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## **Are there export spillovers in manufacturing industry? Evidence from Switzerland**

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**Abstract:** Apart from foreign direct investment (FDI), multinationals' (MNCs) export activities are also a valuable source of knowledge for domestic firms (in the home and the host countries). The aim of this paper is to focus in detail on the role of MNCs' export activities in improving the export performance of domestic firms through export spillovers. In particular, we test whether export activities of both Swiss and foreign MNCs located in Switzerland may benefit the Swiss economy when the export specific knowledge that is experienced on foreign markets may spill over to domestic firms, raising their export propensity. We argue that export spillovers do not occur automatically. They depend upon the mechanism by which they take place, the absorptive capacity of domestic firms, the export destination, and the geographical proximity. We found that the probability that domestic firms exports is positively and significantly associated with the presence of MNCs exporters in their sector. Demonstration-imitation is the main mechanism for these benefits. These benefits are larger when specific by destination and when domestic firms are in close proximity to foreign and Swiss MNCs. In addition, domestic firms with high technological capacities benefit more from export spillovers.

**Keywords:** MNCs; export spillovers; regional effect; export destination; spillover mechanisms; Switzerland.

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## 1 Introduction

MNCs are widely considered the main source for spillover benefits reflected in productivity of the domestic firms.<sup>1</sup> In fact, MNCs are assumed to possess a countervailing advantage over the domestic firms in host countries (Hymer, 1960, 1968) since they use advanced technology in production, marketing, management, etc., which makes them more efficient than domestic firms (Dunning and Rugman, 1985). Such advanced technology may spill over to domestic firms allowing them to improve their performance.

The export operations of MNCs may also be a valuable source of knowledge for domestic firms (in the home as well as host countries), allowing them to start exporting to a given market. That is MNC's parent or affiliate is highly likely to be in a better position to start export operations and overcome the fixed costs induced by these activities, since it can benefit from the existing international network of the entire corporation (Blomström and Kokko, 1998). The contacts of domestic firms with export oriented MNCs provide both knowledge about the product and process technologies and international market conditions and access to foreign marketing and distribution networks – for example, foreign preferences regarding design, packaging, and product quality – raising the export and productivity performances in domestic firms through export spillovers.

That is the export activities of MNCs' parent and affiliate may benefit domestic economy when the export specific knowledge of MNCs that are experienced on foreign markets may spill over to domestic firms, improving domestic export performance, by for example, reducing the cost of access to foreign markets. This kind of spillovers is more likely to be vertical than horizontal, since export oriented MNCs are likely to be relatively isolated from the domestic market (Kokko et al., 2001). Linkages and labour training are the main mechanisms of this kind of spillover effects since they create opportunities for export spillovers. For example, MNCs' parents or affiliates may train their domestic employees in export management and these skills may spill over to domestic firms when these employees change jobs to join an existing domestic firm. Domestic firms may also learn how to succeed in foreign markets simply by the observation and the imitation.

The core hypothesis we test in this paper is that MNCs act as export catalysts raising the export performance of domestic firms. This hypothesis has been studied by a number of scholars (Aitken et al., 1997; Greenaway et al., 2004; Ruane and Sutherland, 2005; Koeing et al., 2009; Giuliano et al., 2014; and so on), nonetheless, the empirical results have been mixed for both developed and developing countries and export spillovers on host and home economies are not well understood. This paper investigates in details export spillovers according to their key determinants, in order to exactly identify the potential benefit for domestic firms.

Part of the problem may be that export spillover benefits occur through a variety of mechanisms and thus the assessment of these effects calls upon a detailed analysis according to the mechanisms by which they take place. First, there are demonstration effects, i.e., domestic firms learn through imitation from MNCs. Second, there are competition effects when the increased competitions following the presence of MNCs' exporters force local firms to work harder or absorb new technologies. Third, there are worker mobility effects when domestic workers who having previously trained by and/or worked in MNCs' exporters may leave the firm to join an existing domestic firm. In addition, export spillovers might not be observed at the aggregate level (for all firms/products/destinations//industries/regions), but only in the subset of firms which share some common characteristics and are located not far from foreign affiliates. Finally, the absorptive capacity of the domestic firms is important in determining the scope of export spillovers – an argument that has not well been explored in the scant empirical literature available. We argue that sufficient levels of domestic absorptive capacity are likely to efficiently exploit export spillovers, whereas, insufficient absorptive capacity may hinder critical learning processes at the firm which in turn could not exploit the knowledge transfer opportunities arising from MNCs' export activities (Cohen and Levinthal, 1989).

We posit that the decision by domestic firms in Switzerland to enter the export market is determined by the export activities of Swiss and foreign MNCs in their sectors. To the best of our knowledge, this study will be the first to explore in detail the Swiss case using firm-level data. We hypothesise that:

- a export spillovers depend on the mechanism by which they take place
- b these effects are higher when specific by destination
- c when domestic firms are in close proximity to MNCs exporters
- d when domestic firms have large absorptive capacities.

Switzerland is particularly and interesting case study since its economic development relies on exports. First, although the ratio of exports in gross domestic product has decreased of about 10% between 2013 and 2015<sup>2</sup>, it accounts for 63% of gross domestic product in 2015 (BFS, 2016) wherein an important part of this ratio originated from Swiss MNCs' and foreign affiliates' export activities – for example, the pharmaceutical industry counting a significant number of Swiss and foreign MNCs, contributes to more than one-third of Swiss exports in 2014 (Le Temps, 2015). Second, Switzerland is regarded to have achieved competitive technological levels in many industries such as chemicals, pharmaceuticals, and watches and then possesses sufficient level of absorptive capacity to efficiently exploit export spillover benefits. Third, Swiss government, especially at canton level, is more and more active in encouraging export activities. Fourth, to date, there has been no investigation of the potentially beneficial export spillover effects of foreign and local MNCs on domestic manufacturing firms in Switzerland. Therefore, it is promising to study these effects and assess their key determinants for Swiss domestic firms, so as to give insights for managers as well as policy makers (especially at the regional and canton levels) about how to promote export learning activities of domestic firms to leverage potential export spillover benefits.

Following this introduction, Section 2 discusses theoretical and empirical frameworks underlying our hypotheses we present in Section 3. We introduce in Section 4 the model we use to test spillovers from export activities of foreign and Swiss MNCs. Section 5 analyses Swiss data. Section 6 discusses regression results and Section 7 concludes the paper.

## 2 Theoretical framework

Endogenous growth theory suggests that international trade is an important channel for enhancing knowledge creation and diffusion (Coe et al., 1997). For example, when local goods are exported, foreign buyers may suggest ways to improve the manufacturing process (Grossman and Helpman, 1991) – they want low-cost, better quality products from suppliers. To obtain this, foreign buyers transmit tacit and occasionally proprietary knowledge from their other suppliers (Wei and Liu, 2004). They also tend to transmit the prototypes of exported goods, knowledge on foreign markets, and offer technical assistance to domestic users (Minska-Strusik, 2012). Some part of the export specific knowledge of firms that have experienced on foreign markets may spill over to other domestic firms, improving domestic export performance, by for example, reducing the cost of access to foreign markets.<sup>3</sup>

As previously noted, the export operations of MNCs may be a valuable source of knowledge for domestic firms (in the home as well as the host countries), allowing them to start exporting and/or to intensify their export activities to a given market.

“The potential for spillovers from multinational enterprises (MNEs) derives from the fact that foreign firms have a multi-market presence. MNEs are a natural conduit for information about foreign markets, foreign consumers, and foreign technology, and they provide channels through which domestic firms can distribute their goods. To the extent that MNEs directly or indirectly provide information and distribution services, their activities enhance the export prospects of local firms.” (Aitken et al., 1997)

An emerging body of work has analysed the existence of export spillovers from MNCs. Nonetheless, the empirical results are rather mixed and evidence on this kind of spillovers demonstrates considerable heterogeneity (Harasztosi, 2016). For example, Greenaway et al. (2004) supported the finding of positive export spillovers from the foreign affiliates’ export operations on the export decision of domestic firms in the UK. They also tested export spillover effects on the domestic firms’ exported volume on which they failed to find a significant effect. Ruane and Sutherland (2005) also found that the decision by domestic firms in Ireland to enter the export market is positively associated with the presence of foreign affiliates in their sector, while, their export intensity is negatively associated with the export sales ratios of foreign affiliates. In addition, Barrios et al. (2001) and Lutz et al. (2003) failed to find evidence on the probability those domestic manufacturing firms in, respectively, Spain and Ukraine will export following the export activity of MNCs’ affiliates in the same sectors. Only other foreign affiliates benefit from export spillovers. Barrios et al. (2003) failed as well to find evidence on export spillovers from MNCs or from other domestic firms in Spain between 1990 and 1998.

We argue that export spillovers do not occur at a national level. Regional dimension plays an important role in assessing export spillover effects. “It may be easier to monitor competitors’ strategy on international markets when they are located close by”

[Choquette and Meinen, (2012), p.6]. In addition, to assess the whole benefit of export spillovers, we need a detailed analysis of these effects according to the characteristics of both MNCs' exporters and domestic firms, namely, the mechanisms by which spillovers take place, the technological characteristics of domestic firms that able them to absorb the foreign knowledge and integrate it in their existing technological process, and the export destination.

### *2.1 On the role of geographical proximity and regional dimension*

When spillover effects are measured for domestic firms in all regions (i.e., at a national level), the regional benefits might not be observed if they are too small to offset the overall negative effect across all regions (Aitken and Harrison, 1999). Learning is expected to be highly localised (Yildizoglu and Jonard, 1999) and spillovers are geographically bound.

Technological interaction among firms is deeply rooted in regional space (Menghinello et al., 2010). Spillovers tend to be captured, firstly, by domestic firms located in the same region as MNCs and may gradually spread to other, more distant ones (Aitken and Harrison, 1999). Because, knowledge is transmitted more efficiently by local proximity and its transmission costs are assumed to increase with distance (Audretsch, 1998), domestic firms in the same region observe and imitate foreign technology more efficiently than others. The channels of technological diffusion are then reinforced at regional level (Crespo et al., 2008).

A few empirical studies have analysed regional export spillovers. Aitken et al. (1997) lead the way in exploring the export spillovers associated with inward FDI. Using panel data on Mexican manufacturing firms, they found evidence consistent with the role of foreign affiliates as 'catalysts' for domestic exporters when they are in close proximity. The local concentration of export activity in Mexico however does not seem to influence the probability that a domestic firm exports. Koeing et al. (2009) support as well the evidence of the presence of export spillovers on the export decision in France from neighbouring exporters but not on the exported volume.

Further analyses are then required to investigate in details export spillovers at the regional level.

### *2.2 On the role of the characteristics of domestic firms and MNCs' exporters*

First, domestic firms do not learn from MNCs' exporters using the same mechanism. First, there are demonstration effects, i.e., domestic firms learn through imitation from MNCs, this is probably the most obvious overflow channel. Second, there are competition effects when the increased competitions following the presence of MNCs' exporters force domestic firms to work harder or absorb new technologies. Third, there are worker mobility effects when local workers who having previously trained by and/or worked in MNCs may leave the firm to join an existing domestic firm or open a new one. Spillovers may occur in the MNCs' own industry (horizontal effects) or in other industries – among the MNCs suppliers or customers (vertical effects).

In this context, the importance of export spillover effects differs according to the mechanism by which they take place. For example, spillovers from worker mobility are expected to be the greatest effects since this channel transfer not only the public

knowledge but also the tacit element. It appears then that assessing spillovers needs to distinguish the effect of competition and worker mobility from the effect of demonstration by using different control variables for each spillover mechanism.

Second, not all domestic firms should be expected to benefit from spillovers from MNCs' export activities. In fact, local firms need to have sufficient levels of technological capacity to be able to recognise the valuable new knowledge and use it productively. Technological capacity is, therefore, a prerequisite to facilitate absorptive capacity of local firms; i.e., the ability of the firm to decode, acquire, assimilate, transform, and efficiently exploit foreign knowledge (Cohen and Levinthal, 1990; Cantwell, 1989). Assessing export spillovers needs to control for the capacity of domestic firms to absorb and use productively foreign market knowledge.

Third, we agree that the cost of exporting, particularly the sunk costs, depend on the type of market destination. It increases with destination's geographical and cultural distances (Lawless, 2010; Giuliano et al., 2014). Exporting costs are higher as the destination's geographical and cultural distances increase. A higher cultural and geographical distance may hamper the path of domestic international expansion. Foreign and domestic MNCs in their industry or in their region that have multi-market presence would be a valuable source of knowledge on foreign market, allowing domestic to export to the culturally and geographically distant destinations. We argue then that the size and the importance of export spillovers depend on the firm's export destination.

Few studies have controlled for spillover mechanisms, domestic absorptive capacity and export destination when assessing export spillovers. For example, Buck et al. (2007) found that the exports of MNCs generate positive export spillovers for China and supported the hypothesis that knowledge on international markets can be transferred through production links and imitation by local firms. This seems to be true for export propensity and intensity of Chinese domestic firms. Kugler et al. (2004) and Kugler and Alborno (2008) suggest that spillovers from MNCs' export activities occur mainly across industries and found evidence on export spillovers for domestic upstream suppliers in Venezuela and Argentina, respectively. Venezuelan domestic firms seem to also benefit from horizontal spillovers. The evidence for Argentina is larger from MNC affiliate exporters than domestic exporters. Furthermore, Kugler et al. (2004) found that small and medium firms do not experience export productivity benefits from FDI while large domestic producers experience higher productivity growth, suggesting the importance of differences in absorptive capacity when assessing export spillovers. Yet, Nguyen (2008) showed that horizontal and forward linkages are the two main mechanisms of export spillovers from foreign affiliates in Vietnam, whereas domestic firms did no benefit from backward linkages to enter the export markets as well as to increase their export value. He also found that export oriented foreign firms are the unique source of export spillovers in Vietnam. Koeing et al. (2009) added that spillovers on the decision of French domestic firms to start exporting are stronger when specific, by product and destination, and are not significant when considering all products or all products-all destinations. Giuliano et al. (2014) confirmed that export spillovers through backward linkages are only active when they are destination specific.

Export spillovers in Switzerland have been analysed in few papers at the national level wherein Switzerland appears among the OECD countries. For example, Falvey et al. (2004) examined whether trade a channel for knowledge spillovers on a panel of 21 OECD countries for 1975–1990. They found evidence for export spillovers only when

knowledge is a public good. Using macro-level data from 34 countries during the period 2002–2005, De Clercq et al. (2008) found that a country's proportion of export-oriented new ventures affects the subsequent emergence of new businesses. None of these studies tested export spillovers in Switzerland using firm-level data or distinguished the effect of MNCs' export activities from those of domestic firms.

This paper seeks to contribute to the emerging body of knowledge on export spillovers from MNCs by testing the presence and the extent of these effects for domestic manufacturing firms in Switzerland, using firm-level data, so as to exactly identify the potential benefit for the domestic firms.

### 3 Hypotheses

According to the above arguments, we expect the following hypotheses:

- H1 The presence of export spillovers on the export decision of domestic firms is more pronounced with neighbouring foreign and domestic MNCs.
- H2 Export spillovers on the export decision of domestic firms are higher as the level of domestic absorptive capacity increases.
- H3 The importance of export spillovers on the export decision of domestic firms differs according to spillover mechanisms.
- H4 Export spillovers on the export decision of domestic firms are higher as export destination's geographical and cultural distances increase.

### 4 The model

Following existing empirical studies, we model the effect of export spillover for the  $i^{\text{th}}$  domestic firm as follows:

$$Pr(\text{Export}_i = 1) = \Phi(\beta + \alpha X_i + \gamma \text{export\_spillover}_j + \varepsilon_{ij}) \quad (1)$$

where the subscripts  $i$  and  $j$  denote firm and industry, and  $\alpha$ ,  $\beta$ , and  $\gamma$  are the parameters to be estimated. Table 1, at the end of the paper describes the variables and their measurements.

$X_i$  denotes the vector of firm level controls, it includes  $I$  the gross investment of domestic firm in equipment and structure,  $L$  its employment,  $HC$  the level of its human capital,  $Age$  its age,  $Invest$  the level of its investment in absorbing foreign knowledge (namely, employees' training and/or recruitment, innovation process, technology),  $Comp$  the degree of competition on its principal market as perceived by the firm<sup>4</sup>, and  $Gap$  its existing technological capacities.  $Gap$  and  $Invest$  control for the absorptive capacity of domestic firms. The coefficients of these controls, except  $Gap$ , are expected to be positive and significant. We expect the estimated coefficient of  $Gap$  to be negative and significant since domestic firms need to have sufficient technological capacities to absorb and use productively foreign market knowledge.

**Table 1** Variable definitions

	<i>Variable</i>	<i>Definition</i>
Dependent variable	$Export_i$	Equal to 1 if domestic firm exports in 2014, 0 otherwise.
Firm level controls	$Exp_j$	The ratio of Swiss exports over sales in an industry $j$ , calculated for 2014. <sup>a</sup>
	$I_i$	Gross firm's investment in structure and equipment, calculated for 2012 (in 10,000,000 s of CHF).
	$L_i$	Total number of employees in a firm, calculated for 2012 (in 10 <sup>3</sup> ).
	$HC_i$	The labour cost of the firm, calculated for 2012 (in 100,000 s of CHF).
	$Comp_i$	Equal to 1 if the firm evaluates high the degree of competition (in terms of price, new products, technology, etc.) on its principal market.
	$Gap_i$	The ratio of the average labour productivity of foreign and Swiss MNCs in the three digit industry to domestic firms' own labour productivity, calculated for 2012.
Export spillover variables	$Age_i$	The age of the firm.
	$Invest_i$	The level of investment expenditures in new equipment and training activities for product/process innovation, within the period 2012–2014.
	$IndExp_j$	The share of total number of foreign and Swiss MNCs' exporters in an industry $j$ , calculated for 2014.
	$RegExp_r$	The share of total number of foreign and Swiss MNCs' exporters in region $r$ , calculated for 2014.
	$IndExp_j^{EU}$	The share of total number of foreign and Swiss MNCs' exporters to European union in an industry $j$ , calculated for 2014.
	$IndExp_j^{US}$	The share of total number of foreign and Swiss MNCs' exporters to the USA in an industry $j$ , calculated for 2014.
	$IndExp_j^{AS}$	The share of total number of foreign and Swiss MNCs' exporters to Asia in an industry $j$ , calculated for 2014.
	$RegExp_r^{EU}$	The share of total number of foreign and Swiss MNCs' exporters to European Union in region $r$ , calculated for 2014.
	$RegExp_r^{US}$	The share of total number of foreign and Swiss MNCs' exporters to the USA in region $r$ , calculated for 2014.
	$RegExp_r^{AS}$	The share of total number of foreign and Swiss MNCs' exporters to Asia in region $r$ , calculated for 2014.

Note: <sup>a</sup>We use the data of the Federal tax administration to measure  $Exp_j$ .

Source: <https://www.estv.admin.ch/estv/fr/home/allgemein/steuerstatistiken/fachinformationen/steuerstatistiken/mehrwertsteuer.html>

The inclusion of industry and regional dummies, *Dummies*<sup>5</sup>, in equation (1) controls for the industry- and regional-specific productivity differences; it corrects for the omission of unobservable variables that might undermine the relationship between export spillover variables and export decision of domestic firms. Regional dummies also account for agglomeration effects that may result in an upward bias of a region-specific spillover coefficient, since some foreign firms could be attracted to regions which benefit from

agglomeration economies (Aitken and Harrison, 1999). Swiss regions considered here are; the Lemanic region, Mittelland space, North West Switzerland, Zurich, Western Switzerland, Central Switzerland, and Ticino.<sup>6</sup> We also add an industry level measure of Swiss exports  $Exp_j$  to control for the impact of the country's comparative advantages that might affect export spillovers.

We include in equation (1) export spillover variables  $IndExp_j$  to assess horizontal effects that occur in the MNCs' own industry, and  $RegExp_r$  to assess spillovers in the region from neighbouring MNCs (horizontal and vertical effects). Both  $IndExp_j$  and  $RegExp_r$  are used to capture spillovers from demonstration-imitation and the increase of competition.<sup>7</sup> However, they are not, in our point of view, appropriate to assess the effect of labour mobility. We employ two interaction terms  $IndExp_j * HC_i$  and  $RegExp_r * HC_i$  between the level of local human capital and the shares of MNCs' exporters to assess the effect of labour mobility related to the presence of MNCs' exporters in the industry and in the region of domestic firm, respectively. It is argued that human capital increases the ability of domestic firms to benefit from positive spillovers (Borensztein et al., 1998) – the sign of the interaction effect is then expected to be positive. That is investing in human capital by attracting skilled domestic employees working in MNCs' exporters, affects the knowledge capital of domestic firms and enhances their learning capacity (Griliches, 1998; Narula and Marin, 2003).

We test export spillovers according to the destination market (hypothesis 4). To do so, we consider European Union markets, which are geographically and culturally closer to Swiss firms due to their long lasting relations in economic and cultural issues, and more distant market such as the USA and Asia. We argue that export spillovers may influence domestic propensity differently according the destination market and we expect higher positive effects as export destination's geographical and cultural distances increase.

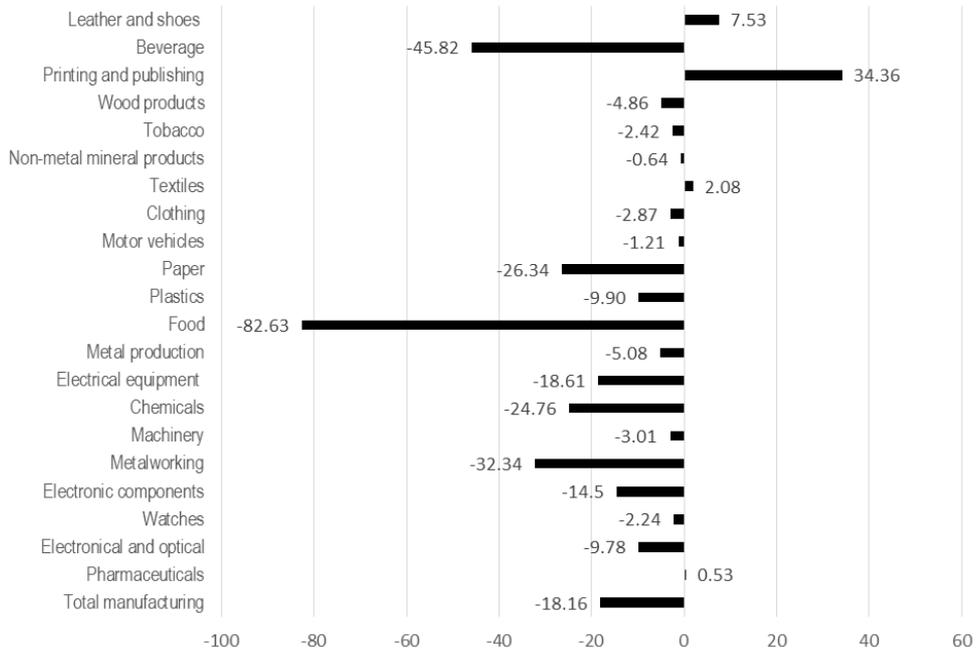
## 5 Data analysis

Data used for regression is derived from innovation activity survey (2015) of manufacturing firms, with at least five employees, conducted at the Swiss Institute for Business Cycle Research (KOF).<sup>8</sup> Individual information covers the technological behaviour and export activity of 2,518 domestic and foreign firms (MNCs and SMEs) in 2014 and in 2012. It also includes data on the name of the firm's export market, we used to determine export destination. Descriptive statistics of variables we use in regression are given in Table 2.

Table 3, Figure 1 and Figure 2 present a summary of the export trend of all foreign and domestic firms (MNCs and SMEs) in Switzerland for manufacturing. All these calculations are based on the data of structural business statistics (STATENT) of the Federal Statistical Office in Switzerland. Table 3 shows the distribution of exports and sales across two-digit manufacturing industries in Switzerland in 2015. The data in this table confirms the importance of export activity in Swiss manufacturing industry. Around three quarters of manufacturing industries experienced large export shares – more than 10% of their whole sales. Export share was pre-eminent in watches, electronic components, pharmaceuticals, machinery and textiles (from 50% to 68%). Only tobacco,

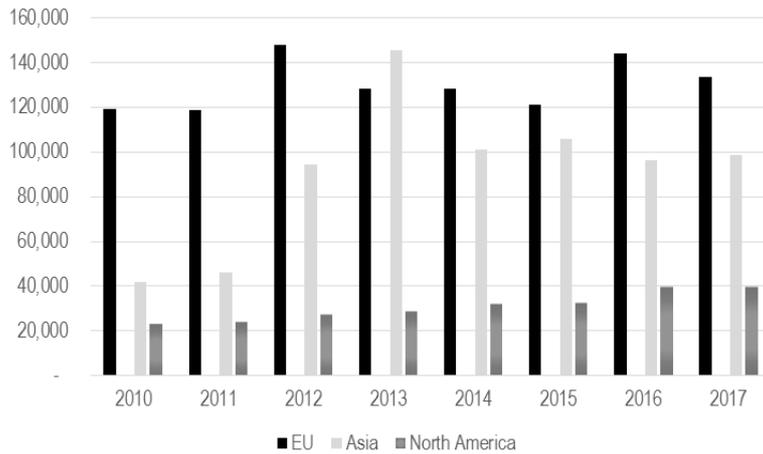
wood products, non-metal mineral products, food, and beverage reported small shares, less than 8%.

**Figure 1** Swiss exports evolution, per sector, between 2013 and 2015 (%)



Source: Federal tax administration – Statistics of the Swiss Economic Structure 2008–2015, (AFC)

**Figure 2** Swiss exports evolution, per destination, from 2010 to 2017 (%)



Source: Statistics encyclopaedia of Switzerland 2018 – Statistics of the Swiss Economic Structure, Federal Statistical Office in Switzerland (BFS)

Across sectors, Figure 1 shows that, except in leather and shoes and beverage, all manufacturing industries experienced decreasing export shares between 2013 and 2015. Figure 2 illustrates exports by destination from both manufacturing and service sectors. The data for the aggregate indicates that on average, European Union remains the most important export market for Swiss firms which could to some extent explain the decline of Swiss exports due to the slowdown in European economic growth and the continuing strong Swiss franc. Asian markets have experienced strong presence of Swiss products mainly in 2013 whereas Swiss firms are more and more exploring the US markets by continuously increasing their presence – Swiss exports in North America have doubled between 2010 and 2017.

To sum up, export is a preeminent activity in Switzerland. Largest export share reaches European Union countries, nonetheless Asian and the US markets started to be an important destinations since 2010, two years after the economic crisis of 2008. We expect that export spillover is destination specific, in which the importance of the effects is not the same across market destinations. In the following section, we test these effects at the national and regional level. We also control for export spillover mechanisms and the absorptive capacity of domestic firms.

**Table 2** Descriptive statistics of regression variables

<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>Std. dev.</i>
<i>Export<sub>i</sub></i>	408	0.678	0.467
<i>I<sub>i</sub></i> (in 10,000,000 s of CHF)	953	0.323	1.596
<i>L<sub>i</sub></i> (in 10 <sup>3</sup> )	1,062	0.189	0.711
<i>HC<sub>i</sub></i> (in 100,000 s of CHF)	874	1.022	2.058
<i>Comp<sub>i</sub></i>	736	0.714	0.451
<i>Gap<sub>i</sub></i>	890	3.59	16.751
<i>Age<sub>i</sub></i>	1,044	63.413	44.50
<i>Invest<sub>i</sub></i>	430	2.473	0.748
<i>Exp<sub>j</sub></i>	2,518	0.323	0.195
<i>IndExp<sub>j</sub></i> (in %)	2,518	29.765	13.097
<i>RegExp<sub>r</sub></i> (in %)	2,518	31.72	3.449
<i>IndExp<sub>j</sub><sup>EU</sup></i> (in %)	2,518	22.59	10.19
<i>IndExp<sub>j</sub><sup>US</sup></i> (in %)	2,518	0.761	2.381
<i>IndExp<sub>j</sub><sup>AS</sup></i> (in %)	2,518	2.27	1.915
<i>RegExp<sub>r</sub><sup>EU</sup></i> (in%)	2,518	24.18	2.46
<i>RegExp<sub>r</sub><sup>US</sup></i> (in %)	2,518	0.894	0.88
<i>RegExp<sub>r</sub><sup>AS</sup></i> (in %)	2,518	2.357	1.223

**Table 3** Sales and exports of Swiss manufacturing in 2015 (in millions CHF)

<i>Sector</i>	<i>Sales</i>	<i>Exports (%)</i>
Manufacturing	521,287.4	179,574.5 (34.44%)
Pharmaceuticals	97,224.7	55,646.4 (57.23%)
Electronical and optical	56,474.1	34,022.5 (60.24%)
<i>Including watches</i>	22,740.3	14,503.1 (63.78%)
<i>Including electronic components</i>	16,037.1	10,954.5 (68.31%)
Metalworking	109,625.0	30,453.8 (27.78%)
Machinery	30,237.6	15,841.9 (52.39%)
Chemicals	31,931.5	11,282.4 (35.33%)
Electrical equipment	19,170.7	6,713.8 (35.02%)
Metal production	21,841.5	4,735.1 (21.68%)
Food	53,557.1	3,442.0 (6.43%)
Plastics	9,030.9	2,262.3 (25.05%)
Paper	9,602.3	1,295.2 (13.49%)
Motor vehicles	1,955.0	1,008.5 (51.59%)
Clothing	1,374.8	748.8 (54.46%)
Textiles	1,648.8	677.0 (41.06%)
Non-metal mineral products	9,428.4	584.3 (6.20%)
Tobacco	25,014.9	573.2 (2.29%)
Wood products	9,401.8	514.2 (5.47%)
Printing and publishing	4,083.1	412.1 (10.09%)
Beverage	3,032.0	54.0 (1.78%)
Leather and shoes	296.7	42.4 (14.28%)
Others manufacturing	8,849.1	3,607.5 (40.77%)

*Source:* Federal tax administration – Statistics of the Swiss Economic Structure 2008–2015, (AFC)

## 6 Empirical results

This section presents empirical results. The model (1) is estimated using probit method. All estimations in Table 4 are robust.<sup>9</sup> We report the estimated coefficient of marginal effects to be able to assess the magnitude of spillover effects on domestic export propensity.

The first and the second columns of Table 4 present estimation results when considered the export market as a whole. Column 1 reports horizontal export spillovers while column 2 reports regional export spillovers (horizontal and vertical effects).<sup>10</sup> In the remaining columns the dependent variable is the probability to export to a specific destination. Spillover measurements are then destination specific. Columns 3 to 5 reports horizontal spillovers in terms of, respectively, European Union, the USA, and Asia, while columns 6 to 8 reports regional effects according to these destinations.

**Table 4** Probit regression for decision to export

	$Exporter_I$	$Exporter_R$	$Exporter^{EU}$	$Exporter^{US}$	$Exporter_I^{AS}$	$Exporter_R^{EU}$	$Exporter_R^{US}$	$Exporter_R^{AS}$
$I$	0.0385	0.022	0.0503	0.0313	0.0258	-0.004	0.00005	0.006
$L$	0.049	0.016	0.0346	0.049	0.0507	0.0432	0.0341	0.034
$Age$	-0.0003	-0.0003	-0.0003	-0.0004	-0.0004	-0.0001	-0.0001	-0.0001
$HC$	-0.0794	-0.0183	-0.0955	0.0667	-0.0732	-0.0630	-0.0942	-0.0516
$Comp$	0.0816	0.1241	0.0853	0.0822	0.0885	0.128*	0.1106*	0.117
$Gap$	-0.0142***	-0.0066*	-0.0129**	-0.0149*	-0.0152*	-0.0039	-0.0035	-0.0049
$Invest$	0.0193	0.0613	0.0142	0.009	0.011	0.0634	0.0548	0.0632
$Exp$	0.269	0.538***	0.174	0.101	0.385	0.525***	0.445*	0.527***
$IndExp$	0.009**							
$RegExp$		0.0339**						
$IndExp^{EU}$			0.014**					
$IndExp^{US}$				0.275				
$IndExp^{AS}$					0.0679**			
$RegExp^{EU}$						0.0481		
$RegExp^{US}$							0.629***	
$RegExp^{AS}$								0.13**
$IndExp * HC$	-0.0050							
$RegExp * HC$		-0.0308						
$IndExp^{EU} * HC$			-0.0088					
$IndExp^{US} * HC$				0.0858				
$IndExp^{AS} * HC$					-0.0358			
$RegExp^{EU} * HC$						0.0374		
$RegExp^{US} * HC$							-0.133*	
$RegExp^{AS} * HC$								-0.0709
Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	183	164	180	184	180	164	193	164
Pseudo-R <sup>2</sup>	0.1385	0.0452	0.1416	0.1313	0.1198	0.0597	0.0684	0.0608
Wald Chi <sup>2</sup>	26.24	8.32	26.05	21.87	22.39	11.42	13.46	11.61
Log-likelihood	-81.04	-91.10	-80.74	-82.83	-83.92	-85.66	-84.88	-85.57

Notes: All estimations include industry or region dummies. All estimates are robust. Variables ( $HC$ ,  $IndExp$  and  $RegExp$ ) used for interactions are centred by subtracting the full sample means, so that multi-collinearity between the variables and their product is reduced, good estimates of ( $HC$ ,  $IndExp$  and  $RegExp$ ) with accurate size and sign are ensured, and more meaningful interpretations of those estimates are granted (Aiken and West, 1991). \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% levels, respectively.

The estimated coefficients of  $IndExp_j$  and  $RegExp_r$  are positive and significant for all models, except column 6. This indicates that export propensity of domestic firms is significantly and positively influenced by the presence of MNCs' exporters in their industry and in their region. The size of these effects differs by export destination. Spillovers are higher when exporting to extra-European Union markets and domestic firms reaching the US market experienced the highest benefits from the presence of MNCs in their sector and in their region, exporting to the USA. For example, column 7 shows that the presence of MNCs exporting to the US market increases of 6.29% the probability that domestic firms export to the same market. This result corroborate to some extent hypothesis 4, in which export spillovers on the export decision of domestic firms are higher as export destination's geographical and cultural distances increase. As it is clear from Table 4, export spillovers are higher when considering Asian and the US destinations and are more pronounced for the USA. However, regarding Hofstede cultural measurements, Switzerland seems to be culturally closer to the USA than Asian countries like China and India. This indicates that export spillovers are certainly higher with geographical distance and to a lesser extent with cultural distance.

In addition, positive spillovers are higher when MNCs are in close proximity. Domestic firms are more likely to export when MNCs' exporters are in their region. The estimated coefficient of  $RegExp_r$  is 0.0339 and that of  $IndExp_j$  is 0.009, indicating that the presence of MNCs' exporters in the region of domestic firms increases three times more likely their probability to export than the presence of MNCs in their industry. This result confirms our hypothesis 1.

Regarding interaction terms, the estimated coefficients in Table 4 of  $IndExp_j * HC_i$  and  $RegExp_r * HC_i$  are not significant. This indicates that investing in human capital does not significantly impact export spillovers and hence worker mobility does not seem to be a significantly important mechanism. Domestic firms seem to benefit mainly from imitation-demonstration and competition mechanisms. Although the estimated coefficient of  $Comp$  is not significant, except in columns 6 and 7, the increase of competition contributes to spillover benefit, since it might force domestic firms to absorb new technologies via imitation-demonstration mechanism. These findings seem to confirm hypothesis 3.

For all probit estimates, the coefficients of firm level characteristics are insignificant except the  $Gap$  which is negative and significant in columns 1, 3, 4 and 5. This means that the probability that domestic firms exports increases with their technological levels. It seems that high technology domestic firms benefit more from the presence of MNCs' exporters in their industry. The estimated coefficient of  $Gap$  remains negative but no longer significant when considering regional spillover effects.  $Invest$  is also positive in all columns but not significant. This could indicate that domestic firms do not need to make significant investment and/or training efforts to be able to absorb export market knowledge. High technological capacities seem to be sufficient to decode and integrate export market knowledge. This finding corroborates our hypothesis 2 at industrial level. The estimated coefficient of  $Exp_j$  is not significant, except in columns 2, 6 and 8.

## 7 Conclusions

The effect of export spillovers from MNCs on export performance of domestic firms is a challenging research topic. Even though empirical results have been mixed, export

operations of MNCs are continuously a valuable source of knowledge for domestic firms, allowing them to start exporting to a given market. There is a need to analyse the contribution of this activity in domestic development, since many governments pay special attention to export benefits when measuring the successful performance of their export policies.

This paper argues that export spillovers are highly localised and analyses these effects at the regional level of the Swiss manufacturing industry. It suggests that:

- a export spillovers are destination specific
- b the size of spillovers differs according to the mechanisms by which they take place
- c domestic firms need to have a sufficient absorptive capacity to be able to decode and use productively export market knowledge.

On average, our results give support to our hypotheses and demonstrate that domestic firms are more likely to export when MNCs' exporters are in close proximity. They seem to mainly benefit from imitation-demonstration mechanism. Export spillovers are higher as export destination's distances, particularly geographical distance, increases.

On the policy front, suggestions with respect to encourage export, following such findings, must consider that export spillovers from MNCs occur in the region and that demonstration-imitation is the main mechanism for these benefits. Actions should then encourage collaborations between domestic firms and MNCs of the same region to promote the flow of knowledge between firms and facilitate the assimilation and absorption processes. This would contribute to successful domestic export learning. Considering the technological heterogeneity of domestic firms and supporting their learning process by helping them to upgrade the level of their technological capacity could also be included in the policy package.

Future studies exploring export spillovers in terms of export volume could be very promising; so as to test if MNCs' exported volume contributes to increase the exported volume of domestic firms. It should also interesting to use an input-output matrix to precisely measure spillovers from vertical linkages.

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## Notes

- 1 Domestic firms used in this project refer to exporting and non-exporting firms that are not investing in FDI.
- 2 The decline of Swiss exports results mainly from the slowdown in European economic growth and a continuing strong Swiss franc.
- 3 It is by far argued in the literature of international trade that the cost of access to foreign markets is a core factor in determining firms' export decisions (Wagner, 2007).
- 4 Firm's principal market could be either national or international, as perceived by domestic firm.
- 5 We have 18th industry dummies in manufacturing.
- 6 We use the regional classification of KOF institute.
- 7 *Comp* is also used to assess spillovers from the increase of competition. We expect a positive and significant estimated coefficient. This indicates that domestic firms are more likely to export when they perceive the level of competition on their market increases.
- 8 Questionnaire can be downloaded from <http://www.kof.ethz.ch> (Industrieökonomik), however, the firm-level data is unpublished and highly confidential.
- 9 Predicted probabilities of our models (columns 1 to 8) are quiet high – about 83% of the data are correctly predicted.
- 10 The effects via vertical linkages are also of great importance and worthy of being explored. Regional spillovers include these effects, since *RegExp<sub>r</sub>* is not industry specific. We recognise that is better to use the input-output matrix to assess these vertical effects. Unfortunately our data do not allow for such information.