Open Econ Rev (2015) 26:333–350
DOI 10.1007/s11079-014-9334-8

RESEARCH ARTICLE

The Effects of Internationalization on Innovation: Firm-Level Evidence for Transition Economies

Martijn Adriaan Boermans · Hein Roelfsema

Published online: 24 October 2014

Abstract This study analyses how various internationalization modes affect innovation in ten transition economies. Using propensity score matching to account for selection, we match firms on size, sector, and country. A key contribution is that firms are also matched based on the heterogeneity of institutional legacy systems at the firm level as such burden is commonly associated with firms in transition economies and affects internationalization. The empirical results show that internationalization raises a firm's tendency to innovate. More specific, outsourcing is connected to product innovation, whereas exporting and FDI are associated with R&D spending and patenting.

Keywords Exporting · FDI · Outsourcing · Innovation · Transition countries

1 Introduction[1]

In this paper, we use data for 1,355 firms in ten Eastern European and Central Asian transition economies to analyze the effects of internationalization on innovation. Our results show that various internationalization modes raise the firm's tendency to innovate. More specifically, we look at three types of innovation measures, the likelihood of product innovation, R&D efforts, and international patenting, and find a consistent positive impact of internationalization on innovation. Our paper fits into an upcoming literature that analyses the effects of internationalization for firms from transition economies with a focus on innovation, typically

[1]We thank the two anonymous referees for their comments and helpful suggestions. We also thank Sergei Guriev, conference and seminar participants at the 73th International Atlantic Economic Society (IAES) Conference in Turkey and the international conference on "Entrepreneurship, Family Firms and Economic Development" in Poland, Cracow University of Economics, Università Politecnica delle Marche, the European Council for Small Business and Entrepreneurship (ECSB), the International Council for Small Business (ICSB) and the Tjalling C. Koopmans Research Institute at Utrecht University for valuable comments, and, the European Bank for Reconstruction and Development (EBRD) for assistance with the data.

M. A. Boermans (✉)
De Nederlandsche Bank, Amsterdam, The Netherlands
e-mail: m.a.boermans@dnb.nl

M. A. Boermans · H. Roelfsema
Utrecht University, School of Economics, Utrecht, The Netherlands

with a more narrow definition of innovation than in our work. A stylized fact for developed economies is that the most productive firms within an industry self-select into international activities. In contrast, firms from transition economies and emerging markets often need to gain access to advanced technologies to improve productivity. For these firms the motive for internationalization often is to acquire the ownership advantages needed to broaden the customer base (Mathews and Zander 2007). Internationalization also provides access to inputs not readily available in the domestic market, thus fostering innovation (Salomon and Shaver 2005). In general, this is consistent with the fact that increased competition from imports induces productive firms to innovate by increasing R&D efforts, patenting licensing, and upgrading IT technologies (Bloom et al. 2011).

Several related papers show the effects of exporting in a transition economy setting. Using a Heckman selection model, Damijan et al. (2009) find that for several transition countries exporting to advanced markets gives rise to organizational learning whereas exporting to less developed economies does not. Using panel data from the Community Innovation Survey (CIS) for Slovenia, Damijan et al. (2010) show that exporting increases the likelihood to engage in process innovation, but that it is not related to product innovation. To study the effect of international activities on innovation Şeker (2012) uses data from 43 developing countries of which the majority are in fact transition economies. He shows that trade-oriented firms are more likely to introduce new products and improve the firm's production process. De Loecker (2007) uses matching methods to study the effects of internationalization in Slovenia. Accounting for selection effects, this paper shows that exporting results in higher levels of productivity. [2]

The key innovation is that we include legacy effects. In the studies above, the empirical difficulty that arises is that self-selection of firms into exporting is likely to be related to the degree to which the communist institutional legacy system is embedded in the firm's organization (Brooke and Ramage 2001; Estrin et al. 2009; Filatotchev et al. 2008; Gelbuda et al. 2008).v[3] Thus, for these countries, to analyze the effects of internationalization using standard secondary firm-level characteristics like size would not be sufficient, because in transition economies such variables do not fully capture key differences in legacy variables across firms that may drive the selection into international activities. An example may help. Suppose that we match two firms based on size and industry because these two variables are predictors of internationalization. We may then find that two large firms have the same propensity to be exporters, but one of them is and the other is not. We then find that the exporter is more innovative. However, it may well be the case that the firm that is large but not exporting is a former state-owned enterprise serving the domestic market, while the other firm is an upcoming entrepreneurial one. Hence, especially in the context of transition economies a standard matching approach based on only firm size and industry characteristics would create a bias in finding positive effects of internationalization on innovation.

The reason why other studies match on size follows the theoretical prediction of the Melitz (2003) model that exporters within an industry are the most productive and thus

[2] However, also using data for Slovenia, Damijan and Kostevc (2006) do not find substantial learning effects from exporting.

[3] We also build on insights from Bloom et al. (2012) who show that there is a gap in organizational practices between firms from advanced economies is and transition economies. Firms from transition economies face relatively low levels of domestic competition and make relatively small investments in human capital. An important consequence of the legacy system influence at the firm level is that it reduces the degree of internationalization (Estrin et al. 2009; Gelbuda et al. 2008).

largest firms and are the ones that benefit most from globalization. This theoretical finding is based on early empirical work on expvorters (Bernard and Jensen 1999, 2004) and firms that engage in foreign direct investment (FDI) (Helpman et al. 2004; Arnold and Hussinger 2010). Recent extensions of the seminal Melitz (2003) model focus on the relationship between internationalization and innovation. The most productive firms in general have an incentive to engage in innovative activities prior to foreign market entry. In an early paper, Yeaple (2005) studies a situation where homogenous firms make R&D investments, in anticipation of internationalization, to increase productivity. Melitz and Costantini (2008) present a model in which before trade liberalization the most productive subset of firms in an industry makes investments to upgrade the production process, so as to take advantage of higher profit margins. For several countries in the Pacific, Aw et al. (2007, 2008, 2011) show that exporters have a tendency to make complementary investments in R&D and invest more in training workers to increase innovative capabilities.

As an alternative strategy for identification, a large set of papers exploits periods of aggressive trade liberalization for individual countries to estimate how international trade affects the firm's technological capabilities and productivity. Amiti and Konings (2007) use a tariff reform shock in Indonesia to uncover that firms that start importing increase product variety and quality. Goldberg et al. (2010) use firm-level data from India and find that trade liberalization induces domestic firms to use superior foreign inputs. Bustos (2011) studies the effect of trade liberalization on R&D efforts for Argentinean firms. She shows that firms in sectors where tariffs are reduced substantially also have the highest growth rate in R&D spending. As opening up to international trade often is part of a wider liberalization program, it may well be that firm behavior is driven by unobserved heterogeneity in the firm's business environment unrelated to trade liberalization and by country-specific factors.

We also contribute to the small literature that compares the effects of different internationalization strategies. We show that the impact of internationalization on innovation varies across internationalization modes. Exporting and outsourcing contribute to new product development, whereas exporting and FDI are connected to R&D investments and patenting. Castellani and Zanfei (2007) also study the relationship between exporting, FDI, and innovation. In line with our results, they find that the internationalization of Italian manufacturers allows firms to acquire knowledge, which in turn results in innovation. Related work by Kafouros et al. (2008) further shows that British firms with a higher degree of internationalization spend more on R&D, possibly suggesting that indeed foreign market expansion may drive innovation. For Spanish firms, Golovko and Valentini (2011) find that exports raise innovation because there is a complementarity. In contrast Monreal-Pérez et al. (2012) find no additional learning effects from exporting on product and process innovation for Spanish firms.[4]

For our estimation strategy, we use the insights from various papers that analyze the roots of the legacy system in former communist countries (Dixon et al. 2010; Filatotchev et al. 2008; Gelbuda et al. 2008; Kriauciunas and Kale 2006; Meyer and Peng 2005; Steensma et al. 2008). Lyles and Salk (1996) study the role of knowledge acquisition in Hungarian international joint ventures. They highlight the vital role of organizational

[4] Although in the international business literature there are several case studies that show how internationalization drives innovation and technology adoption (Knight and Cavusgil 2004; Child and Rodrigues 2005; Mathews 2006; Bonaglia et al. 2007; Duysters et al. 2009; Contractor 2012), econometric evidence is still scant and context specific.

practices and managerial capabilities to reconfigure resources and to absorb new knowledge. Rojec et al. (2004) show that foreign-owned Estonian and Slovenian manufacturers are more efficient than domestic firms and that foreign ownership affects the propensity to export. Using a sample of 406 firms from Estonia, Hungary, Poland, Slovakia, and Slovenia, Filatotchev et al. (2008) find that foreign investment and foreign control of the firm have a positive effect on export intensity. In a recent study, Hagemejer and Tyrowicz (2012) use matching techniques to evaluate the impact of foreign ownership on the performance of Polish firms. They find that inward FDI improves productivity, but note the importance of reverse causality in that foreign investors prefer to invest in Polish firms that are exporting. Wilhelmsson and Kozlov (2007) look at productivity trajectories of Russian firms. They provide some support for learning by exporting effects, although after some years this effect disappears.

2 Data and Estimation Strategy

2.1 Data

We use data from the EBRD-World Bank Management, Organisation and Innovation (MOI) survey to analyze the impact of internationalization on innovation. The primary goal of this survey is to get a better understanding of the role of innovation and management quality in transition economies (see Bloom et al. 2012; EBRD 2009; Schweiger and Friebel 2013). The survey also includes a number of questions related to the international activities of the firm, which allow us to link internationalization and firm characteristics to innovation. The survey staff conducted interviews with a production or operations manager in the period October 2008 to March 2009. The response rate was 44 % and each interview took on average 50 min. In total, 1.355 firms are included in the full sample ranging across ten transition economies.[5]

We consider three internationalization modes. First, the variable *international outsourcing* indicates whether the establishment subcontracts production to another country. That is, domestic subcontracting activities are excluded from this variable as well as production activities that the firm engages in for a foreign partner, for this would be included in the export variable. In the sample, 9.2 % of the firms outsource, with Germany as most frequent destination. Second, the variable *export* indicates whether the firm sells its main product mostly abroad, that is, most sales are international. This implies that in our setup there are firms classified a non-exporters that in fact sell a part of their production abroad and may potentially be large exporters in absolute volume. In total, 23.4 % of the firms report that their sales are mainly international and these firms are thus counted as exporters. Third, *FDI* is a dummy variable that shows whether the firm has establishments abroad. This variable only identifies firms that have foreign establishments, however, it does not indicate how important these establishments are

[5] This means that our results are less affected by context-specific liberalization trajectories, which are uncontrolled for in individual country studies. Most empirical studies that investigate the effects of internationalization often focus on selected individual countries. The estimation of the effects of internationalization is especially challenging in transition economies. In this context, firm behavior is strongly influenced by the rapid economic and institutional transformation of society from a planned to a market economy in the late 1990s (Meyer and Peng 2005; Berglöf et al. 2010).

relative to the total firm revenues, since there is no information in the data about the foreign sales or input production generated by subsidiaries. In our sample, 6.9 % of the firms indicate that they have one or more establishments abroad.

We examine the effect of internationalization of three innovation measures. First, *product innovation* is the current share of sales attributed to new products and services that were introduced over the past 3 years. In the sample, 67.4 % of the firms have launched new products and services over the last 3 years. For these firms, on average the share of annual sales accounted for by new products and services is 30.1 %, with a median share of sales of 20.0 %. We prefer a percentage measure of product innovation to a dummy that indicates whether new products and services are launched, as such a dummy is not informative about the importance of product innovation nor is it very selective given the high share of firms that indicate to have launched new products and services. Second, *R&D* captures whether the firm invests in research and development, defined as creative work undertaken systematically to increase the firm's knowledge. In our sample, 37.8 % of the firms undertake R&D efforts. Third, *patents* is a dummy variable that measures whether the firm has registered patents abroad. In total, 8.0 % of the firms own international intellectual property rights in the form of patents.

The survey data allow us to capture large heterogeneity in institutional legacy system effects at the individual firm level. Brooke and Ramage (2001) define a legacy system as made up of technical components and social factors (such as software, people, skills, business processes), which no longer meet the needs of the business environment. The following set of variables refer (in combination) to potential administrative heritage of the communist system. First, we include two ownership variables. *Foreign owned* is a dummy variable that indicates if a foreign owner holds a share of at least 25 % in the firm. *State owned* indicates state ownership of the firm for the past 3 years. Managers were asked if the 'national' state was the largest owner 3 years ago, and, whether this has changed. In general one may expect that the communist legacy is larger than average in state owned firms and smaller than average in foreign owned firms. In addition to the origin of firm ownership we include two legacy variables that measure the background of the firm's management they are indicative of a generally lower legacy system at the firm. *MNE experience* captures the share of top managers that have prior work experience in a multinational firm. *MBA* measures the share of top and middle managers with a Master of Business Administration degree.

We also include a set of organizational and managerial practices that are suggestive of legacy effects. The variable *Consult* indicates whether the firm recently hired an external consultant to help improve the management of the firm. *Organizational levels* measures the number of hierarchical levels in the control structure of the firm, which when combined with firm size can be thought of as an indicator for the degree of decentralization. *Best practices* is used as a measure for organizational excellence. The manager was asked to indicate how well managed the firm is relative to other firms using a five-point scale of best practices in terms of people management (promotions, rewards, hiring people, etc.), operations management (processes, production, etc.) and in overall terms. Moreover, we replicate the normalized management practices scale in Bloom et al. (2012). This *Management practices* indicator uses information from 12 items on four key management principles at the firm-level related to i) how operational problems are handled, ii) how monitoring is implemented, iii) how targets are given, and, iv) what incentives and rewards are used. To capture the degree of openness at the

organizational level, a five item scale *Democracy* measures whether management asks employees for their opinion with regard to decisions about i) working hours, ii) days of factory holidays, iii) employing new workers, iv) making investment decisions (purchasing fixed assets), and, v) setting prices (Cronbach's alpha =0.63).

In terms of legacy variables we use information about the competitive environment of the firm, as competitive pressure is indicative of a greater movement away from planned markets. *Competition* is a dummy that captures whether firms face more than five competitors in their main product market. *Competition MNEs* is a dummy variable that indicates whether there are multinational firms selling in the domestic market. Apart from firm level competition, variation in legacy systems at the firm level may well be accounted for by overall country level transition effects, for which we want to control. Krammer (2009) looks at the drivers of innovation in Eastern Europe at the macro-level and finds wide regional differences in institutional heritage and commitment to technological upgrading. The country indicator for 2009 calculated by the EBRD scores each country's transition to a market economy. The scores for the 29 transition countries considered range from 1.4 to 4.0. In our study we categorize countries with a score below 3.0 as 'low', those with a score between 3.0 and 3.5 as 'medium' and those with 3.5 or higher as 'high' (Berglöf et al. 2010).

Finally, we use a set of standard control variables. *Firm size* is the log of the number of employees and *Firm age* is the log of the number of years after the inception of the firm. *Uniqueness* measures on a five-point ordinal scale how long it takes the largest customer to find an alternative supplier if the firm shuts down. Uniqueness relates to the theoretical concept of asset specificity, which is often assumed to be predictive for both internationalization and innovation as it can augment ownership advantages. Finally, eight industry dummies are included: *chemicals* (4.0 %), *clothing* (garments and textiles, 14.4 %), *electronics* (4.4 %), *foods* (15.7 %), *machinery* (9.1 %), *metallurgy* (13.9 %), *plastics and rubber* (4.2 %). *Other manufacturing* (34.3 %) is used as the base category.

Table 1 presents an overview of the key internationalization and innovation variables per country ordered by transition phase. Firms in transition countries that have restructured their economies have on average the highest scores on internationalization and innovation. Firms in the low transition group are in general the least active abroad and innovate relatively little, although these differences are not substantial when compared to the medium transition group. There is also much variation in international activities. For example, Bulgaria, Lithuania, Poland and Romania - countries that have adopted market reforms and are now part of the European Union - have the highest share of exporting firms. Lithuania and Poland also are home to firms that have many establishments abroad, with average shares above 15 %, while in Ukraine and Uzbekistan only about one percent of the firms has foreign affiliates. International outsourcing is common in Lithuania, where 47.0 % of the firms interviewed do so, and least common in Uzbekistan, where less than one percent of the firms engage in international production sharing.

With respect to innovation, a similar pattern along the country's transition phase emerges. Firms from countries with high transition scores are more engaged in R&D, product innovation, and international patenting. More than 40 % of the manufacturing firms in Belarus, Bulgaria, Lithuania, Poland and Russia are engaged in R&D activities, whereas only 15 % of the firms in Uzbekistan return such R&D efforts. Firms that launch most new products and services are located in Bulgaria, Lithuania, and Poland. Finally,

Table 1 Summary statistics of key variables per country by transition phase

Transition	Country	Obs.	Internationalization			Innovation		
			Int. outsourcing	Export	FDI	Product innovation	R&D	Patents
Low		485	0.04	0.15	0.06	16.55	0.32	0.07
	Belarus	102	0.06	0.25	0.06	21.58	0.47	0.14
	Kazakhstan	125	0.02	0.09	0.05	16.53	0.32	0.07
	Serbia	135	0.08	0.19	0.13	11.96	0.39	0.07
	Uzbekistan	123	0.01	0.11	0.01	18.34	0.15	0.03
Medium		513	0.06	0.16	0.04	18.9	0.37	0.06
	Romania	152	0.11	0.38	0.04	18.58	0.27	0.04
	Russia	214	0.04	0.03	0.05	19.57	0.47	0.09
	Ukraine	147	0.03	0.11	0.01	18.27	0.35	0.06
High		357	0.20	0.45	0.12	23.79	0.45	0.11
	Bulgaria	154	0.05	0.50	0.06	22.04	0.45	0.10
	Lithuania	100	0.47	0.47	0.15	28.03	0.41	0.12
	Poland	103	0.17	0.36	0.18	22.12	0.52	0.12
Overall		1355	0.09	0.23	0.07	19.33	0.38	0.08

patents abroad are observed mainly in advanced transition economies, which on average have over 10 % of manufacturers holding an international patent. Belarus is the exception.

Table 2 shows the correlations among of the variables used in this study. The internationalization modes are correlated, although the strength of the relationships is modest ($r<0.20$). International activities are especially correlated with patents abroad, whereas R&D efforts and sales from product innovation are only weakly related to internationalization ($r<0.10$). All innovation variables are significantly inter-correlated. Foreign owned firms have a higher tendency to be internationally active than firms with domestic ownership, while the opposite holds for state-owned firms. The analysis further shows that firms with managers that have experience in multinational firms and in which managers hold MBAs are more likely to be internationally active.[6] Firms that hire international consultants, incorporate best practices and managerial principles, and, have higher worker participation also have a higher likelihood to be internationally active. Further, there is a positive relationship between internationalization and competitiveness, however, facing competitions from multinationals tends to decrease export participation. Firms with a unique product have a higher likelihood to be internationally active.

In Table 2, certain correlation patterns emerge between the internationalization modes. Firms that engage in FDI have more organizational levels. There is no significant relationship between exports and the number of organizational levels.

[6] Firm owners that foresee international activities may engage in hiring executives with international experience. Although these managers contribute to the internationalization of the firm, when they are hired because of a previous decision to internationalize the firm, their capabilities do not *cause* internationalization. In a recent working paper, using Brazilian linked employer-employee mobility data, Molina and Muender (2013) show that firms that later become engaged in exporting invest in hiring internationally experienced managers.

Table 2 Descriptive statistics and correlation matrix of variables

	Mean	s.d.	1	2	3	4	5	6
Internationalization								
1 Int. outsourcing	0.09	0.29						
2 Export	0.23	0.42	0.13					
3 FDI	0.07	0.25	0.18	0.09				
Innovation								
4 Product innovation	19.33	25.05	0.10	0.06	0.04			
5 R&D	0.38	0.49	0.10	0.04	0.10	0.27		
6 Patents	0.08	0.27	0.11	0.16	0.22	0.07	0.14	
Legacy variables								
Foreign ownership	0.13	0.34	0.12	0.20	0.31	0.01	−0.02	0.09
State owned	0.13	0.34	−0.04	−0.07	−0.03	−0.01	0.04	0.03
MNE experience	0.03	0.13	0.10	0.11	0.08	0.10	0.03	0.03
MBA	11.56	27.46	0.07	0.05	−0.02	0.04	0	0.06
Consultancy	0.06	0.24	0.15	0.02	0.20	0.05	0.15	0.04
No. organizational levels	15.38	28.48	0.02	−0.03	0.07	−0.02	−0.02	−0.01
Best practices	3.77	0.79	0	0.09	0	0.02	0.05	0.03
Management practices	0	1	0.02	0.11	0.07	0.06	0.13	0.06
Democracy	0.24	0.25	0.15	0.07	0.01	0.1	0.08	0.03
Competition (high)	0.55	0.49	0	0.06	−0.03	0.06	0.05	−0.05
Competition MNEs	0.50	0.50	−0.02	−0.55	0.02	0.06	0.09	−0.07
Controls								
Firm size	5.04	0.92	0.06	0.12	0.11	0.09	0.20	0.16
Firm age	3.02	0.90	0	−0.08	−0.03	0	0.05	0.02
Uniqueness	2.94	1.17	0.07	0.19	0.02	0.10	0.10	0.09

Firm size is highly correlated with internationalization, while firm age tends to have a negative association with international activities, in line with the idea that older firms are stronger affected by legacy. We find that the dummies for best practices and good management practices are uncorrelated with outsourcing and FDI, but tend to have a positive correlation with exporting. Finally, firms that score lower on legacy system variables tend to be more involved in R&D activity, gain more sales from product innovation, and have more patents abroad.

2.2 Matching Method

In this paper we use propensity score matching techniques to analyze the effect of internationalization on innovation because a well-known problem in this field of research is that there is a selection effect into foreign market entry (Melitz 2003). Ordinary least square (OLS) regressions would thus yield biased estimates since OLS cannot account for endogeneity. Matching methods allow us to correct for sample selection bias due to observable differences between the group of firms that is internationally active (treatment

group) and the group of firms that is not internationally active (control group). Matching simply involves the pairing of treated firms with a control group in terms of a range of observed characteristics. Related studies have applied matching techniques to study the effect of internationalization (e.g. Arnold and Hussinger 2010; Damijan and Kostevc 2006; Damijan et al. 2010; De Loecker 2007; Girma et al. 2004; Hagemejer and Tyrowicz 2012; Wagner 2002, 2007;).[7] The main difference with other studies is that we take the heterogeneity of institutional legacy at the firm-level into account in the matching procedure. That is, other studies have omitted such context-specific variables which might lead to biased estimates (Dehejia and Wahba 2002). We expect that by matching firms on firm size, one may not find a proper match in transition economies, because various large firms are still affected by their communist past.

An important feature of matching techniques is the construction of a counterfactual. Suppose that in a cross-section setting we ask whether internationally active firms score higher on measures of innovation. In order to obtain a credible estimate of the effect of internationalization we should assess these effects in contrast to those of a *counterfactual*: "what would have happened if the firm did not engage in international activities (which it actually did)?" For internationally active firms, we have to compare the outcomes to firms that are of 'the same type' but are *not* internationally active. For example, if close to all large firms export and nearly all small firms do not export, then we cannot find counterfactuals from which we can infer an unbiased estimate of the impact of internationalization on innovation.

To control for selection we want to match firms of the same type, but then still selection reduces the number of counterfactuals from the dataset to only a few observations. Rosenbaum and Rubin (1983) introduce the propensity score, as being the probability that a firm is, in our case, internationally active. What the propensity score matching procedure does is trying to find a comparison group that is statistically equivalent to the internationalized firm, except for the treatment status of being internationally active. Clearly, we must check whether the sample of treated and counterfactual firms is balanced, because after matching the treated and controls should be statistically equivalent.[8] One problem in cross-sectional data often is that the measures applied as controls may be

[7] To take selection effects into account, apart from matching techniques, another common strategy to circumvent potential selection bias is to cleverly pick trade liberalization events that first generate variance in the internationalization of firms, which in turn influences productivity and innovation over time (Lileeva and Trefler 2010; Bustos 2011). However, qualitative firm-level data collection often involves survey methods for which it is difficult to trace individual firms over time. In our case, the data from transition economies are a cross-section of firms, which means that we cannot observe the firm-level adjustments over time.

[8] A first requirement for matching is to account for these differences in observables by controlling for a set of covariates (conditional independence). This is a set of covariates such that the potential outcomes are independent of the treatment status, which has the effect that the selection into internationalization becomes random; this is essential for the 'construction' of a counterfactual. A second requirement is that firms can be sufficiently matched to these counterfactuals such that there is overlapping between the observable characteristics of the treated and the untreated firms (common support). Formally, common support means that for each value (or range) of the covariates, there is a positive probability of being both treated and untreated to ensure substantial overlap in the characteristics of international and not-international firms. As a treatment is binary, to estimate the propensity score a probit or logit model can be used. The set to check conditional independence must include all relevant covariates that relate to both internationalization as well as the outcome (here: innovation), which produces the specification of the selection model. Obviously, after calculating propensity scores for each firm, there are various ways to match international firms to counterfactuals. To interpret the results of the impact, standard errors of propensity score matching estimates are obtained using bootstrapping, although this produces error estimates that are asymptotically unbiased, meaning that in small samples there is no guarantee of unbiased estimates.

connected the outcome variable or, more importantly, to the likelihood of treatment. However, the quality of matching itself is not influenced by a high correlation between the controls and the outcome.[9]

Matching involves two stages. First, one has to obtain a list of covariates to yield good matches between the treatment and control group. Once such pairs or nearest neighbors are obtained, as a second step the average treatment effect on the treated firms can be derived by comparing the mean differences across the treatment and control group on the outcome variables (for a technical discussion of matching methods, see Dehejia and Wahba 2002; Rosenbaum and Rubin 1983).

We start by presenting the first-stage estimation results. To keep the matching equation parsimonious and efficient, in the selection process of relevant covariates, we have worked from general to specific modelling. This means that after stepwise removal of insignificant variables, only the variables that have significant explanatory power for the three internationalization variables – outsourcing, exporting, and, FDI - are included. We have used so-called forced matching so as to ensure that firms only become can be matched if they are located in transition countries that have a comparable score for the transition phase (see Table 1).

The findings for the first stage of the matching procedure in Table 3 show that firm size and legacy variables are main determinants of internationalization, however, for the various internationalization modes not all legacy variables have statistically significant explanatory power. Table 3 therefore gives an overview of the variables that are included in the matching process (and thus will be the basis for the outcomes in stage two). For sake of completion we also show the results of the general specification (full regressions) which includes all variables before moving to the parsimonious results that include only significant variables. Notice that the inclusion of the legacy characteristics, such as foreign ownership, best practices, and management consultancy substantially enhances the fit of the matching procedure. This is an important finding. To build intuition for this, observe that firm size is a good predictor of international activities. Suppose that we match manufacturing firms - so not utilities or large service firms where we expect large public involvement - only on how their size predicts international activity. The matched pair will then consist of a firm that is internationally active while the other is not. When size is also a good predictor for management practices, it captures many underlying characteristics of the firm and thus filters out self-selection into internationalization and innovation. However, in transition economies large firms in manufacturing may well differ substantially because of institutional legacy system effects. When selection into exporting and innovation is affected by such legacy effects

[9] Because for treated firms with relatively high propensity scores there are only few untreated firms, it is a challenge to match properly. If a 'with replacement' procedure is followed, we will in some cases compare several internationally active firms with the same not-internationally active firm. This could potentially lead to estimation problems, as it is possible that this selected counterfactual has unobserved characteristics that create a bias towards low levels of innovation (Dehejia and Wahba 2002). However, using the 'without replacement' method increases the variance and gives rise to problems of finding common support. Therefore, we choose to use the 'with replacement' method as default. In addition, we restrict the sample to the common support area by using a caliper of 0.10 to ensure a high quality of the match.

Table 3 Probit regression results for matching procedure

	Parsimonious model			Full regression model		
	Int. outsourcing	Export	FDI	Int. outsourcing	Export	FDI
	1	2	3	4	5	6
Legacy variables						
Foreign ownership	0.345***	0.555***	1.248***	0.218*	0.479***	1.361***
	[0.139]	[0.133]	[0.139]	[0.162]	[0.160]	[0.168]
State owned	−0.330*	−0.367**		0.038	−0.450**	0.05
	[0.152]	[0.150]		[0.289]	[0.186]	[0.262]
MNE experience	0.613**			0.315	0.295	0.567
	[0.305]			[0.323]	[0.682]	[0.710]
MBA		0.0038**		0.003	0.002	−0.012*
		[0.002]		[0.003]	[0.003]	[0.005]
Consultancy	0.732***		0.686***	0.550*	−0.260	0.511***
	[0.168]		[0.174]	[0.289]	[0.370]	[0.084]
No. organizational levels				0.002	0.008	0.002
				[0.001]	[0.005]	[0.002]
Best practices		0.150**		−0.205*	0.151*	−0.065
		[0.068]		[0.106]	[0.075]	[0.144]
Management practices				0.082	0.104*	0.019
				[0.082]	[0.053]	[0.072]
Democracy	0.904***			0.656***	−0.199	−0.388
	[0.184]			[0.227]	[0.239]	[0.301]
Competition (high)		0.410***		−0.061	0.341***	−0.414**
		[0.107]		[0.186]	[0.120]	[0.195]
Competition MNEs			0.204*			0.229*
			[0.130]			[0.150]
Other variables						
Firm size	0.097*	0.251***	0.242***	0.187	0.383***	0.329***
	[0.055]	[0.056]	[0.062]	[0.069]	[0.070]	[0.084]
Firm age				0.066	−0.001	−0.008**
				[0.096]	[0.002]	[0.169]
Uniqueness		0.265***		0.060	0.182***	−0.070
		[0.051]		[0.100]	[0.057]	[0.065]
No. firms	1296	981	1343	1241	894	1179
Chi^2	91.59	129.5	131.12	180.26	187.7	152.5
Pseudo R^2	0.124	0.177	0.216	0.257	0.300	0.293

*** $p<0.01$, ** $p<0.05$, * $p<0.10$. Robust standard errors in brackets, industry dummies included

(not the case in non-transition economies), then in the transition context these factors improve the results with respect to filtering out self-selection. Clearly, matching does not fix endogeneity completely, but the extent to which it does can be measured by investigating the power of the selection variables to influence the treatment assignment.

In our case we find that the legacy system variables on top of the other more standard firm characteristics explain to a large extent the internationalization status of the firm.[10]

There can be other firm characteristics that might explain the treatment than those listed in Table 3. We apply a parsimonious matching function so there may still be differences across the treatment and control groups in terms of other (unobserved) variables; variables on which we did not explicitly match on. To check this balancing, we calculate the mean differences across the treatment and control groups for a set of observables, including several variables not used in the main setup. Table 4 presents an overview of the average scores on a list of variables for firms in the treatment and control group, before and after the application of the parsimonious matching procedure.

Parsimonious matching cannot fully nullify the differences between treatment and control groups, however, Table 4 suggests that the first-stage results may provide unbiased estimates.[11] For international outsourcing, before matching there are significant differences in terms of legacy system variables, in particular for democracy, best practices, management practices, MBA, stated owned and uniqueness. For instance, before the matching, the average share of managers with a MBA degree was 18 % for firms that were outsourcing internationally while the other firms had on average a share of 12 %. In the column after matching, the difference between the treatment and control group were not significant anymore (indicated by the absence of a 'star'), thus indicating that although the firms were not matched on the share of MBA's, the differences across the treatment and control group disappeared with respect to the share of MBA's after matching. There were also ex ante difference for international outsourcing in terms of other controls, specifically for indicators of share listed, family business and urban location, which after the matching did not differ significantly anymore across firms that were outsourcing internationally and other firms. The same holds for export and FDI. For export in the main analysis we apply a wide set of legacy system variables so these columns are largely empty. Still, matching on these characteristics solves ex ante differences for other variables, specifically for firm age, share listed, multiple owners, manager's experience and urban location, but also for the non-matched legacy variables democracy and MNE experience. For FDI we find a similar pattern. Taken together, after matching on a parsimonious set of variables, the ex ante

[10] Balancing tests are performed to confirm that legacy system variables make a significant contribution to the matching properties so as to overcome selection on observables (see Rosenbaum and Rubin 1983, 1985). Covariate imbalance tests check if the estimated propensity scores adequately balance the observed characteristics between the treatment and the control group firms by evaluating the difference in covariate means. After matching on these characteristics, there are no differences in these variables so that there is no selection bias on observables. The standardized difference calculated - which is the size of the difference in means of the covariate between the treatment and comparison firms scaled by the square root of the average of the sample variances - is substantially below 20 after matching.

[11] Table 4 presents three exceptions where there are observed differences across treatment and control groups, which potentially creates a selection bias. First, for international outsourcing differences in best practices persist ($p<0.10$), where the other firms score higher in term of best practices than firms that outsource internationally. To our interpretation, this selection effect would in theory only create a downward bias, as better practices could translate into more subcontracting. Second, for FDI we find that firms in the treatment group score higher in terms of management practices ($p<0.10$). Before matching these differences were more pronounced ($p<0.01$) than after matching ($p<0.10$). The robustness tests in Table 5 under specification 15 show that if we match firms on management practices, the main results are the same: firms engaged in FDI are more likely to make R&D efforts and obtain patents. Third, for FDI, compared to the control group firms in the treatment still have more organizational levels ($p<0.10$) after matching, although after matching these differences again become much smaller. Given that for most variables that fall outside the matching procedure we were able to take away ex ante difference, one may suggest that due to proper matching possible bias from unobservable is also reduced.

Table 4 Differences between treatment and controls (observed selection)

	Int. outsourcing				Export				FDI			
	Means		Sig. mean differences		Means		Sig. mean differences		Means		Sig. mean differences	
	Treatment	Control	Before match.	After match.	Treatment	Control	Before match.	After match.	Treatment	Control	Before match.	After match.
Legacy variables												
State owned	0.1	0.07	*	=				=				=
MNE experience				=	0.05	0.04	***	=				=
MBA	18.03	12.05	**	=				=	6.95	6.43	*	=
No. organizational levels	17.29	15.31		=	14.11	15.95		=	24.51	15.91	***	*
Best practices	3.76	3.93	*	*				=	3.76	3.83		=
Management practices	0.01	0.01	*	=				=	0.27	0.06	***	*
Democracy	0.36	0.38	***	=	0.26	0.27	**	=	0.24	0.27		=
Competition high	0.55	0.57		=				=				=
Competition MNEs	0.44	0.48		=				=	0.55	0.43		=
Other variables												
Firm age	31.02	28.08		=	30.1	28.78	*	=	28.45	34.01		=
Uniqueness	3.19	3.15	***	=				=				=
Share listed	0.15	0.16	**	=	0.21	0.23	**	=	0.27	0.24		=
Multiple owners	0.16	0.18		=	0.12	0.17	**	=	0.15	0.09		=
Family business	0.1	0.06	**	=	0.05	0.07		=	0.04	0.03		=
CEO age	48.79	47.73		=	49.27	48.37		=	48.8	47.36		=
Manager's experience	2.47	2.47		=	2.58	2.53	**	=	2.46	2.37		=
Urban location	0.29	0.27	***	=	0.27	0.32	***	=	0.37	0.37		=

This table only includes legacy variables that in the first-stage of the matching procedure were not significant. For the control variables, only firm age and uniqueness are presented as they were not part of all parsimonious matching for the three forms of internationalization. The list of other variables includes a set of available observables from the MOI survey. The results indicate that although these variables were not used in the first-stage (and thus not part of the second stage results), there was significant balancing due to the matching on other observables, as indicated by the "=" sign as there were no significant differences, where *** $p<0.01$, ** $p<0.05$, * $p<0.10$

differences disappears, suggesting that the matching takes care of potential selection effects, thus possibly also of unobserved variables.

3 Results

Table 5 shows the main results for the second stage comparison between paired treated and untreated observations. From left to right we present that data for increasing levels of innovation. We have indicated that new product launches are a rather common innovation, R&D spending is a proxy for more comprehensive innovation efforts, and a portfolio of international patents signals high levels of innovativeness. Comparing rows, when the dependent variable is a dummy, the data show the increase in probability of innovation activities when firms engage in outsourcing, exporting, and FDI when compared to similar firms that do not engage in these activities. In addition, we may qualitatively compare the effects of deeper forms of internationalization (FDI) on innovation when compared to lower levels of international commitment (outsourcing, exporting).

In the first row, we see that outsourcing production has a small and weakly significant positive effect on the probability of product innovation. The second row shows that exporting firms have higher scores on all innovation measures when compared to similar firms that do not export. The third row reports that firms that engage in FDI are also more likely to be engaged in R&D activities and international patenting when compared to similar firms that do not have foreign establishments. Panel A reports the mean differences across the treatment and control group in the outcome variable, whereas Panel B translates this in the increase in percentages of probability that the firm is engaged in the activity. As a general conclusion, firms that are engaged in international activities are more likely to innovate when compared to firms that are not internationally active.

We have argued that deeper foreign commitments potentially translate into a higher probability of complex forms of innovation. Comparing the results in row two to those in row three, we see that the low commitment mode (exporting) has a stronger effect on the probability of product innovation. By contrast, the effects of FDI are stronger for the incidence of R&D and international patenting. The effects of deeper commitment modes with respect to vertical global integration can be seen by comparing row one to row three. Again, the low commitment mode (outsourcing) only has an effect on the assumed relative simple forms of innovation (product innovation) and no statistically significant effect on the proxies for complex forms of innovation (R&D and patenting). By contrast, FDI has an effect on the proxies for complex innovation but not on those for product innovation. Overall, we conclude from these results that firms that have deeper international commitments when compared to similar firms have a higher probability to be engaged in complex forms of innovation that require R&D.[12]

For robustness purposes, we check whether the configuration of the first-stage covariate list in the matching procedure affects the main results. In Appendix 1 we show that the coefficients of various estimation models are similar to the key findings in Table 5. Here we

[12] The new product dummy (without the requirement of significant contribution to sales) is insignificant for FDI and export, but significant for international outsourcing. We do not use this dummy in the main analysis, because we only want to look at how meaningful these product and service innovations are for the firm. The fact that over two-third of the firms indicate that they launched new products and services suggests that it is difficult to use such an indicator as a measure of distinction between innovators and non-innovators.

Table 5 The impact of internationalization on innovation

	Panel A: ATE (mean difference)			Panel B: estimated effect size		
	Product innovation	R&D	Patents	Product innovation	R&D	Patents
Int. outsourcing	4.7*	0.07	0.06	20.1 %*	14.9 %	42.7 %
Export	4.6*	0.10**	0.11***	18.7 %*	24.8 %**	121.8 %**
FDI	1.6	0.16***	0.24***	7,1 %	41.5 %***	263.6%***

*** $p<0.01$, ** $p<0.05$, * $p<0.10$. Nearest neighbour matching ($n=5$), with replacement, caliper (0.1). Exact forced matching on transition category. Significance levels are determined by bootstrapping with 500 replications

briefly discuss some interesting findings.[13] For instance, specification 1 uses a subsample of only domestically owned firms, where we find no substantial difference with the full sample, except that the effect of exporting on patents is insignificant. We also test the effects of international outsourcing for the subsample of domestically owned firms, where we specify whether production is subcontracted to an OECD country. In this sub-sample, 6.1 % of the firms outsources towards these countries, while the rest of the outsourcing of production is done in countries like China, Thailand and Vietnam. Using this regional measure of subcontracting, we find a significant effect of international outsourcing on the share of sales of new products (mean difference between treated and controls is 4.9) implying that enterprises that outsource production towards relatively rich countries are able to introduce new products and services. However, subcontracting towards OECD countries does not affect deeper forms of innovation like R&D and patenting.

4 Conclusion

This study explores how different forms of internationalization affect innovation at the firm-level. The data cover 10 transition economies from Eastern Europe and Central Asia. We exploit detailed information on the firm's degree of institutional legacy to take selection effects into account when evaluating the impact of international outsourcing, exporting, and FDI on various innovation measures. The results show that low international commitment modes (outsourcing and exporting) are associated with the introduction of new products and services. Deeper forms of international commitment (FDI) are connected to more complex innovation in the form of R&D spending and international patenting.

Although we use a broad survey that covers multiple countries, as we use cross-sectional data it is difficult to convince that we are presenting causal relations. Certainly, future research may use time series, however, for the moment we are restricted to time-invariant data from qualitative questionnaires. By contrast, studies that use secondary databases to create time-series often have to rely on indirect proxies. Such time-series data also are unable to include qualitative indicators for individual firms that signal selection, so that one would need long time series to use a firm-level fixed effect panel estimation to take account of such 'unobservables'.

[13] Another potential issue is the interplay between the different internationalization forms, that is, firms that are exporting can also be involved with other internationalization forms (see weak correlations in Table 2). We have tested subsamples where we dropped firms that undertake more than one international activity and the main findings remain unchanged.

From a policy perspective, our study supports other studies that present micro-level evidence of the benefits of trade liberalization and integration in the world economy for transition economies. When trade liberalization – for example through membership of the WTO and the European Union - results in increased internationalization of firms, this has a positive effect on innovation.

Appendix

Table 6 Robustness tests for the effects of internationalization on innovation

	Product innovation			R&D			Patents		
	Int. outsource	Export	FDI	Int. outsource	Export	FDI	Int. outsource	Export	FDI
Panel A									
1	8.0***	2.2*	0.4	0.05	0.13**	0.13*	0.07	0.01	0.19**
2	3.6*	2.5*	2.4	0.05	0.04	0.13**	0.11**	0.10**	0.26***
3	3.7*	0.2	2.0	0.04	0.10**	0.20***	0.08	0.10**	0.27***
4	4.7*	1.2	2.4	0.14**	0.04	0.10**	0.06	0.09***	0.26***
5	4.3*	3.5*	6.1*	0.09*	0.05	0.20***	0.08	0.10***	0.25***
6	7.6**	2.8*	2.7	0.11**	0.06*	0.15***	0.10*	0.10**	0.24***
7	0.8	2.2*	1.2	0.10**	0.04	0.09*	0.06	0.09**	0.25***
8	5.6**	4.9**	5.4	0.03	−0.02	0.25***	0.12**	0.10**	0.27***
9	6.6**	1.9	0.8	0.09	0.01	0.14**	0.12**	0.06*	0.19**
10	−2.9	2.0	−0.5	0.19***	0.10**	0.09*	0.10*	0.10***	0.26***
11	6.6**	3.9*	5.9*	0.05	0.04	0.16**	0.12**	0.10**	0.25***
12	6.5**	−1.4	1.4	0.12**	0.05	0.11*	0.10*	0.08**	0.22***
13	1.2	4.6**	0.1	0.14**	0.09**	0.11**	0.08	0.10***	0.28***
14	4.2**	5.1**	0.12	0.04	0.12**	0.29**	0.00	0.02	0.09*
15	8.9**	3.5**	4.2	0.17***	0.05*	0.18***	0.10**	0.08**	0.25**
Panel B									
Count	12/15	10/15	2/15	8/15	7/15	15/15	8/15	12/15	15/15
Average	4.6	2.6	2.77	0.10	0.06	0.16	0.09	0.08	0.24

Matching procedure is similar to Table 4. The summary in Panel B indicates that the results are comparable to the main findings from Table 4, although there is the usual variation across specifications. Specification 1 uses a subset of firm that have no foreign ownership. Specifications 2–4 use forced (exact) matching on the transition indicator categories, while specifications 5–13 do not apply exact matching. Specifications 5–7 use nearest neighbour matching (n=5). Specifications 2 and 9–10 use Epanechnikov kernels for matching treated and controls. Specifications 3 and 11–13 use one-to-one matching with no replacements. Specification 2,3,5,8, and 11 use the full set of covariates, where specifications 5,8 and 11 also include country dummies. Specifications 6,9 and 12 also apply the full set of covariates but without country specific information. The analyses from 4,7,11 and 13 are based on a minimum set of covariates, where in specification 4 firms are matched on SIZE, AGE and industry dummies before exact matching on transition group. Specifications 7, 10, 13 and 14 match on SIZE, AGE, industry and country dummies. Specification 14 uses without replacement. Specification 15 matches firms on size and management practices similar to the procedure in Table 4

References

Amiti M, Konings J (2007) Trade liberalization, intermediate inputs, and productivity: evidence from Indonesia'. Am Econ Rev 97(5):1611–1638

Arnold JM, Hussinger K (2010) Export versus FDI in German manufacturing: firm performance and participation in international markets'. Rev Int Econ 18(4):595–606

Aw BY, Roberts MJ, Winston T (2007) Export market participation, investments in R&D and worker training, and the evolution of firm productivity'. World Econ 30(1):83–104

Aw BY, Roberts MJ, Xu DY (2008) R&D investments, exporting, and the evolution of firm productivity'. Am Econ Rev 98(2):451–456

Aw BY, Roberts MJ, Xu DY (2011) R&D investment, exporting, and productivity dynamics'. Am Econ Rev 101(4):1312–1344

Berglöf E, Bruynooghe L, Harmgart H, Sanfey P, Schweiger H, and Zettelmeyer J (2010) 'European transition at twenty: Assessing progress in countries and sectors', *UNI-WIDER Working Paper No. 2010/91*

Bernard AB, Jensen JB (1999) Exceptional exporter performance: cause, effect, or both?'. J Int Econ 47(1):1–25

Bernard AB, Jensen JB (2004) Why some firms export'. Rev Econ Stud 86(2):561–569

Bloom N, Draca M, and Van Reenen J (2011) 'Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity', NBER Working Paper No. 16717

Bloom N, Schweiger H, Van Reenen J (2012) The land that lean manufacturing forgot? Management practices in transition countries'. Econ Transit 20(4):593–635

Bonaglia F, Goldstein A, Mathews JA (2007) Accelerated internationalization by emerging markets' multinationals: the case of the white goods sector'. J World Bus 42(4):369–383

Brooke C, Ramage M (2001) Organisational scenarios and legacy systems'. Int J Inf Manag 21(5):365–384

Bustos P (2011) Trade liberalization, exports, and technology upgrading: evidence on the impact of MERCOSUR on Argentinean firms'. Am Econ Rev 101(1):304–340

Castellani D, Zanfei A (2007) Internationalisation, innovation and productivity: how do firms differ in Italy?'. World Econ 30(1):156–176

Child J, Rodrigues SB (2005) The internationalization of Chinese firms: a case for theoretical extension?'. Manag Organ Rev 1(3):381–410

Contractor FJ (2012) Why do multinational firms exist? A theory note about the effect of multinational expansion on performance and recent methodological critiques'. Glob Strateg J 2(4):313–331

Damijan JP, Kostevc Č (2006) Learning-by-exporting: continuous productivity improvements or capacity utilization effects? Evidence from Slovenian firms'. Rev World Econ 142(3):599–614

Damijan JP, De Sousa J, Lamotte O (2009) Does international openness affect the productivity of local firms?'. Econ Transit 17(3):559–586

Damijan JP, Kostevc Č, Polanec S (2010) From innovation to exporting or vice versa?'. World Econ 33(3): 374–398

De Loecker J (2007) Do exports generate productivity? Evidence from Slovenia'. J Int Econ 73(1):69–98

Dehejia RH, Wahba S (2002) Propensity score-matching methods for nonexperimental causal studies'. Rev Econ Stat 84(1):151–161

Dixon SE, Meyer KE, Day M (2010) Stages of organizational transformation in transition economies: a dynamic capabilities approach. J Manag Stud 47(3):416–436

Duysters G, Jacob J, Lemmens C, Jintian Y (2009) Internationalization and technological catching up of emerging multinationals: a comparative case study of China's Haier group'. Ind Corp Chang 18(2):325–349

EBRD (2009) Transition report 2009: Transition in crisis? EBRD, London

Estrin S, Hanousek J, Kočenda E, Svejnar J (2009) The effects of privatization and ownership in transition economies'. J Econ Lit 47(3):699–728

Filatotchev I, Stephan J, Jindra B (2008) Ownership structure, strategic controls and export intensity of foreign-invested firms in transition economies'. J Int Bus Stud 39(7):1133–1148

Gelbuda M, Meyer KE, Delios A (2008) International business and institutional development in Central and Eastern Europe'. J Int Manag 14(1):1–11

Girma S, Greenaway D, Kneller R (2004) Does exporting increase productivity? A microeconometric analysis of matched firms'. Rev Int Econ 12(5):855–866

Goldberg PK, Khandelwal AK, Pavcnik N, Topalova P (2010) 'Imported intermediate inputs and domestic product growth: evidence from India'. Q J Econ 125(4):1727–1767

Golovko E, Valentini G (2011) Exploring the complementarity between innovation and export for SMEs' growth'. J Int Bus Stud 42(3):362–380

Hagemejer J, Tyrowicz J (2012) Is the effect really so large? Firm-level evidence on the role of FDI in a transition economy'. Econ Transit 20(2):195–233

Helpman E, Melitz M, Yeaple S (2004) Export versus FDI with heterogeneous firms'. Am Econ Rev 94(1): 300–316
Kafouros MI, Buckley PJ, Sharp JA, Wang C (2008) The role of internationalization in explaining innovation performance'. Technovation 28(1):63–74
Knight GA, Cavusgil ST (2004) Innovation, organizational capabilities, and the born-global firm'. J Int Bus Stud 35(2):124–141
Krammer SMS (2009) Drivers of national innovation in transition: evidence from a panel of eastern European countries'. Res Policy 38(5):845–860
Kriauciunas A, Kale P (2006) The impact of socialist imprinting and search on resource change: A study of firms in Lithuania. Strateg Manag J 27(7):659–679
Lileeva A, Trefler D (2010) Improved access to foreign markets raises plant-level productivity… for some plants'. Q J Econ 125(3):1051–1099
Lyles MA, Salk J (1996) Knowledge acquisition from foreign parents in international joint ventures: an empirical examination in the Hungarian context'. J Int Bus Stud 27(5):877–903
Mathews JA, Zander I (2007) The international entrepreneurial dynamics of accelerated internationalisation'. J Int Bus Stud 38(3):387–403
Melitz MJ (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity'. Econometrica 71(6):1695–1725
Melitz MJ, Costantini JA (2008) The dynamics of firm level adjustment to trade liberalization'. In: Helpman E, Marin D, Verdier T (eds) The organization of firms in a global economy. Harvard University Press, Massachusetts
Meyer KE, Peng MW (2005) Probing theoretically into Central and Eastern Europe: Transactions, resources, and institutions. J Int Bus Stud 36(6):600–621
Monreal-Pérez J, Aragón-Sánchez A, Sánchez-Marín G (2012) A longitudinal study of the relationship between export activity and innovation in the Spanish firm: the moderating role of productivity'. Int Bus Rev 21(5):862–877
Rojec M, Damijan JP, Majcen B (2004) Export propensity of Estonian and Slovenian manufacturing firms'. East Eur Econ 42(4):33–54
Rosenbaum PR, Rubin DB (1983) The central role of the propensity score in observational studies for causal effects'. Biometrika 70(1):41–55
Rosenbaum PR, Rubin DB (1985) Constructing a control group using multivariate matched sampling methods that incorporate the propensity score'. Am Stat 39(1):33–38
Salomon RM, Shaver JM (2005) Learning by exporting: new insights from examining firm innovation'. J Econ Manag Strateg 14(2):431–460
Schweiger H, Friebel G (2013) Management quality, ownership, firm performance and market pressure in Russia'. Open Econ Rev 24(4):763–788
Şeker M (2012) Importing, exporting, and innovation in developing countries'. Rev Int Econ 20(2):299–314
Steensma HK, Barden JQ, Dhanaraj C, Lyles M, Tihanyi L (2008) The evolution and internalization of international joint ventures in a transitioning economy. J Int Bus Stud 39(3):491–507
Wagner J (2002) The causal effect of exports on firm size and labor productivity: first evidence from a matching approach'. Econ Lett 77(2):287–292
Wagner J (2007) Exports and productivity: a survey of the evidence from firm level data'. World Econ 30(1): 60–82
Wilhelmsson F, Kozlov K (2007) Exports and productivity of Russian firms: in search of causality'. Econ Chang Restruct 40(4):361–385
Yeaple SR (2005) A simple model of firm heterogeneity, international trade, and wages'. J Int Econ 65(1):1–20