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

Ursula Fritsch
Christian-Albrechts-University of Kiel

Holger Görg
Kiel Institute for the World Economy and
Christian-Albrechts-University of Kiel; CEPR

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 international and domestic outsourcing are associated with a greater probability to introduce new products and upgrade existing products. There is no difference in the effect between domestic and international outsourcing (offshoring). We implement an instrumental variable strategy and also show that the results crucially depend on the level of protection of intellectual property in the economy.

Acknowledgements: We are grateful to Aoife Hanley and Iulia Siedschlag for helpful comments on an earlier draft. Part of the work for this paper was carried out while Holger Görg was visiting IIIS at Trinity College Dublin. The hospitality is gratefully acknowledged, as is financial support through the European Commission 7th Framework Programme, Grant Agreement no: 244 552 (SERVICEGAP).

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[1]. 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 international outsourcing/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 intermediates are at a value of just over $ 100 billion far than negligible. 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. This is done 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 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,

[1]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. Abramovsky and Griffith (2006) use British data to investigate the link between ICT investment and outsourcing.

if outsourcing takes place to technologically advanced countries it may provide access to higher quality inputs[2]. This allows the firm to learn new technologies and push outwards its technology frontier. While the restructuring effect is present for both domestic and international outsourcing, it is likely that the technology effect may be particularly important for international outsourcing. 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 productivity (e.g. Amiti and Konings (2007), Halpern et al. (2011), Kasahara and Rodrigue (2008), Goldberg et al. (2010)).

What does this imply for the decision to outsource of firms located in emerging economies? Of course, firms in emerging markets may outsource 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. In this regard, Amiti and Konings (2007), in their analysis for Indonesia, stress the benefits of learning, variety and quality effects through imported intermediate products for firms in an emerging economy. Thus, we would also expect to see that firms in emerging economies increase innovation as a result of offshoring.

This paper, to the best of our knowledge for the first time, attempts to investigate this empirically[3]. 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.

[2]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.

[3]Gorodnichenko et al. (2010) also 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/offshoring, also considering differences in effects depending on competition. Secondly, Gorodnichenko et al. (2010) use data from the 2002 and 2005 surveys, while we use 2005 and 2009 data.

We find robust evidence that international and domestic outsourcing is associated with a greater probability to introduce new products and upgrade existing products. There is no difference in this effect between domestic and international outsourcing (offshoring). 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 more from outsourcing in terms of increased new product development when their intellectual property is sufficiently protected. We find no conclusive evidence that higher levels of competition reinforce the effect between outsourcing and innovation. We interpret that 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.

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 domestic and international outsourcing on innovation[4]. The dataset comprises companies with at least five full-time 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 13 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

[4]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.

firms that were either included in both the 2009 and 2005 surveys or in the three surveys 2009, 2005 and 2002[5]. 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 international outsourcing 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.

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 international outsourcing (offshoring) so that we cannot disentangle the two effects.

In order to consider international outsourcing, 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 2004 and 2007 (or 2001 and 2004, respectively) and calculate the *change* in imported intermediates over 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 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.

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

The dataset also provides alternative measures of innovation at the firm level. It has information on whether or not firms have, over the last three years, "newly introduced products and services", or "upgraded products and services". We use these two measures for 2007 and 2004 to generate dummy variables for whether or not firms introduced new products, or upgraded products, respectively. We view the former as a stronger measure of innovation, as this concerns the development of completely new products, and use this as our main innovation variable in the econometric analysis. Product upgrading is used as an alternative measure.

Table 1 presents descriptive statistics for the data set used[6]. Observations for 1,163 firms are available for the analysis[7]. Of those, 289 (25 percent) outsource production. Outsourcers (which can be domestic or foreign outsourcing) are more likely to introduce new products and upgrade products. They are also more likely to be importers or exporters. They spend more often on R&D and they are on average larger than non-outsourcers. Outsourcing is also positively associated with companies which were founded as a joint venture with a foreign partner. We use this information to proxy foreign ownership. The table also shows that 43 percent of outsourcers also offshore. In other words, 57 percent of outsourcers only outsource domestically.

Table 1: Descriptives: Outsourcing vs. non-outsourcing

Outsourcing	No			Yes		
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.
New product	874	0.501	0.500	288	0.663	0.473
Upgrading	874	0.644	0.479	289	0.817	0.387
Offshoring	874	0	0	289	0.432	0.496
Imports	874	34.052	37.368	289	38.394	36.336
Exports	874	14.543	27.479	289	20.907	30.275
RD	874	0.246	0.431	289	0.450	0.498
Joint Venture	874	0.043	0.204	289	0.041	0.199
Finance	874	0.243	0.429	289	0.252	0.435
University	874	19.826	22.610	289	20.432	21.215
Size	874	1.916	0.804	289	2.207	0.762

[6]The variables are discussed in more detail in Section 3. A table with definitions is available in the Appendix (Table 15).

[7]320 observations relate to firms that participated in the 2002, 2005 and 2009 survey. 843 observations are from firms that are in both the 2005 and 2009 survey, but not in 2002.

Table 2 presents a similar breakdown for firms that offshore vis-à-vis those that do not. Overall, 11 percent of the firms in our sample offshore. As can be seen, offshoring firms are more likely to introduce new products or upgrade existing products, and the difference appears to be more pronounced than in the case of outsourcing. They all, by definition, outsource activities and import intermediates. Furthermore, offshorers are, on average, larger and spend more often on R&D. They also are more likely to be partially foreign owned, and import and export, than non-offshorers.

Table 2: Descriptives: Offshoring vs. non-offshoring

Offshoring	No			Yes		
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.
New product	1037	0.515	0.500	125	0.760	0.429
Upgrading	1038	0.668	0.471	125	0.848	0.360
Outsourcing	1038	0.158	0.365	125	1	0
Imports	1038	32.906	36.957	125	53.616	33.513
Exports	1038	15.522	27.949	125	21.128	30.906
RD	1038	0.267	0.443	125	0.544	0.500
Joint Venture	1038	0.042	0.202	125	0.048	0.215
Finance	1038	0.243	0.429	125	0.272	0.447
University	1038	20.219	22.600	125	17.968	19.211
Size	1038	1.966	0.806	125	2.176	0.763

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 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 foreign, on innovation. The coefficient *gamma* represents an additional differential effect for international outsourcing/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 international outsourcing additionally allows better access to foreign technology through imported inputs and, therefore, provides a further impetus to innovation, 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 dummies for whether a firm imported and exported. 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. 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).

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 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)).

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 six variables of which the first four are used to instrument outsourcing/offshoring when new product innovation is the dependent variable and the last four are used to instrument outsourcing/offshoring when upgrading is used as the dependent variable: (i) the extent to which labor regulation is an obstacle to the operations of the company, (ii) a dummy whether material inputs could be paid after delivery, (iii) the importance of pressure from customers in affecting decisions to develop new products or services and markets (iv) whether the company uses e-mail to communicate with customers and suppliers, (v) a dummy whether the firm applied for an import license and (vi) the extent to which tax regulation is an obstacle to the company[8].

The rationale for the choice of these variables is as follows. The first and the last variable relate to the institutional environment for firms. If firms perceive themselves as excessively hindered by the regulatory environment, then they may decide to relocate part of their production processes abroad. This would, hence, lead to outsourcing and offshoring as defined in this paper. Hence, the presence of such bureaucratic hurdles should be correlated with offshoring and outsourcing - in other words, they should be relevant instruments. However, there is no reason

[8]See Table 15 in the appendix for a detailed description of the variables.

to think that they should affect innovation through any channel other than offshoring/outsourcing (conditional on exogenous variables). Hence, they should also be valid instruments. A firm's ability to pay its inputs after delivery should be strongly correlated with outsourcing and offshoring. If firms are able to delay the payment until after delivery, this will encourage them to source more from external suppliers, i.e. outsource. Pressure from customers to reduce production costs is another 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 new product development or product upgrading, controlling for other covariates[9]. The usage of e-mail to communicate with customers and suppliers should also be positively associated with outsourcing companies, as it reduces search costs for potential suppliers abroad and allows easier communication with them. This is however unrelated to the concept of innovation. For the same reason, applying for an import license should be correlated with international outsourcing but not with innovation. We test for instrument relevance and validity 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 preferred dependent variable, new product development (columns 1 to 3) and the alternative, product upgrading (columns 4 to 6). Columns (1) and (4) show the estimates obtained from the linear probability model (estimated using OLS) without an importer dummy. Columns (2) and (5) include an importer dummy, in order to allow for the fact that import activity is not necessarily identical to offshoring/outsourcing. Columns (3) and (6) present marginal effects from a probit model as comparison. The different estimation procedures produce results that are similar in magnitude

[9]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 with contemporaneous innovation activity.

and statistical significance.

Table 3: Exogenous outsourcing and offshoring

	New product LPM	New product LPM	New product Probit	Upgrading LPM	Upgrading LPM	Upgrading Probit
Outsourcing	0.027	0.039	0.038	0.067*	0.077**	0.093**
	(0.042)	(0.042)	(0.047)	(0.035)	(0.035)	(0.038)
Offshoring	0.123**	0.089	0.113*	0.025	-0.002	-0.008
	(0.054)	(0.055)	(0.065)	(0.047)	(0.048)	(0.065)
Imports		0.001***	0.001***		0.001***	0.001***
		(0.000)	(0.000)		(0.000)	(0.001)
Exports	0.000	0.000	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Finance	0.017	0.014	0.024	0.002	-0.000	-0.004
	(0.033)	(0.033)	(0.039)	(0.030)	(0.030)	(0.033)
RD	0.272***	0.262***	0.292***	0.201***	0.193***	0.219***
	(0.031)	(0.031)	(0.033)	(0.028)	(0.028)	(0.028)
Joint venture	0.162**	0.135**	0.170**	0.055	0.034	0.055
	(0.068)	(0.068)	(0.077)	(0.061)	(0.062)	(0.070)
University	0.002***	0.002***	0.002**	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Size1	0.092**	0.090**	0.106***	0.118***	0.116***	0.120***
	(0.036)	(0.036)	(0040)	(0.034)	(0.034)	(0.033)
Size2	0.016	0.007	0.013	0.089**	0.082**	0.087**
	(0.040)	(0.040)	0.046	(0.037)	(0.037)	(0.037)
Observations	1165	1165	1163	1165	1165	1163
R squared	0.2013	0.2081	0.1670	0.1995	0.2045	0.1852

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

Our results show that the probability of innovating is statistically significantly related to a firm's own R&D activity, and to the importer dummy, irrespective of the innovation measure chosen. 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 Amiti and Konings (2007).

We find evidence for a positive association between offshoring and innovation only in the specification that does not control for imports in the OLS model, and only for new product development. This suggests that general import activity and the special offshoring activity are correlated. This is, of course, not surprising,

as offshoring involves relocating abroad a part of the production chain that was previously carried out at home, which necessarily involves trade in intermediates. The result, thus, shows that it is important to carefully define offshoring and delineate it from any general import activity that may be quite unrelated to the concept of outsourcing/offshoring.

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, but this effect is statistically insignificant for offshoring (see columns (4), (5) and (6)). 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. There is additional (though limited) evidence in the probit model that only offshoring is positively associated with the introduction of new products. This could reflect the additional potential of offshoring over domestic outsourcing to save on costs and to access better technology abroad.

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 14.

Table 4: Endogenous outsourcing and offshoring

	New product LPM	New product Probit	Upgrading LPM	Upgrading Probit
Outsourcing	0.767***	2.354***	0.605***	2.152**
	(0.248)	(0.796)	(0.230)	(0.855)
Offshoring	-0.372	-1.224	-0.779	-2.805
	(0.690)	(2.102)	(0.619)	(2.250)
Imports	0.002*	0.006*	0.002*	0.009*
	(0.001)	(0.004)	(0.001)	(0.005)
Finance	0.014	0.067	0.006	0.033
	(0.037)	(0.116)	(0.035)	(0.136)
RD	0.222***	0.673***	0.236***	0.953***
	(0.067)	(0.200)	(0.062)	(0.219)
Joint venture	0.143*	0.478*	0.075	0.399
	(0.080)	(0.266)	(0.073)	(0.323)
University	0.000	0.001	0.001	0.004
	(0.001)	(0.003)	(0.001)	(0.004)
Size1	0.027	0.088	0.084*	0.296*
	(0.043)	(0.131)	(0.044)	(0.151)
Size2	-0.074	-0.215	0.082**	-0.026
	(0.047)	(0.144)	(0.044)	(0.158)
F test - outsourcing	11.42		11.33	
F test - offshoring	3.12		2.34	
Underidentification (p-value)	0.0200		0.0728	
Hansen J test (p-value)	0.2367		0.2227	
Exogeneity test (p-value)	0.0010	0.0007	0.0494	0.0480
Observations	1189	1187	973	932

Clustered standard errors in parentheses. Industry, country and time 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 not larger than 10 for offshoring (the critical value usually considered as "safe" for instrument relevance). The F-statistic is, however, larger than 10 for outsourcing. We also report an under-identification test, which allows us to reject the assumption of under-identification. Also, we show in Table 14 that the excluded instruments are individually statistically significant predictors of outsourcing/offshoring[10]. In

[10]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

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. Hence, we proceed in our analysis with instrumental variables estimations.

Looking at the estimates in Table 4 we find that the significance of the control variables roughly reflects previous findings in Table 3. We also find that outsourcing (domestic or foreign) has positive effects on both new product development and product upgrading. Offshoring (i.e., outsourcing abroad) does not convey any further advantage compared to outsourcing per se.

This suggests that both domestic and international outsourcing lead to a reorganization of the production process towards innovative activity. International outsourcing may, additionally, provide access to foreign technology through imported inputs, which may be expected to give a further boost to innovative activity. This, however, is not apparent in the data. Does this mean that foreign technology is not important in emerging economies? This is unlikely to be the case. The similar effects of international and domestic outsourcing may rather suggest that access to foreign technology is not just through offshoring activities abroad. 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[11]. Furthermore, the positive coefficient on the general import dummy indicates that imported foreign technology may be important. It is worth mentioning that the outsourcing coefficients appear to be different in the estimations using different dependent variables. In particular, the coefficient of outsourcing explaining the introduction of new products appears larger than the coefficient explaining upgrading. This is in line with our conjecture that outsourcing releases resources which are used to restructure the company. This goes beyond the concept of upgrading, i.e. making small changes to existing products and services, and instead causes more profound change in the company in the form of new product innovation. As new product development is our preferred measure of innovation we focus

OLS estimates.

[11] 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.

on this variable in the further analysis.

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 local competition[12]. In our sample of countries we have considerable variation in terms of competitive pressure in the economies. For example, the 2008 edition of the *Global Competitiveness Report* conducted by the World Economic Forum shows that the Czech Republic is the country with the highest level of local competition in the sample (ranked 13th out of 134 countries world-wide), while Armenia has the lowest (ranked 132). We use the *Global Competitiveness Report* to group our countries into those with relatively high and relatively low levels of competition[13]. We then estimate equation 1 separately on the two samples.

We would expect the positive effects of offshoring and outsourcing on innovation to be stronger in an environment where there are high levels of competition. A lack of competition implies that firms can be X-inefficient and refrain from optimizing their production process after offshoring/outsourcing. This is not the case in environments with high levels of competition, where firms are forced to be more innovative to stay ahead of competitors. Assuming they can appropriate the rents from new products which can be protected by patents or product complexity, the incentive to innovate is, thus, much stronger in an environment with high levels of competition.

The estimations for the two country samples are reported in Tables 5 and 6 based on linear probability models with instrumental variables. In a first step, we instrument outsourcing and offshoring and find, as expected, differences in the effect that outsourcing has on innovation (Table 5). The model specification is,

[12]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.

[13]In the *Global Competitiveness Report*, countries are ranked with an index between 1 and 7. We use the information on "intensity of local competition" and make use of the mean (4.73) as cut off. We define countries with high levels of competition as countries with an index of 4.73 or higher. See Table 11 in the appendix for a list of countries.

however, of some concern as the F-statistics for offshoring and outsourcing are smaller than 10 and we cannot reject the under-identification tests.

Table 5: Country-level competition: endogenous outsourcing & offshoring

Dependent var: New product	High competition	Low competition
Outsourcing	0.864**	0.571**
	(0.434)	(0.283)
Offshoring	-0.171	-0.476
	(1.121)	(0.841)
Imports	0.001	0.003
	(0.002)	(0.002)
Finance	0.038	-0.009
	(0.057)	(0.049)
RD	0.166*	0.284***
	(0.092)	(0.105)
Joint venture	0.108	0.171*
	(0.145)	(0.098)
University	-0.000	0.001
	(0.002)	(0.001)
Size1	0.022	0.024
	(0.066)	(0.062)
Size2	-0.094	-0.050
	(0.065)	(0.073)
F test - outsourcing	5.27	6.22
F test - offshoring	1.62	1.27
Underidentification (p-value)	0.1938	0.1872
Hansen J test (p-value)	0.1893	0.2716
Exogeneity test (p-value)	0.0063	0.1005
Observations	665	524

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, email, customers pressure and payments after delivery

We then drop offshoring, as it is consistently statistically insignificant, to focus on the main variable of interest as found in the IV-model, that is outsourcing. In the specification in Table 6, we only include outsourcing[14]. Eyeballing the coefficients for outsourcing in the two country groupings suggests that the competitive environment matters for firms' potential to benefit from outsourcing[15]. The other

[14]The F-statistic improves but remains smaller than 10.

[15]However, we also test for the significance of the difference explicitly by estimating a pooled model with an interaction term of outsourcing and the competition dummy. The interaction term, which we instrument, is, however, not statistically significant. In other words, the apparent difference in the effect of outsourcing for the two country samples is not statistically significant. Results

Table 6: Country-level competition: endogenous outsourcing

Dependent var: New product	High competition	Low competition
Outsourcing	0.886***	0.634**
	(0.294)	(0.305)
Imports	0.001**	0.001**
	(0.001)	(0.000)
Finance	0.027	0.004
	(0.046)	(0.042)
RD	0.147**	0.180***
	(0.059)	(0.061)
Joint venture	0.124	0.098
	(0.137)	(0.085)
University	0.001	0.001*
	(0.001)	(0.001)
Size1	0.078*	0.089**
	(0.045)	(0.044)
Size2	-0.044	0.043
	(0.054)	(0.053)
F test - outsourcing	7.22	7.13
Underidentification (p-value)	0.0001	0.0001
Hansen J test (p-value)	0.1123	0.1193
Exogeneity test (p-value)	0.0016	0.0395
Observations	996	974

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, email and payments after delivery

control variables convey a similar picture as before.

We can also measure competitive pressure in our firm-level data. For this, we utilize information on whether or not firms see formal and/or informal competitors as an obstacle to their business operations. Specifically, we generate a dummy equal to one if the firm answers that such competition is a moderate, major or very severe obstacle[16]. Using this variable may be preferable to the measure of country level competition, as this is arguably a more reliable estimate of the level of competition that a firm actually experiences. It also allows for heterogeneity in competition within countries.

are not reported here to save space.

[16]The questionnaire explicitly asks if "practices of competitors in the informal (formal) sector are no obstacle (0), a minor obstacle, a moderate obstacle, a major obstacle, or a very severe obstacle (4) to the current operations of this firm". We perform the split by computing the mean of the variables. The mean is 1.65 for both, formal and informal sector competition.

Table 7: Firm-level competition: endogenous outsourcing & offshoring

Dependent var: New product	High competition	Low competition
Outsourcing	0.926**	0.693
	(0.365)	(0.945)
Offshoring	-0.108	-0.625
	(0.748)	(2.217)
Imports	0.001	0.002
	(0.002)	(0.004)
Finance	-0.008	-0.083
	(0.056)	(0.252)
RD	0.196***	0.231
	(0.075)	(0.210)
Joint venture	0.102	0.261**
	(0.121)	(0.133)
University	-0.001	0.001
	(0.002)	(0.003)
Size1	-0.026	0.036
	(0.069)	(0.105)
Size2	-0.082	-0.111
	(0.068)	(0.120)
F test - outsourcing	4.57	2.91
F test - offshoring	2.07	0.98
Underidentification (p-value)	0.0567	0.8275
Hansen J test (p-value)	0.1665	0.6533
Exogeneity test (p-value)	0.0033	0.4211
Observations	674	285

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, email, customers pressure and payments after delivery

We again split the data according to this dummy variable. The estimation results are presented in Tables 7 and 8[17]. The effect of outsourcing on innovation (Table 8) differs from the results of the previous Table 6 as outsourcing is only positive and statistically significant for firms in the high competition environment[18]. However, when we test for the statistical significance of this difference (using a pooled model with an interaction term of outsourcing and competition) we do not find evidence for such a difference. Hence, when considering competition at the country or at the firm level we do not find any conclusive evidence that competitive

[17]We report, as before, a model with outsourcing and offshoring included, but prefer to focus on the model with outsourcing only.

[18]Note however, that the exogeneity assumption cannot be rejected for firms facing low levels of competition.

pressure is important for the impact of outsourcing on innovation.

Table 8: Firm-level competition: endogenous outsourcing

Dependent var: New product	High competition	Low competition
Outsourcing	0.849***	0.517
	(0.324)	(0.394)
Imports	0.000	0.001
	(0.001)	(0.001)
Finance	0.003	-0.063
	(0.050)	(0.085)
RD	0.207***	0.153
	(0.061)	(0.101)
Joint venture	0.086	0.244**
	(0.118)	(0.124)
University	-0.000	0.003*
	(0.002)	(0.002)
Size1	-0.017	0.058
	(0.069)	(0.084)
Size2	-0.063	-0.076
	(0.068)	(0.096)
F test - outsourcing	7.82	4.17
Underidentification (p-value)	0.0005	0.0079
Hansen J test (p-value)	0.0986	0.9293
Exogeneity test (p-value)	0.0026	0.1909
Observations	691	296

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, customers pressure and payments after delivery

The underlying assumption in the interpretation of the effect of competition is that firms can appropriate rents from the newly developed or upgraded products, which is only possible if there is some level of intellectual property rights protection (IPRP). Of course, the level of IPRP is quite heterogeneous across the countries in our sample. We, therefore, now focus explicitly on intellectual property protection. The *Global Competitiveness Report* shows that Estonia is the country with the highest level of IPRP in our sample; it is ranked 32nd out of 134 countries worldwide. By contrast, Bosnia and Herzegovina has the lowest level and is ranked at 125. We use the *Global Competitiveness Report* to group our countries into those with relatively high and relatively low levels of protection[19]. We then estimate

[19]In the *Global Competitiveness Report*, countries are ranked with an index between 1 and 7. We use the mean (3.27) as cut off and define countries with high IPR protection as countries with

equation 1 separately on the two samples.

We would expect differences in the effect of the offshoring/outsourcing variables on new product development depending on the strength of IPR protection. These effects may be expected to be stronger in countries with good IPR protection, as the incentives for innovation should be generally higher there. The estimation results based on LPM-IV estimations are reported in Tables 9 and 10.

Table 9: IPR protection: endogenous outsourcing and offshoring

Dependent var: New product	High IPR protection	Low IPR protection
Outsourcing	0.299	0.813**
	(0.829)	(0.332)
Offshoring	4.353	-0.890
	(5.250)	(0.754)
Imports	-0.007	0.003**
	(0.009)	(0.001)
Finance	0.298	0.020
	(0.342)	(0.051)
RD	-0.055	0.291***
	(0.386)	(0.080)
Joint venture	-0.037	0.126
	(0.498)	(0.095)
University	0.008	-0.001
	(0.007)	(0.001)
Size1	-0.206	0.026
	(0.377)	(0.053)
Size2	-0.201	-0.105
	(0.347)	(0.067)
F test - outsourcing	3.85	12.70
F test - offshoring	0.27	3.90
Underidentification (p-value)	0.6482	0.0239
Hansen J test (p-value)	0.9664	0.3650
Exogeneity test (p-value)	0.0437	0.0147
Observations	383	807

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, customers pressure and payments after delivery

an index of 3.27 or higher. See Table 12 in the appendix for the country grouping.

We find positive effects of outsourcing on new product development in both types of countries (Table 10). There also appears to be a strong difference in the strength of these effects as evidenced by the magnitude of the point estimate. Hence, IPR protection may be important for reaping the benefits from product innovation in our sample countries[20].

Table 10: IPR protection: endogenous outsourcing

Dependent var: New product	High IPR protection	Low IPR protection
Outsourcing	0.851***	0.606**
	(0.311)	(0.236)
Imports	0.001	0.001**
	(0.001)	(0.000)
Finance	0.039	0.002
	(0.045)	(0.041)
RD	0.110*	0.207***
	(0.060)	(0.050)
Joint venture	0.030	0.104
	(0.132)	(0.078)
University	0.002	0.001
	(0.001)	(0.001)
Size1	0.074	0.092**
	(0.048)	(0.039)
Size2	0.048	-0.020
	(0.059)	(0.047)
F test - outsourcing	6.31	10.54
Underidentification (p-value)	0.0004	0.0003
Hansen J test (p-value)	0.2512	0.0886
Exogeneity test (p-value)	0.0048	0.0080
Observations	736	1198

Clustered standard errors in parentheses. Industry, country and time dummies included.
* 10% significance, ** 5% significance, *** 1% significance. Instruments used: labor regulation, customers pressure and payments after delivery

5 Conclusion

This paper looks at the link between outsourcing, offshoring and innovation using firm-level data for emerging economies. The literature generally focuses on

[20]We implement also a pooled model using an interaction term of outsourcing and IPRP to test the statistical significance of the two models. The interaction term is significant at 10 percent and at a value of 0.664; therefore, we can provide evidence that the benefits of outsourcing largely depend on the level of IPR protection. We are careful to point out, however, that the test for instrument validity cannot be rejected in the low IPR protection group.

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 may be an important motive for such offshoring activity.

Using firm-level data for over 20 transition countries from the BEEPS data set, we find robust evidence that domestic and international outsourcing are associated with a greater probability to introduce new products and upgrade existing products. There is no difference in the effect between domestic and international outsourcing (offshoring). 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. We also show that the results crucially depend on the level of protection of intellectual property rights. In particular, we find that the gains from outsourcing are larger if firms operate in an environment in which their intellectual property is more intensely protected. We do not find any strong evidence that the level of competition in the economy matters for firms.

The evidence in 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 and to a smaller extent competitive pressure. In the absence of such, firms do not turn the potential benefits from outsourcing into practice. This is an important finding for policy makers.

References

Abramovsky, Laura and Rachel Griffith, "Outsourcing and Offshoring of Business Services: How Important is ICT?," *Journal of the European Economic Association*, 2006, *4*, 594–601.

Amiti, Mary and Jozef Konings, "Trade Liberalization, Intermediate Inputs and Productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

Antràs, Pol and Elhanan Helpman, "Global Sourcing," *Journal of Political Economy*, 2004, *112*, 552–580.

Bloom, Nicholas, Mirko Draca, and John Van Reenen, "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity," NBER Working Papers Series 16717, NBER 2011.

Criscuolo, Chiara, Jonathan E. Haskel, and Matthew J. Slaughter, "Global Engagement and the Innovation Activities of Firms," *International Journal of Industrial Organization*, 2010, *28* (2), 191–202.

Cusmano, Lucia, Maria Luisa Mancasi, and Andrea Morrison, "Innovation and the Geographical and Functional Dimensions of Outsourcing: An Empirical Investigation Based on Italian Firm Level Data," *Structural Change and Economic Dynamics*, 2008, *20* (3), 183–195.

Girma, Sourafel, Yundan Gong, and Holger Görg, "Foreign Direct Investment, Access to Finance, and Innovation Activity in Chinese Enterprises," *World Bank Economic Review*, 2008, *22*, 367–382.

Glass, Amy Jocelyn and Kamal Saggi, "Innovation and Wage Effects of International Outsourcing," *European Economic Review*, 2001, *45* (1), 67–86.

Goldberg, Pinelopi Koujianou, Amit Kumar Khandelwal, Nina Pavcnik, and Petia Topalova, "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *The Quarterly Journal of Economics*, 2010, *125* (4), 1727–1767.

Görg, Holger and Aoife Hanley, "Services Outsourcing and Innovation: An Empirical Investigation," *Economic Inquiry*, 2011, *49* (2), 321–333.

Gorodnichenko, Yuriy, Jan Svejnar, and Katherine Terrell, "Globalization and Innovation in Emerging Markets," *American Economic Journal: Macroeconomics*, 2010, *2* (2), 194–226.

Hall, Bronwyn H., "The Financing of Research and Development," *Oxford Review of Economic Policy*, 2002, *18* (1), 35–51.

Halpern, Lázló, Miklós Koren, and Adam Szeidl, "Imports and Productivity," CEPR Discussion Papers 5139, CEPR 2011.

Hoskisson, Robert E., Richard A. Johnson, Laszlo Tihanyi, and Robert E. White, "Diversified Business Groups and Corporate Refocusing in Emerging Economies," *Journal of Management*, 2005, *31*, 941–965.

Kasahara, Hiroyuki and Joel Rodrigue, "Does the Use of Imported Intermediates Increase Productivity?," *Journal of Development Economics*, 2008, *87* (1), 106–118.

Miroudot, Sebastien, Rainer Lanz, and Alexandros Ragoussis, "Trade in Intermediate Goods and Services," OECD Trade Policy Working Papers 93, OECD Publishing 2009.

Muûls, Mirabelle and Mauro Pisu, "Imports and Exports at the Level of the Firm: Evidence from Belgium," *The World Economy*, 2009, *32*, 692–734.

Siedschlag, Iulia, Neil Killeen, Donal Smith, and Catriona O'Brien, "Internationalisation and the Innovation Activities of Services Firms," ESRI Series 406, Economic and Social Research Institute 2011.

UNCTAD, "World Investment Report 2005: Transnational Corporations and the Internationalization of R&D," 2005. United Nations.

Appendix

Table 11: Country classification: Local competition

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

Countries are sorted by their degree of local competition, i.e. the Czech Republic is the country with the higher level of local competition and Armenia has the lowest level of local competition.

Table 12: Country classification: Intellectual property rights protection

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

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

Table 13: Country coverage

Country	Number	Per cent
Albania	13	1.12
Belarus	19	1.63
Georgia	32	2.75
Tajikistan	29	2.49
Turkey	296	25.41
Ukraine	39	3.35
Uzbekistan	42	3.61
Russia	16	1.37
Poland	30	2.58
Romania	45	3.86
Serbia	54	4.64
Kazakhstan	38	3.26
Moldova	77	6.61
Bosnia and Herzegovina	26	2.23
Azerbaijan	45	3.86
FYROM	47	4.03
Armenia	61	5.24
Kyrgyz Republic	31	2.66
Estonia	23	1.97
Czech Republic	10	0.86
Hungary	27	2.32
Latvia	19	1.63
Lithuania	13	1.12
Slovakia	14	1.20
Slovenia	40	3.43
Bulgaria	55	4.72
Croatia	22	1.89
Montenegro	2	0.17
Total	1,165	100.00

Table 14: First stage regression results for excluded instruments from linear probability model

	New product offshoring	New product outsourcing	Upgrading offshoring	Upgrading outsourcing
Labor regulation	0.018**	0.038***		
	(0.009)	(0.012)		
Email	-0.003	0.058*	0.015	0.086**
	(0.022)	(0.033)	(0.026)	(0.037)
Customers pressure	-0.009	0.037***	-0.008	0.045***
	(0.009)	(0.013)	(0.011)	(0.015)
Payments after delivery	0.047***	0.096***		
	(0.018)	(0.030)		
Tax regulation			0.037*	0.087***
			(0.021)	(0.029)
Import license			0.010**	0.199***
			(0.043)	(0.053)
F-test joint significance	3.12	11.42	2.34	11.33
Observations	1189	1189	973	973
R squared	0.0840	0.0918	0.0898	0.0866

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

Table 15: Variable definitions

Variable	Variable definition
Newproduct	Has this establishment introduced new products or services in the last 3 years?*
Upgradproduct	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
R&D	Has this establishment invested in R&D (in-house or outsourced) in the last 3 years?*
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)
Exports	Did this firm export, either directly or indirectly, in the last fiscal year?*
Size	small (5-19 employees), medium (20-99) and large (100 and more)
Instruments	
E-mail	Do you currently communicate with clients and suppliers by e-mail?*
Customers	How important is pressure from customers in affecting decisions to develop new products or services and markets?**
Payments after delivery	In the last fiscal year, did this establishment purchase any material inputs or services and pay for them after delivery (on credit)?*
Labor regulations	Are labor regulations an obstacle to the current operations of this establishment? 0 (no obstacle) - 4 (very severe obstacle)
Import license	Over the last two years, did this establishment submit an application to obtain an import license?*
Tax regulation	Are tax rates an obstacle to the current operations of this establishment? 0 (no obstacle) - 4 (very severe obstacle)***

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.