IPWRA analysis is that it provides a robustness check. Reading down the first column shows the difference created by removing the treatment effects (comparing no treatment to treatment) both individually and jointly. These are all negative and statistically significant. Thus, firms who do not innovate have statistically significantly lower foreign ownership (negative and significant at 99%), Firms who have less than 60% of their workforce with university degrees also have lower foreign ownership (negative and significant at 90%). Firms who neither innovate nor have a highly educated workforce have an even stronger joint effect of lower foreign ownership (significant at 99%).

The results show that the main insights of the propensity score matching analysis are confirmed when the treatment effects are made endogenous. That is, both innovation and a highly educated workforce are individually associated with greater foreign ownership. In addition the analysis shows that they are jointly as well as individually associated with more foreign ownership.

Table 3 reports IPWRA analysis with the percentage foreign ownership again as the outcome variable and both R&D expenditure and licensing of foreign technology. As with the earlier analysis it seeks to support the insights from the propensity score matching analysis by making both treatment effects endogenous. It also serves to provide an idea of the relative strengths of the effects (a) knowledge creation (strategic asset seeking) through R&D and (b) technology transfer through the licensing of foreign technology.

Table 3: IPWRA Analysis with R&D Expenditure and Licensed Foreign Technology as Treatments				
	Treatment Group			
Control Group	None	R&D	Licensing	Both
None	-	1.790102**	6.893564***	8.783877***
		(0.9020296)	(1.027954)	(2.053306)
R&D Expenditure	-1.515293*	-	5.378271***	6.21806***
	(0.8788985)		(1.256278)	(2.245342)
Licensing of Foreign	-5.056666***	-5.581572***	-	0.5349254
Technology	(0.839567)	(1.371093)		(2.434635)
Both	-12.63283***	.-7.97795***	-4.534167	-
	(3.453173)	(2.249245)	(2.955861)	

As before *** denotes statistically significant at 99%, ** at 95% and * at 90%.

The results (reading across the first row) suggest that both R&D expenditure and licensing of foreign technology are both individually and jointly statistically significant (at 95% and at 99%) in explaining foreign ownership. That is, in innovation both local knowledge creation (strategic asset seeking) and technology transfer through licensing are statistically significant determinants of foreign ownership. Since the combined effect is more substantial than either individual effect they re-enforce rather than contradict each other.

The robustness check (reading down the first column) suggests that not spending on R&D and not licensing foreign technology are associated with a lower percentage of foreign ownership – both coefficients are negative and statistically significant at 90% and 99%. The combined effect is again more substantial than either individual effect and statistically significant at 99%. This confirms that the two treatments – R&D expenditure and licensing – are complementary. Reading across the second row and down the second column shows that the effect of licensing (technology transfer) dominates the effect of R&D expenditure (strategic asset seeking) on foreign ownership. Licensing foreign technology has a statistically significantly (at 99%) stronger positive effect on foreign ownership than R&D

expenditure (row 2, column 3). Likewise not licensing foreign technology has a substantial and statistically significant (99%) negative effect on foreign ownership. These results suggest that, with respect to innovation and foreign ownership, both strategic asset seeking and technology transfer are of importance but that technology transfer is the more important of the two.

8. Conclusions

The study examined the relationship between innovation and foreign ownership in a large sample of firms (in excess of 9000) from 29 transitional countries in 2013. This relationship was viewed from the perspective of two different strands of FDI theory – technology transfer and strategic asset seeking. The results show a statistically significant positive relationship between innovation and foreign ownership for all three of the innovation indicators: the introduction of new products, new production processes and new management techniques. They also show that, as does existing literature, innovation is associated with highly educated labour.

The study then finds that local R&D expenditure was statistically significantly associated with higher levels of foreign ownership in the sample of firms from 2013. This supports the view that strategic asset seeking is one motive for inward investment in transitional countries. It also uses the licensing of foreign technology and the training of local workers to assess technology transfer and finds that both are statistically significantly related to higher levels of foreign ownership. This evidence supports the view that technology transfer is an important feature of inward investment in transitional countries. Thus the study finds that both technology transfer and strategic asset seeking with respect to R& D were features of inward FDI in transitional countries in 2013.

Finally, the issue of whether strategic asset seeking (with respect to R&D) or technology transfer is the more important feature is addressed. The results support the view that, although both co-exist, technology transfer is a more important feature of inward investment than strategic (R&D) asset seeking.

This analysis has important implications for managers of potential and current parent companies and affiliates in transitional countries. It shows that technology transfer is not necessarily a unidirectional flow of knowledge to transitional countries but that sometimes locally undertaken R&D also offers strategic asset seeking opportunities to access local

knowledge creation. It also offers important insights for policy makers in transitional countries. There is a commonly expressed feeling in some transitional countries that inward FDI is focused on efficiency seeking from low wage but highly educated workforces in transitional countries. This point of view has some support in the literature. This study shows a relationship also exists between foreign ownership and innovation; that inward investment is more than mere exploitation of cheap labour.

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Appendix 1: List of Countries Included in the Sample

Albania

Armenia

Azerbaijan

Belarus

Bosnia-Herzegovina

Bulgaria

Croatia

Czech Republic

Estonia

Georgia

Hungary

Kazakhstan

Kosovo

Kyrgyzstan

Latvia

Lithuania

Macedonia

Moldova

Mongolia

Montenegro

Poland

Romania

Russia

Serbia

Slovakia

Slovenia

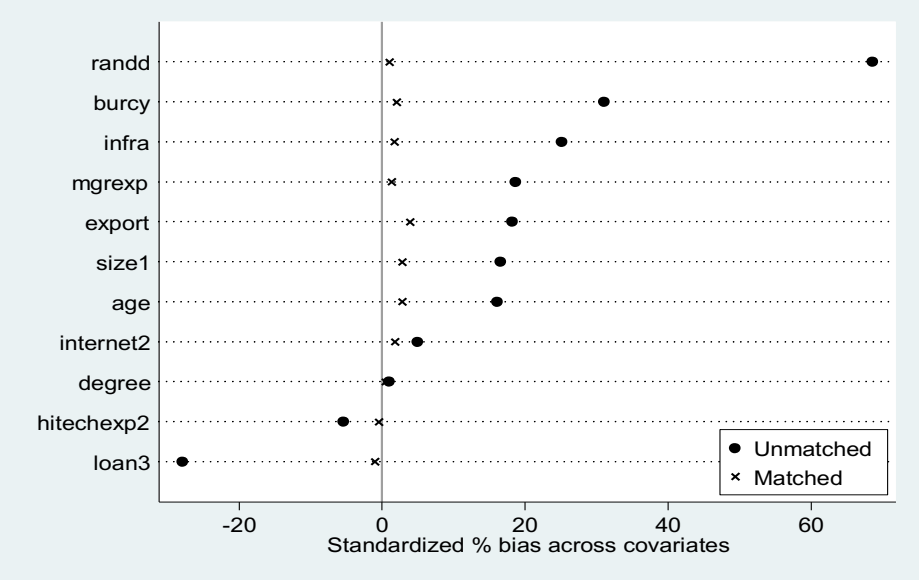
Tajikistan

Ukraine

Uzbekistan

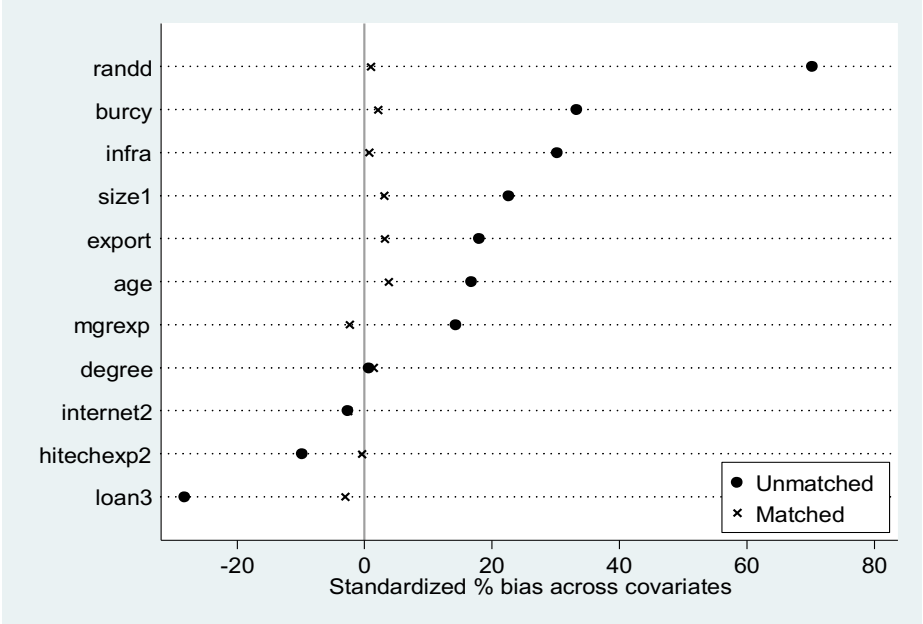
Appendix 2: Checks for Bias on Observables

Outcome = % foreign ownership, Treatment = new product innovation



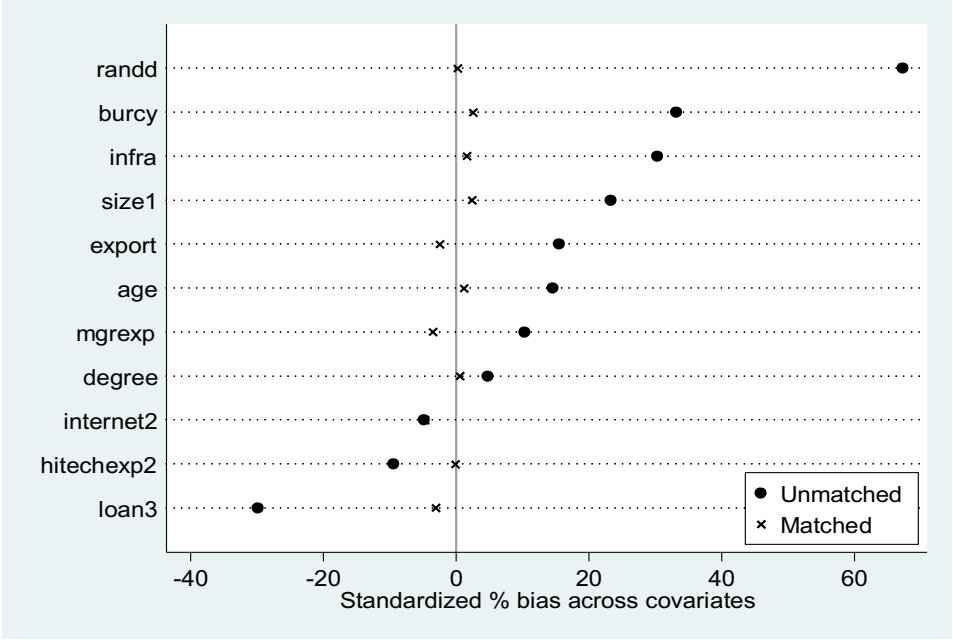
Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.5439	1.6786	-27.9		-12.14	0
	M	1.5439	1.5489	-1	96.3	-0.35	0.725
size1	U	1.6007	1.4762	16.5		7.23	0
	M	1.6007	1.5796	2.8	83.1	0.97	0.333
export	U	11.471	7.1925	18.2		8.07	0
	M	11.471	10.554	3.9	78.6	1.28	0.2
age	U	16.229	14.339	16.1		7.2	0
	M	16.229	15.898	2.8	82.5	0.94	0.345
infra	U	1.0621	0.79812	25.2		11.08	0
	M	1.0621	1.044	1.7	93.1	0.58	0.563
burcy	U	0.90464	0.66685	31.1		13.59	0
	M	0.90464	0.88904	2	93.4	0.69	0.49
mgrexp	U	17.861	16.017	18.7		8.1	0
	M	17.861	17.728	1.3	92.8	0.47	0.642
randd	U	0.29405	0.04931	68.6		34.78	0
	M	0.29405	0.29029	1.1	98.5	0.29	0.768
degree	U	35.834	35.529	1		0.42	0.674
	M	35.834	35.678	0.5	49	0.18	0.858
hitechexp2	U	5.6694	6.0729	-5.4		-2.24	0.025
	M	5.6694	5.704	-0.5	91.4	-0.17	0.862
internet2	U	58.743	57.941	5		2.14	0.032
	M	58.743	58.45	1.8	63.4	0.63	0.528

Outcome = % foreign ownership, Treatment = new process innovation



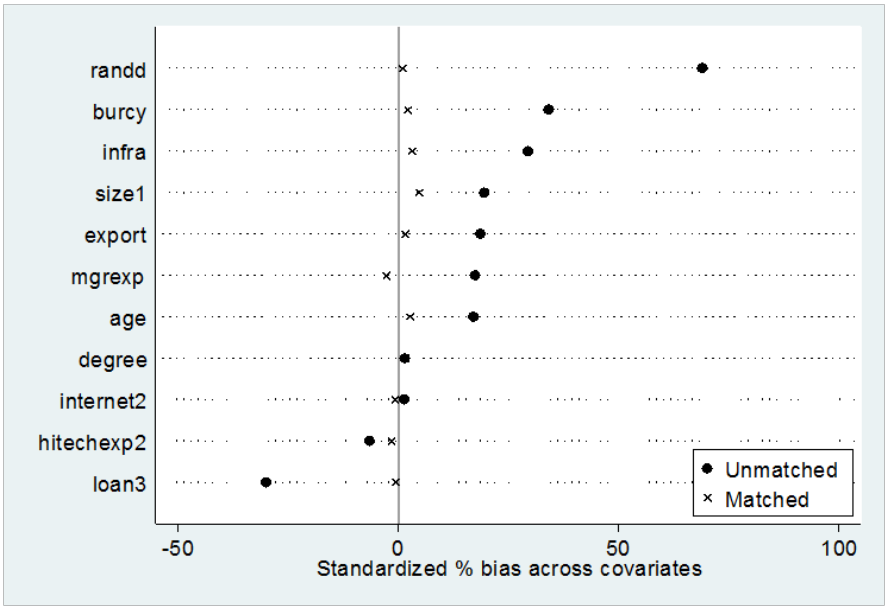
Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.5358	1.6726	-28.2		-11.56	0
	M	1.5358	1.5504	-3	89.3	-0.95	0.341
size1	U	1.6436	1.4713	22.6		9.41	0
	M	1.6436	1.6201	3.1	86.3	0.97	0.331
export	U	11.662	7.3959	17.9		7.55	0
	M	11.662	10.92	3.1	82.6	0.93	0.35
age	U	16.429	14.392	16.7		7.29	0
	M	16.429	15.973	3.7	77.6	1.14	0.255
infra	U	1.1187	0.79839	30.2		12.64	0
	M	1.1187	1.1118	0.7	97.8	0.2	0.843
burcy	U	0.93094	0.67413	33.2		13.78	0
	M	0.93094	0.91487	2.1	93.7	0.64	0.524
mgrexp	U	17.625	16.211	14.3		5.82	0
	M	17.625	17.854	-2.3	83.8	-0.73	0.465
randd	U	0.31584	0.05764	70.2		34.43	0
	M	0.31584	0.31228	1	98.6	0.25	0.804
degree	U	35.764	35.55	0.7		0.28	0.782
	M	35.764	35.332	1.4	-102	0.45	0.649
hitechexp2	U	5.4091	6.1314	-9.8		-3.76	0
	M	5.4091	5.4429	-0.5	95.3	-0.17	0.868
internet2	U	57.833	58.277	-2.7		-1.11	0.266
	M	57.833	58.275	-2.7	0.3	-0.84	0.4

Outcome = % foreign ownership, Treatment = new management innovation



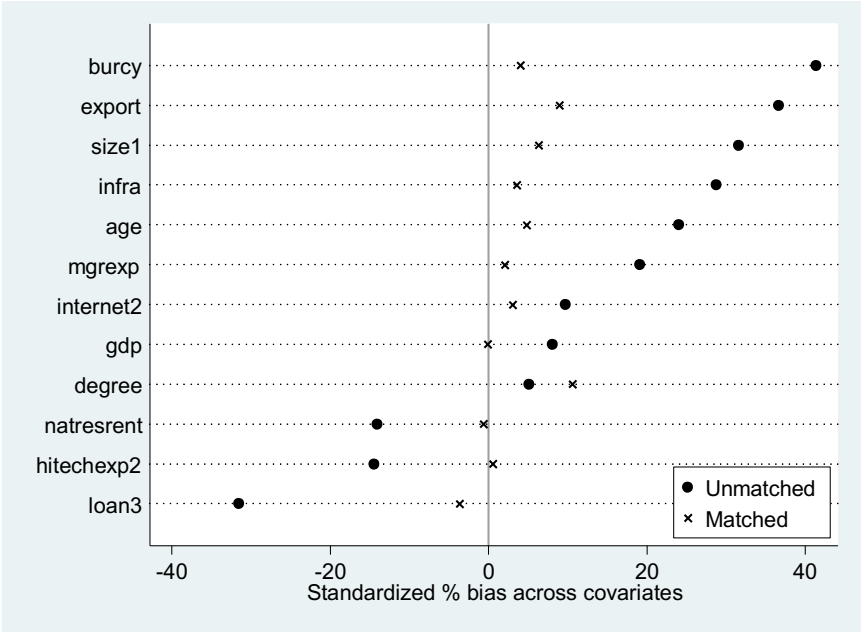
Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.5314	1.6761	-29.9		-12.49	0
	M	1.5314	1.5465	-3.1	89.6	-1.01	0.314
size1	U	1.6442	1.4683	23.2		9.79	0
	M	1.6442	1.6263	2.4	89.8	0.76	0.445
export	U	11.175	7.4944	15.5		6.64	0
	M	11.175	11.769	-2.5	83.9	-0.76	0.446
age	U	16.177	14.431	14.5		6.37	0
	M	16.177	16.038	1.2	92	0.36	0.717
infra	U	1.1121	0.79368	30.3		12.82	0
	M	1.1121	1.0957	1.6	94.8	0.48	0.628
burcy	U	0.92641	0.67177	33.1		13.92	0
	M	0.92641	0.90726	2.5	92.5	0.79	0.432
mgrexp	U	17.293	16.288	10.3		4.21	0
	M	17.293	17.639	-3.5	65.6	-1.15	0.252
randd	U	0.30248	0.05759	67.2		33.14	0
	M	0.30248	0.30177	0.2	99.7	0.05	0.959
degree	U	36.679	35.217	4.7		1.92	0.054
	M	36.679	36.503	0.6	87.9	0.19	0.851
hitechexp2	U	5.4273	6.1314	-9.5		-3.74	0
	M	5.4273	5.4399	-0.2	98.2	-0.06	0.95
internet2	U	57.582	58.385	-4.9		-2.06	0.04
	M	57.582	58.37	-4.8	1.9	-1.55	0.121

Outcome = % foreign ownership, Treatment = 60% or more of employees with degree



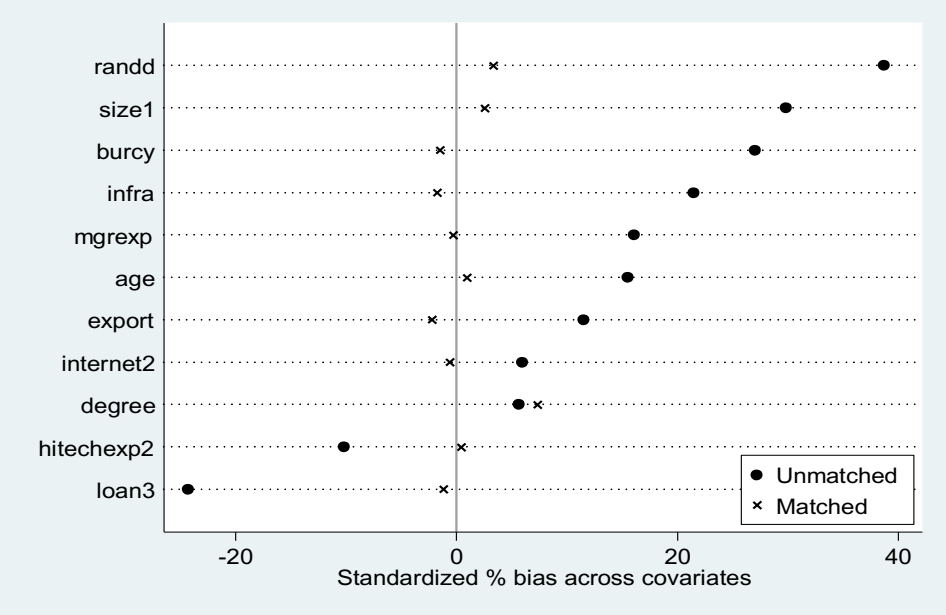
Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.7218	1.6118	23.5		10.09	0
	M	1.7218	1.7231	-0.3	98.9	-0.1	0.92
size1	U	1.5438	1.5084	4.9		2.08	0.037
	M	1.5438	1.5439	0	99.7	-0.01	0.996
export	U	5.1416	9.6259	-21.1		-8.62	0
	M	5.1416	5.1068	0.2	99.2	0.07	0.942
age	U	12.627	15.707	-28.7		-11.92	0
	M	12.627	13.119	-4.6	84	-2.01	0.044
infra	U	0.9396	0.84137	9.5		4.19	0
	M	0.9396	0.91809	2.1	78.1	0.74	0.458
burcy	U	0.70183	0.73755	-4.7		-2.06	0.039
	M	0.70183	0.70209	0	99.3	-0.01	0.99
mgrexp	U	14.621	17.155	-26.4		-11.37	0
	M	14.621	14.747	-1.3	95	-0.5	0.614
randd	U	0.11537	0.11444	0.3		0.13	0.898
	M	0.11537	0.11337	0.6	-114.4	0.23	0.82
hitechexp2	U	5.7526	6.0774	-4		-1.84	0.066
	M	5.7526	5.8189	-0.8	79.6	-0.3	0.766
internet2	U	57.788	58.438	-4.1		-1.78	0.075
	M	57.788	57.449	2.1	47.8	0.78	0.438

Outcome = % foreign ownership, Treatment = R & D expenditure



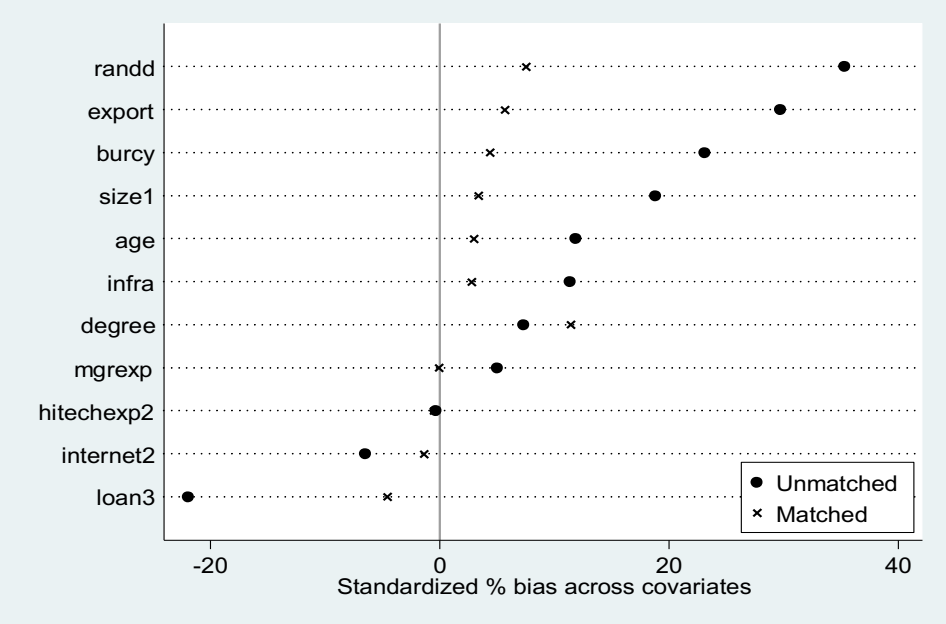
Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.5059	1.6597	-31.6		-10.06	0
	M	1.5059	1.5239	-3.7	88.3	-0.85	0.398
size1	U	1.7352	1.49	31.6		10.35	0
	M	1.7352	1.6862	6.3	80	1.45	0.148
export	U	16.847	7.2974	36.6		13.17	0
	M	16.847	14.51	9	75.5	1.83	0.067
age	U	17.677	14.495	24		8.76	0
	M	17.677	17.04	4.8	80	0.99	0.322
infra	U	1.1435	0.83274	28.7		9.49	0
	M	1.1435	1.1053	3.5	87.7	0.78	0.435
burcy	U	1.0091	0.69127	41.4		13.21	0
	M	1.0091	0.97809	4	90.2	0.88	0.381
mgrexp	U	18.157	16.238	19.1		6.11	0
	M	18.157	17.951	2.1	89.3	0.47	0.64
degree	U	36.986	35.395	5.1		1.57	0.115
	M	36.986	33.684	10.6	-107.5	2.48	0.013
hitechexp	U	5.1038	6.1026	-14.4		-4.03	0
	M	5.1038	5.0681	0.5	96.4	0.14	0.887
internet2	U	59.697	58.073	9.7		3.18	0.001
	M	59.697	59.19	3	68.8	0.73	0.467
natresren	U	9.3491	10.661	-14.1		-4.19	0
	M	9.3491	9.4068	-0.6	95.6	-0.16	0.877

Outcome = % foreign ownership, Treatment = training



Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.571	1.6875	-24.3		-11.65	0
	M	1.571	1.5766	-1.2	95.2	-0.49	0.623
size1	U	1.6533	1.4305	29.8		14.42	0
	M	1.6533	1.6343	2.6	91.4	1.08	0.282
export	U	10.01	7.3618	11.5		5.53	0
	M	10.01	10.526	-2.2	80.5	-0.9	0.371
age	U	15.957	14.151	15.5		7.59	0
	M	15.957	15.848	0.9	93.9	0.36	0.716
infra	U	1.0017	0.78035	21.5		10.33	0
	M	1.0017	1.0198	-1.8	91.8	-0.71	0.476
burcy	U	0.85292	0.64913	27		12.93	0
	M	0.85292	0.86421	-1.5	94.5	-0.6	0.546
mgrexp	U	17.441	15.862	16.1		7.69	0
	M	17.441	17.473	-0.3	98	-0.13	0.893
randd	U	0.19238	0.06513	38.7		19.36	0
	M	0.19238	0.18135	3.4	91.3	1.22	0.222
degree	U	36.654	34.896	5.6		2.65	0.008
	M	36.654	34.372	7.3	-29.8	3.13	0.002
hitechexp2	U	5.5153	6.2935	-10.2		-4.8	0
	M	5.5153	5.4821	0.4	95.7	0.2	0.838
internet2	U	58.818	57.855	5.9		2.87	0.004
	M	58.818	58.921	-0.6	89.3	-0.28	0.779

Outcome = % foreign ownership, Treatment = licensing of foreign technology



Variable	Unmatched/ Matched	Mean Treated	Mean Control	%bias	% reduction in bias	t	p>t
loan3	U	1.548	1.6548	-21.9		-7.17	0
	M	1.548	1.5702	-4.6	79.2	-1.09	0.278
size1	U	1.6457	1.5016	18.8		6.25	0
	M	1.6457	1.6198	3.4	82	0.8	0.427
export	U	15.067	7.4556	29.7		10.78	0
	M	15.067	13.612	5.7	80.9	1.21	0.225
age	U	16.165	14.678	11.9		4.2	0
	M	16.165	15.792	3	74.9	0.67	0.503
infra	U	0.97338	0.85447	11.4		3.72	0
	M	0.97338	0.94454	2.8	75.7	0.65	0.513
burcy	U	0.88474	0.70632	23.1		7.59	0
	M	0.88474	0.85086	4.4	81	1.03	0.305
mgrexp	U	16.898	16.41	5		1.6	0.11
	M	16.898	16.906	-0.1	98.4	-0.02	0.984
randd	U	0.2277	0.0991	35.3		13.06	0
	M	0.2277	0.20031	7.5	78.7	1.62	0.105
degree	U	37.6	35.302	7.3		2.33	0.02
	M	37.6	34.006	11.4	-56.4	2.75	0.006
hitechexp2	U	5.9552	5.9812	-0.3		-0.11	0.914
	M	5.9552	5.9939	-0.5	-49	-0.13	0.899
internet2	U	57.427	58.479	-6.5		-2.14	0.033
	M	57.427	57.649	-1.4	78.9	-0.32	0.746