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RESEARCH ARTICLE

In or Out: How Insourcing Foreign Input Production Affects Domestic Production

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Abstract When a firm imports inputs from foreign countries, the management faces two options: buying from unaffiliated firms or insourcing the foreign production. This paper suggests that this decision directly affects domestic production because international insourcing affects the operational flexibility and the firms' opportunities for accessing knowledge and capabilities developed abroad. Empirical results based on firm-level data of Swiss firms confirm this hypothesis. Concretely, the insourcing of international production increases domestic productivity, decreases (at least in the short run) domestic employment and possibly investments. In line with transaction cost literature, we observe that contractual hazards moderate these effects.

Keywords Imports · International insourcing · Governance mode · Productivity · Domestic production · Contractual hazards

JEL Classification F23 · F61

1 Introduction

As globalization has become an undisputed reality, management decisions nowadays more frequently refer to action on foreign markets. In order to improve the quality of these decisions, it is thus not surprising that not only the international

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business literature but also the strategic management literature analyzes the consequences of the managers' foreign markets decisions for the firms' domestic production (see, e.g., Bertrand and Capron 2015; Larsen et al. 2013; Zhang et al. 2010).

Along with the significant increase in international trade in inputs since 1960 (Hummels et al. 2001), the analysis of how importing inputs affects domestic production has become a key theme within the international business literature (see Olsen 2006 for a review of the literature). Hence, we have a quite good understanding of how offshoring[1] affects domestic production. Moreover, there is a substantial make vs. buy literature that looks at governance choices (see Grant 1996; Leiblein et al. 2002; Veugelers and Cassiman 1999). In this paper, we combine these two strands of the literature by analyzing how the choice between different governance modes of foreign production, i.e. international insourcing vs. international outsourcing, affects domestic production. We argue that not only offshoring, but also the decision to insource foreign input production, i.e. to opt for an internal rather than external governance mode, affects domestic production because international insourcing affects the operational flexibility and the firms' opportunities for accessing knowledge developed abroad.

While a broad literature analyzes the effect of international production as a whole, it remains largely unknown whether international insourcing affects domestic production differently than international outsourcing. To our knowledge, the only exception is the paper of Rodríguez and Nieto (2016). Based on a sample of Spanish SMEs, these authors compare the effect of insourcing and outsourcing of international R&D activities on domestic firm growth. R&D is an important but very specific type of input that mostly accounts for a small share of total inputs. The present study adds to this literature by analyzing the effect of insourcing and outsourcing of *total imports* on domestic production based on a sample of Swiss firms. Switzerland is a particularly interesting case for such an analysis. Due to its high labor costs, downstream trade flows from foreign countries are important to remain competitive. Accordingly, it is likely that the performance of the parent companies in Switzerland strongly depends on their international activities. Moreover, in line with the transaction cost literature which suggests that optimal firm boundaries depend on contractual hazards, we argue that contractual hazards are an important moderator of the effect of international insourcing on domestic production. To the best of our knowledge, this moderating effect has not been analyzed so far.

In order to empirically analyze the effect of the firms' international insourcing decisions, we include the firms' share of imports from affiliated suppliers in total imports (*international insourcing share*) in equations of domestic firm performance. To get a comprehensive picture of how international insourcing affects the domestic production process, we complement the analysis of firm productivity by

[1] In some of the literature, the term outsourcing is used for all imports, i.e. for all types of international activities that are external to the domestic firm. In order to avoid confusion, this paper uses the term international outsourcing only for international activities that are external to the firm, i.e. imports that stem from unaffiliated foreign firms. International activities as a whole is denoted as offshoring.

investigating the effects on further relevant domestic production inputs such as capital (in form of investment expenditures) and labor inputs.

The results indicate that international insourcing in terms of imports of inputs from affiliated firms of Swiss multinational corporations (MNC) abroad increases domestic productivity. Furthermore, the findings suggest a negative relationship between international insourcing share and domestic employment and investments. However, these short-term negative effects on production inputs might be offset in the long-run by the productivity gains of domestic production. Moreover, our empirical results indeed confirm that contractual hazards moderate the effect of insourcing foreign input production. This broad picture of productivity increase and input decrease is consistent with the theoretical framework suggesting that insourcing foreign inputs allows firms characterized by high contractual hazards to focus on their core competencies and dynamic capabilities.

2 Conceptual Framework

The broader theoretical framework of the present study is given by the theory of the international enterprise, particularly the internalization theory of the international enterprise as formulated in the work of Casson and Buckley (see, e.g., surveys of the respective literature in Buckley and Strange 2015; Buckley 2009; Casson et al. 2009; see also Jensen et al. 2013). Internalization is defined as the theoretical approach that "explains how the boundaries of firms are set at the margin where the advantages of internal coordination are just offset by the costs of supplanting external markets" (Casson et al. 2009, p. 236). In this context the research focus is directed to questions of location, coordination and control of geographically dispersed activities, i.e. questions about the governance of the "global factory" (Buckley and Strange 2015). Key issues in the analysis of the multinational enterprise are according to Buckley and Strange (2015) the "fine-slicing" and relocation of activities along the value chain, increased internalization of knowledge-intensive activities and increased externalization of control of less knowledge-intensive operations. Evidence on the line of the internalization reasoning was offered recently in a study based on offshoring operations of 263 multinational companies from 15 European countries (Linares-Navarro et al. 2014). The most important finding is that core activities are typically internalized, while non-core activities are outsourced. In a further recent paper comparing the governance modes of offshoring activities of German and US firms Hutzschenreuter et al. (2011) found that firms make their governance decisions based on the institutional environment, the surrounding population of similar firms, and firm-specific characteristics.

The economic impact of the governance structure of the international enterprise, which is the topic of the present study, is mostly analyzed for the entire enterprise or for the foreign affiliates in the host countries, but much less for the part of the firm in the origin country. For this more specific research question, the present study builds on the offshoring literature, which analyses the impact of the ratio of imported

inputs over costs on domestic performance (Feenstra and Hanson 1999; Görg and Hanley 2005a). The offshoring literature distinguishes two channels through which imported inputs affect the domestic production, which we label the flexibility channel and the knowledge sourcing channel (see, e.g., Bustinza-Sanchez et al. 2010; Girma and Görg 2004). In contrast to the offshoring literature, the focus of this paper is not on the impact of total imported inputs, but on whether imports from affiliated suppliers (*international insourcing*) have the same effect as imports from unaffiliated suppliers (*international outsourcing*). In the following, we argue that the channels through which the mix of these two types of imports affect domestic production are the same as for total imported inputs. However, the following theoretical considerations suggest that international insourcing differently affects both the flexibility channel and the knowledge sourcing channel as compared to international outsourcing.

2.1 Flexibility Channel

Compared to domestic production, international activities increase the flexibility of relocation processes (Kogut 1983). Hence, importing inputs may affect domestic production as it increases flexibility by allowing firms to relocate relatively inefficient processes to another country where they can be produced at lower costs. The increased operating flexibility of firms with international activities can primarily be observed in times of strong fluctuations of economic activities, as it allows firms to quickly shift production capacity from locations with rising factor costs to countries with lower factor costs (Belderbos et al. 2014; Lampel and Giachetti 2013; Fisch and Zschoche 2012; Kogut and Kulatilaka 1994). Empirical studies support the evidence that firms with international activities make use of operational flexibility by adjusting their value chain activities as a response, for example, to exchange rate fluctuations (see, e.g., Song 2015; Lee and Song 2012), changing labour costs (see, e.g., Belderbos and Zou 2007) or an economic crisis (see, e.g., Chung et al. 2010; Lee and Makhija 2009).

Complementing the offshoring literature, we expect flexibility gains of international activities to differ between international insourcing and international outsourcing, depending on the size of *contractual hazards*. Analyzing the determinants of optimal firm boundaries, the transaction cost (e.g., Williamson 1975; Oxley 1997) and property rights (e.g., Grossman and Hart 1986) literatures suggest that incomplete contractibility of transactions that involve assets that cannot be redeployed at the same price outside the transaction—due, for example, to asset specificity—could create contractual hazards. These contractual hazards render market solutions, i.e. outsourcing, imperfect and hence increase the relative benefits of hierarchy, i.e. insourcing (e.g., Williamson 1988). Concretely, relocating processes that are characterized by contractual hazards to unaffiliated foreign firms, i.e. international outsourcing, induces two types of costs, namely coordination costs and costs in terms of knowledge leakage (Handley and Benton 2013; David and Han 2004; Jain and Thietart 2014; Jiang et al. 2007; Leiblein and Miller 2003). First, contractual hazards induce the need for increased communication and coordination. Intra-firm trade creates internal product markets that enable member

firms to exchange their products at relatively low costs and thus reduce communication and coordination costs relative to trade between unaffiliated firms (Song 2015). Hence, the relocation to unaffiliated foreign firms increases communication and coordination costs to ensure that the supplied products meet the demands of the domestic firm. Second, specific assets often embody firm-specific knowledge. Therefore, relocation to unaffiliated firms may lead to unwanted knowledge leakage (Williamson 1991; Handley and Benton 2013). These costs deter firms from shifting production processes. Hence, they limit the realization of potential gains from flexibility in terms of reducing input costs. We thus expect higher flexibility gains from insourcing compared with outsourcing if contractual hazards are high.

Contrasting this view, one could argue that gains from flexibility might be larger for outsourcing than for insourcing because firms can easier shift production to other suppliers if the international activities are outsourced rather than insourced (Rodríguez and Nieto 2016; Jiang et al. 2007; Farrell 2005). For example, we observe that the clothing and shoes industry, industries that typically face low contractual hazards, tend to use outsourcing more often than insourcing, which may be due to higher operational flexibility.

Hence, insourcing international activities can either increase or decrease production flexibility, where the direction of this effect depends on the relevance of contractual hazards. If contractual hazards are low, then coordination and communication costs and the threat of knowledge leakage are also low, which reduces flexibility gains from insourcing and thus makes outsourcing more attractive. Conversely, if contractual hazards are important, insourcing international activities is relatively more attractive because international outsourcing induces higher costs.

To sum up, we hypothesize increased flexibility gains from insourcing for domestic production if contractual hazards are high, but decreased flexibility gains if contractual hazards are low. From this we conclude that (a) the firms' international insourcing share shows a positive flexibility effect on domestic production if contractual hazard is high, and (b) contractual hazards moderate the flexibility effect of insourcing on domestic production.

2.2 Knowledge Sourcing Channel

A growing body of literature argues that offshoring not only serves to reduce costs of inputs, but that firms also seek to develop new and diverse knowledge and capabilities abroad (see, e.g., Chung and Alcácer 2002; Berry 2006; Berry and Kaul 2015). Hence, the second channel discussed in the offshoring literature refers to knowledge gains from international activities that may affect home production. Berry and Kaul (2015) model the production function in a simple fashion as $Q = \theta x$, where Q represents output, x denotes the amount of inputs and θ captures productivity of the firm. Hence, the knowledge sourcing channel refers to three types of knowledge and capabilities that may affect the productivity parameter θ, namely (a) inputs from foreign countries that may be of higher quality than those available at home, (b) foreign production that may lead to a technology transfer to

home plants, and (c) knowledge referring to the local environment that may provide access to new markets.

The transaction cost literature provides two reasons why knowledge and capabilities can be transferred and exploited more efficiently through intra-organizational networks than through external market mechanisms (Berry 2014; Peltokorpi and Vaara 2014; Tallman and Chacar 2011).

First, a large portion of external knowledge is tacit and thereby non-tradable. Hence, knowledge transfer requires frequent interpersonal contacts (Chung and Yeaple 2008; Gupta and Govindarajan 2000). Since communication costs are lower and interpersonal contacts are more common within firm boundaries, international insourcing facilitates knowledge sourcing. Furthermore, knowledge sourcing requires that the foreign firm has an interest in knowledge sourcing. The incentives to knowledge sourcing are clearly larger in the case of international insourcing. Hence, the incentives faced by the foreign firm provide an additional argument why knowledge sourcing is larger in the case of international insourcing than in the case of international outsourcing (Chi 2015; Elango 2005; Kogut and Zander 1996; Speckbacher et al. 2015). Due to these reasons, insourcing international activities facilitates accessing knowledge and capabilities that require cooperation between the domestic and foreign firm. This is particularly true for production processes but also matters in cases where complete reverse engineering remains impossible. Furthermore, cooperation matters particularly regarding the development of knowledge and capabilities related to the local environment.

Second, international insourcing poses a smaller risk of unwanted knowledge transfer due to information leakage or appropriability problems than international outsourcing. This deters the domestic firm from sharing knowledge with unaffiliated foreign firms, which in turn reduces quality improvements in inputs because they cannot be adapted ideally to the production process of the domestic firm. This is also in line with the internalization theory of the multinational firm (Buckley and Casson 2009), which describes internalization as the replacement of imperfect external markets by more efficient internal markets, and argues that primarily knowledge intensive activities are internalized (Buckley and Strange 2015).

On the other hand, one could argue that outsourcing modes provide firms with access to a wide range of suppliers with the latest technologies which may increase knowledge sourcing. Moreover, outsourcing to specialized suppliers permits firms to complement their own resources and absorb new knowledge that would be unavailable in any other way (Rodríguez and Nieto 2016). We hypothesize that these aspects dominate primarily in case contractual hazards are not important.

In sum, we thus hypothesize increased knowledge sourcing from insourcing for domestic production if contractual hazards are high, but decreased knowledge sourcing if contractual hazards are low. From this we conclude that (a) the firms' insourcing share shows a positive knowledge effect on domestic production if contractual hazard is high, and (b) contractual hazards moderate the knowledge effect of insourcing on domestic production.

2.3 Expected Effects of a Firm's International Insourcing Share

The previous discussion shows that the theory does not offer clear predictions about whether a firm's international insourcing share, i.e. the share of imports from affiliated suppliers in total imports, strengthen or weaken the two channels through which the import of inputs can affect domestic production. However, based on the transaction cost literature, we expect that both channels are moderated by the firms' contractual hazards.[2] Concretely, both the knowledge and the flexibility gains for domestic production are expected to be larger if contractual hazards are high. Hence, we expect that contractual hazards moderate the effect of a firm's international insourcing share, which is also in line with the internalization theory of the multinational firm, which predicts that primarily knowledge-intensive activities, i.e. activities that are typically characterized by high contractual hazards, are internalized, while more routine activities tend to be outsourced (Buckley and Strange 2015).

H1: Contractual hazards: *Contractual hazards moderate the effect of a firm's international insourcing share, i.e. the share of imports from affiliated suppliers in total imports, on domestic production.*

As described in the beginning, we will use a sample of Swiss firms in order to test this prediction empirically. The Swiss industrial production structure is characterized by high shares of value-added generated by complex high-tech products, mostly pharmaceuticals, electronic devices, instruments, and devices of medical technology.[3] The production of such goods creates relatively high contractual hazards. Based on the discussion above, we hypothesize insourcing to increase knowledge sourcing and flexibility gains if contractual hazards are high. Due to the relatively high contractual hazards of the *average* Swiss firm, an increase in the share of imported inputs received from affiliated foreign companies is thus hypothesized to enhance the effect of both channels on domestic production in our sample that is representative to the Swiss industry structure.[4] This is similar to what the offshoring literature predicts for an

[2] While this insight allows us to formulate hypotheses regarding the relationship between international insourcing share and domestic production, we remain agnostic regarding the relative magnitude of the two potential channels.

[3] According to OECD statistics, Switzerland has the largest manufacturing value added share of high-tech products among European countries (2010: 62.5 vs. 61.4% in Germany and 54.2% in Denmark). Also the export share of high-tech products is the highest among European countries (2013: 48.9%). This share has increased significantly since 2000 (from 32.3 to 48.9%), which can be interpreted as a hint that less complex production in low-tech industries has been relocated at a large extent to foreign destinations. This is in accordance with the decrease of the value added share of low-tech industries such as textiles, cloth and food industry in the last 15 years. The Swiss economy has also a large value added share of knowledge-intensive service industries such as financial services, computer services, and engineering, so that the entire knowledge-intensive sector of the economy amounted 2010 to 48.6% of business sector value added (Germany 50.2; USA 52.6%).

[4] In countries where firms with less specific assets dominate, it is likely that the effect goes in the opposite direction. Based on data for Spanish SMEs Rodríguez and Nieto (2016) for example find that international insourcing of R&D shows a significantly lower effect on sales growth than international outsourcing of R&D.

increase in the total import share. The direction of how the firm's insourcing share affects domestic production should thus be the same as for a firm's import share. Therefore, we can thus make use of the existing theoretical and empirical evidence on how domestic production is affected by total import shares in order to formulate our hypotheses on the impact of the firms' international insourcing share on domestic production.

2.3.1 Productivity of Domestic Production

The general prediction is that by increasing a firm's ability to relocate inefficient production stages from the home country to foreign countries (flexibility channel), and to transfer knowledge from foreign countries to the parent company (knowledge sourcing channel), the import of inputs increases the productivity of domestic production (see, e.g., Görg et al. 2008). The empirical findings generally support this hypothesis by showing that importing inputs increases productivity (Girma and Görg 2004; Abramovsky and Griffith 2009; Amiti and Wie 2006) and profitability (Görzig and Stephan 2002; Görg and Hanley 2004, 2011; Bustinza-Sanchez et al. 2010). However, the empirical results suggest that these effects might differ between material and service inputs (Görzig and Stephan 2002; Görg and Hanley 2011; Abramovsky and Griffith 2009; Amiti and Wie 2006), between small and large firms (Görg and Hanley 2004) and between exporters and non-exporters (Görg et al. 2008).

Based on the prediction that not only the import of inputs but also the share of international insourcing increases the effect of the flexibility and knowledge sourcing channels if contractual hazards are high, we formulate the following hypothesis for our sample of Swiss firms:

> *H2: Productivity: A firm's international insourcing share, i.e. the share of imports from affiliated suppliers in total imports, increases the productivity of domestic production.*

2.3.2 Inputs of Domestic Production

The import of inputs is expected to increase productivity through increasing flexibility (flexibility channel) and/or through the use of qualitatively better inputs (knowledge sourcing channel). In the short run this should *reduce* the use of production inputs (i.e., labor, capital) in domestic production. This effect may change to a positive one in the long run, because the increased overall productivity would enhance a firm' s international competitiveness and, as a consequence, would stimulate also production and sales at home (see, e.g., Engel and Procher 2013; Kohler and Wrona 2010). As we observe the development of the firms' performance over a period of three years, the focus of our paper, however, is on short time effects.

Only few studies empirically investigate the relationship between offshoring and domestic production inputs. Based on plant-level data for the Irish electronics sector, Görg and Hanley (2005b) find that international outsourcing negatively

affects labor demand. Moreover, Lo Turco and Maggioni (2012) find that the import of intermediates on average has a negative effect on labor demand of Italian firms.

Because we expect that not only the import of inputs but also the share of international insourcing increases the effect of the flexibility and knowledge sourcing channels if contractual hazards are high, we also expect to observe a negative net-effect of international insourcing on domestic production inputs for our sample of Swiss firms.

H3: Domestic Production Inputs: A firm's international insourcing share, i.e. the share of imports from affiliated suppliers in total imports, decreases the use of production inputs (i.e., employment, investment in capital) of domestic production.

3 Data

The study is based on firm data that has been collected in a postal survey on the "Internationalization of the Swiss Economy" carried out in spring 2010. The questionnaire has been addressed to a sample of 4533 firms with at least five employees covering all business sectors of the Swiss economy. The sample is stratified by 29 industries and three firm size classes (with full coverage of large companies) drawn from the population of firms with more than five employees. The survey yielded valid information for 1921 enterprises, implying an overall response rate of 42%, what is satisfactory given the very demanding questionnaire of seven pages.

Nevertheless, this highlights a drawback of survey data, namely the question whether response behavior is random or whether it induces a selection bias due to unit non-response. However, due to selective reminding calls among firms that were underrepresented in a first round of data collection, the final structure of the responding firms in terms of firm size and industry affiliation is quite similar to that of the underlying sample (see Arvanitis et al. 2011). This provides first evidence that possible non-response bias remain limited for this survey. In addition, 713 non-responding firms were contacted by phone, eliciting a response rate of 88%. This non-response analysis provided no evidence of selection bias in terms of internationalization as the share of MNCs within the responding firms is representative for the whole sample.

As firms without FDI cannot insource international inputs, the share of imports that these firms receive from their foreign subsidiaries is zero per definition. Hence, these firms could be included in the analysis as well. However, while this would significantly increase the number of observations, this would add a lot of noise. Furthermore, these firms had to start FDI first in order to be able to switch from external to internal foreign production. Hence, our main regressions are restricted to the 545 firms that reported foreign affiliates (about 28% of all valid responses), i.e. the firms that were engaged *themselves* in direct foreign activities through FDI (see Sect. 5.3 for alternative regressions based on the full sample). In what follows we refer to these firms as MNCs. Foreign owned firms are considered only if their local headquarters in Switzerland have their own FDI activities. As their performance

may be affected by their international network, our models control for foreign owned firms. Even though the above discussion suggests that unit non-response is not a serious problem for our survey, firms might be selective in terms of answering particular questions, leading to the so-called item non-response problem with respect to important variables. In our sample, item-non-response reduces the sample substantially to 264 observations.

Using data from a postal survey further suffers from a higher degree of measurement error than administrative data. This is particularly relevant in terms of the common method bias, which arises because both the dependent and independent variable are assessed by the same respondent, giving rise to a potential correlation in the subjective measurement error (see, e.g., Chang et al. 2010). However, three characteristics help to address these issues of measurement error. First, the dependent variables refer to objective numbers, which the respondents ideally gain from the accountancy. Second, the complexity of the multivariate estimations render the issue of a common method bias less troublesome. Third, the instrumental variable approach using industry averages to instrument insourcing intensity helps to alleviate the bias arising due to measurement error in the main independent variable.

On average the MNCs in our sample have 814 employees, whereupon the distribution is strongly right-skewed. 51% of the firms have between 50 and 250 employees and only 22% employ more than 250 employees. 72% of the MNCs belong to the manufacturing sector, 26% to the service sector and only 2% to the construction sector. In the service sector the sub-sector of modern (knowledge-intensive) services (e.g., banking and insurance, business services) has a larger share than the sub-sector of traditional services (e.g., trade, hotels and catering) (53 vs. 47%). In the manufacturing sector there are more high-tech (e.g., chemicals, pharmaceuticals, electrical equipment) than low-tech firms (66 vs. 34%).

Referring to the parent companies the survey yielded information on basic firm characteristics (e.g., firm age, industry affiliation), firm performance and activity level (e.g., sales, value added, number of employees) and innovative activities.[5] Descriptive statistics for all model variables based on the estimation sample is presented in Table 5 in the Appendix.

Most important for this study is the information on the firms' international insourcing share. In contrast to the offshoring literature (see, e.g., Feenstra and Hanson 1999), we are thus not interested in the effect of the total import share, but in the share of imports from affiliated suppliers in total imports. This information is based on an ordinal variable with nine categories (0, 1–5, 6–10, 11–15, 16–20, 21–30, 31–40, 41–50 and 51–100%) that measure the share of goods and services that the Swiss parent company imported from their foreign subsidiaries. Figure 1 presents the descriptive statistics for this variable. The figure shows that firm-internal imports are of relative low importance compared with firm-external imports. 37% of the MNCs do not have internal trade imports at all and about 75% of the MNCs receive less than 10% of the imports from their foreign subsidiaries.

[5] The questionnaire is available in German, French and Italian on http://www.kof.ethz.ch/en/surveys/structural-surveys/other-surveys/survey-internationalisation-swiss-economy-2010/.

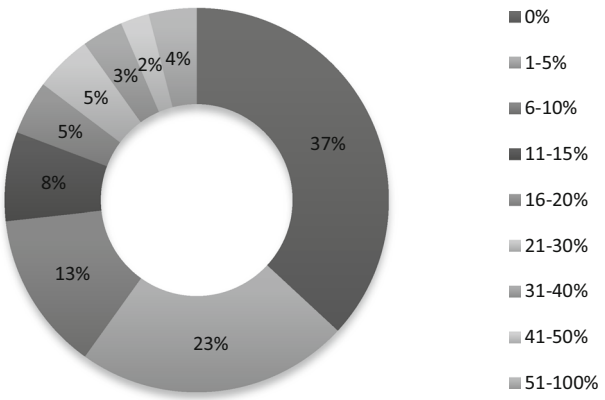

Fig. 1 International insourcing share, i.e. the share of imports received from foreign affiliates

4 Econometric Framework

4.1 Model Specification

In this section we discuss the specification of the variables and the econometric methodology. Table 1 and Tables 5 and 6 in the Appendix display the variable definitions, summary statistics and cross-correlations of variables, respectively.

The main right-hand variable of interest is the MNCs' international insourcing share in 2008 (*Insourcing Share*).[6] In order to capture the broad effects of a firm's international insourcing share on production output and input at home, we examine three dependent variables y_j, (j = 1, 2, 3), namely one measure of production output and two measures of production inputs. Value added per full-time equivalent (FTE) employee (*VA per Emp*) measures productivity. Measures of production input include capital input measured by gross investment expenditures in Switzerland (*Inv*), labor input is captured by the number of FTE employees (*Emp*).

We estimate the effect of a firm's international insourcing share (*Insourcing Share*) on the *j*th dependent variable y_{ji}, of firm *i* in t = 2008 using OLS:

$$lny_{j,i,t} = \alpha_{j,0} + \beta_{j,1} lny_{j,i,t-1} + \beta_{j,2} lnInsourcing\ Share_{i,t} + \beta_{j,3} lnInput\ Share_{i,t} + \beta_{j,4} lnX_{j,i,t} + \varepsilon_{j,i,t},$$

where $\varepsilon_{j,i,t}$ represents the normally distributed error term with mean zero. The matrix $X_{j,i,t}$ entails firm characteristics specific to each dependent variable. Concretely, following standard specification of simple production functions (see, e.g., Griliches and Mairesse 1995), estimates for productivity (*VA per Emp*) include measures of production inputs for quantity (*Emp*) and quality (*Share High Qual*) of labor inputs,

[6] In order to ease the interpretation of coefficients, the original ordinal variable enters as the log of the midpoint of each category of the ordinal scale (0, 3, 8, 13, 18, 25.5, 35.5, 45.5, and 75.5%). Using alternatively the original ordinal variable (1–9) or dummy variables indicating whether insourced imports is zero, low (1–20%) or high (21–100%), yield qualitatively similar results. These results can be obtained from the authors upon request.

Table 1 Variable definitions

Variable	Description
Dependent variables	
VA per Emp[a]	Sales less intermediate inputs per FTE employee
Investments[a]	Gross investment
Employees[a]	Number of FTE employees
Main explanatory variables	
Insourcing dummy	Binary variable taking the value 1 if insourcing share is larger than 0; and 0 otherwise
Insourcing share[a]	Quasi-metric variable measuring the share of imports received from foreign affiliates constructed as the mean value of intervals in the original ordinal variable (0, 3, 8, 13, 18, 25.5, 35.5, 45.5, 75.5%)
Protection problem	Binary variable taking the value 1 if lack of copyright and patent protection represents a strong hampering factor of international activities; and 0 otherwise
Protection ineffectiveness	Binary variable taking the value 1 if informal measures are ineffective in protecting innovation; and 0 otherwise
Control variables	
Share High Qual[a]	Share of FTE employees with tertiary education
R&D/R&D per Emp[a]	R&D expenditures/R&D expenditures per FTE employee
VA[a]	Sales less intermediate inputs
Inv per Emp[a]	Gross investment per FTE employee
Wage total[a]	Labor costs per FTE employee
Input share[a]	Ratio of input costs and sales
Age[a]	Firm age in years
Foreign	Binary variable taking the value 1 if the firm is foreign owned; and 0 otherwise
Spinoff	Binary variable taking the value 1 if spinoffs have been brought out between 2003 and 2008; and 0 otherwise
Merger	Binary variable taking the value 1 if mergers have occurred between 2003 and 2008; and 0 otherwise
Price competition	Three-digit industry average of the share of firms indicating strong price competition (Value of 4 or 5 on a 5-point Likert scale)
Non-price competition	Three-digit industry average of the share of firms indicating strong price competition (Value of 4 or 5 on a 5-point Likert scale)
FDI 1990	Binary variable taking the value 1 if the firm has had its first FDI activities before 1990; and 0 otherwise
FDI 2000	Binary variable taking the value 1 if the firm has had its first FDI activities between 1990 and 2000; and 0 otherwise
Location old Europe	Binary variable taking the value 1 if the firm has FDI activities in EU15 or EFTA countries; and 0 otherwise
Location East Europe	Binary variable taking the value 1 if the firm has FDI activities in Poland, Hungary, Slovenia, Czech Republic, Slovakia, Latvia, Lithuania or Estonia; and 0 otherwise
Location South Europe	Binary variable taking the value 1 if the firm has FDI activities in Romania, Bulgaria, Croatia, Serbia, Montenegro, Bosnia, Macedonia or Albania; and 0 otherwise
Location Russia	Binary variable taking the value 1 if the firm has FDI activities in Russia, Ukraine or Belarus; and 0 otherwise

Table 1 continued

Variable	Description
Location USA	Binary variable taking the value 1 if the firm has FDI activities in the USA or Canada; and 0 otherwise
Location Latin America	Binary variable taking the value 1 if the firm has FDI activities in Latin American countries; and 0 otherwise
Location China	Binary variable taking the value 1 if the firm has FDI activities in China; and 0 otherwise
Location Asia I	Binary variable taking the value 1 if the firm has FDI activities in South-Korea, Taiwan, Hong-Kong or Singapore; and 0 otherwise
Location Asia II	Binary variable taking the value 1 if the firm has FDI activities in India, Thailand, Malaysia, Indonesia or the Philippines; and 0 otherwise
Location other	Binary variable taking the value 1 if the firm has FDI activities in other countries; and 0 otherwise
Instrument	
Mean insourcing share[a]	Two-digit industry mean of insourcing share

[a] The variable enters estimations as the natural logarithm of the original variable plus one

capital inputs per FTE employee (*Inv per Emp*) and R&D expenditures per FTE employee (*R&D per Emp*). Controlling for R&D intensity matters particularly because it might affect both international insourcing intensity (see, e.g., David and Han 2004) and productivity.

The specification of the equations for capital input approximated by investment expenditures (*Investments*) as dependent variable contains controls for output measured by value added (*VA*), the number of employees (*Emp*), and R&D (*R&D*).

The equations for labor inputs (*Employees*) include, besides controls for output (*VA*) and R&D (*R&D*), measures for the average wages (*Wage Total*) in accordance with standard specification of labor demand equations (see, e.g., Hamermesh 1993).

Moreover, besides internally or externally sourcing from foreign countries, firms may also source externally from the home country (Gray et al. 2011). As the different sourcing options are likely to be correlated, the exclusion of one option may bias the effect of the others. In addition, the results may be biased as imports from affiliated parties as a proportion of total imports, our main variable, may be correlated with a firm's level of total inputs. In order to deal with these issues, we add a control for total input share (*Input Share*) that captures the effect of external sourcing in general.

Further firm characteristics controlled for in all output and input equations include firm age (*Age*), whether the company is foreign-owned (*Foreign*), whether the firm has recently experienced company restructuring in the form of spinoffs (*Spinoff*) or merging (*Merger*), the intensity of price (*Price Competition*) and non-price competition (*Non-Price Competition*),[7] and the industry affiliation (NACE

[7] This information stems from a prior survey of the firm conducted in 2009 in the course of the KOF Innovation Survey (for more information, see https://www.kof.ethz.ch/en/surveys/structural-surveys/innovation-survey/). This information was used to construct industry averages of price and non-price competition on the three-digit industry level (NACE Revision 2).

2-digit). Moreover, as insourcing share may show different effects for firms with more FDI experience than for firms with little FDI experience (Rabbiosi and Santangelo 2013), we control whether the firm already started their FDI activities before 1990 (*FDI 1990*) or between 1990 and 2000 (*FDI 2000*). Finally, as macro-economic conditions vary across countries, we add ten indicator variables for the locations of FDI activities (*Location* variables) to account for differences in the host countries.

4.2 Econometric Issues

Though we control for a broad range of observable firm characteristics, concerns regarding potential endogeneity due to unobserved heterogeneity and reverse causality remain. This might be the case because high fixed costs could deter low-productivity firms from engaging in international insourcing as suggested by the theoretical model of Antràs and Helpman (2004) and supported by some empirical evidence (e.g., Corcos et al. 2013; Haller 2012; Kohler and Smolka 2011a, b; Federico 2010; Nunn and Trefler 2008; Tomiura 2007, while Defever and Toubal 2007 find no such evidence).

We attempt to tackle these identification issues in two ways. First, in order to address unobserved heterogeneity, we exploit the fact that the dependent variables were measured for the years 2003 and 2008. This allows us to include the lagged dependent variable y_{jit-1}, i.e. the value of the jth output/input measure in the year 2003, in order to control for individual effects.[8]

Secondly, in order to tackle potential reverse causality, we provide evidence based on a two stage least squares (2SLS) instrumental variable approach that instruments the firms' international insourcing share by the respective industry averages.[9]

Hence, though concerns regarding the causal interpretation of our results remain, controlling for unobserved heterogeneity by the use of lagged dependent variables in addition to exploiting an IV approach provides some evidence that the reported correlations reflect causal effects. The results are discussed in detail in Sect. 5.3.

A further concern regarding the validity of our identification strategy is a potential selection bias due to the restriction of our sample to firms that have foreign affiliates. In order to test the relevance of such a bias, Table 4 further reports estimates that employ the full sample of firms, exploiting the knowledge that the international insourcing share of firms that have no foreign affiliates is necessarily zero. The direct effect of having an affiliate on the output and input measures is captured in these estimates by a dummy variable. A comparison of the results is presented in Sect. 5.3.

[8] Estimating a model with firm fixed effects is not possible because we observe international insourcing share in 2008 only.

[9] While these estimates require dropping the industry dummies, they continue to account for unobserved heterogeneity across firms by including the lagged dependent variable.

5 Results

5.1 Direct Effects of Foreign Insourcing

Before analyzing the potential moderating effect of contractual hazards as discussed in hypothesis 1, we focus on the direct effects of the variable *Insourcing Share* discussed in hypotheses 2 and 3. Table 2 displays our main results for three dependent variables. The main estimations account for unobserved heterogeneity by including the lagged dependent variable. Each column displays the results for one output/input measure. All models explain a substantial share of the variation in the dependent variable as shown by the R^2 statistics between 0.78 and 0.98. This reflects the inclusion of the lagged dependent variable, but the models excluding the lagged dependent variable have high R^2s as well (see Table 4).

Assessing the inclusion of the lagged dependent variable in the model reveals that the coefficients of the variable *Insourcing Share* remain practically the same for productivity (*VA per Emp*), *Investments,* and *Employees*. Note that the insignificant correlation between the firms' international insourcing share and productivity when we do not control for the lagged dependent variable (see Table 4) provides suggestive evidence that the significant main estimation results presented in Table 2 are not driven by reverse causality due to sorting of more productive firms into insourcing (Antràs and Helpman 2004). Since including the lagged dependent variable increases the precision of the estimates substantially, we focus the following discussion on the results of the main estimation with lagged dependent variables.

The results suggest that the performance of domestic production in Switzerland is affected by the firms' international insourcing share. As predicted by hypothesis 2, the firms' international insourcing share increases labor productivity measured by value added per employee (*VA per Emp*).

Furthermore, capital input as measured by investment expenditures (*Inv*) and labor input (*Emp*) decrease with increasing international insourcing share. Thus, the net effects on employment and investment expenditures as they are captured by this firm cross-section seem to be negative. These findings support hypothesis 3, suggesting that productivity gains do not offset input reductions in the short run. This implies that international insourcing is associated primarily with an increase of the efficiency of resources in domestic production in the short run.

In order to analyze whether our main estimation results are driven by the extensive or intensive margin of insourcing, we additionally estimate a model that separately includes an indicator variable for the presence of insourcing (*Insourcing Dummy*) in addition to the share of insourcing (*Insourcing Share*) (see Table 4). The results suggest that our results are driven by the intensive margin rather than the extensive margin.

Table 2 Full results of main estimates

	VA per employee	Investments	Employees
Insourcing share	0.025** (0.012)	−0.073 (0.049)	−0.026** (0.013)
LDV (y_{t-1})	0.785*** (0.044)	0.640*** (0.099)	0.588*** (0.051)
R&D		0.027** (0.013)	0.004 (0.003)
R&D per Emp	−0.000 (0.005)		
VA		−0.157 (0.155)	0.388*** (0.049)
Share High Qual	0.061** (0.026)		
Employees	−0.011 (0.013)	0.651*** (0.193)	
Inv per Emp	0.015 (0.015)		
Wage total		0.184 (0.131)	−0.244** (0.095)
Input share	−0.107*** (0.033)	0.037 (0.137)	0.099** (0.039)
Age	0.013 (0.026)	0.027 (0.091)	−0.019 (0.024)
Foreign	0.075* (0.041)	−0.001 (0.155)	−0.053 (0.036)
Spinnoff	−0.036 (0.053)	−0.259 (0.166)	−0.023 (0.055)
Merger	0.112** (0.050)	−0.279 (0.207)	−0.055 (0.053)
Price competition	−0.263* (0.137)	0.506 (0.498)	0.002 (0.177)
Non-price competition	0.057 (0.083)	−0.003 (0.302)	0.030 (0.102)
FDI 1990	0.066 (0.052)	−0.083 (0.194)	−0.113** (0.050)
FDI 2000	0.026 (0.058)	0.174 (0.241)	−0.071 (0.056)
Location old Europe	−0.068* (0.036)	0.165 (0.149)	0.076** (0.035)
Location East Europe	−0.021 (0.041)	−0.194 (0.164)	−0.013 (0.039)
Location South Europe	0.017 (0.050)	0.090 (0.233)	−0.014 (0.054)
Location Russia	0.126 (0.086)	−0.304 (0.242)	−0.166** (0.071)
Location USA	−0.032 (0.046)	0.350** (0.173)	0.106** (0.043)
Location Latin America	−0.038 (0.078)	−0.260 (0.337)	0.039 (0.070)
Location China	0.039 (0.049)	0.036 (0.191)	−0.007 (0.042)
Location Asia I	−0.018 (0.054)	0.169 (0.188)	0.055 (0.042)
Location Asia II	0.065 (0.042)	0.031 (0.176)	−0.066* (0.034)
Location other	−0.051 (0.053)	−0.361* (0.205)	−0.039 (0.057)
Constant	2.704*** (0.688)	2.166 (2.129)	−2.007** (0.956)
Industry Control	Yes	Yes	Yes
N	264	264	264
R^2	0.776	0.851	0.975

The table displays the OLS coefficient estimates and heteroscedasticity-robust standard errors. The estimations further include indicators for the two-digit industry

*, **, and *** denote statistical significance of the 10, 5 and 1% level, respectively. Definitions, summary statistics and cross-correlations are reported in Tables 1, 5 and 6, respectively

5.2 The Moderating Effect of Contractual Hazards

We make use of the heterogeneity in production of the firms included in our sample, in order to get an idea whether the contractual hazards of production really moderate

Table 3 The moderating effect of contractual hazards of production

Dependent variable	VA per employee	Investments	Employees
Interaction term with R&D intensity			
R&D per head	−0.007 (0.006)	0.011 (0.102)	−0.069** (0.030)
Insourcing share	−0.006 (0.019)	−0.102 (0.106)	−0.023 (0.021)
R&D per head × insourcing share	0.005* (0.003)	0.004 (0.013)	−0.000 (0.003)
N	264	264	264
R^2	0.778	0.851	0.976
Interaction term with protection problem			
Protection problem	−0.032 (0.079)	0.601** (0.254)	0.112** (0.051)
Insourcing share	0.017 (0.013)	0.006 (0.058)	−0.000 (0.013)
Protection problem × insourcing share	0.030 (0.033)	−0.361*** (0.111)	−0.104*** (0.027)
N	264	264	264
R^2	0.777	0.857	0.977
Interaction term with protection ineffectiveness			
Protection ineffectiveness	−0.047 (0.050)	−0.078 (0.215)	0.044 (0.045)
Insourcing share	−0.005 (0.020)	−0.022 (0.093)	0.008 (0.018)
Protection ineffectiveness × insourcing share	0.045* (0.025)	−0.076 (0.108)	−0.052** (0.024)
N	264	264	264
R^2	0.775	0.848	0.975

The table displays the OLS coefficient estimates and heteroscedasticity-robust standard errors in parentheses. All estimates further control for the variables shown in Table 2. Definitions, summary statistics and cross-correlations of variables are reported in Tables 1, 5 and 6, respectively

*, **, and *** denote statistical significance of the 10, 5 and 1% level, respectively

the effect of a firm's international insourcing share. Concretely, we test the suggested heterogeneity in two ways displayed in Table 3. First, we interact the firms' international insourcing share with the firms' R&D expenditures in Switzerland.[10] Contractual hazards increase with R&D intensity because (a) asset specificity increases in technological complexity and (b) the risk of knowledge leakage rises. Hence, both the transaction cost literature (see David and Han 2004, for an overview) and the economic literature (e.g. Arvanitis et al. 2013; Yeaple 2006; Zhao et al. 2004; Andersson and Fredriksson 2000; Cho 1990) use R&D intensity as a proxy for contractual hazards.

Second, as the firms' domestic and foreign contractual hazards may differ, we interact the international insourcing share with two variables that reflect the firms'

[10] The results remain qualitatively the same when we additionally control for the firms' R&D activities abroad to capture a potential correlation between contractual hazards of production at home and abroad.

global contractual hazards. Concretely, the two variables measure the relevance of efficient knowledge protection (a) in the form of the ineffectiveness of informal measures to protect the firms' innovations, and (b) by measuring whether lack of copyright and patent protection represents a strong hampering factor of international activities. This second type of proxies refers to the transaction cost literature suggesting that property rights uncertainty is especially important if contractual hazards are high and thus a lot of firm-specific knowledge is embodied in exchanged products and services (see, e.g., Corcos et al. 2013; Nunn and Trefler 2008).

Although not all interaction terms turn out to be statistically significant, which is not that surprising given the relatively low number of observations, the significant results are all in line with hypothesis 1 (see Table 3). First, we observe that contractual hazards tend to increase the positive effect of international insourcing on domestic labor productivity. Second, contractual hazards magnifies the negative effect of international insourcing on the two measures of domestic production inputs, namely employment and investments.

5.3 Robustness Tests

Beside of reporting estimates excluding the lagged dependent variable and testing for whether our results are driven by the extensive or intensive margin of the insourcing share, Table 4 displays results that address two additional concerns regarding the estimates, namely sample selection and reverse causality. As discussed in the methodology section, controlling for the lagged dependent variables might be insufficient to account for endogeneity of the estimates due to potential reverse causality. Hence, Table 4 displays results in which the firms' international insourcing share is instrumented. The two-digit industry average of international insourcing share (*Mean Insourcing Share*) serves as the instrument in the IV Industry Average estimation. Since we need to drop industry affiliations dummies in these IV estimates, we further test whether excluding controls for industry affiliation affects our estimation results. This is not the case. Neither the direction nor the size of the different coefficients are significantly affected by this modification. We report the F-Statistics of the instruments to evaluate the strength of the instruments, whereby a value above about 10 suggests sufficient strength. Hence, the instruments seem to have sufficient strength. For all three models explaining productivity, material and labor input, respectively, the effect of insourcing share goes in the same direction as in the main estimates, i.e. we observe positive effects on productivity and negative effects on capital and labor input. In the productivity labor input models, the size of the effects is even slightly larger in the IV estimates compared with our main results. However, due to the low number of observations, instrumenting the insourcing variable reduces the estimation precision. While the positive effect of insourcing share on productivity still is statistically significant, the negative effect of insourcing share on the number of employees gets insignificant.

Finally, Table 4 contains evidence as to the occurrence of selection bias due to the fact that our dependent variable is only available for firms engaged in FDI. Since the international insourcing share of firms without foreign affiliates is

Table 4 Robustness of the results

Estimation	VA per employee	Investments	Employees
Excluding LDV (y_{t-1})			
Insourcing share	0.006 (0.022)	−0.076 (0.069)	−0.009 (0.018)
Industry control	Yes	Yes	Yes
N	264	264	264
R^2	0.345	0.699	0.940
Extensive vs. intensive margin			
Insourcing dummy	−0.051 (0.059)	0.143 (0.219)	0.038 (0.054)
Insourcing share	0.039** (0.019)	−0.113 (0.075)	−0.037* (0.021)
Industry control	Yes	Yes	Yes
N	264	264	264
R^2	0.776	0.851	0.975
Excluding industry control			
Insourcing share	0.028** (0.013)	−0.057 (0.049)	−0.027** (0.013)
Industry control	No	No	No
N	264	264	264
R^2	0.739	0.837	0.971
Reverse causality: IV industry average			
Insourcing share	0.088*** (0.031)	−0.009 (0.179)	−0.078 (0.054)
Industry control	No	No	No
N	264	264	264
R^2	0.620	0.518	0.562
F-statistics	82.983	111.063	101.555
Selection: inclusion non-FDI firms			
Insourcing share	0.026** (0.012)	−0.065 (0.054)	−0.020 (0.013)
Industry control	Yes	Yes	Yes
N	1134	1133	1133
R^2	0.674	0.643	0.967

The table displays the OLS coefficient estimates and heteroscedasticity-robust standard errors in parentheses. The IV estimates display coefficients of a 2SLS estimate with standard errors clustered at industry level. The *F-statistics* of the instruments provides a weak instrument test. All estimates further control for the variables shown in Table 2. Definitions, summary statistics and cross-correlations of variables are reported in Tables 1, 5 and 6, respectively

*, **, and *** denote statistical significance of the 10, 5 and 1% level, respectively

always 0, Table 4 provides estimates for the full sample by setting insourcing share to 0 if a firm does not have FDI. The estimates reveal a similar picture as in our main models presented in Table 2, i.e. a positive relationship with productivity and a significant negative relationship with investment expenditures and total number of employees. Moreover, the size of these effects only marginally differ. However, the significance of the effects is a bit lower, which may be due to the fact that the shares of imports from foreign subsidiaries is zero per definition for firms without FDI, and the inclusion of these firms thus primarily adds a lot of noise to the model (see discussion in Sect. 3).

6 Discussion and Conclusions

This paper seeks to enhance the understanding of how the import of inputs affects domestic production. The impact of the import of inputs on domestic production has already been intensively discussed in the offshoring literature. However, this strand of the literature does not differentiate between different governance modes of foreign input production. In the first part of the paper, we present several arguments for why imports from affiliated suppliers are expected to affect domestic production differently than imports from unaffiliated suppliers and we also develop several hypotheses on how domestic firm productivity and production inputs are expected to be affected by the choice between these two governance modes. In line with transaction cost literature, we predict that contractual hazards moderate these effects.

The second part of the paper tests our predictions empirically by including the share of imports from affiliated suppliers in total imports (*international insourcing share*) in equations for several measures of production output and production inputs. Concretely, we analyze the impact of a firm's insourcing share on production output in terms of productivity in addition to measures of production inputs, namely investment expenditures as a measure of capital input and employment as a measure of labor input. The analysis is based on a sample of Swiss multinational corporations (MNC).

Our empirical results confirm that the differentiation between the two governance modes is in fact important in order to understand how the import of inputs affects domestic production. The international insourcing share variable shows significant effects on all tested measures of domestic production. Hence, the results confirm that not only the firms' offshoring decision per se, but also their decisions referring to the governance mode of the respective offshoring activities directly affects their domestic production. Furthermore, we show that a firm's contractual hazards of production seem to be an important moderator of the insourcing effect. This finding links the choice of the governance mode to the transaction cost theory, which suggests that contractual hazards increases the advantage of insourcing compared to outsourcing because of increased coordination costs and risk of unwanted knowledge transfer. Moreover, this finding indicates that the effect of international insourcing is likely to differ between countries with different levels of contractual hazards.[11]

The main argument, why we expect that the governance modes differently affect domestic production, is that the insourcing of foreign input production magnifies both channels through which imported inputs affect domestic production

[11] Rodríguez and Nieto (2016) argue that international outsourcing is linked to greater flexibility than international insourcing and they find some evidence for their prediction for Spanish SMEs, i.e. they find that international insourcing of R&D shows a significantly lower effect on sales growth than international outsourcing of R&D. This finding is in accordance with aggregated data that indicate that the average contractual hazards are lower for the average Spanish than for the average Swiss firm. An alternative explanation could be that the composition of the samples of firms used in the Spanish and Swiss study is quite different. While Rodríguez and Nieto (2016) focus on SMEs only, our sample entails the full population of firms. However, preliminary analysis suggests that our qualitative results hold for both small and large firms, though the sample reduction renders some coefficient estimates insignificant.

if the firms' contractual hazards are relatively high. First, international insourcing increases the firm's operational flexibility, i.e. reducing input costs by improving the flexibility to relocate the value chain activities from unfavorable to favorable locations, even more than international outsourcing. Second, international insourcing also facilitates access to knowledge and capabilities developed abroad stronger than international outsourcing, thereby increasing input quality, creating knowledge transfer to home plants and accessing knowledge referring to the local environment. Hence, our empirical results are in line with this theoretical framework. However, the data does not allow us to measure these channels directly. Hence, future research should verify that these channels are indeed driving the relationship between international insourcing share and domestic production. Importantly, such an analysis should also clarify the relative magnitude of the two potential channels.

A main finding of this study is that the insourcing of foreign input production positively affects the productivity of domestic production, at least if contractual hazards are relatively high. Hence, the insourcing of foreign input production makes the parent firm stronger and more productive, and thus seems to be a mechanism that managers can use to increase the productivity of their business. In order to understand the drivers of this positive productivity effect, we further analyze the relationship between the governance mode and measures of domestic production inputs. The results indicate that, at least in our short-run setting, the productivity gains come along with a decrease in domestic production inputs. The insourcing of foreign input production negatively affects both capital and labor inputs. These results are consistent with the view that insourcing foreign input production allows the firm to focus on its core competencies and dynamic capabilities (Bustinza-Sanchez et al. 2010). Hence, at least from a macroeconomic perspective, the productivity gains have a flip side, as they may put people out of work. However, it is likely that these negative effects decrease or even change to a positive one in the longer run, because the increased overall productivity should stimulate also production and employment at home (see Engel and Procher 2013 or Kohler and Wrona 2010 for such an argumentation with respect to a firm's offshoring activities).

In an extension, we show that the insourcing effect is primarily driven by the intensity of international insourcing rather than by the discrete choice between international insourcing and outsourcing. This finding highlights that managers need to choose the optimal mix of insourcing foreign input production rather than choosing between the two governance modes in an 'all or nothing' way. These findings show the relevance of further investigation into the heterogeneity of the insourcing effect.

The problems of possible endogeneity and reverse causality are addressed by using the lagged dependent variable as an additional right-hand variable in the main estimates. Robustness checks based on IV regressions, in which the variable *Insourcing Share* is instrumented by econometrically valid and

economically justifiable instruments, indicate that our estimates could be interpreted as causal effects, to the extent that this is possible with cross-section data. Future research should use natural experiments to validate whether this interpretation is justified and whether the relationship found in this paper represents a causal relationship. Furthermore, the study relies on survey data, which might suffer from unit non-response, item non-response, measurement error and common method bias. Hence, future research should better use administrative data to confirm the suggested impact of the insourcing share on domestic production.

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Appendix

See Tables 5 and 6.

Table 5 Summary statistics

Variable	N	Mean	Std. dev.	Min	Max
Dependent variables					
VA per Emp	264	209,245.1	157,106	50,017.05	1,581,818
Inv in Mio. CHF	264	27	160	0	1670
Employees	264	5.28	1.34	1.95	11.04
Main explanatory variables					
Insourcing dummy	264	0.625	0.49	0	1
Insourcing share	264	10.22	18.05	0	75
R&D per head	264	8969.87	14,683.96	0	147,901
Protection problem	264	0.20	0.40	0	1
Protection ineffectiveness	260	0.59	0.49	0	1
Control variables					
High Qual Share	264	27.97	20	2	100
R&D in Mio. CHF	264	4.91	18.50	0	248
VA in Mio. CHF	264	208	1030	0.91	10,300.00
Foreign	264	0.21	0.41	0	1
Age	264	69.61	44	6.00	316.00
Price competition	264	0.67	0.12	0.25	1
Non-price competition	264	3.21	0.19	2.375	3.71
Spinoff	264	0.13	0.34	0	1
Merger	264	0.14	0.34	0	1
FDI 1990	264	0.63	0.49	0	1
FDI 2000	264	0.24	0.43	0	1
Location old Europe	264	0.67	0.47	0	1
Location East Europe	264	0.27	0.45	0	1
Location South Europe	264	0.14	0.34	0	1
Location Russia	264	0.05	0.22	0	1
Location USA	264	0.22	0.42	0	1
Location Latin America	264	0.08	0.27	0	1
Location China	264	0.25	0.43	0	1
Location Asia I	264	0.13	0.33	0	1
Location Asia II	264	0.19	0.39	0	1
Location other	264	0.09	0.29	0	1
Input share	264	46.50	18.21	3	93
Average wage	264	104,631	69,012	3877	1,063,636
Instruments					
Mean insourcing share	264	10.22	6.12	0	75

Table 6 Correlation matrix

	VA per Emp	Inv in Mio. CHF	Employees	Insourcing dummy	Insourcing share	R&D per head	Protection problem	Protection ineffectiveness
VA per Emp	1.00							
Inv in Mio. CHF	0.04	1.00						
Employees	−0.02	0.51	1.00					
Insourcing dummy	0.09	−0.06	0.06	1.00				
Insourcing share	0.13	−0.07	−0.09	0.44	1.00			
R&D per head	0.18	−0.06	0.06	0.01	0.11	1.00		
Protection problem	0.09	−0.07	−0.07	0.20	0.17	0.09	1.00	
Protection ineffectiveness	0.08	0.06	0.02	−0.06	0.09	−0.05	−0.08	1.00
High Qual Share	0.22	−0.01	−0.05	0.06	0.07	0.35	−0.03	−0.08
R&D in Mio. CHF	0.08	0.28	0.42	0.02	−0.02	0.41	−0.01	−0.06
VA in Mio. CHF	0.17	0.86	0.56	−0.02	−0.07	−0.04	−0.07	0.05
Foreign	0.15	−0.07	−0.04	0.06	0.07	0.05	0.06	0.04
Age	−0.11	0.01	0.22	0.04	0.03	−0.15	−0.01	−0.01
Price competition	0.07	−0.03	0.00	−0.07	−0.04	−0.18	−0.07	0.13
Non-price competition	−0.02	0.03	0.04	0.01	0.05	0.10	−0.01	−0.05
Spinoff	−0.02	−0.03	−0.01	0.09	0.06	0.04	0.03	−0.01
Merger	0.16	0.19	0.16	0.17	0.02	0.05	0.13	0.04
FDI 1990	0.04	−0.06	0.03	0.03	0.08	0.04	0.06	−0.14
FDI 2000	0.03	0.02	−0.10	0.04	0.02	−0.01	0.00	0.03
Location old Europe	0.07	0.11	0.23	0.22	0.17	0.10	0.14	−0.13
Location East Europe	−0.03	−0.04	0.13	0.21	0.19	0.01	0.09	−0.01
Location South Europe	−0.04	−0.05	0.00	0.03	0.07	0.00	0.10	−0.05
Location Russia	0.15	0.02	0.09	0.11	−0.02	0.04	0.17	−0.01

Table 6 continued

	VA per Emp	Inv in Mio. CHF	Employees	Insourcing dummy	Insourcing share	R&D per head	Protection problem	Protection ineffectiveness
Location USA	0.10	−0.03	0.16	0.25	0.04	0.11	0.13	−0.04
Location Latin America	0.11	−0.02	0.14	0.10	0.05	0.17	0.07	−0.05
Location China	0.13	−0.04	0.07	0.21	0.15	0.17	0.19	−0.23
Location Asia I	0.14	−0.01	0.03	0.13	0.08	0.06	0.01	−0.06
Location Asia II	0.17	0.05	0.17	0.15	0.13	0.12	0.12	0.04
Location other	0.04	−0.03	0.07	0.12	0.03	0.14	0.00	0.03
Input share	−0.14	0.02	0.09	−0.03	−0.07	−0.05	−0.07	−0.02
Average wage total	0.61	−0.04	−0.13	0.07	0.21	0.28	−0.04	0.04
Mean insourcing share	0.02	−0.17	−0.16	0.13	0.34	−0.01	0.05	0.06

The table displays the correlation of dependent variables and main explanatory variables among themselves and with the control variables

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