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

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Abstract

This paper investigates two sourcing strategies of firms, outsourcing and importing, and links these to innovation activities. We investigate this empirically using firm-level data for 28 emerging market economies. We find robust evidence that outsourcing increases the likelihood to spend on R&D and via this channel raises innovation output, whereas importing increases innovation output, but not R&D. The results hold when implementing an instrumental variables approach. We also find that results crucially depend on the institutional environment in the economy, e.g., property rights and intellectual property rights protection. Our results suggest that better institutions magnify the gains from importing, but not from outsourcing. EU-countries also reap additional positive innovation effects from importing compared to non-EU countries.
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1 Introduction

In this paper we look empirically at the implications of outsourcing and importing for innovation activities in the outsourcing and/or importing firm. We differentiate between outsourcing and importing as the former involves a realignment of the boundaries of the firm, whereas the latter provides access to a larger variety of goods and services. We investigate these relationships 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.

Outsourcing can be loosely defined as the contracting out of activities that were previously performed within a firm, to subcontractors outside the firm. 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), Girma and Görg (2004)).[1]

If outsourcing crosses borders it also leads to importing of intermediate inputs. However, importing may also occur without outsourcing if, e.g., a firm merely switches from a domestic to a foreign supplier or imports goods that it never used to make itself. The use of imported inputs - our second sourcing variable -**,** 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), Kasahara and Rodrigue (2008), Goldberg et al. (2010), Halpern et al. (2005), Topalova and Khandelwal (2011), Bas (2012)). This allows the firm to learn new technologies and push outwards its technology frontier. 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 for the period 1997 to 2008.

Both outsourcing and importing of intermediates are highly relevant activities for

firms in emerging economies. About a sixth of the firms in our sample report that they have outsourced activities in the last three years to another firm (either domestic or abroad). 58% of the firms import intermediates. Miroudot et al. (2009) present some stylized facts on trade in intermediates. 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 amounted to about $100 billion. 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. Furthermore, a growing literature has recently focused on global value chain participation highlighting that transition countries are heavily integrated into global production networks (Koopman et al. (2014)). This involves importing intermediates and most likely, outsourcing.

Hence, it is relevant to investigate the implications of these two activities for firms in emerging economies. We are, to the best of our knowledge, the first to differentiate the effects of outsourcing and importing on innovation. We choose to do so as outsourcing is likely to reflect benefits from reorganizing production while importing captures the ability to access larger input varieties or higher quality inputs. Distinguishing these two effects is not possible when just considering imports which also includes, to some extent, benefits from outsourcing-related restructuring (see most empirical studies on firm-level effects of importing as cited above).

Another contribution of our paper is to consider the importance of the institutional environment for these effects. Since we have firm-level data covering a number of countries we can consider differences in property rights, intellectual property rights protection, labour market flexibility and supplier availability in different countries.

We use firm-level data from the Business Environment and Enterprise Performance Survey (BEEPS), provided by the EBRD-World Bank, for 28 transition countries.

Specifically, the dataset covers companies located in Eastern and Central European, and Central Asian countries.

The papers by Gorodnichenko et al. (2010), Correa et al. (2010), Crinò (2012) and Seker (2012) also use BEEPS data to investigate various aspects of innovation activity in emerging countries. The main difference in our paper is that we consider firm-level information on outsourcing, which is not being done in the other studies. Hence, we are able to distinguish outsourcing-related restructuring from importing-related variety effects. Gorodnichenko et al. (2010) consider the effects of foreign competition, exports and imports on innovation. Seker (2012) differentiates exporters, importers and firms doing both and relates these to innovation. Correa et al. (2010) investigate determinants of technology absorption. Crinò (2012) also focuses on the effects of imported intermediates as a transmission channel for technology upgrading. He finds positive effects on skill upgrading. Imports also boost various innovation activities given that firms are engaged in high-skill intensive activities. He suggests that these effects might be related. The paper by Crinò (2012) is closest in terms of analysis as he also looks at causal effects of importing (though not outsourcing). We use, however, a different identification strategy and - in contrast to the other studies - data from 2001, 2004 and 2007.[2]

We find evidence that outsourcing is associated with a greater probability to spend on research and development and - via the R&D channel - to introduce new products and to upgrade existing products. Importing is as well associated with the latter two innovation measures but not with spending on research and development. This suggests that outsourcing leads to restructuring of activities towards more complex activities (such as R&D) while importing of larger input varieties or higher quality inputs has direct effects on innovation (but not R&D). We address endogeneity concerns by implementing instrumental variables estimations.

We also show that the results crucially depend on the institutional environment in the economy. In particular, property rights and intellectual property protection, and

to a smaller extent the availability of local suppliers, impact positively on the effect of importing on innovation. This is not true for outsourcing, however, which does not appear to depend on such institutional characteristics. This suggests that importing is more complex than outsourcing, as it involves partners in countries with different institutional setups. Furthermore, being located in an EU-member state is associated with higher gains from importing. We attribute these findings to better overall institutions and lower trade barriers within the EU.

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

2 Data description

We use the BEEPS dataset to analyze the impact of outsourcing and importing on innovation.[3] The dataset comprises companies with at least five full-time employees in 28 countries in Central and Eastern Europe, the Baltic, the CIS and Central Asia (including Turkey) (see Table 11 in the appendix). The BEEPS survey provides a wide range of information on companies in the manufacturing and service sector. The survey was conducted roughly every three years (1999, 2002, 2005 and 2009). We skip, however, observations for 1999 as variables are only consistently defined for the following three waves of the survey. The 2009, 2005 and 2002 surveys provide information relating to 2007, 2004 and 2001, respectively. The data is exploited in the cross-sectional dimension.

The data enable us to measure two aspects of sourcing strategies: outsourcing, i.e., the realignment of the boundaries of the firm, and importing. The first measurement is based on the explicit question whether firms have "contracted with other companies (outsourced) activities previously performed in-house". Firms are also asked to declare their "foreign material inputs as a proportion of all material inputs".

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 well 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, 2004 and 2001 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.[4] Tables 1 and 2 present descriptive statistics for outsourcing vs. non-outsourcing firms and importing vs. non-importing firms.[5] We document that there are strong selection effects into outsourcing and importing presumably due to sunk costs associated with these activities, as suggested by Antràs and Helpman (2004), Bernard et al. (2007) and Kasahara and Lapham (2013). Observations for 8879 firms are available for the analysis. Of those, 1556 (18 percent) outsource production and 5044 (59 percent) import.

Outsourcers differ from non-outsourcers with respect to all innovation measures. They are also more likely to be importers or exporters. Additionally, outsourcers are on average larger and older than non-outsourcers. Ownership structures also differ between outsourcing and non-outsourcing firms. Firms which are part of a partnership or limited partnership are less likely to outsource and so are firms in which the government holds a stake. On the contrary, foreign-owned firms are associated with a higher likelihood to outsource. Outsourcers are less financially constrained and perceive domestic competition less of a pressure that induces them to innovate. Outsourcers and non-outsourcers are not different with respect to the percentage of people holding a university degree.

Hence, there are significant differences between the two groups of firms.

(*Table 1 here*)

A similar pattern emerges for importing and non-importing firms. The table also shows that the propensity to outsource is higher for importers than non-importers. The raw correlation between outsourcing and an importer dummy is at 0.14 positive but not very high. Table 3 also shows that only a small share of firms import and outsource simultaneously (1113 firms equalling 13 percent of firms). This suggests that we can differentiate outsourcing from importing activities.

(*Table 2 here*)

(*Table 3 here*)

3 Econometric methodology

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

$$Prob(Innov_{it}) = \alpha + \beta * Out_{it} + \gamma * Imports_{it} + \lambda * X_{it} + \kappa_1 * D_c + \kappa_2 * D_i + \kappa_3 * D_y + \varepsilon_{it} \quad (1)$$

where *Innov* is alternatively defined as a dummy if the firm conducted R&D in t (= 2007, 2004 or 2001), or if the firm introduced new products in t (= 2007, 2004 or 2001) or the previous three years, or if it upgraded a product over the same period. *Out* captures outsourcing activities of a firm over the last three years, as defined in section 2. *Imports* captures the share of intermediate inputs that is sourced from abroad in a given fiscal year. D_c, D_i and D_y are full sets of country, industry and year dummies. The error term ε_{it} is robust to heteroscedasticity. It is important to note that R&D also includes outsourced R&D which is by definition correlated with outsourcing. We report results for R&D but are careful to point out that the measure might overestimate the effect on *in-house* R&D.

The model also includes a number of control variables which are collected in the vector X. We include in the baseline estimation a number of control variables which are standard in the literature. Firstly, we include the share of sales that the firm directly or indirectly exports. This variable controls for the fact that firms that are internationally engaged in exporting tend to be more productive (e.g., Melitz (2003), Muûls and Pisu (2009), Siedschlag et al. (2011)) and, hence, may also be more active in innovation, even in the absence of any outsourcing. Furthermore, we include a dummy equal to one if a firm reports any R&D expenditure (in-house or outsourced) 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).[6] We further control for firm age which has been identified to be an impediment to innovation (Lin et al. (2010)). 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 which makes firms innovate (a point similarly made by Correa et al. (2010)). Furthermore, we include size as a proxy for productivity, as we are not able to compute an accurate productivity measure from the data without losing a large number of observations.[7]

Finally, we take the financial situation in a firm into account. This may be important as innovation is likely to be affected by financial constraints in a firm (Hall (2002)). We do not consider self-reported financial constraints as firms might be reluctant to state openly whether they are financially constrained or not. Instead, we rely on a measure whether firms did not apply for a loan although they *did not* have sufficient own capital. They give a number of reasons which are related to inefficient financial markets, for instance "the application procedures are complex" or "it is necessary to make informal payments to get bank loans".

In an extended specification, ownership controls are added to the vector X. Partnership and limited partnership is supposed to reflect pressure from private equity owners

or a joint partner of the firm. We believe that these firms are better run than other firms which are less exposed to ownership control. This may, however, come at the cost that these firms do not experience the necessary flexibility to innovate or are specialized in medium-skilled tasks in the production chain. We also control for the share of foreign owners. 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)). We hypothesize that the effect might not be linear. It is, for instance, likely that affiliates that are 100% owned by the headquarter are specialized in assembling rather than innovation activities. On the other hand, a 5% stake in a foreign company is likely to be a capital investment which might stimulate innovation activities of the domestic firm. Finally, we also control for government ownership.

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 probit models and linear probability models (LPM). Secondly, outsourcing and importing 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 outsource and import as they are able to overcome the sunk costs associated with these activities (Antràs and Helpman (2004), Kasahara and Lapham (2013)). While the inclusion of our control variables should mitigate this problem - in particular the inclusion of exporting and importing, which is 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). Specifically, we use three variables for two endogenous variables: (i) the average share of imports reported by

other firms operating in the same industry and country in the same year, (ii) the average propensity to outsource reported by other firms operating in the same industry and country in the same year and (iii) an average assessment of the firm on whether cost reduction is important for its operations. That latter variable is computed using information on the firm's assessment of whether pressure from domestic companies, foreign companies and customers induces the firm to reduce production costs. To do so we standardize (mean = 0 and std. dev. = 1) three questions on the importance of (a) domestic competitors, (b) foreign competitors and (c) customers in affecting decisions with respect to reducing the production costs of existing products or services. We compute an average over these variables.

The rationale for the choice of these variables is as follows. The average assessment of other firms' propensity to import and outsource should be a good proxy for the outsourcing/importing behavior of the individual firm. Average assessments of other firms operating in the same industry and the same country reflect a multitude of factors which affect the outsourcing/importing decision such as trade barriers or transportation obstacles. These barriers differ on the country-industry level. This should be strongly correlated with the individual firm decision to outsource and import. These averages should, most importantly, not be correlated with firm-specific effects and can, hence, be considered to be exogenous instruments.[8]

The average assessment of the importance of cost reduction is our third instrument. Minimizing production costs is one of the main arguments for outsourcing put forth in the literature (e.g., Glass and Saggi (2001), Antràs and Helpman (2004), Rodríguez-Clare (2010)). Egger and Egger (2003) instrument outsourcing of Austrian firms with unit labor costs in Eastern Europe. They show that cost reduction is a significant driver of outsourcing. Similarly, Girma and Görg (2004) document that firms with higher wages outsource more. Hence, our instrument should be positively correlated with outsourcing and importing.

Given the definition of our cost reduction variable it is possible that it is correlated with competition in general, and competition has been shown to impact innovation (Aghion et al. (2004), Aghion et al. (2005), Gorodnichenko et al. (2010), Bloom et al. (forthcoming)). If this were the case then our instrument would be correlated with the error term in equation (1) and, hence, be invalid. We believe, however, that our instrument can be differentiated from competition that may impact on innovation as we control for the importance of pressure from domestic competitors to develop new products or services in equation (1). The question on which this variable is based precedes the questions on the reduction of production costs in the survey questionnaire. We may therefore argue that our instrument picks up a distinct effect and that firms can distinguish these effects. We come back to this issue in the discussion of our empirical results.

Furthermore, we test for instrument relevance and validity of over-identification restrictions in the empirical analysis using the standard tests.

4 Econometric results

4.1 Baseline model and IV estimation

Table 4 presents the baseline estimates from equation 1 using alternative dependent variables: new product development (columns 1 to 3), product upgrading (columns 4 to 6) and R&D (columns 7 to 9). Columns (1), (4) and (7) show the baseline estimation including only outsourcing. Columns (2), (5) and (8) also include importing. Columns (3), (6) and (9) furthermore include a set of ownership controls. We report marginal effects from Probit regressions. LPM estimations are not presented here to save space, as they produce very similar results. They are available from the authors upon request.[9]

(*Table 4 here*)

We find evidence for a positive association between outsourcing, importing and the innovation variables. The magnitude and the significance of the results are robust and

not affected by the inclusion of further control variables. They are fully in line with the predictions that outsourcing and importing (a) increase productivity and this increases innovation activities within the firm and (b) there is a direct learning effect because of superior products that have been outsourced/imported. It is also important to note that we pick up two distinct effects of sourcing strategies as the estimated coefficient of outsourcing barely changes with the inclusion of the importing variable.

As for our control variables, results 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)). Exporting is no longer positively associated with innovation after controlling for importing. We find negative effects of age, similar to Lin et al. (2010) corroborating the hypothesis that young firms tend to be more innovative than older firms. Older firms are, however, more likely to spend on R&D. Size, the proxy for productivity, is highly significant and shows that larger firms tend to be more innovative. The finance variable depicts the expected sign and is very robust throughout all specifications. Additionally, we find that domestic competition fosters innovation.

In the final step, we include a set of ownership control variables. Partnership turns out to significantly negatively affect innovation, probably because partners like private equity companies rely in transition countries on medium-skilled labor and not on highly innovative work. We find an inverted-U-shaped effect of foreign ownership on R&D. This relates most likely to the idea that foreign owners that hold small shares in companies do not interfere with the innovation activities of firms. On the other hand, if we look at an affiliated company of a foreign-owned company, R&D is most likely located at the headquarter. Government ownership has no effect on R&D spending but affects negatively innovation output. This is a plausible result as governments may not be as

effective as private companies in terms of generating innovation output.

The assumption in the estimations thus far is that outsourcing and importing 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 regression estimates for the instrumental variables estimations (LPM and Probit) are shown in Table 5. Detailed first stage results for the LPM model are relegated to the appendix (Table 13).

(*Table 5 here*)

First note that we use all three instruments in the Newproduct and Upgrading equations while we do not use the cost reduction instrument in the R&D equation. The reason is that R&D includes R&D outsourced to other companies. This could be correlated with cost reduction motives. Therefore, only two instruments are used in the R&D equation. When considering instrument relevance, note that the first stage F-tests are statistically significant, suggesting that the excluded instruments are jointly relevant. The reported F-statistics are well above 10 (except for outsourcing in the R&D specification), the critical value usually considered as "safe" for instrument relevance. We also report an under-identification test, which allows us to reject the assumption of under-identification. We show in Table 13 that the excluded instruments are individually statistically significant predictors of outsourcing and importing.[10] 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 all innovation variables. Note also that we report marginal effects from a Probit model and a LPM to show that our estimates are robust to different model specifications.

Looking at the estimates in Table 5 we find that the significance of the control variables broadly reflects previous findings in Table 4. A difference is that age and

education are no longer statistically significant in most specifications. The coefficients on the finance variable are significant for new product development and product upgrading but not for the R&D regression. Also, the coefficient size in the new product regression appears somewhat smaller than in Table 4.[11]

Our results for outsourcing and importing are similar to previous findings. This suggests that our results are robust to specifications which address endogeneity concerns. We have discussed potential drawbacks of the instruments in section 3 and are careful to point out that our results rely on the assumption of instrument exogeneity. Comparing our results to the previous literature, we can confirm a positive link between importing and innovation output (e.g., Gorodnichenko et al. (2010), Goldberg et al. (2010), Crinò (2012)). We add to this literature that importing does not increase the propensity to spend on R&D so that the ability to engage in novel innovation might not be increased by importing. We can also differentiate the importing effect from an outsourcing effect. Outsourcing depicts complementarity with conducting own R&D which is a positive effect that the literature on outsourcing has neglected thus far.

4.2 Robustness checks

In this section we consider a number of robustness checks. The first issue that one may be concerned with is that we may have a relatively low number of firms with which to calculate the instruments based on the averages of importing or outsourcing in the same country, industry and year. If that were the case we might be likely observing a limited number of firms in each cell, potentially implying that our innovation variable is based on a strategic competitive response to the outsourcing or importing activity of other firms. This could then invalidate our instruments.

To counter such criticisms we show in Tables 11 and 14, as well as in Figures 1 and 2 in the appendix the number of firms per country and industry and the distribution of the actual number of firms used to calculate the instrument, respectively. The figures

show that for most cases we have a fairly large number of firms.[12] In order to check the robustness of our results we report estimations where we drop those observations for which the instrument is based on less than nine observations (lowest ten percent of the distribution). Results are very similar to those obtained earlier, see Table 6, with one difference being the coefficients on outsourcing in the R&D equation which are lower than before.

(*Table 6 here*)

To control for the possibility of a strategic effect we also run an estimation where we control additionally for the concentration ratio of the top four firms with the largest market shares or the Hirschman-Herfindahl index of concentration, respectively. The results are in Table 7. The inclusion of these variables does again not change results strongly. Market concentration does not emerge as a robust and significant control in the model which might be partly because we already control for domestic competition. As the concentration variables are calculated using sales per firms, for which we have a substantial number of missing observations we do not include these variables in what follows in order to maximise the number of observations in our estimations.

(*Table 7 here*)

Another concern is with our third instrument, namely, the assessment of the firm of the importance to reduce costs. Here, a potential reverse causality may exist. If a firm has innovated in the past to produce a highly differentiable and competitive good, it may face less or no pressure from competition to reduce costs in the subsequent period. This would introduce a correlation between the instrument and innovation. In order to check for this possibility, we ran regressions with the instrument as dependent variable and lagged innovation and R&D variables as explanatory variables. For this purpose, we exploit the panel dimension of the data. The innovation variables are in all cases statistically insignificant, suggesting that reverse causality is not an issue. Results are in the appendix Table 15.

A further potential problem with this instrument is that it may be correlated with competition in general, which might drive firms to outsource. In order to alleviate such concerns, we can refer back to the above robustness check, where we included measures of the Herfindahl index and concentration ratios. Furthermore, equation (1) includes the firm's assessment of pressure from domestic competition to developing new products (i.e., innovate) as explanatory variable. However, if pressure to reduce costs and pressure to innovation were highly correlated, then this might introduce a problem as the instrument may then be correlated with innovation activity. In order to consider this issue, we firstly check the raw correlation of the two variables which at 0.57 is indeed high (see Table 16 in the appendix). However, what matters is not this raw correlation but the correlation conditional on other variables included in the model. As our results thus far show, this does not seem to be problematic, as we are able to identify a statistically significant coefficient on the "exogenous" pressure to innovate variable as well as on the excluded instrument in the first step regression (see Table 5 and Table 13 in the appendix). A test for multicollinearity is also reassuring, returning a VIF test of 1.70 and 1.65 for the instrument and the domestic competition control. Still, we do acknowledge that even when controlling for these variables, we may not be able to capture all aspects of competition that may potentially be driving outsourcing, importing and innovation activities. This should be kept in mind when interpreting our results.[13]

Another robustness issue concerns the R&D variable, which is treated as exogenous in the innovation equations. In the results in Table 8 we treat R&D instead as endogenous, using an instrument based on the average share of R&D of firms in the same industry, country and year. The results show that this has no impact on the import variable, however, it does render the outsourcing variable statistically insignificant. This suggests that in the previous tables the positive coefficient on outsourcing is driven by the effect that outsourcing has on R&D and that this is not properly controlled for.

Once this is taken into account, there is no direct impact of outsourcing on innovation. This suggests that outsourcing affects R&D and through this R&D effect also impacts on innovation. However, there is no direct impact on innovation from outsourcing, in contrast to importing.

(*Table 8 here*)

To summarize our results for different innovation variables, we find that only outsourcing leads 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. Once R&D is controlled for, we observe a direct positive effect of importing (though not outsourcing) on innovation activities. We do not observe this effect explicitly for importing in the R&D estimations, but the firm could nevertheless undertake efforts in the production process to improve existing products or respond to changing preferences of customers. The summary statistics show, for instance, that 30% of all firms spend on R&D but that about half of all firms introduce new products or services and two thirds of all firms upgrade existing products and services. Hence, firms that change their product line do not necessarily report to have spent on R&D. Many firms might also not have their own R&D laboratory but they have measures in place that ensure quality control. We, therefore, conclude that foreign inputs due to, for instance, larger product variety and outsourcing involve the sourcing of specific inputs that, likely in combination with own R&D improvements, lead to higher innovation output.[14]

4.3 Model extensions

We now turn to exploiting an important aspect of heterogeneity as an extension to our baseline model, namely different institutional variables. We consider the quality of property rights, the strength of intellectual property rights (IPR), hiring and firing practices as well as the quantity and the quality of local suppliers of the country in which the firm is located. There is great variation in these variables among the countries in our sam-

ple. We use the *Global Competitiveness Report* to group our countries into two groups with favorable and less favorable institutions.[15] We then estimate equation 1 with two additional interaction effects, namely interacting outsourcing and importing with the different institutional proxies, respectively. We treat outsourcing and importing, as well as the interaction terms as endogenous. Additional instruments are the instruments used before interacted with the institutional variables.[16] [17] We estimate a LPM for all innovation models.

Results in Table 9 show that institutions such as property rights and intellectual property rights protection matter, in particular for importing. This is intuitively reasonable as importing involves complicated transactions and partners in more than one country. Clear property rights may therefore be important for the trade partner abroad in order to facilitate trade.

Also, IPR might be important as firms may only engage in upgrading technology if they are ensured that they can reap the gains of such investments, i.e., if their output can be sufficiently protected. This relationship does not hold for R&D though, implying that direct complementarily between imports and innovation is IPR-sensitive. It is nevertheless a reassuring result because firms are ultimately concerned with protecting their innovation output and not R&D spending. Hiring and firing captures the flexibility of national labor markets. This institutional aspect only matters for the relationship between importing and R&D in our estimation. This may indicate that flexible labour markets are important for hiring the best talent for R&D.

Local supplier quantity and quality may be important as they facilitate importing in the first place. Importing requires a sufficient quantity of local suppliers which provide auxiliary services to importing. We find that the quantity of suppliers matters for the relationship between importing and innovation, though this is statistically significant only for product upgrading. Supplier quality does not appear to matter, which may

perhaps indicate poor measurement of actual quality in the country level index we use.

Note that the interactions of institutional variables with outsourcing are generally statistically insignificant, as are the coefficients on the outsourcing variable on its own. This suggests that the specification without interactions is more appropriate for the outsourcing - innovation link. It is likely that we cannot identify more detailed results for outsourcing as we can not quantify the amount of outsourcing and this is more likely to be reflected in the importing measure. Institutions may also be more relevant for importing as this involves partners abroad with potentially different institutional set-ups, while this is not the case for outsourcing within the same country. Lastly, it is interesting to find a negative coefficient for importing and R&D. This could suggest that imports substitute for domestic R&D in countries which are far away from the technological frontier and that institutions play a crucial role in stimulating or hampering R&D in domestic firms.

(*Table 9 here*)

In a further extension, we distinguish firms in EU countries from firms in non-EU countries. The results comparing EU with non-EU countries show that the benefits in terms of innovation from importing are higher in EU than in non-EU countries, while this is not the case for outsourcing. This may indicate that complex sourcing strategies involving foreign partners, such as importing, are easier to implement within the EU due to lower trade barriers and fewer institutional impediments.[18]

(*Table 10 here*)

5 Conclusion

This paper looks at the link between outsourcing, importing and various innovation measures using rich firm-level data for *emerging economies*. We add to a literature on gains from outsourcing which has mostly focused on industrialized countries. We also

consider importing as an important channel to access goods of different variety and quality. Arguably, gaining access to foreign technology due to quality and variety effects may be an important motive for importing in transition economies (Crinò (2012)).

Using firm-level data for 28 transition countries from the BEEPS dataset, we find evidence that outsourcing is associated with a greater probability to spend on research and development and, through this R&D channel, to introduce new products and to upgrade existing products. Importing is as well associated with the latter two innovation measures but not with spending on research and development. This suggests that outsourcing leads to restructuring of activities towards higher value-added activities (such as R&D) while importing of better varieties/qualities of intermediate inputs has direct effects on innovation (but not R&D). We implement an instrumental variable strategy to address endogeneity concerns.

We also show that the results crucially depend on institutional characteristics. Outsourcing leads to more R&D and thus innovation activities irrespective of the institutional environment. However, institutional characteristics influence the effects of importing. Good institutions related to property rights, intellectual property rights protection and quantity of suppliers increase the benefits that firms may reap from importing. This may not be too surprising, as good institutions facilitate trade. We also show that there are pronounced differences between EU and non-EU member states. Our findings suggest that being an EU-member increases the positive effects of importing on innovation. Complex sourcing strategies, such as importing, should be easier to implement within the EU due to lower trade barriers and fewer institutional impediments. These are important findings 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.

Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt, "Competition and Innovation: An Inverted-U Relationship," *The Quarterly Journal of Economics*, May 2005, *120* (2), 701–728.

_ , Richard Blundell, Rachel Griffith, Peter Howitt, and Susanne Prantl, "Entry and Productivity Growth: Evidence from Microlevel Panel Data," *Journal of the European Economic Association*, 2004, *2* (2-3), 265–276.

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.

Arvanitis, Spyros and Euripidis N. Loukis, "Outsourcing and Firm Performance - a Comparative Study of Swiss and Greek Firms," *Industrial and Corporate Change*, 2013, *22* (3), 771–806.

Bas, Maria, "Input-trade Liberalization and Firm Export Decisions: Evidence from Argentina," *Journal of Development Economics*, 2012, *97* (2), 481–493.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott, "Firms in International Trade," *Journal of Economic Perspectives*, 2007, *21* (3), 105–130.

Bloom, Nicholas, Mirko Draca, and John Van Reenen, "Trade Induced Technical Change: The Impact of Chinese Imports on Innovation, Diffusion and Productivity," *Review of Economic Studies*, forthcoming.

Chen, Bo and Hong Ma, "Import Variety and Welfare Gain in China," *Review of International Economics*, 2012, *20* (4), 807–820.

Correa, Paulo G., Ana M. Fernandes, and Chris J. Uregian, "Technology Adoption and the Investment Climate: Firm-Level Evidence for Eastern Europe and Central Asia," *World Bank Economic Review*, 2010, *24* (1), 121–147.

Crinò, Rosario, "Imported Inputs and Skill Upgrading," *Labour Economics*, 2012, *19* (6), 957–969.

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 Mancusi, and Andrea Morrison, "Innovation and the Geographical and Functional Dimensions of Outsourcing: Evidence from Italian Firm-Level Data," *Structural Change and Economic Dynamics*, 2009, *20* (3), 183–195.

Egger, Hartmut and Peter Egger, "Outsourcing and Skill-Specific Employment in a Small Open Economy: Austria after the Fall of the Iron Curtain," *Oxford Economic Papers*, 2003, *55* (4), 625–643.

Fisman, Raymond and Jakob Svensson, "Are Corruption and Taxation Really Harmful to Growth? Firm Level Evidence," *Journal of Development Economics*, 2007, *83* (1), 63–75.

Girma, Sourafel and Holger Görg, "Outsourcing, Foreign Ownership, and Productivity: Evidence from UK Establishment-level Data," *Review of International Economics*, 2004, *12* (5), 817–832.

_ , Yundan Gong, and Holger Görg, "Foreign Direct Investment, Access to Finance, and Innovation Activity in Chinese Enterprises," *World Bank Economic Review*, 2008, *22* (2), 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, László, Miklós Koren, and Adam Szeidl, "Imports and Productivity," CEPR Discussion Papers 5139, CEPR 2005.

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* (6), 941–965.

Kasahara, Hiroyuki and Beverly Lapham, "Productivity and the Decision to Import and Export: Theory and Evidence," *Journal of International Economics*, 2013, *89* (2), 297–316.

_ **and Joel Rodrigue**, "Does the Use of Imported Intermediates Increase Productivity? Plant-level Evidence," *Journal of Development Economics*, 2008, *87* (1), 106–118.

Koopman, Robert, Zhi Wang, and Shang-Jin Wei, "Tracing Value-Added and Double Counting in Gross Exports," *American Economic Review*, 2014, *104* (2), 459–94.

Lin, Chen, Ping Lin, and Frank Song, "Property Rights Protection and Corporate R&D: Evidence from China," *Journal of Development Economics*, 2010, *93* (1), 49–62.

_ **,** _ **, Frank M. Song, and Chuntao Li**, "Managerial Incentives, CEO Characteristics and Corporate Innovation in China's Private Sector," *Journal of Comparative Economics*, 2011, *39* (2), 176–190.

Marjit, Sugata and Arijit Mukherjee, "International Outsourcing and R&D: Long-Run Implications for Consumers," *Review of International Economics*, 2008, *16* (5), 1010–1022.

Melitz, Marc J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

Miroudot, Sébastien, 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* (5), 692–734.

Rodríguez-Clare, Andrés, "Offshoring in a Ricardian World," *American Economic Journal: Macroeconomics*, 2010, *2* (2), 227–58.

Seker, Murat, "Importing, Exporting, and Innovation in Developing Countries," *Review of International Economics*, 2012, *20* (2), 299–314.

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

Topalova, Petia and Amit Khandelwal, "Trade Liberalization and Firm Productivity: The Case of India," *The Review of Economics and Statistics*, 2011, *93* (3), 995–1009.

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

Table 1: Descriptives: Outsourcing vs. non-outsourcing firms

Outsourcing	Yes	No	Difference
Newproduct	0.675	0.454	0.220***
	(0.469)	(0.498)	(0.013)
Upgrading	0.835	0.627	0.208***
	(0.372)	(0.484)	(0.011)
RD	0.466	0.28	0.186***
	(0.499)	(0.449)	(0.014)
Imports	39.025	30.384	8.641***
	(36.678)	(37.147)	(1.042)
Partnership	0.131	0.216	-0.084***
	(0.338)	(0.411)	(0.010)
Foreign Owners	11.922	8.645	3.277***
	(29.915)	(25.685)	(0.818)
Gov	4.797	5.94	-1.143**
	(19.364)	(22.316)	(0.557)
Exports	24.77	13.647	11.123***
	(34.485)	(27.576)	(0.932)
Age	18.211	15.359	2.853***
	(20.364)	(17.98)	(0.557)
Finance	0.096	0.128	-0.033***
	(0.294)	(0.335)	(0.008)
University	25.745	24.69	1.055
	(25.747)	(26.234)	(0.721)
Dom. Competition	2.742	2.837	-0.095***
	(1.041)	(1.027)	(0.029)
Size	2.116	1.785	0.331***
	(0.785)	(0.79)	(0.022)
Observations	1556	7323	8879

Mean values in columns 1 and 2. Std. deviation in parentheses for columns 1 and 2 and std. error in parentheses for column 3. Outsourcing is a dummy variable taking on the value of 1 if the establishment outsourced activities previously done in-house in the last three years and 0 otherwise. Newproduct is a dummy variable taking on the value of 1 if the establishment reports to have introduced new products or services in the last 3 years and 0 otherwise. Upgrading is a dummy variable taking on the value of 1 if the establishment reports to have upgraded an existing product line or service in the last 3 years and 0 otherwise. R&D is a dummy variable taking on the value of 1 if the establishment invested in R&D (in-house or outsourced) in the last 3 years. Imports is the share of material inputs and supplies of foreign origin in the last fiscal year. Partnership is a dummy variable taking on the value of 1 if the establishment's current legal status is a partnership or limited partnership. Foreign owner (government) is the share of the establishment that is owned by private foreign individuals, companies or organizations (the government or state). Exports is the share of the establishment's sales that were indirectly and directly exported. Firm age is the years in operation since establishment. Finance is a dummy variable taking on the value of 1 if the establishment reports that it did not apply for a loan and checks any of the following answers: the application procedures are complex, interest rates are not favorable, collateral requirements are too high, the size of the loan is insufficient, it is necessary to make an informal payment, the establishment did not think it would be approved and other. It takes on the value of 0 if the establishment applied for a loan or if there was no need for a load as the establishment reported to have sufficient capital. University is the share of employees at the end of the fiscal year with a university degree. Domestic competition takes on values from 1-4 ranking how important pressure from domestic competitors is in affecting decisions to develop new products or services and markets for the establishment (4 being very important and 1 being not at all important). Size is a categorical variables which is 1 for small establishments (5-19 employees), 2 for medium-sized establishments (20-99) and 3 for large establishments (100 and more).

Table 2: Descriptives: Importing vs. non-importing firms

Importing	Yes	No	Difference
Newproduct	0.582	0.369	0.214***
	(0.493)	(0.483)	(0.011)
Upgrading	0.736	0.556	0.180***
	(0.441)	(0.497)	(0.010)
RD	0.392	0.200	0.192***
	(0.488)	(0.4)	(0.010)
Outsourcing	0.221	0.111	0.110***
	(0.415)	(0.314)	(0.008)
Partnership	0.200	0.203	-0.003
	(0.4)	(0.403)	(0.009)
Foreign Owners	12.881	4.074	8.807***
	(30.788)	(17.62)	(0.525)
Gov	5.247	6.212	-0.965**
	(20.755)	(22.867)	(0.482)
Exports	20.926	7.877	13.049***
	(32.285)	(21.75)	(0.582)
Age	16.714	14.800	1.914***
	(19.703)	(16.728)	(0.394)
Finance	0.100	0.157	-0.056***
	(0.3)	(0.363)	(0.007)
University	25.965	22.888	3.077***
	(25.995)	(25.876)	(0.567)
Dom. Competition	2.813	2.834	-0.021
	(1.034)	(1.023)	(0.022)
Size	1.976	1.664	0.312***
	(0.813)	(0.744)	(0.017)
Observations	5044	3576	8620

Mean values in columns 1 and 2. Std. deviation in parentheses for columns 1 and 2 and std. error in parentheses for column 3. Importing is a dummy variable taking on the value of 1 if the establishment imported material inputs and supplies in the last fiscal year and 0 otherwise. Newproduct is a dummy variable taking on the value of 1 if the establishment reports to have introduced new products or services in the last 3 years and 0 otherwise. Upgrading is a dummy variable taking on the value of 1 if the establishment reports to have upgraded an existing product line or service in the last 3 years and 0 otherwise. R&D is a dummy variable taking on the value of 1 if the establishment invested in R&D (in-house or outsourced) in the last 3 years. Imports is the share of material inputs and supplies of foreign origin in the last fiscal year. Outsourcing is a dummy variable taking on the value of 1 if the establishment outsourced activities previously done in-house in the last three years and 0 otherwise. Partnership is a dummy variable taking on the value of 1 if the establishment's current legal status is a partnership or limited partnership. Foreign owner (government) is the share of the establishment that is owned by private foreign individuals, companies or organizations (the government or state). Exports is the share of the establishment's sales that were indirectly and directly exported. Firm age is the years in operation since establishment. Finance is a dummy variable taking on the value of 1 if the establishment reports that it did not apply for a loan and checks any of the following answers: the application procedures are complex, interest rates are not favorable, collateral requirements are too high, the size of the loan is insufficient, it is necessary to make an informal payment, the establishment did not think it would be approved and other. It takes on the value of 0 if the establishment applied for a loan or if there was no need for a load as the establishment reported to have sufficient capital. University is the share of employees at the end of the fiscal year with a university degree. Domestic competition takes on values from 1-4 ranking how important pressure from domestic competitors is in affecting decisions to develop new products or services and markets for the establishment (4 being very important and 1 being not at all important). Size is a categorical variables which is 1 for small establishments (5-19 employees), 2 for medium-sized establishments (20-99) and 3 for large establishments (100 and more).

Table 3: Descriptives: Outsourcing and importing activities of firms

		Importing	Importing	
		No	Yes	Total
Outsourcing	No	3180	3931	7111
Outsourcing	Yes	396	1113	1509
	Total	3576	5044	8620

The table depicts information on the number of importing/non-importing firms vs. outsourcing/non-outsourcing firms.

Table 4: Exogenous outsourcing and importing

	Newprod.	Newprod.	Newprod.	Upgrading	Upgrading	Upgrading	R&D	R&D	R&D
Sourcing strategy									
Outsourcing	0.106***	0.100***	0.100***	0.122***	0.118***	0.119***	0.109***	0.105***	0.104***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.010)	(0.010)	(0.010)
Imports		0.001***	0.001***		0.001***	0.001***		0.001***	0.001***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Ownership structure									
Partnership			-0.005			-0.033***			-0.032***
			(0.014)			(0.013)			(0.012)
Foreign Owners			0.002			-0.001			0.002**
			(0.001)			(0.001)			(0.001)
For. Ow. squared			-0.000			0.000			-0.000**
			(0.000)			(0.000)			(0.000)
Gov			-0.001**			-0.001***			0.000
			(0.000)			(0.000)			(0.000)
Other control variables									
Exports	0.000**	0.000	0.000	0.000**	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.001**	-0.001**	-0.000	-0.001**	-0.001**	-0.000	0.000**	0.001**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RD	0.227***	0.216***	0.216***	0.177***	0.170***	0.169***			
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)			
Finance	-0.091***	-0.087***	-0.088***	-0.075***	-0.079***	-0.079***	-0.034**	-0.037***	-0.036***
	(0.016)	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
University	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dom. Competition	0.017***	0.018***	0.016***	0.024***	0.024***	0.022***	0.005	0.005	0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Size medium	0.071***	0.069***	0.070***	0.076***	0.075***	0.081***	0.117***	0.118***	0.119***
	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.010)
Size large	0.071***	0.067***	0.067***	0.069***	0.067***	0.076***	0.215***	0.212***	0.214***
	(0.015)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.011)	(0.011)	(0.012)
Obervations	8874	8616	8579	8859	8601	8564	8879	8620	8583

Reported coefficients are marginal effects from Probit estimations. Robust standard errors are in parentheses. Industry, country and time dummies included. * 10% significance, ** 5% significance, *** 1% significance. Coefficients from standard OLS-regressions are quantitatively similar.

Table 5: Endogenous outsourcing and importing

	Newproduct LPM	Newproduct Probit	Upgrading LPM	Upgrading Probit	R&D LPM	R&D Probit
Sourcing strategy						
Outsourcing	0.497**	0.512***	0.341*	0.316***	0.735**	0.742***
	(0.218)	(0.132)	(0.196)	(0.114)	(0.290)	(0.174)
Imports	0.004***	0.004***	0.004***	0.004***	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ownership structure						
Partnership	-0.003	-0.004	-0.032**	-0.035**	-0.018	-0.033*
	(0.015)	(0.018)	(0.015)	(0.016)	(0.013)	(0.018)
Foreign Owners	0.001	0.001	-0.002	-0.002	0.002*	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
For. Ow. squared	-0.000	-0.000	0.000	0.000	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gov	-0.001*	-0.001*	-0.001***	-0.001***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Other control variables						
Exports	-0.000*	-0.001*	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.000	-0.000	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RD	0.153***	0.170***	0.101***	0.129***		
	(0.028)	(0.031)	(0.025)	(0.027)		
Finance	-0.059***	-0.068***	-0.071***	-0.080***	-0.008	-0.021
	(0.019)	(0.023)	(0.018)	(0.022)	(0.020)	(0.025)
University	0.000	0.001	-0.000	-0.000	0.001*	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dom. Competition	0.015**	0.017**	0.022***	0.025***	0.001	0.002
	(0.006)	(0.007)	(0.006)	(0.006)	(0.005)	(0.007)
Size medium	0.057***	0.062***	0.080***	0.080***	0.087***	0.145***
	(0.016)	(0.018)	(0.014)	(0.015)	(0.018)	(0.022)
Size large	0.040**	0.043*	0.057***	0.058***	0.188***	0.267***
	(0.020)	(0.023)	(0.019)	(0.020)	(0.028)	(0.034)
F-test Outsourcing	13.83		14.08		8.38	
F-test Imports	80.67		81.05		100.11	
Underidentification (p-value)	0.0000		0.0000		0.0000	
Hansen J test (p-value)	0.4731		0.6669			
Exogeneity test (p-value)	0.0000	0.0000	0.0000	0.0000	0.0332	0.0720
Obervations	8233	8233	8217	8217	8529	8529

We report marginal effects for Probit estimations. Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, the average propensity to outsource reported by other firms operating in the same industry, country and year and an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs. Instruments used for R&D: the average share of imports reported by other firms operating in the same industry, country and year and the average propensity to outsource reported by other firms operating in the same industry, country and year. * 10% significance, ** 5% significance, *** 1% significance.

Table 6: Robustness of construction of instrumental variables

	Newprod. Test outsourcing-IV	Newprod. Test imports-IV	Upgrading Test outsourcing-IV	Upgrading Test imports-IV	R&D Test outsourcing-IV	R&D Test imports-IV
Sourcing strategy						
Outsourcing	0.427**	0.472**	0.385**	0.338*	0.449**	0.448**
	(0.184)	(0.191)	(0.168)	(0.173)	(0.176)	(0.191)
Imports	0.005***	0.004***	0.003***	0.004***	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ownership structure						
Partnership	-0.011	-0.010	-0.033**	-0.035**	-0.020	-0.019
	(0.016)	(0.016)	(0.016)	(0.016)	(0.012)	(0.012)
Foreign Owners	-0.000	-0.000	-0.002*	-0.002**	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
For. Ow. squared	-0.000	-0.000	0.000	0.000	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gov	-0.001*	-0.001**	-0.001***	-0.001***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Other control variables						
Exports	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RD	0.158***	0.155***	0.109***	0.111***		
	(0.026)	(0.027)	(0.023)	(0.024)		
Finance	-0.065***	-0.063***	-0.072***	-0.073***	-0.019	-0.018
	(0.019)	(0.020)	(0.019)	(0.019)	(0.016)	(0.016)
University	0.000	0.000	-0.000	-0.000	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dom. Competition	0.017***	0.018***	0.023***	0.023***	0.003	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Size medium	0.057***	0.058***	0.075***	0.077***	0.098***	0.099***
	(0.016)	(0.016)	(0.015)	(0.015)	(0.014)	(0.015)
Size large	0.035*	0.036*	0.045**	0.051***	0.205***	0.204***
	(0.021)	(0.021)	(0.019)	(0.020)	(0.022)	(0.023)
F-test Outsourcing	18.33	16.50	18.41	16.55	18.76	15.52
F-test Imports	76.13	79.76	76.16	79.78	98.55	104.54
Underidentification (p-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hansen J test (p-value)	0.2769	0.2712	0.5241	0.4252		
Exogeneity test (p-value)	0.0000	0.0000	0.0001	0.0001	0.1344	0.1589
Observations	7307	7304	7293	7290	7572	7569

Reported coefficients are from LPMs using instrumental variables as in Table 5. We drop all observations for which the number of observations used to construct the outsourcing (importing) instrument is in the lowest 10% of observations, i.e., it is based on less than 9 (9) observations. We report these results in columns *Test outsourcing IV* (*Test imports IV*). Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, the average propensity to outsource reported by other firms operating in the same industry, country and year and an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs. Instruments used for R&D: the average share of imports reported by other firms operating in the same industry, country and year and the average propensity to outsource reported by other firms operating in the same industry, country and year. * 10% significance, ** 5% significance, *** 1% significance.

Table 7: Controlling for market concentration

	Newproduct	Newproduct	Upgrading	Upgrading	R&D	R&D
Sourcing strategy						
Outsourcing	0.591***	0.560**	0.397**	0.377*	0.733***	0.754***
	(0.226)	(0.221)	(0.201)	(0.197)	(0.274)	(0.272)
Imports	0.004***	0.004***	0.004***	0.004***	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market concentration						
Concentration ratio	0.081**		-0.003		-0.045	
	(0.039)		(0.035)		(0.034)	
HHI		0.032		-0.060*		-0.005
		(0.036)		(0.033)		(0.032)
Ownership structure						
Partnership	-0.008	-0.007	-0.031**	-0.030**	-0.020	-0.020
	(0.016)	(0.016)	(0.015)	(0.015)	(0.014)	(0.014)
Foreign Owners	0.001	0.001	-0.002*	-0.002*	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
For. Ow. squared	-0.000	-0.000	0.000	0.000	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gov	-0.001*	-0.001*	-0.001***	-0.001***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Other control variables						
Exports	-0.000*	-0.000*	-0.000*	-0.000*	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.000	-0.000	-0.000	-0.000	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RD	0.140***	0.142***	0.098***	0.100***		
	(0.028)	(0.028)	(0.025)	(0.024)		
Finance	-0.062***	-0.063***	-0.073***	-0.074***	-0.005	-0.004
	(0.021)	(0.020)	(0.019)	(0.019)	(0.020)	(0.020)
University	0.001*	0.001*	-0.000	-0.000	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dom. Competition	0.014**	0.014**	0.022***	0.022***	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Size medium	0.057***	0.058***	0.079***	0.079***	0.086***	0.085***
	(0.016)	(0.016)	(0.015)	(0.015)	(0.017)	(0.017)
Size large	0.035	0.037*	0.060***	0.061***	0.198***	0.196***
	(0.021)	(0.021)	(0.020)	(0.019)	(0.028)	(0.028)
F-test Outsourcing	14.55	14.76	18.41	14.85	9.89	10.11
F-test Imports	77.41	77.69	76.16	77.84	93.12	93.84
Underidentification (p-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hansen J test (p-value)	0.4574	0.4541	0.8158	0.7989		
Exogeneity test (p-value)	0.0000	0.0000	0.0001	0.0000	0.0205	0.0121
Observations	7703	7703	7689	7689	7967	7967

Reported coefficients are based on instrumental variables estimation of a LPM as in Table 5. Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, the average propensity to outsource reported by other firms operating in the same industry, country and year and an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs. Instruments used for R&D: the average share of imports reported by other firms operating in the same industry, country and year and the average propensity to outsource reported by other firms operating in the same industry, country and year. * 10% significance, ** 5% significance, *** 1% significance.

Table 8: Endogenous outsourcing, importing and spending on R&D

	Newproduct LPM	Newproduct Probit	Upgrading LPM	Upgrading Probit
Sourcing strategy				
Outsourcing	0.159	0.226	0.053	0.116
	(0.230)	(0.241)	(0.215)	(0.212)
Imports	0.004***	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Spending on RD				
RD	0.513***	0.524***	0.382***	0.358***
	(0.094)	(0.075)	(0.089)	(0.068)
Ownership structure				
Partnership	-0.000	-0.000	-0.030*	-0.032**
	(0.016)	(0.018)	(0.015)	(0.016)
Foreign Owners	0.001	0.001	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
For. Ow. squared	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Gov	-0.000*	-0.001*	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Other control variables				
Exports	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.000	-0.001	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Finance	-0.062***	-0.072***	-0.073***	-0.082***
	(0.019)	(0.022)	(0.018)	(0.022)
University	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Dom. Competition	0.015**	0.017**	0.021***	0.024***
	(0.006)	(0.007)	(0.006)	(0.006)
Size medium	0.030*	0.031	0.059***	0.060***
	(0.017)	(0.019)	(0.016)	(0.017)
Size large	-0.023	-0.029	0.011	0.012
	(0.026)	(0.029)	(0.024)	(0.027)
F-test Outsourcing	13.51		13.73	
F-test Imports	62.64		62.93	
F-test R&D	61.59		61.51	
Underidentification (p-value)	0.0000		0.0000	
Hansen J test (p-value)	0.6860		0.4194	
Exogeneity test (p-value)	0.0012	0.0000	0.0000	0.0000
Observations	8200	8200	8184	8184

We report marginal effects for Probit estimations. Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, the average propensity to outsource reported by other firms operating in the same industry, country and year, the average propensity to spend on R&D reported by other firms operating in the same industry, country and year and an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs. * 10% significance, ** 5% significance, *** 1% significance.

Table 9: Extension 1: Institutions

	Newprod.	Upgrad.	R&D	Newprod.	Upgrad.	R&D	Newprod.	Upgrad.	R&D	Newprod.	Upgrad.	R&D	Newprod.	Upgrad.	R&D
Imports	0.006***	0.003***	-0.003***	0.005***	0.003***	-0.002*	0.007***	0.004***	-0.003**	0.005***	0.003***	-0.003**	0.005***	0.003***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Outsourcing	0.129	0.109	0.027	0.135	0.169	0.127	0.166	0.194	0.114	0.329**	0.018	0.210*	0.369**	0.104	0.207
	(0.135)	(0.118)	(0.109)	(0.147)	(0.128)	(0.114)	(0.145)	(0.129)	(0.113)	(0.157)	(0.133)	(0.127)	(0.159)	(0.135)	(0.135)
Imports*Prop. rights	0.002*	0.002**	0.003***												
	(0.001)	(0.001)	(0.001)												
Outsourcing*Prop. rights	0.047	0.126	0.054												
	(0.137)	(0.123)	(0.107)												
Imports*Intell. prop. rights				0.003**	0.002***	0.000									
				(0.001)	(0.001)	(0.001)									
Outsourcing*Intell. prop. rights				-0.056	-0.112	-0.108									
				(0.138)	(0.123)	(0.107)									
Imports*Hiring firing							-0.001	-0.000	0.001*						
							(0.001)	(0.001)	(0.001)						
Outsourcing*Hiring firing							-0.035	-0.094	-0.046						
							(0.137)	(0.122)	(0.112)						
Imports*Supplier Quantity										0.001	0.002**	0.001			
										(0.001)	(0.001)	(0.001)			
Outsourcing*Supplier Quantity										0.001	0.122	-0.232*			
										(0.151)	(0.131)	(0.122)			
Imports*Supplier Quality													0.002	0.001	0.001
													(0.001)	(0.001)	(0.001)
Outsourcing*Supplier Quality													-0.062	0.031	-0.188
													(0.140)	(0.120)	(0.115)
Observations	6861	6846	7095	6861	6846	7095	6861	6846	7095	6307	6294	6525	6307	6294	6525

Reported coefficients are from LPMs using instrumental variables. Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, a dummy for whether the propensity to outsource reported by other firms operating in the same industry, country and year is high (=1) or low (=0), an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs and interaction terms of these three instruments with the respective institutional variables. Instruments used for R&D: the average share of imports reported by other firms operating in the same industry, country and year, a dummy for whether the propensity to outsource reported by other firms operating in the same industry, country and year is high (=1) or low (=0) and interaction terms of these two instruments with the respective institutional variables. * 10% significance, ** 5% significance, *** 1% significance.

Table 10: Extension 2: EU vs. non-EU countries

	Newproduct	Upgrading	R&D
Sourcing strategy			
Imports	0.004***	0.004***	-0.000
	(0.001)	(0.001)	(0.001)
Outsourcing	0.069	0.058	0.131
	(0.116)	(0.109)	(0.090)
Imports*EU	0.003**	0.003**	0.001
	(0.001)	(0.001)	(0.001)
Outsourcing*EU	0.184	0.114	-0.002
	(0.123)	(0.115)	(0.096)
Ownership structure			
Partnership	-0.010	-0.037**	-0.030***
	(0.015)	(0.015)	(0.011)
Foreign Owners	0.001	-0.001	0.002*
	(0.001)	(0.001)	(0.001)
For. Ow. squared	-0.000*	0.000	-0.000**
	(0.000)	(0.000)	(0.000)
Gov	-0.001*	-0.001***	-0.000
	(0.000)	(0.000)	(0.000)
Other control variables			
Exports	-0.000*	-0.000*	0.000
	(0.000)	(0.000)	(0.000)
Age	-0.000	-0.000	0.001**
	(0.000)	(0.000)	(0.000)
RD	0.193***	0.127***	
	(0.019)	(0.017)	
Finance	-0.077***	-0.083***	-0.039***
	(0.017)	(0.017)	(0.013)
University	0.001**	0.000	0.001***
	(0.000)	(0.000)	(0.000)
Dom. Competition	0.017***	0.023***	0.005
	(0.005)	(0.005)	(0.004)
Size medium	0.070***	0.089***	0.115***
	(0.014)	(0.013)	(0.011)
Size large	0.063***	0.074***	0.238***
	(0.018)	(0.017)	(0.015)
Observations	8233	8217	8529

Reported coefficients are from LPMs using instrumental variables. Robust standard errors are in parentheses. Industry, country and time dummies included. Instruments used for Newproduct and Upgrading: the average share of imports reported by other firms operating in the same industry, country and year, a dummy for whether the propensity to outsource reported by other firms operating in the same industry, country and year is high (=1) or low (=0), an assessment of the firm on the variable whether pressure from domestic companies, foreign companies and customers induce the firms to reduce production costs and interaction terms of these three instruments with the EU dummy. Instruments used for R&D: the average share of imports reported by other firms operating in the same industry, country and year, a dummy for whether the propensity to outsource reported by other firms operating in the same industry, country and year is high (=1) or low (=0) and interaction terms of these two instruments with the EU dummy. * 10% significance, ** 5% significance, *** 1% significance.

Appendix

Table 11: Country coverage (number of firms)

Country	Number
Albania	130
Armenia	373
Azerbaijan	116
Belarus	152
Bosnia	164
Bulgaria	226
Croatia	189
Czech Republic	346
Estonia	220
FYROM	179
Georgia	190
Hungary	422
Kazakhstan	382
Kyrgyz Republic	182
Latvia	189
Lithuania	254
Moldova	223
Montenegro	30
Poland	769
Romania	481
Russia	843
Serbia	247
Slovakia	181
Slovenia	249
Tajikistan	204
Turkey	631
Ukraine	632
Uzbekistan	207
Total	8411

Table 12: Variable definitions

Variable	Variable definition
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?*
R&D	Has this establishment invested in R&D (in-house or outsourced) in the last 3 years?*
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
Partnership	Is this establishment's current legal status a partnership or limited partnership?*
Foreign owner	Share of the establishment that is owned by private foreign individuals, companies or organizations****
Government	Share of the establishment that is owned by the government/state****
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
Age	Number of years in operation since establishment
Finance	Dummy variable taking on the value of 1 if the establishment reports that it did not apply for a loan and checks any of the following answers: the application procedures are complex, interest rates are not favorable, collateral requirements are too high, the size of the loan is insufficient, it is necessary to make an informal payment, the establishment did not think it would be approved and other. It takes on the value of 0 if the establishment applied for a loan or if there was not no need for a load as the establishment reported to have sufficient capital.
Size	Small (5-19 employees), medium (20-99) and large (100 and more)***
Dom. Competition	How important is pressure from domestic competitors in affecting decisions to develop new products or services and markets?**
Concentration ratio	Sum over the four largest market shares of firms for the respective country-industry-year
HHI	Herfindahl-Hirschman-Index for the respective country-industry-year
Instruments	
Dom. Compet. IV	How important is pressure from domestic competitors in affecting decisions with respect to reducing the production costs of existing products or services?**
For. Compet. IV	How important is pressure from foreign competitors in affecting decisions with respect to reducing the production costs of existing products or services?**
Customers Compet. IV	How important is pressure from customers in affecting decisions with respect to reducing the production costs of existing products or services?**
Institutional variables	
Property rights	How would you rate the protection of property rights, including financial assets, in your country? (1 = very weak; 7 = very strong)
Intellectual property protection	How would you rate intellectual property protection, including anti-counterfeiting measures, in your country? (1 = very weak; 7 = very strong)
Hiring and firing practices	How would you characterize the hiring and firing of workers in your country? (1 = impeded by regulations; 7 = flexibly determined by employers)
Local supplier quantity	How numerous are local suppliers in your country? (1 = largely nonexistent; 7 = very numerous)
Local supplier quality	How would you assess the quality of local suppliers in your country? (1 = very poor; 7 = very good)

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; *** Defined between 0 and 100

Table 13: First stage regression results for excluded instruments from linear probability model

	New product outsourcing	New product importing	Upgrading outsourcing	Upgrading importing	R&D outsourcing	R&D importing
Average pressure to reduce costs	0.028***	3.361***	0.028***	3.375***		
	(0.005)	(0.503)	(0.005)	(0.503)		
IV Imports	0.000	0.463***	0.000	0.465***	0.000	0.463***
	(0 .000)	(0.033)	(0 .000)	(0.033)	(0 .000)	(0.033)
IV Outsourcing	0.164***	-3.954	0.168***	-3.830	0.179***	-1.507
	(0.045)	(3.700)	(0.045)	(3.712)	(0.045)	(3.675)
F-test joint significance	13.83	80.67	14.08	81.05	8.38	100.11
Observations	8233	8233	8217	8217	8529	8529

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

Table 14: Industry coverage (number of firms)

Country	Number
Other manufacturing	906
Food	1600
Textiles	282
Garments	727
Chemicals	296
Plastics & rubber	166
Non metallic mineral products	284
Basic metals	73
Fabricate metal products	644
Machinery and equipment	547
Electronics	78
Construction	536
Other services	706
Wholesale	512
Retail	474
Hotel and restaurants	233
Transport	310
IT	37
Total	8411

Figure 1: Validity of instrumental variable: outsourcing

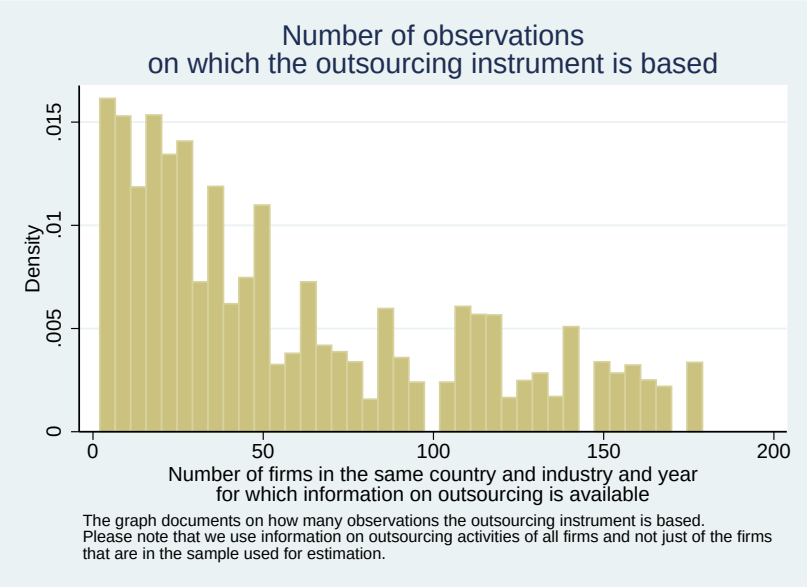

Figure 2: Validity of instrumental variable: imports

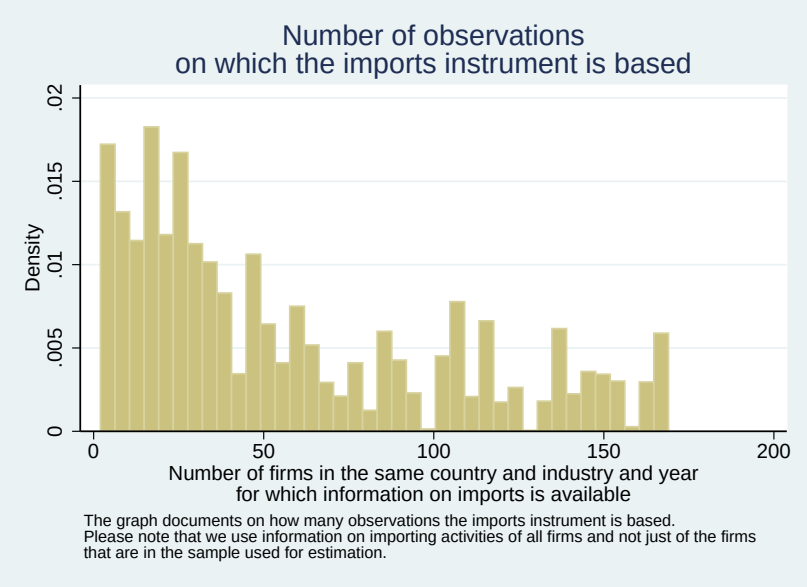

Table 15: Robustness check: Testing reverse causality

	Average pressure to reduce costs	Average pressure to reduce costs	Average pressure to reduce costs
Innovation activities			
Newproduct lagged	0.023		
	(0.033)		
Upgrading lagged		0.039	
		(0.033)	
RD lagged			0.021
			(0.069)
Other control variables			
Partnership	-0.018	-0.015	0.030
	(0.047)	(0.047)	(0.066)
Foreign Owners	0.001	0.001	-0.002
	(0.003)	(0.003)	(0.005)
For. Ow. squared	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Gov	-0.003***	-0.003***	0.000
	(0.001)	(0.001)	(0.001)
Exports	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)
Age	0.003***	0.003***	0.003**
	(0.001)	(0.001)	(0.001)
RD	0.080**	0.080**	
	(0.040)	(0.040)	
Finance	0.049	0.047	0.016
	(0.042)	(0.042)	(0.058)
University	0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)
Dom. Competition	0.507***	0.507***	0.504***
	(0.017)	(0.017)	(0.024)
Size medium	0.022	0.021	-0.007
	(0.038)	(0.038)	(0.053)
Size large	0.022	0.021	0.039
	(0.051)	(0.051)	(0.072)
Observations	2653	2654	1328
R squared	0.40	0.40	0.42

Reported coefficients are from LPMs. Robust standard errors are in parentheses. Industry, country and time dummies included. * 10% significance, ** 5% significance, *** 1% significance.

Table 16: Correlation table: Instruments and endogenous variables

Variables	Average pressure to reduce costs	New products: dom. competition	Outsourcing	Imports
Average pressure to reduce costs	1.000			
New products: dom. competition	0.566*	1.000		
Outsourcing	0.056*	-0.029*	1.000	
Imports	0.085*	-0.045*	0.087*	1.000

* 1% significance

Notes

[1]Note that Marjit and Mukherjee (2008) model outsourcing and R&D as either substitutes or complements. Hence, the effect is a priori unclear.

[2]Our paper also relates and contributes to other studies that look specifically at the link between innovation and outsourcing - e.g., Görg and Hanley (2011) for Ireland and Cusmano et al. (2009) for Italy. Bloom et al. (forthcoming) have a related paper that looks at the impact of Chinese imports on productivity and innovation in 12 advanced European countries. Arvanitis and Loukis (2013) relate various forms of outsourcing to product and process innovation. Abramovsky and Griffith (2006) use British data to investigate the link between ICT investment and outsourcing.

[3]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.

[4]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 because different waves of the survey offer different innovation measures (e.g., Correa et al. (2010), Gorodnichenko et al. (2010) and Crinò (2012)).

[5]The variables are discussed in more detail in Section 3. A table with definitions is available in the appendix (Table 12).

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

[7]We included lagged productivity for t-3 computed as log(sales / workers+1) in the baseline regression. The results show that lagged productivity matters for R&D but is highly insignificant for the other innovation measures. Including lagged productivity does not qualitatively change the results but is, in our view, a flawed measure as it is not defined in terms of value added. Results are available from the authors upon request.

[8]A number of papers use similar instrumentation strategies, see, e.g., Fisman and Svensson (2007) for industry-location averages of bribes, Lin et al. (2010) for industry-location averages of contract enforcement and government expropriation, Gorodnichenko et al. (2010) for industry-location averages of foreign competition, Lin et al. (2011) for industry-location averages of CEO incentive measures.

[9]We also estimated an alternative specification with country-industry dummies instead of separate sets of country and industry dummies. This does not change the results. Results are not reported here to save space.

[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 OLS estimates.

[11]One possible explanation for the weaker result on finance in the IV regression is that finance negatively correlates with both innovation and outsourcing/importing. The latter result is evident from the unreported first stage results, which show a robust and strong negative coefficient for finance. If our proposed instruments are correlated with confounding factors such as economic development/institutions, then this variation is captured in the second stage of the IV estimation by offshoring/importing and this reduces the impact of the finance variable. We are confident that these effects are not too strong though as the estimated coefficients on finance in the second stage are only slightly reduced for innovation output.

[12]We construct the instrument based on all available observations, not just the observations that are part of the final sample.

[13]We also test whether our results are sensitive to the inclusion of the cost reduction instrument. Results using only two instruments in the Newproduct and Upgrading specifications are broadly similar to results using all three instruments. Results can be obtained upon request.

[14]It is noteworthy that foreign technology can affect innovation patterns through multiple channels and importing 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. 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. In our data, such local sourcing would be picked up by our outsourcing variable.

[15]The *Global Competitiveness Report* presents country rankings based on hard data and survey data carried out in 2001, 2004 and 2007. We compute the median value over all country-year observations for which data is available and use the median as cut off. This means that countries can switch classification between years. A list of country groupings is available from the authors upon request.

[16]We use a slightly different instrument for outsourcing: a dummy for whether the propensity to outsource reported by other firms operating in the same industry, country and year is high (=1) or low (=0). We split the sample, for this purpose, at the median value of all country-industry-year observations. We subsequently interact this dummy with the institutional variables.

[17]The instruments pass the usual tests for instrument relevance and validity. We do not report these in the table to save space but they can be obtained upon request.

[18]Note that this does not hold for R&D. This highlights that the differentiation between R&D and innovation output is crucial. It also suggests that R&D might not cover all innovation activities that firms engage in.