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by Ursula Fritsch,
Holger Görg

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Outsourcing, Offshoring and Innovation: Evidence from Firm-level Data for Emerging Economies

Ursula Fritsch and Holger Görg

Abstract:
It is striking that by far the lion's share of empirical studies on the impact of outsourcing on firms considers industrialized countries. However, outsourcing by firms from emerging economies is far from negligible and growing. This paper investigates the link between outsourcing and innovation empirically using firm-level data for over 20 emerging market economies. We find robust evidence that outsourcing is associated with a greater probability to spend on research and development and to introduce new products and upgrade existing products. The effect of offshoring on R&D spending is significantly higher than the effect of domestic outsourcing. However, only domestic outsourcing increases the probability to introduce new products. We also show that the results crucially depend on the level of protection of intellectual property in the economy. Firms increase their own R&D effort in the wake of outsourcing only if they operate in an environment that intensively protects intellectual property.

Keywords: outsourcing, offshoring, innovation, emerging economies.

JEL classification: F14, O31, O34

Ursula Fritsch
Kiel Institute for the World Economy
24100 Kiel, Germany
Telephone: +49 431 8814 468
E-mail: ursula.fritsch@ifw-kiel.de

Holger Görg
Kiel Institute for the World Economy
24100 Kiel, Germany
Telephone: +49 431 8814 258
E-mail: holger.goerg@ifw-kiel.de

1 Introduction

It is striking that by far the lion's share of empirical studies on the impact of outsourcing on firms considers industrialized countries[3]. This presumably partly reflects data availability, but may also reflect the presumption that industrialized countries offshore low skill parts of the production chain to emerging or developing countries. In other words, firms in such emerging or developing countries are suppliers for offshored components to the industrialized countries.

However, this is not the end of the story. Firms in emerging countries also outsource production themselves, both domestically and internationally. For example, Miroudot et al. (2009) present some stylized facts on trade in intermediates, a measure frequently used as a proxy for offshoring. They show that, while exports of intermediates were about double the level of imports of intermediates for the Commonwealth of Independent States (CIS) countries in 2006, imports of intermediate goods are at the value of just over $ 100 billion far than negligible. Imports of intermediate services account for an additional $ 30 billion. They also show that there is no discernible difference in the growth rate of trade in intermediates between OECD economies and emerging market economies. Hence, it seems highly opportune and relevant to investigate the implications of this activity for emerging economies.

In this paper we look empirically at the implications of domestic and international outsourcing for innovation activities in the outsourcing firms. We subsequently use the expression of *outsourcing* for domestic outsourcing or outsourcing irrespective of the sourcing location and *offshoring* for international outsourcing. This analysis is carried out using firm-level data for emerging economies in Central and Eastern Europe, and Central Asia. Our focus on innovation as a measure of firm performance reflects the importance of innovations as a driver of productivity growth.

In industrialized countries, one expects an effect of outsourcing on innovation for a number of reasons. First, since firms are assumed to outsource parts of the production process which are not at the core of their activities, it allows

[3]Studies that look specifically at the link between innovation and outsourcing are, for example, Görg and Hanley (2011) for Ireland and Cusmano et al. (2008) for Italy. Bloom et al. (2011) have a related paper that looks at the impact of Chinese imports on productivity and innovation in 12 advanced European countries. Arvanitis and Loukis (2012) relate various forms of outsourcing to product and process innovation. They find particularly robust positive effects of outsourcing on process innovation. They look at Swiss and Greek firms. As innovation effects are also at work for Greek firms, this hints at effects between outsourcing and innovation that also hold for countries which do not operate close to the technological frontier. Griffith et al. (2006) use British data to investigate the link between ICT investment and outsourcing.

the firm to save on factor costs and restructure operations towards higher value added activities, such as R&D and innovation (e.g., Glass and Saggi (2001)). Secondly, if offshoring takes place to technologically advanced countries it may provide access to higher quality inputs (e.g., Griffith et al. (2006))[4]. This allows the firm to learn new technologies and push outwards its technology frontier. While the restructuring effect is present for both outsourcing and offshoring, it is likely that the technology effect may be particularly important for offshoring. The use of imported inputs, in particular from industrialized countries, is likely to provide strong learning effects for firms in emerging economies, which affect their technology level and innovation activities. Goldberg et al. (2010) show for India that tariff reductions increased the number of varieties that were imported which in turn increased the innovation activities of Indian firms. Bas (2012) finds similar results for Argentina when examining tariff reductions and subsequent effects on the use of imported intermediate goods and technology spending. Gorodnichenko et al. (2010), Correa et al. (2010), Crinò (2012) also identify imports as an important driver of innovation efforts; they use the same dataset that we exploit. In line with these results, imports enhance productivity of emerging market firms (e.g., Schor (2004) for Brazil, Amiti and Konings (2007) for Indonesia, Halpern et al. (2011) for Hungary, Topalova and Khandelwal (2011) for India, Kasahara and Rodrigue (2008) and Kasahara and Lapham (2013) for Chile).[5]

While the papers cited above establish a link between trade policy and firm characteristics, only few studies illuminate what triggers increases in productivity and innovation activities. Kugler and Verhoogen (2009) emphasize the link between imports and technology upgrading. They find that more productive Colombian plants select into buying inputs of higher quality. Hence, access to higher quality inputs seems to be a concern for firms in emerging markets. In this regard, Amiti and Konings (2007) stress the benefits of learning, variety and quality effects through imported intermediate products (see also Goldberg et al. (2010)). Most importantly, the sourcing destination matters for importing firms. Goldberg et al. (2009) show that the increase in imported varieties in India following trade reform is mostly attributable to new inputs which originate from advanced countries and that these imports have higher unit values than

[4] Miroudot et al. (2009) show that 66% of intermediate services imports of CIS countries are sourced from Europe and merely 12% from other CIS countries.

[5] Chen and Ma (2012) look at this from a welfare perspective and estimate that the welfare gain due to newly imported varieties amounts to 6.2% of Chinese GDP during 1997 to 2008. Hence, the welfare gains from imports can be substantial.

before trade reform. Thus, we would also expect to see that firms in emerging economies increase innovation as a result of engaging in another activity of international sourcing, namely offshoring. This effect differs from the effect of imported intermediates as outsourcing and offshoring involve a realignment of the activities of the firm.

What does this imply for the decision to outsource of firms located in emerging economies? Of course, firms in emerging markets may outsource and offshore production in order to save on factor costs and restructure their activities, similar to their counterparts in advanced economies. However, exploiting access to superior intermediate inputs in industrialized countries may play a particularly strong role for outsourcing by firms in emerging countries. Replacing own production with foreign intermediate products or services could enable these firms to close the technological gap faster than if they used domestic intermediates.

This paper, to the best of our knowledge for the first time, attempts to investigate the link between outsourcing, offshoring and innovation empirically[6]. To do so, we use firm level data from the Business Environment and Enterprise Performance Survey (BEEPS), provided by the EBRD-World Bank, for over 20 transition countries. Specifically, the dataset covers companies located in Eastern and Central European, and Central Asian countries.

The novelty of our approach is that we separate the effects of outsourcing, offshoring and intermediate imports on innovation activities. We construct, in particular, an offshoring measure that we feel is closer to the conceptual idea of offshoring than an import variable. This measure reflects that firms produce something themselves in t but do no longer do so in t+1. Hence, merely setting up an affiliate in another location is not part of our outsourcing measure, what matters is the relocation of production processes. Introducing another

[6]Gorodnichenko et al. (2010), Correa et al. (2010) and Crinò (2012) use BEEPS data to investigate innovation activity in emerging countries. Our study differs in a number of respects. Firstly, while Gorodnichenko et al. (2010) consider the effect of foreign competition, exports and imports they do not at all examine outsourcing and offshoring. We also control for exports and imports, but focus on outsourcing and offshoring, also considering differences in effects depending on the protection of intellectual property. Correa et al. (2010) investigate determinants of technology absorption but also abstain from looking at outsourcing. We do not focus on technology absorption as such but look at innovation activities that the firm conducts on its own. Crinò (2012) also focuses on the effects of imported intermediates as a transmission channel for technology. He finds positive effects on skill upgrading. He also reports tentative positive effects on various innovation measures given that firms are engaged in high-skill intensive activities. He suggests that these effects might be related. All of these papers use data from the 2002 and 2005 surveys, while we use 2002, 2005 and 2009 data and they do not consider outsourcing.

dimension of firm activity, i.e., outsourcing, adds to the literature on production fragmentation and the internationalization strategies of firms. The fact that we emphasize outsourcing as another dimension of firm activity markedly distinguishes our work from other studies on innovation activities in developing economies, i.e., Goldberg et al. (2010), Gorodnichenko et al. (2010), Correa et al. (2010), Crinò (2012) and Bas (2012).

We find robust evidence that outsourcing, in general, is associated with a greater probability to spend on research and development, to introduce new products and to upgrade existing products. The positive effect of offshoring is stronger than the effect of outsourcing in the case of research and development efforts. We find that only outsourcing positively influences the introduction of new products. We implement an instrumental variable strategy to make sure that our results are not subject to endogeneity bias and can, therefore, be interpreted as causal effects.

We also show that the results crucially depend on the institutional environment in the economy, in particular the protection of intellectual property. Specifically, firms benefit only from outsourcing in terms of higher R&D spending if their intellectual property is sufficiently protected. We interpret this as suggesting that a lack of protection of intellectual property prevents firms from restructuring the company towards innovation activities. Instead, the firm may prefer to invest in projects which the regulatory environment facilitates. Intellectual property rights protection does not matter for the introduction of new products and for upgrading. The aforementioned effect is not present in this model as we control for R&D spending at the level of the firm so that we capture a direct innovation effect through access to better technology.

The remainder of the paper is structured as follows. Section 2 presents the data set, Section 3 the methodology and Section 4 discusses the empirical results. In Section 5, we summarize the main findings and present some conclusions.

2 Data description

We use the BEEPS dataset to analyze the impact of outsourcing and offshoring on innovation[7]. The dataset comprises companies with at least five full-time

[7]The EBRD-World Bank Business Environment and Enterprise Performance Survey (BEEPS) is carried out by the European Bank for Reconstruction and Development (EBRD) and the World Bank. For detailed information on the BEEPS dataset, for instance the questionnaires and the report on sampling and implementation, see http://www.ebrd.com/pages/research/analysis/surveys/beeps.shtml.

employees in more than 20 countries in Central and Eastern Europe, the Baltics, the CIS and Central Asia (including Turkey). A list of countries included in our data is provided in Table 7 in the appendix. The BEEPS survey provides a wide range of information on companies in the manufacturing sector. The survey was conducted roughly every three years (1999, 2002, 2005 and 2009).

In this paper we exploit the panel dimension in the BEEPS data and focus on firms that were either included in both the 2009 and 2005 surveys or in the three surveys 2009, 2005 and 2002[8]. The 2009, 2005 and 2002 surveys provide information relating to 2007, 2004 and 2001, respectively. This panel aspect to the data allows us to define an offshoring measure by combining information for the 2007 or 2004 cross-section on whether a firm outsourced activities over the previous three years and the change in imported inputs over the same period.

Our main contribution lies in using a novel measure of offshoring. We do not merely use information on imported inputs, as we feel that this does not capture the main idea of offshoring, namely, that firms produce something in t and in t+1 they do no longer produce it themselves. Although the survey provides a rather general question on outsourcing which does not ask for the destination of relocated activities, we are confident that we construct a suitable proxy for offshoring. This allows us to examine different dimensions of production fragmentation.

More specifically, the data enable us to measure two aspects of outsourcing. The first measurement is based on the explicit question whether firms had "outsourced products and services in the past three years". This variable is available for 2007 and 2004. We generate a dummy equal to one if firms answer this question in the affirmative, and denote this measure as "outsourcing". This variable captures both domestic outsourcing as well as offshoring so that we cannot disentangle the two effects. Note that outsourcing, according to this definition, involves a realignment of the activities of the firm. This variable does not cover setting up an affiliated plant which is another concept frequently referred to as outsourcing or offshoring.

In order to consider offshoring, we also use firms' answers to a question about imports of intermediates. In each of the surveys, firms are asked to declare their "foreign material inputs as a proportion of all material inputs". This captures the level of imports and, as such, does not enable us to say anything about the propensity to offshore production. Still, we can use information for

[8]We cannot identify any firms that participated in all four surveys.

2004 and 2007 (or 2001 and 2004, respectively) and calculate the *change* in imported intermediates over all intermediates for that period. We then generate a dummy variable equal to one if a firm increased its share of imported intermediates over the period in question. Using this information, we calculate a proxy for offshoring based on whether a firm outsources (the aforementioned measure of outsourcing) and also increases its proportion of imported intermediates over the past three years. If a firm both outsources and increases imports, we set a dummy variable termed "offshoring" equal to 1, and zero otherwise.

Note that, for firms that were in the 2009 and 2005 survey, we use the difference between the 2007 and 2004 values of imports of intermediates to generate the offshoring measure. All other variables relate to 2007. Hence, we have only one observation per firm for these types of firms. For firms that were in the 2002, 2005 and 2009 surveys, we can calculate two offshoring measures, one based on the difference between 2001 and 2004, the other for 2004 to 2007. Hence, for these firms we have two observations per firm.

The dataset also provides alternative measures of innovation at the firm level. It has information on whether "the establishment invested in R&D (in-house or outsourced) in the last 3 years" which reflects the effort that the firm undertakes to generate innovation output. The survey offers two questions with respect to innovation output, namely whether or not firms have, over the last three years, "newly introduced products and services", or "upgraded products and services". We use these three measures for 2007 and 2004 to generate dummy variables for whether or not firms spend on R&D, introduced new products, or upgraded products, respectively. Thus, we differentiate between a measure which proxies an input factor (R&D spending) into the innovation process and the latter two output measures. We view the introduction of new products as a stronger measure of innovation compared to upgrading, as this concerns the development of completely new products[9].

Table 1 presents descriptive statistics for firms that outsource and firms that do not outsource[10]. Observations for 1,154 firms are available for the analysis[11]. Of those, 289 (25 percent) outsource production. Outsourcers (which

[9] Our innovation measures are different from innovation measures previously deployed in studies which use BEEPS data. This is because these studies use data from 2005 and 2002 only and different waves of the survey offer different innovation measures (e.g., Correa et al. (2010), Gorodnichenko et al. (2010) and Crinò (2012)).

[10] The variables are discussed in more detail in Section 3. A table with definitions is available in the Appendix (Table 8).

[11] 319 observations relate to firms that participated in the 2002, 2005 and 2009 survey. 835 observations are from firms that are in both the 2005 and 2009 survey, but not in 2002.

can be domestic or international outsourcing) spend more often on R&D and they are more likely to introduce new products and upgrade products. They are also more likely to be importers or exporters. Additionally, outsourcers are on average larger than non-outsourcers. We do not find a relationship between outsourcing and firms that are in a joint venture with a foreign partner. We use this information to proxy foreign ownership. Neither do we find a significant role for financial obstacles, the share of the employees that hold a university degree and the extent of domestic competition.

Table 2 presents a similar breakdown for firms that offshore vis-à-vis those that outsource. The table shows that 43 percent of outsourcers also offshore. In other words, 57 percent of outsourcers only outsource domestically. Overall, 11 percent of the firms in our sample offshore. As can be seen, offshoring firms differ from outsourcing firms with respect to several characteristics. They tend to be more innovative in terms of engagement in R&D and new product innovation, that is fundamental innovation. Unsurprisingly, offshorers rely more heavily on imports in comparison to outsourcing companies.

Hence, outsourcing and offshoring firms differ from non-outsourcing firms in a number of important dimensions, but there are also pronounced differences between outsourcing and offshoring firms. This is why it is important to distinguish the concepts of outsourcing and offshoring in the subsequent analysis.

Table 1: Descriptives: Outsourcing vs. non-outsourcing

Outsourcing	Yes	No	Difference
RD	0.450	0.246	0.204***
	(0.498)	(0.431)	(0.033)
New product	0.663	0.502	0.161***
	(0.473)	(0.5)	(0.033)
Upgrading	0.817	0.646	0.170***
	(0.388)	(0.478)	(0.028)
Imports	38.394	33.912	4.482*
	(36.337)	(37.312)	(2.486)
Exports	28.848	19.312	9.536***
	(34.587)	(31.185)	(2.294)
Finance	0.471	0.461	0.009
	(0.5)	(0.499)	(0.034)
Jointownership	0.042	0.044	-0.002
	(0.2)	(0.205)	(0.014)
University	20.433	19.995	0.437
	(21.215)	(22.782)	(1.469)
Size medium	0.377	0.348	0.029
	(0.486)	(0.477)	(0.033)
Size large	0.415	0.284	0.131***
	(0.494)	(0.451)	(0.033)
Dom.compet	2.595	2.675	-0.080
	(1.044)	(1.036)	(0.071)
Observations	289	865	1154

Authors calculations based on BEEPS dataset.
Mean values in columns 1 and 2. Std. deviation in parentheses for columns 1 and 2 and std. error in parentheses for column 3.

Table 2: Descriptives: Offshoring vs. outsourcing

Offshoring	Yes	No	Difference
RD	0.544	0.378	0.166***
	(0.5)	(0.486)	(0.059)
New product	0.760	0.589	0.171***
	(0.429)	(0.494)	(0.054)
Upgrading	0.848	0.793	0.055
	(0.36)	(0.407)	(0.045)
Imports	53.616	26.793	26.823***
	(33.513)	(34.138)	(4.011)
Exports	31.088	27.140	3.948
	(35.539)	(33.853)	(4.134)
Finance	0.520	0.433	0.087
	(0.502)	(0.497)	(0.059)
Jointownership	0.048	0.037	0.011
	(0.215)	(0.188)	(0.024)
University	17.968	22.311	-4.343*
	(19.211)	(22.501)	(2.458)
Size medium	0.392	0.366	0.026
	(0.49)	(0.483)	(0.058)
Size large	0.392	0.433	-0.041
	(0.49)	(0.497)	(0.059)
Dom.compet	2.496	2.671	-0.175
	(1.052)	(1.034)	(0.124)
Observations	125	164	289

Authors calculations based on BEEPS dataset.
Mean values in columns 1 and 2. Std. deviation in parentheses for columns 1 and 2 and std. error in parentheses for column 3.

3 Econometric methodology

In order to investigate whether outsourcing and offshoring have an impact on innovation activity at the firm level we estimate variants of the following model

$$Prob(Innov_{it}) = \alpha + \beta * Out_{it} + \gamma * Off_{it} + \lambda * X_{it} + \kappa_1 * D_j + \kappa_2 * D_k + \kappa_3 * D_{07} + \varepsilon_{it} \quad (1)$$

where *Innov* is alternatively defined as a dummy if the firm conducted R&D in t (= 2007 or 2004), or if the firm introduced new products in t (= 2007 or 2004) or the previous three years, or if it upgraded a product over the same period. *Off* and *Out* are the dummy variables capturing offshoring and

outsourcing activity of a firm over the last three years, as defined in section 2. D_j and D_k are full sets of industry and country dummies. D_{07} is a dummy equal to one if the dependent variable relates to 2007; observations for 2004 are the baseline. The error term ε_{it} is clustered at the firm level, as we have two observations for some firms (that participated in three surveys).

In this model, the coefficient *beta* captures the general effect of outsourcing, both domestic and international, on innovation. The coefficient *gamma* represents an additional differential effect for offshoring compared to domestic outsourcing. We would expect *beta* to be positive, as both types of outsourcing allow restructuring of activities towards innovation. Moreover, if offshoring additionally allows better access to foreign technology through imported inputs and, therefore, provides a further impetus to innovation, or if offshoring generates additional profits due to exploitation of lower factor prices, then *gamma* should also be positive.

The model also includes a number of control variables which are collected in the vector X. Firstly, we include the share of intermediates that are imported and the share of sales that the firm directly or indirectly exports. These variables control for the fact that firms that are internationally engaged in exporting or importing tend to be more productive (e.g., Muûls and Pisu (2009), Siedschlag et al. (2011)) and, hence, may also be more active in innovation, even in the absence of any outsourcing/offshoring activity. This means, in particular, that we investigate an outsourcing/offshoring effect that can be differentiated from a more general importing effect. Outsourcing and offshoring affect the boundaries of the firm whereas this is not necessarily true for importing. This also markedly distinguishes our work from other studies. Furthermore, we include a dummy equal to one if a firm reports any R&D expenditure over the last three years. R&D, of course, is an important input into the knowledge creation process, see, for example, Criscuolo et al. (2010) and Correa et al. (2010)[12].

We also control for two aspects of the financial situation in a firm. This may be important as innovation is likely to be affected by financial constraints in a firm (Hall (2002)). The first variable is a dummy equal to one if a firm considers access to finance as a major or severe obstacle to firm operations. This is based on a survey question where firms can respond on a scale from 0 to 4 whether access to finance is no obstacle (0), minor, moderate, major or very severe (4) obstacle to current operations of the firm. The second financial variable is a

[12]We only control for R&D when considering innovation measured as the introduction of a new product or product upgrading.

dummy equal to one if the firm was founded as a joint venture with a foreign partner. This reflects the prior that foreign capital may be an important source of finance for firms, in particular for financing innovative activities (Girma et al. (2008)). However, it may also control for the fact that multinationals are more likely to undertake R&D and innovate in the headquarters in the home country (UNCTAD (2005)).

Lastly, we look at the innovation potential of the firm acknowledging that high-skilled labor, measured as the share of employees with a university degree, is a prerequisite for innovation (Gorodnichenko et al. (2010)). We also control for the degree of domestic competition (similar to Correa et al. (2010) and Crinò (2012)).

Two econometric issues arise in the estimation of equation 1. Firstly, we have a binary dependent variable. In order to deal with this, we estimate linear probability models (using OLS) as a benchmark, as well as probit models. Secondly, the offshoring and outsourcing variables are likely to be endogenous due to unobserved firm effects. For example, well-performing firms may both be likely to innovate but may also have high propensities to offshore or outsource as they are able to overcome the sunk costs associated with these activities (Antràs and Helpman (2004)). While the inclusion of our control variables should mitigate this problem - in particular the inclusion of import and export variables, which are also related to sunk costs - we nevertheless also implement instrumental variables techniques.

The challenge is, of course, to find instruments that are both relevant (i.e., correlated with the potentially endogenous variables) and valid (i.e., uncorrelated with innovation conditional on exogenous regressors in the model). Fortunately, the BEEPS survey, which asks firms about a variety of aspects related to the perception of the business environment and regulations, provides a number of potential candidates. Specifically, we use three variables for two endogenous variables: (i) the importance of pressure from customers in affecting decisions with respect to reducing the production costs of existing products or services (ii) a dummy whether the firm applied for an import license and (iii) the number of documents to import goods per shipment (on the country-level provided by the World Bank, Doing Business project) interacted with the lagged share of foreign intermediates in all intermediates (from the BEEPS survey)[13].

The rationale for the choice of these variables is as follows. Pressure from

[13]See Table 8 in the appendix for a detailed description of the variables.

customers to reduce production costs is one potential instrument. If such pressure exists, it may lead to outsourcing/offshoring in order to save on production costs. However, pressure to reduce costs of existing products should not be correlated with innovation activities, controlling for other covariates[14]. In a similar manner, applying for an import license should be correlated with offshoring but not with innovation. Lastly, we interact the number of documents to import goods per shipment with the lagged share of foreign intermediates in all intermediates. We use lagged values to avoid endogeneity concerns. We suppose that firms that are already engaged in importing are more likely to become involved in offshoring and should hence be hurt more by importing frictions. If firms, therefore, perceive themselves as excessively hindered to import by the regulatory environment, then they should abstain from offshoring. Hence, the presence of such bureaucratic hurdles should be negatively correlated with offshoring - in other words, they should be relevant instruments. However, there is no reason to think that they should affect innovation through any channel other than offshoring (conditional on exogenous variables). Hence, they should also be valid instruments. We test for instrument relevance and validity of overidentification restrictions in the empirical analysis using the standard tests.

4 Econometric results

4.1 Baseline model

Table 3 presents the baseline estimates from equation 1 using our alternative dependent variables: R&D effort (columns 1 to 3), new product development (columns 4 to 6) and product upgrading (columns 7 to 9). Columns (1), (4) and (7) show the estimates obtained from the linear probability model (estimated using OLS) without an importer dummy. Columns (2), (5) and (8) include an importer dummy, in order to allow for the fact that import activity is not necessarily identical to offshoring/outsourcing. Columns (3), (6) and (9) present marginal effects from a probit model as comparison. The different estimation procedures produce results that are similar in magnitude and statistical significance.

[14] Note that Gorodnichenko et al. (2010) use pressure from foreign competition as an explanatory variable in their analysis of innovation activity. Our measure is different in that it only considers pressure from customers, which is unlikely to be related to contemporaneous innovation activity. We are confident that our instrument is uncorrelated with innovation as another question in the survey explicitly asks for the importance of pressure from customers to develop new products or services and markets.

Table 3: Exogenous outsourcing and offshoring

	R&D LPM	R&D LPM	R&D Probit	Newprod. LPM	Newprod. LPM	Newprod. Probit	Upgrading LPM	Upgrading LPM	Upgrading Probit
Outsourcing	0.067	0.078*	0.093**	0.026	0.038	0.037	0.066*	0.075**	0.091**
	(0.042)	(0.042)	(0.044)	(0.042)	(0.042)	(0.047)	(0.035)	(0.036)	(0.038)
Offshoring	0.164***	0.130**	0.119*	0.127**	0.094*	0.119*	0.022	-0.004	-0.010
	(0.057)	(0.058)	(0.062)	(0.054)	(0.055)	(0.065)	(0.047)	(0.048)	(0.066)
Exports	0.000	0.000	0.000	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
Finance	0.044	0.042	0.050*	0.020	0.019	0.023	0.040	0.038	0.045
	(0.027)	(0.027)	(0.030)	(0.030)	(0.030)	(0.034)	(0.027)	(0.027)	(0.030)
Jointownership	0.052	0.027	0.046	0.159**	0.134*	0.170**	0.053	0.034	0.056
	(0.064)	(0.063)	(0.083)	(0.068)	(0.069)	(0.078)	(0.062)	(0.062)	(0.069)
University	0.002***	0.002**	0.002**	0.002**	0.002**	0.002**	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Size medium	0.100***	0.097***	0.126***	0.090**	0.088**	0.106***	0.119***	0.118***	0.123***
	(0.031)	(0.031)	(0.040)	(0.036)	(0.036)	(0.041)	(0.034)	(0.034)	(0.033)
Size large	0.199***	0.190***	0.226***	0.019	0.012	0.019	0.092**	0.087**	0.091**
	(0.037)	(0.037)	(0.045)	(0.041)	(0.041)	(0.047)	(0.038)	(0.038)	(0.038)
Dom.compet	0.006	0.006	0.009	0.031**	0.031**	0.037**	0.011	0.010	0.009
	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.016)	(0.013)	(0.013)	(0.015)
Imports		0.001***	0.002***		0.001***	0.002***		0.001**	0.001**
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
RD				0.271***	0.261***	0.293***	0.198***	0.190***	0.218***
				(0.031)	(0.031)	(0.033)	(0.028)	(0.028)	(0.028)
Observations	1154.00	1154.00	1123.00	1153.00	1153.00	1151.00	1154.00	1154.00	1152.00
R squared	0.20	0.21		0.21	0.21		0.20	0.21	

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance.

We find evidence for a positive effect of outsourcing and an additional positive effect of offshoring on R&D spendings. Even after controlling for imports, we find robust evidence that offshoring has a stronger effect on R&D activity than domestic sourcing only. This corroborates our initial hypothesis that offshoring provides an additional channel to transfer either superior technology or to generate higher productivity effects through the exploitation of factor price differences than domestic outsourcing. Of course, these channels might not be mutually exclusive. One potential implication of these results is that sourcing foreign technology and increasing own R&D activities are complements.[15]

The relative importance of offshoring and outsourcing is the main difference when comparing the results for new product development with those for product upgrading. For the latter, we find a statistically significantly positive effect of outsourcing on innovation, though the coefficient on offshoring is statistically insignificant (see columns (7), (8) and (9)). This implies that offshoring does not have any additional effect over and above the effect of (domestic) outsourcing. In contrast to the development of new products, product upgrading only represents small improvements to already existing products. The reorganization of the production process following outsourcing (domestic or international) seems to foster this activity.

Offshoring has a stronger potential to strengthen product innovation activities. This is reflected in the positive relation between offshoring and new product innovation (see columns (4), (5) and (6)). It is important to control for imports in our regressions as this coefficient is always highly significant and partly changes the results for R&D expenditures. Hence, the results in column (2) depict a more accurate description of the relation between imports, outsourcing and offshoring and R&D than column (1). The result, thus, shows that it is important to carefully define outsourcing and offshoring and delineate it from any general import activity that may be quite unrelated to the concept of outsourcing/offshoring.

We also find that the economic magnitude of the estimated coefficients is far from negligible. In most specifications, outsourcing and offshoring increase the probability to engage in innovation by about 10%. This is comparable to the difference between small and medium sized firms in terms of innovation. It

[15] Our results are in line with Görg and Hanley (2011) who also look at R&D spending as a measure of innovation activity. They report stronger effects for offshoring than for domestic outsourcing in case of services outsourcing and mixed results for outsourcing of manufacturing goods. We cannot compare our study to other research on outsourcing and innovation because other studies do not differentiate between outsourcing and offshoring.

also shows that offshoring provides a strong additional effect over and above outsourcing in the case of R&D spending.

Our results further show that the probability of generating innovation output is statistically significantly related to a firm's own R&D activity and its skill potential, as found by Gorodnichenko et al. (2010), Correa et al. (2010) and Crinò (2012). This suggests that the firm's own input into the innovation process is very important, in line with the literature (Criscuolo et al. (2010)). The importance of the import dummy may be related to the fact that firms in emerging economies may be importing new technology from abroad, as suggested by Kugler and Verhoogen (2009), Amiti and Konings (2007) and Goldberg et al. (2010). In fact, Crinò (2012) provides some evidence for this hypothesis using BEEPS data. He reports the main sourcing destination of foreign inputs for each country by using bilateral trade data. He finds that many transition countries source mainly from more advanced economies, particularly from the EU. This corroborates the view that quality and variety motives matter for firms located in transition economies. Additionally, we find that domestic competition fosters innovation for new product innovation and that larger firms seem to engage more intensively in innovation activities[16]. These findings are broadly in line with results presented by Correa et al. (2010) and Crinò (2012). Correa et al. (2010) find - partly in line with our results - that joint ownership matters. Finance has been found to be a major determinant of innovation (Correa et al. (2010)) but is never found to be a significant predictor in our regressions. This may be because our sample is slightly biased in favor of larger firms which might face smaller obstacles to obtain access to finance.

The assumption in the estimations thus far is that offshoring and outsourcing are exogenous in the model, i.e., not correlated with the error term in equation 1. If this assumption were violated, our estimates would be biased. We therefore now proceed to testing this assumption explicitly, using instrumental variables estimations. The instruments used and the rationale for their choice is explained in Section 3. The regression estimates for the instrumental variables estimations (LPM and Probit) are shown in Table 4. Detailed first stage results for the LPM model are relegated to the Appendix, Table 9.

[16] We also ran all regressions presented in this paper with additional control variables, such as firm age and the share of owners that are of foreign origin. Foreign owners comprise private foreign individuals, companies or organizations. None of these variables is statistically significant and they do not alter the results of the regressions. The results are available from the authors upon request.

Table 4: Endogenous outsourcing and offshoring

	R&D LPM	R&D Probit	Newproduct LPM	Newproduct Probit	Upgrading LPM	Upgrading Probit
Outsourcing	0.019	0.063	0.414**	0.448***	0.259	0.260**
	(0.190)	(0.224)	(0.202)	(0.162)	(0.178)	(0.127)
Offshoring	0.194	0.186	-0.348*	-0.402*	-0.212	-0.219
	(0.186)	(0.238)	(0.206)	(0.218)	(0.182)	(0.242)
Imports	0.002***	0.002***	0.002**	0.002**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Exports	0.000	0.000	-0.000	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Finance	0.040	0.039	0.011	0.014	0.024	0.034
	(0.031)	(0.037)	(0.034)	(0.042)	(0.030)	(0.033)
Jointownership	0.028	0.047	0.142*	0.185**	0.087	0.109*
	(0.072)	(0.101)	(0.079)	(0.083)	(0.066)	(0.059)
University	0.002**	0.002**	0.001	0.001	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dom.compet	0.010	0.009	0.033**	0.040*	0.011	0.011
	(0.015)	(0.018)	(0.016)	(0.021)	(0.015)	(0.016)
RD			0.265***	0.291***	0.205***	0.210***
			(0.043)	(0.046)	(0.037)	(0.035)
F-test Outsourcing	9.51		9.28		9.33	
F-test Offshoring	24.73		24.38		24.39	
Underidentification (p-value)	0.0000		0.0000		0.0000	
Hansen J test(p-value)	0.3696		0.7317		0.7394	
Exogeneity test (p-value)	0.9468	0.9828	0.0309	0.0232	0.3262	0.5057
Observations	896.00	896.00	895.00	895.00	896.00	896.00

Clustered standard errors in parentheses. Industry, country, time and size dummies included.
* 10% significance, ** 5% significance, *** 1% significance.

When considering instrument relevance, note that the first stage F-tests are statistically significant, suggesting that the excluded instruments are jointly relevant. We are, however, careful to point out that the F-statistic is slightly below 10 for outsourcing (the critical value usually considered as "safe" for instrument relevance). The F-statistic is, however, larger than 10 for offshoring. We also report an under-identification test, which allows us to reject the assumption of under-identification. Also, we show in Table 9 that the excluded instruments are individually statistically significant predictors of outsourcing and offshoring[17]. In terms of instrument validity, tests of over-identification restrictions do not reject the assumption of instrument validity. Based on these instruments, we can reject the assumption of exogeneity of the two regressors for new product innovation but not for R&D and upgrading. Hence, we proceed in our analysis with instrumental variables estimations for new product innovation. Note also that we report marginal effects from a probit model to show that our estimates are robust to different model specifications.

Looking at the estimates in Table 4 we find that the significance of the control variables reflects previous findings in Table 3. We also find that outsourcing has positive effects on new product development. However, offshoring firms do not experience an increase in the probability to innovate[18]. The economic effect is now a lot larger than in the baseline regression. We abstain from interpreting the results for R&D spending and upgrading as outsourcing and offshoring are not found to be endogenous.

To summarize our results for different innovation variables, we find that both outsourcing and offshoring lead to a reorganization of the production process towards R&D activities. This is in line with productivity enhancements either due to cost savings or due to superior inputs. However, there is no difference in these effects on upgrading after controlling for R&D. This implies that any effect that affects upgrading through R&D is controlled for. The results make intuitively sense as domestic and international suppliers have the potential to provide better goods and services to the firm than the firm itself. This leads to minor improvements to products and services, i.e., upgrading.

Only (domestic) outsourcing has a direct effect on new product innova-

[17] Note that, if weak instruments were a problem, this would lead to the estimates being biased towards the OLS estimates. However, as we show, the IV estimates differ significantly from the OLS estimates.

[18] If a firm offshores, the outsourcing and the offshoring dummy are 1. A joint test on the additive effect of the two terms reveals that they are not significantly different from zero (p-value = 0.7433).

tion while controlling for R&D. There are two potential explanations for this result. First, it could be that we capture with this result complex production structures. Geographical proximity might matter in this context of direct innovation effects as innovation networks are often heavily regionally embedded. This would explain why the effect only exists for (domestic) outsourcing. Suppliers engage in substantial relationship-specific investments in the production of complex goods and this motivates firms to outsource to mitigate the adverse effects of hold-up problems (Antràs and Helpman (2004)). If these sourced inputs are sufficiently complex, this might directly lead to the introduction of a new product. However, international R&D networks might be too expensive to sustain for firms located in transition economies. Secondly, it is noteworthy that foreign technology can affect innovation patterns through multiple channels and offshoring is just one channel. It may, for example, also happen through sourcing inputs from foreign multinationals located in the countries, or from firms being part of large diversified business groups[19]. Hence, these direct innovation effects (when R&D is controlled for) are rather complex and other variables that we cannot control for could shed more light at the exact mechanisms.

Lastly, we implement a seemingly unrelated regression (SUR) to test the robustness of our results. The SUR was implemented in a LPM model as well as in a three-stage least squares regression in which the endogenous variables are instrumented[20]. The results are in line with previous findings as the estimated coefficients are similar in importance and magnitude. They highlight that the firm might pursue joint innovation decisions that trigger various changes - in terms of new product development and upgrading - in the innovation activities of the firm.

[19] Unfortunately, we do not have information on individual sourcing behavior and therefore cannot test this hypothesis directly. However, research in the management literature (Hoskisson et al. (2005)) discuss the importance of such "business groups" in emerging economies and highlight the role played by firms with foreign ownership within such groups.

[20] The Breusch-Pagan test of independence can be rejected at a p-value of 0.0000 and the correlation of the residuals of the dependent variables is high (0.3512). If we also include the R&D equation in the model, the results do not change but the correlations of the residuals are low (0.0000). Hence, we only consider new product innovation and upgrading as dependent variables. We estimate a simple SUR model as well as an instrumented SUR estimation to take into account that outsourcing and offshoring are not found to be endogenous in the estimations for upgrading while they are endogenous in the regressions for new product innovation. Hence, the upgrading results should be compared to Table 3 while the new product estimations are comparable to results presented in Table 4.

Table 5: SUR and three-stage least squares

	Upgrading LPM	New product IV
Outsourcing	0.074*	0.414**
	(0.038)	(0.211)
Offshoring	-0.003	-0.348*
	(0.053)	(0.208)
Imports	0.001**	0.002**
	(0.000)	(0.001)
Exports	0.000	-0.000
	(0.000)	(0.001)
Finance	0.038	0.011
	(0.027)	(0.035)
RD	0.190***	0.265***
	(0.031)	(0.046)
Jointownership	0.034	0.142*
	(0.070)	(0.085)
University	0.002***	0.001
	(0.001)	(0.001)
Size medium	0.118***	0.086*
	(0.033)	(0.047)
Size large	0.087**	-0.022
	(0.037)	(0.051)
Dom.compet	0.010	0.033*
	(0.013)	(0.017)
Observations	1153.00	895.00
R squared	0.21	0.13

Clustered standard errors in parentheses. Industry, country and time dummies included. * 10% significance, ** 5% significance, *** 1% significance.

4.2 Model extensions

We now turn to exploiting an important aspect of heterogeneity as an extension to our baseline model, namely the strength of protection of intellectual property[21]. We consider the strength of IPR of the country in which the firms is located. In our sample of countries we have considerable variation in terms of protection of intellectual property in the economies. For example, the 2005 edition of the *Global Competitiveness Report* conducted by the World Economic Forum shows that Slovenia is the country with the highest level of IPR protection in the sample (ranked 30th out of 117 countries world-wide), while Bosnia and Herzegovina has the lowest (ranked 113). We use the *Global Competitiveness Report* to group our countries into those with relatively high and relatively low levels of IPR[22]. We then estimate equation 1 with two additional interaction effects, namely interacting outsourcing and offshoring with the IPR dummy, respectively. We estimate a LPM for R&D and upgrading and an instrumental variables regression for new product innovation as suggested by previous results. There is a vast literature on the effects of outsourcing to foreign affiliates and the strengthening of IPR in developing countries (e.g., Diwan and Rodrik (1991), Markusen (2001), Glass and Saggi (2002)). However, the strengthening of IPR in the home country - which is a transition country - and outsourcing has been understudied so far.

Protection of IPR matters in the context of outsourcing and innovation (Table 6). Firms only decide to allocate their resources towards R&D if their intellectual property is sufficiently protected. This effect is economically relevant with a point estimate of 0.17%. The offshoring coefficient supports previous results. The estimated coefficient is, however, even larger than in the baseline regression. The insignificance of the interaction term between offshoring and IPR highlights that IPR protection matters for outsourcing in general but not in a systematically different way for offshoring. This is unsurprising as the incentive to invest in R&D should be independent of the height of the profits which can be allocated in the wake of outsourcing and offshoring.

On the other hand, none of the coefficients for outsourcing, offshoring

[21] Since the LPM and Probit models produce similar results in terms of statistical significance and magnitude of the effects, we present in what follows only estimates from LPM. Probit estimations for the instrumental variables specifications that follow also produce similar results; they can be obtained from the authors upon request.

[22] In the *Global Competitiveness Report*, countries are ranked with an index between 1 and 7. We use the median (2.7) as cut off and define countries with high IPR protection as countries with an index higher than 2.7. See Table 10 in the appendix for the country grouping.

Table 6: IPR protection

	R&D	New product	Upgrading
Outsourcing	-0.019	0.623	0.091
	(0.064)	(0.464)	(0.059)
Offshoring	0.245***	-0.400	-0.031
	(0.093)	(0.454)	(0.081)
Outsourcing x IPR	0.166**	0.000	-0.004
	(0.083)	(0.600)	(0.073)
Offshoring x IPR	-0.191	-0.048	0.022
	(0.118)	(0.648)	(0.099)
Imports	0.001***	0.002***	0.001***
	(0.000)	(0.001)	(0.000)
Exports	0.000	0.000	0.000
	(0.000)	(0.001)	(0.001)
Finance	0.051*	0.025	0.044
	(0.028)	(0.037)	(0.028)
Jointownership	0.044	0.151	0.005
	(0.081)	(0.098)	(0.067)
University	0.002***	0.000	0.002***
	(0.001)	(0.001)	(0.001)
Dom.compet	0.004	0.036**	0.013
	(0.013)	(0.018)	(0.014)
RD		0.256***	0.198***
		(0.050)	(0.028)
F test - Outsourcing		5.11	
F test - Offshoring		14.56	
F test - Outsourcing x IPR		5.89	
F test - Offshoring x IPR		11.68	
Underidentification (p-value)		0.0812	
Hansen J test (p-value)		0.3629	
Exogeneity test (p-value)		0.0242	
Observations	1094.00	847.00	1094.00

Clustered standard errors in parentheses. Industry, country, time and size dummies included. * 10% significance, ** 5% significance, *** 1% significance.

and their interaction terms are significant in the estimations for new product innovation and upgrading[23]. As we already control for own R&D effort, this equation captures a direct effect of technology absorption on firms' innovation activities. This external knowledge cannot be protected by the sourcing firm in any case, so that the strength of IPR protection should be irrelevant for outsourcing and offshoring. IPR protection matters whenever firms engage in own innovation effort. But it is unimportant if firms source domestic or foreign technology and thus, expect a direct innovation effect, for instance because they are able to offer a superior product to the market. This implies that IPR protection is crucial for firms that would like to innovate on their own. Firms which operate in low IPR environments can nevertheless profit from technology sourcing through outsourcing and offshoring via direct spill-over effects of knowledge. This is because we find, in general, a positive effect of outsourcing on new product innovation and upgrading.

5 Conclusion

This paper looks at the link between outsourcing, offshoring and various innovation measures using firm-level data for emerging economies. The literature generally focuses on industrialized countries, assuming that firms in emerging economies are suppliers for offshored products. This paper takes a different angle and takes into account that firms in emerging economies themselves outsource and offshore production to other countries. Arguably, gaining access to foreign technology due to quality and variety effects may be an important motive for such offshoring activity in transition economies (Crinò (2012)).

Using firm-level data for over 20 transition countries from the BEEPS data set, we find robust evidence that outsourcing is associated with a greater probability to spend on research and development and to introduce new products and upgrade existing products. The effect of offshoring on R&D spending is significantly higher than the effect of outsourcing. There is no difference in the effects on upgrading. However, only domestic outsourcing increases the probability to introduce new products. We implement an instrumental variable strategy to ensure that our results are not subject to endogeneity bias and can, therefore, be interpreted as causal effects.

[23] The test for joint significance of the interaction terms reveals that they are jointly highly uninformative (p-value = 0.9959 for new product innovation and p-value = 0.9716 for upgrading).

Offshoring provides a larger scope for innovation improvements than outsourcing, at least for R&D as a proxy of innovation activities of the firm. This may reflect larger productivity gains due to the exploitation of factor price differences and technology sourcing from offshoring. If it were to reflect technology sourcing, then R&D spending of a firm and technology sourcing would be complements. Additionally, outsourcing induced firms to upgrade products. Lastly, domestic outsourcing positively affects new product innovation. This reflects a direct effect on innovation while controlling for the R&D spending of the firm. Regional innovation networks and production processes of complex products are in line with this argument.

We also show that the results crucially depend on the level of protection of intellectual property in the economy. Firms increase their own R&D effort in the wake of outsourcing only if they operate in an environment that intensively protects intellectual property. Intellectual property rights protection does not matter for domestic and foreign technology sourcing if R&D is controlled for, i.e., if firms profit from direct innovation effects. This is because external knowledge cannot be protected by the sourcing firm in any case, so that the strength of IPR protection should be irrelevant for the effects of outsourcing and offshoring on innovation output.

The evidence of this paper suggests that outsourcing not only happens in emerging economies, but also that it brings with it potentially positive effects in terms of furthering the technological development of the firm engaged in outsourcing. However, we also show that an important condition needed for this to happen is the protection of intellectual property. In the absence of such, firms do not turn the potential benefits from outsourcing into own R&D effort. This is an important finding for policy makers.

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Appendix

Table 7: Country coverage

Country	Number	Per cent
Albania	13	1.13
Armenia	60	5.20
Azerbaijan	45	3.90
Belarus	19	1.65
Bosnia	26	2.25
Bulgaria	55	4.77
Croatia	21	1.82
Czech Republic	10	0.87
Estonia	23	1.99
FYROM	46	3.99
Georgia	32	2.77
Hungary	27	2.34
Kazakhstan	38	3.29
Kyrgyz	31	2.69
Latvia	19	1.65
Lithuania	13	1.13
Moldova	76	6.59
Poland	30	2.60
Romania	44	3.81
Russia	16	1.39
Serbia	54	4.68
Slovakia	13	1.13
Slovenia	40	3.47
Tajikistan	29	2.51
Turkey	295	25.56
Ukraine	38	3.29
Uzbekistan	41	3.55
Total	1,154	100.00

Table 8: Variable definitions

Variable	Variable definition
R&D	Has this establishment invested in R&D (in-house or outsourced) in the last 3 years?*
New product	Has this establishment introduced new products or services in the last 3 years?*
Upgrading	Has this establishment upgraded an existing product line or service in the last 3 years?*
Offshoring	change in % of material inputs and supplies of foreign origin in the fiscal year 04/07 (01/04) combined with outsourcing*
Outsourcing	Has this establishment outsourced activities previously done in-house in the last three years?*
Imports	% of material inputs and supplies of foreign origin in the last fiscal year
Exports	In fiscal year xxx, what percent of this establishment's sales were indirect and direct exports?
University	% of employees at the end of 2007 with a university degree
Joint Venture	How was this firm established? Joint venture with foreign partner(s)*
Finance	Is access to finance, which includes availability and cost, interest rates, fees and collateral requirements an obstacle to the current operations of this establishment? 0 (no obstacle) - 4 (very severe obstacle)
Size	small (5-19 employees), medium (20-99) and large (100 and more)***
Domestic competition	How important is pressure from domestic competitors in affecting decisions to develop new products or services and markets?**
Instruments	
Customers	How important is pressure from customers in affecting decisions with respect to reducing the production costs of existing products or services?**
Import license	Over the last two years, did this establishment submit an application to obtain an import license?*
Import documents	Number of documents to import goods per shipment interacted with the lagged share of foreign intermediates in all intermediates

Note:
* 1 = yes and 0 = no
** scaled 1-4; 1 being the least important
*** If very severe or major obstacle, we set a dummy equal to 1, otherwise 0.

Table 9: First stage regression results for excluded instruments from linear probability model

	R&D offshoring	R&D outsourcing	New product offshoring	New product outsourcing	Upgrading offshoring	Upgrading outsourcing
Customers pressure	-0.002	0.053***	-0.001	0.053***	-0.001	0.054***
	(0.012)	(0.017)	(0.012)	(0.017)	(0.012)	(0.017)
Import license	0.112***	0.225***	0.106**	0.219***	0.107**	0.218***
	(0.042)	(0.054)	(0.042)	(0.054)	(0.042)	(0.054)
Import documents	-0.000***	-0.000	-0.000***	-0.000	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
F-test joint significance	24.73	9.51	24.38	9.28	24.39	9.33
Observations	896.00	896.00	895.00	895.00	896.00	896.00
R squared	0.1267	0.0580	0.1445	0.0746	0.1445	0.0752

Clustered standard errors in parentheses. Industry, country and time dummies included. * 10% significance, ** 5% significance, *** 1% significance.

Table 10: Country classification: Intellectual property rights protection

High protection	Low protection
Slovenia	Tajikistan
Estonia	Bulgaria
Hungary	Moldova
Slovakia	Ukraine
Czech Republic	FYROM
Poland	Georgia
Latvia	Mongolia
Croatia	Russia
Kazakhstan	Kyrgyz Republic
Lithuania	Armenia
Turkey	Serbia
Romania	Albania
Azerbaijan	Bosnia and Herzegovina

Countries are sorted by their degree of protection of intellectual property, i.e., Slovenia is the country with the higher level of protection and Bosnia has the lowest level of protection.