MNCs in Service/Construction Industry and Regional Productivity Effects

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Abstract

This study analyzes the effects of productivity spillover from foreign MNCs in Switzerland. It argues that learning is highly localized and spillovers are geographically bounded. It covers firms in services/construction, whereas most existing studies deal with manufacturing. It highlights the role of spillover mechanisms and the absorptive capacity of local firms in assessing regional benefits. It hypothesizes that the size and the extent of regional spillovers depend largely upon the interaction between their channels and the existing absorptive capacities of local firms. The results confirm to a great extent the hypotheses, in which competition-related spillovers seem to be totally absorbed by local firms with high technological capacities. Worker-mobility-related spillovers are, by a great extent, absorbed by low technology firms, while demonstration-related regional spillovers in the services/construction industry are absorbed by both mid and low technology firms with lager effects, found in mid technology firms.

Keywords: Regional FDI inra-industry spillovers; Demonstration effects; Competition effects; Worker mobility; Domestic absorptive capacity; Services/construction industries

JEL classification: D21; D62; F21; F23; O33; R11

1. Introduction

MNCs are assumed to possess a countervailing advantage over the host country's firms (Hymer, 1960, 1968). They use advanced technology (production technology, technological know-how, marketing and managerial skills, international experience or reputation, etc.) which makes them more efficient than domestic counterparts (Dunning and Rugman, 1985). Knowledge can be transferred either voluntary through technology transfer agreements or involuntary through spillovers (Perez, 1998). Our paper analyzes spillover effects from MNCs to host country's firms in the services/construction industries, wherein very little attention has been paid by scholars to this aspect.

Despite the sectorial pattern of FDI shifting towards services, most discussions on spillovers from FDI focus on manufacturing industries (among others Haddad and Harrison, 1993; Kokko, 1994; Kokko at al., 1996; Konings, 1999; Yeaple and Keller, 2003; Dimelis, 2005; Liu and Wei, 2006; Hale and Long, 2006; Svejnar et al., 2007; Buckley et al., 2007 and 2009; Castellani

and Zanfei, 2007; Zhang et al., 2009; and Barbosa and Eiriz, 2009). In this paper , we aim to bring new elements into the discussions by testing the presence and the extent of intra-industry spillovers for the services/construction industry in Switzerland. According to UNCTAD (2004), the global FDI stock in the service industry more than quadrupled during the period 1990-2002. As a result of more rapid growth in this sector than in the other sectors, services accounted for about 60% of the global stock of inward FDI in 2002. In Switzerland, the importance of foreign-owned investors in services has significantly increased, in particular, over the period in which we focus, 2001 to 2004. This is mainly in transport, R&D institutions, wholesale trade, and tourism.

In addition, our paper argues that learning is highly localized and spillovers are geographically bounded. The effect of spillovers tends to be captured first by neighboring local firms, and gradually spread to other, more distant ones. The geographic dimension has been controlled by a number of scholars who used regional level and tested spillovers within and outside the region. To the best of our knowledge, except the work of Higón and Vasilakos in 2011, most of these existing empirical studies focus on the manufacturing industry (Aitken and Harrison, 1999; Liu and Wei, 2006; Sjohölm, 1999; Halpern and Muraközy, 2005, etc.). Furthermore, existing results for regional spillovers have been mixed for both developed and developing countries and evidence on regional spillovers has not yet been conclusive. It shows that regional spillover effects of FDI on host economies are not well understood.

This heterogeneity on regional spillover findings could be the result of misspecifications of these effects. Firstly, spillovers might not be observed at the aggregate level (for all firms/industries), but only in the sub-set of firms which share some common technological characteristics. We argue that domestic firms should possess a sufficient technological level to recognize valuable new knowledge; invest in training and learning to integrate the new knowledge and use it productively into its existing technological process. Doing so, local firms might be able to successfully absorb foreign knowledge. Secondly, the literature recognizes that spillovers occur through a variety of mechanisms, namely; demonstration, increased competition and worker mobility. The size and the extent of spillovers depend on the type of their mechanisms and the assessment of the entire spillover effects needs to disentangle these effects according to their

mechanisms. Thirdly, we assume that possible interactions between technological capacities of domestic firms and spillover mechanisms might influence spillover effects in the region. That is high technology firms which fiercely compete with foreign affiliates would not seek to absorb foreign knowledge but rather work harder to maintain their market share. However, low technology firms seem to gain significantly from other mechanisms of spillovers such as worker mobility, since these firms could benefit from personnel assistance which helps them to better understand and implement foreign technologies (Mody, 1989).

This paper attempts to empirically analyze regional intra-industry spillover effects from FDI using firm-level data from the services/construction industries in Switzerland; to the best of our knowledge, this paper will be the first to explore regional effects in the Swiss services/construction industry. As stated by Blomström and Kokko (2002), the composition of inward FDI has changed, thus most FDI concerns services, rather than manufacturing. As a result, we could expect FDI to have more spillover effects in services. Unlike existing empirical studies, our paper attempts a detailed analysis in regional spillovers in the Swiss services/construction industry according to their mechanisms. It controls for the role of the existing technological capacity of domestic firms and their investment efforts in training and learning in determining regional spillovers, and suggests that the size and the extent of these effects depend on the interaction between the mechanisms by which they occur and the existing technological capacities of domestic users.

The structure of the paper is as follows; section 2 analyzes the theoretical framework underlying our hypotheses, together with a review of relevant empirical studies, section 3 discusses the Swiss services/construction data, section 4 presents the econometric model, section 5 presents the regression results, and section 6 concludes the paper .

2. FDI and spillovers: The framework

Recent literature suggests that learning is highly localized and requires geographic proximity (Yildizoglu and Jonard, 1999 and Narula, 2010), furthermore spillovers are geographically bounded – technological interaction among firms is deeply rooted in regional space (Driffield et al. 2010). This paper investigates the role of regional dimension on spillovers in the ser-

vices/construction and argues that the size and the extent of regional spillover effects vary according to the mechanisms by which they occur, and depend on the interaction between these mechanisms and the capacity of domestic firms to absorb and use foreign knowledge productively.

In the following sub-sections, we discuss the theoretical and empirical frameworks underlying these arguments. Sub-section 1 highlights the role of the regional dimension in assessing the benefits of spillovers. Sub-section 2 analyzes the different mechanisms of intra-industry spillovers and calls for a detailed analysis of these effects according to the mechanisms by which they occur. Sub-section 3 highlights the role of the absorptive capacity of domestic firms and demonstrates that the assessment of regional spillovers depends on the interaction between their mechanisms and the technological capacity of local firms.

2.1. Spillovers within regional boundaries

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 effects across all regions (Aitken and Harrison, 1999). Spillover benefits tend to be captured first by neighboring domestic firms, and gradually spread to other, more distant firms. Firstly, MNCs tend to establish affiliates in more competitive regions (Dunning, 1992, and Dunning and Gugler, 2008). Consequently, domestic firms within the same location/region are expected to follow the same technological trajectory and are highly likely to benefit from spillovers. Secondly, knowledge is generated and easily transmitted via local proximity, since its transmission costs are assumed to increase with distance (Audretsch, 1998). Given that, the impact of spillover mechanisms, namely labor mobility and demonstration is expected to be greater in the region. Domestic firms located in the same region as foreign affiliates observe and imitate foreign knowledge more efficiently. In addition, they could easily attract domestic employees who have been trained by and/or worked at foreign firms than more distant ones. The mechanisms of technological diffusion are reinforced at regional level (Crespo et al., 2008) and spillovers are expected to be larger (Ben Hamida, 2013). However, despite these strong arguments supporting that inward foreign direct investment generate spillover benefits at regional

level, this area remains under-researched.

The few existing studies have focused on manufacturing industries, except Higón and Vasilakos (2011) who tested regional spillovers for the British retail sector during the period 1997-2003 and found strong evidence of regional effects. Aitken and Harrison (1999) advanced the idea that spillovers have a regional dimension. They tested whether FDI spillovers occur at the regional level in Venezuelan manufacturing firms. They found that regional foreign investment has positive and significant effects on the productivity of Venezuelan firms, while sectorial foreign investment has negative effects. Regional evidence for spillovers was later confirmed by a few number of scholars focusing on manufacturing. For example, using sector-level data in the UK, Driffield (2004) found positive productivity spillovers from inward FDI in the same region, while these effects are negative outside the regional boundaries. Liu and Wei (2006) found evidence of regional spillovers from inward FDI in China. Spillovers across Chinese regions are negative and insignificant, which might be due to the existence of barriers in the movement of production and output factors across regions in China. Conversely, there exists studies which failed to assess the beneficial return of spillovers in the region, such as Sjohölm (1999) and Halpern and Muraközy (2005). Sjohölm found evidence of positive spillovers for Indonesian manufacturing firms at the national level, whereas regional spillovers from FDI were negative. Based on panel data for Hungarian manufacturing firms, Halpern and Muraközy also found that spillovers within or across regions were not different from each other, both were insignificant. Halpern and Muraközy explain this finding by the fact that Hungary is a homogenous country from the point of view of spillovers because of its small size.

Accordingly, we recognize that evidence on regional spillovers has yet to be conclusive. These apparently contradictory results could be explained by the fact that regional spillovers do not automatically occur, but depend on the mechanisms by which they occur. Other factors such as the level of the technological capacity of domestic firms, as well as, their investment and learning efforts could also influence regional effects. We debate that these arguments are fundamentals to control for, when testing regional spillover effects and that scholars disregarding them may fail in assessing regional spillovers.

2.2. On the role of spillover mechanisms

Regional intra-industry spillovers appear to occur through three mechanisms. The literature distinguishes between competition-related spillovers and knowledge spillovers. The first kind of effects occur when domestic firms are forced to work harder to face the increased competition that follows the entry and the presence of foreign affiliates – in the short term competition - related spillovers could be a negative sign in terms of market stealing effects. Whereas, the latter occurs when firms imitate foreign knowledge by means of demonstration or succeed in getting foreign know-how via the mobility of domestic employees trained by or previously worked in foreign affiliates. The mechanism of worker mobility is particularly interesting in services, since training and human capital development in this sector are more directly focused on strengthening the skills and know-how of employees (Blomström and Kokko, 2002). Some or all of the foreign firm's specific knowledge could be expected to move to domestic firms when domestic employees decide to leave foreign firms and join domestic ones.

Accordingly, the amount and nature of knowledge transferred from foreign to domestic firms largely depend upon the mechanism by which they are transmitted. we expect that worker mobility, for example, can lead to higher spillovers and substantial growth in the productivity of domestic firms, since this mechanism transfers not only public knowledge ("the logy" in the terminology of Nelson (1982)), but also the tacit element (the technique) that is unlikely to be transferred through direct contacts between firms.

Nelson (1982, page 467) states that "*research and development scientists from rival firms give papers at meetings of professional societies. They meet together for lunch to exchange information on the evolving frontiers of the logy, while trying to avoid disclosing details of particular techniques their firms may have under development at the time*".

Futhermore, as Ishall see in the following sub-section, the relevance of each mechanism depends on the technological capacity of domestic firms. If knowledge accumulation is continuous in domestic firm, raising its productivity or lowering its costs along a given line of technological development, then this firm would not abandon its existing pattern of innovation and imitate foreign knowledge (Cantwell, 1999 and Silverberg and Verspagen, 1994). However, large knowledge disparities force domestic firms to introduce the new knowledge of foreign

firms. Domestic users in this case would need to invest in training and learning to be able to decode foreign knowledge and use it productively.

Prior empirical studies analyzing spillovers at both national and regional levels have employed a share of foreign presence in the corresponding industry within the region/ nation – e.g. foreign employment/sales/equity shares to measure spillover effects (among others, Aitken and Harrison, 1999; Haskel et al., 2007; Karpaty and Lundberg, 2004; Buckley et al., 2007; Castellani and Zanfei, 2007; and Tian, 2007). We argue that the share of foreign presence could capture spillovers from demonstration effects but does not seem appropriate to assess the effects of both increased competition and worker mobility (Kokko, 1996 and Ben Hamida, 2007). Competition-related spillovers, for example, could not be determined by the share of foreign presence alone, but rather by the simultaneous interaction between foreign and domestic firms (Kokko, 1996 and Wang and Blomström, 1992).[1]

Based on the above statements, we argue then that a more satisfactory model of regional spillover effects provides a deeper understanding of the process according to the mechanisms by which they occur. Such a modeling strategy is likely to describe the process of spilling- over more correctly and then accurately identify the nature and the size of the resultant effects. Then the following hypothesis emerges:

Hypothesis 1: The distinction of regional spillovers according to the mechanism by which they are transmitted provides different effects in the services/construction industry.

2.3. On the role of the interaction between spillover mechanisms and technological capacities of domestic firms

It is well known in the literature on spillovers that the absorptive capacity of domestic firms is the most important determinant of spillovers. That is only domestic firms that have largely invested in the absorptive capacity benefit from spillovers (Cohen and Levinthal 1989, 1990 and Cantwell, 1989). Many scholars have employed this concept to determine significant spillover effects, particularly, at national level (Cantwell, 1989, Konings, 1999, Girma et al., 1999, Liu et al., 2000, Flôres et al., 2002, Yeaple and Keller, 2003, Narula and Marin, 2003, and Dimelis, 2005, etc.).

At the regional level, Higón and Vasilakos (2011) found that regional spillover effects increase with the absorptive capacity of local retailers, measured by the firm's total factor productivity "TFP" relative to the average of TFP of the 95th percentile most productive firms in the industry. For manufacturing, Girma and Wakelin (2002) found that sectors with high levels of competition and a low technology gap (as a proxy for absorptive capacity) experienced higher spillovers, and more-developed regions in the UK gain more from spillovers than others. Girma and Görg (2007) also considered in their specification of regional spillovers domestic absorptive capacity (proxied by the difference in TFP between the firm and the maximum TFP in the industry), which is quadratically related to spillover effects. Using the technique of conditional quantile regression, they found a U-shaped relationship between the absorptive capacity and spillovers from FDI in the region in all quantiles, while there is an inverted U-shaped relationship for spillovers from FDI outside the region. Conversely, using the same measure of domestic absorptive capacity as Girma and Görg (2007), Girma (2003) found that the relationship between spillovers and domestic absorptive capacity is an inverted U-shape, either from FDI located in the same region as UK firms or outside the region.

This heterogeneity in results regarding the relationship between spillovers and domestic absorptive capacity at the regional level may be the fact that these studies disregarded the role of learning and investment in the firm when measuring domestic absorptive capacity and only retained its existing technological gap. Domestic firms should possess sufficient technological level to recognize valuable new knowledge (proxied by among others the firm's technological gap); invest in new equipment and human capital (for example, training their domestic employees and/or recruiting new ones) to be able to absorb foreign knowledge and successfully integrate it into its existing technological process.

In this paper, we recognize the above problem and consider a thorough measurement for domestic absorptive capacity. We control for firm's investment and learning and argue that, according to its existing technological level, domestic firms do not benefit from regional spillovers in the same way. Actually, domestic firms that have high technological capacities do not look to imitate foreign knowledge, they rather attempt to work harder to reduce imperfection costs related to internalization process in order to maintain their market shares. Whereas, domestic

firms that are not in a position to compete fiercely with foreign firms would prefer to introduce best foreign knowledge in their existing technological process, by means of demonstration and/or worker mobility mechanisms. Recently, Ben Hamida (2013) has analyzed regional FDI spillovers in Swiss manufacturing and controlled for the relationship between spillover channels and the diverse levels of domestic technological capacity. She found that competition-related spillovers appear to be fully absorbed by local firms with high technological capacities; worker-mobility-related spillovers are fully absorbed by low technology firms; while demonstration-related spillovers are absorbed by all groups of firms with mid technology firms experiencing the larger benefit.

Our paper tests the relationship between spillover mechanisms and domestic technological capacities for the services/construction industry and attempts to draw some conclusions concerning the differences in results between manufacturing and services/construction in Switzerland, since the nature of knowledge transferred between firms in services tends to be different from that in manufacturing (Giroud et al., 2009).

These discussions point to the following hypothesis:

Hypothesis 2: Different interactions between spillover mechanisms and existing domestic technological capacities provide different regional spillovers in the services/construction.

3. Data

Switzerland has recorded increased inward FDI over the last few years, particularly, between 2001 and 2004, which even surpassed the flows of outward investment in 2003. FDI inflows are not equally distributed across regions. According to Crevoisier and Roth (2005), the Alpes for example are not internationalized, while cantons such as; Vaud, Geneva, Basel, and Zurich experienced large flows of inward FDI which are above the national average. In addition, Switzerland has achieved competitive technological levels in many service industries such as; theGeneva area in banking and Swiss government is increasingly encouraging inward FDI and attracting foreign MNCs.

Switzerland is thus an interesting example to investigate regional spillovers. We believe that it is promising to investigate the key determinants of regional spillovers to give insights

to policy makers, particularly, at cantonal level about how to promote inward FDI as well as leverage spillover benefits.

This paper uses data derived from innovation activity surveys (2002 and 2005) of services/construction firms, with at least 5 employees, conducted at the Swiss institute for business cycle research "KOF".[2] Individual information covers the productivity and technological behaviors of 1107 firms – 127 majority-owned foreign affiliates – in 2001 and 1170 firms – 134 majority-owned foreign affiliates – in 2004.

Figures 1 to 7 report the sectorial distribution of inward FDI in Swiss regions, measured by the share of foreign investment in services/construction total sales. Following the regional distribution of the KOF institute, the regions considered here are: the Lemanic region, Mittelland space, North West Switzerland, Zurich, Western Switzerland, Central Switzerland, and Ticino.[3] All these calculations are based on weighted data sets so as to give a representative picture of Swiss economy.[4]

In 2001, figure 1 shows that foreign share in wholesale trade and computer services was preeminent in the Lemanic region. Central Switzerland also holds a large foreign share in wholesale trade sectors, as well as, in transport and banking (figure 6). While foreign share in the Mittelland space is preeminent in trading and maintenance of motor vehicles (figure 2). Zurich recognizes large shares mainly in computer services and banking (figure 4). Foreign firms dominate in R&D institutions within both North West and Western Switzerland (figures 3 and 5), while in Ticino they are rather dominant in personal services (figure 7). In 2004, the results change considerably across regions. Some sectors recognize a decrease in foreign shares, mainly, computer services in the Lemanic region and Western Switzerland; banking in Central Switzerland and the Mittelland space; and insurance and the retail trade in Zurich. However, an increase in foreign shares is identified within, for example, Western Switzerland in mainly R&D institutions and retail trade and wholesale trade; Zurich in other business services; and North West and Western Switzerland and Lemanic region in banking.

Whether foreign presence in Swiss regions results in spillover benefits arising from the domestic learning process of foreign technologies is the focal point of our empirical analysis discussed in the next section.[5]

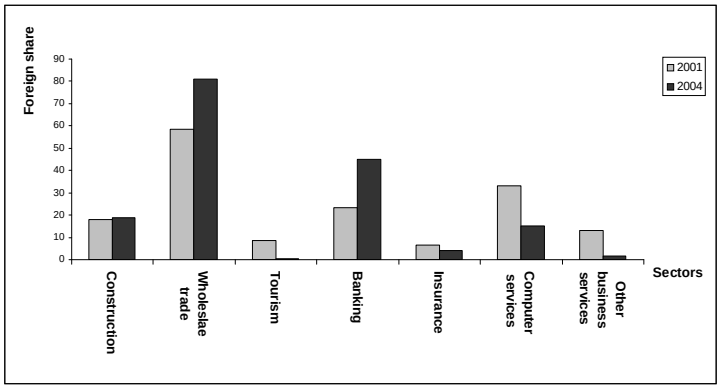

Figure 1: Percent share of foreign firms in total sales in the same sector and region "Lemanic region".

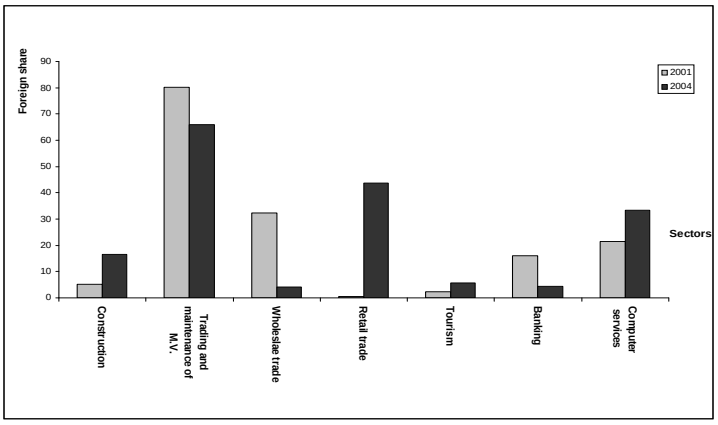

Figure 2: Percent share of foreign firms in total sales in the same sector and region "Mittelland space".

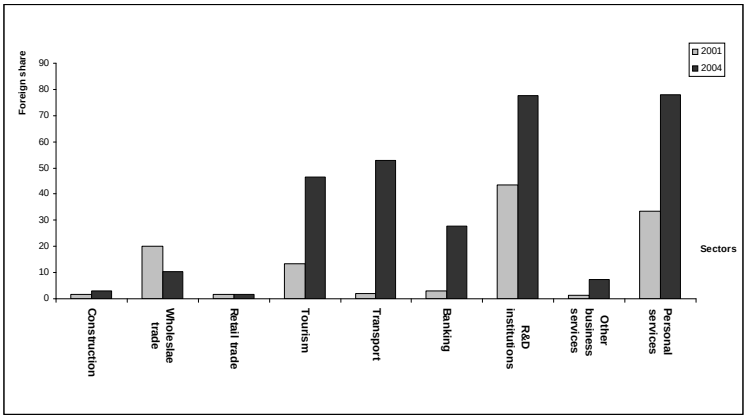

Figure 3: Percent share of foreign firms in total sales in the same sector and region "North West Switzerland".

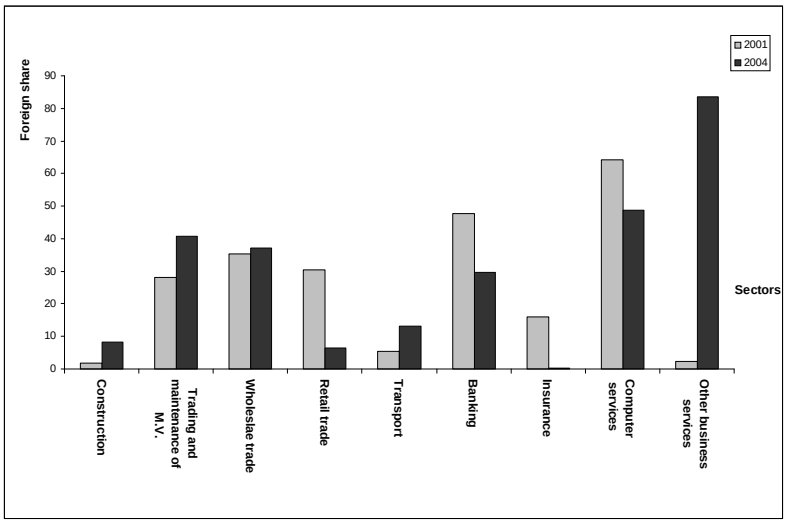

Figure 4: Percent share of foreign firms in total sales in the same sector and region "Zurich".

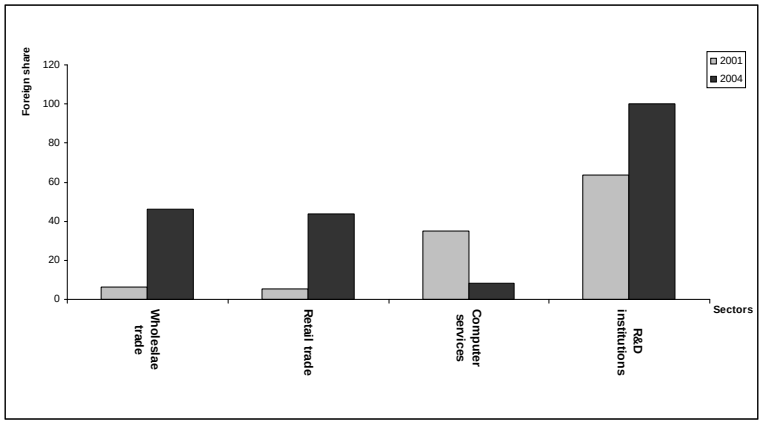

Figure 5: Percent share of foreign firms in total sales in the same sector and region "Western Switzerland".

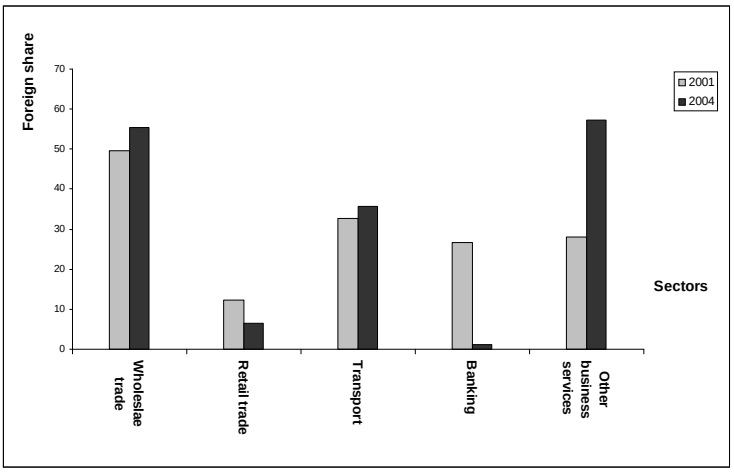

Figure 6: Percent share of foreign firms in total sales in the same sector and region "Central Switzerland".

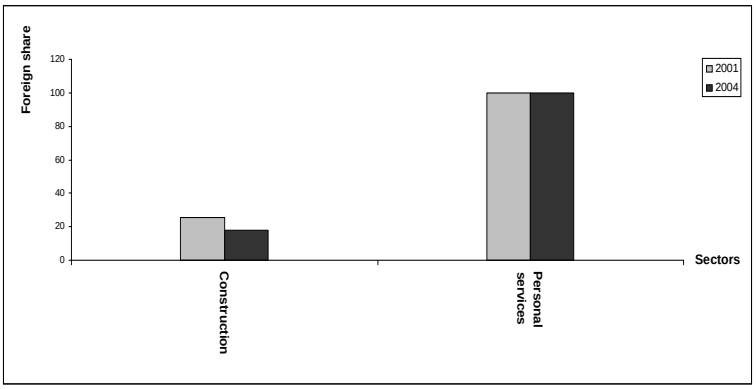

Figure 7: Percent share of foreign firms in total sales in the same sector and region "Ticino".

4. Methodology

We model the effect of regional spillovers within the context of a Cobb-Douglas production function, in which the value-added Y is a function of two inputs, capital and labor. $A_{i,j,t}$ is the level of firm's productivity. The subscripts i and j denote firm and industry, respectively.

$$Y_{i,j,t} = A_{i,j,t} L_{i,j,t}^{\alpha 1} K_{i,j,t}^{\alpha 2}. \tag{1}$$

To estimate equation (1), we take the logarithms of the variables in order to get into a linear form equation and add a stochastic disturbance term $u_{i,j,t}$ to account for variations in the productive capabilities of the i-th firm, Consequently, we rewrite the above equation for $t-3$ =2001 and t =2004 as

$$LnY_{i,j,t} = a_{i,j,t} + \alpha_1 LnL_{i,j,t} + \alpha_2 LnK_{i,j,t} + u_{i,j,t}, (a_{i,j,t} = LnA_{i,j,t}), \tag{2}$$

$$\begin{aligned} LnY_{i,j,t-3} &= a_{i,j,t-3} + \alpha_1 LnL_{i,j,t-3} + \alpha_2 LnK_{i,j,t-3} + u_{i,j,t-3}, \\ (a_{i,j,t-3} &= LnA_{i,j,t-3}). \end{aligned} \tag{3}$$

By taking the difference (2-3), we obtain the following equation with Δ denotes the variation between 2004 and 2001.

$$\Delta LnY_{i,j} = \Delta a_{i,j} + \alpha_1 \Delta LnL_{i,j} + \alpha_2 \Delta LnK_{i,j} + \varepsilon_{i,j,}. \tag{4}$$

Based on the study of Ben Hamida (2013) for manufacturing, we distinguish between spillover mechanisms by employing different control variables. Firstly, the main effect of the share of foreign presence at level of the four-digit services/construction industry, FP, reflects spillovers from demonstration effects. Secondly, the interaction term $FP*HC$ between foreign presence and human capital is assumed to determine the effect of worker mobility related to the presence of foreign firms in the domestic market. Thirdly, the price markup, $\Delta Comp$, is used to assess competition effects. By including these variables, we model the change in a as follows

$$\begin{aligned}\Delta a_{i,j} &= \alpha_3 FP_{j,r,t-3} + \alpha_4 FP_{j,R-r,t-3} + \alpha_5 HC_{i,j,t} + \alpha_6 FP_{j,r,t-3} * HC_{i,j,t} \\ &+\alpha_7 FP_{j,R-r,t-3} * HC_{i,j,t} + \alpha_8 \Delta Comp_j + \alpha_9 \mathrm{Si}\, ze_{i,j,t} + \alpha_{10} Industry_{i,j} \\ &+ \alpha_{11} \mathrm{Re}\, gion_r + \varepsilon_{i,j,r}, \qquad (5)\end{aligned}$$

Where, the change in a is also assumed to vary across sectors, the size of the domestic firms and its human capital (Griliches, 1998 and Dimelis and Louri, 2002). The subscript r denotes region.

Finally, we can rewrite equation (4) as

$$\begin{aligned}\Delta LnY_{i,j} = \alpha_0 + \alpha_1 \Delta LnK_{i,j} + \alpha_2 \Delta LnL_{i,j} + \alpha_3 FP_{j,r} + \alpha_4 FP_{j,R-r} + \alpha_5 HC_{i,j} \\ \alpha_6 FP_{j,r} * HC_{i,j} + \alpha_7 FP_{j,R-r} * HC_{i,j} + \alpha_8 \Delta Comp_{i,j} + \alpha_9 \mathrm{Si}\, ze_{i,j} \\ + \alpha_{10} Industry_j + \alpha_{11} \mathrm{Re}\, gion_r + \varepsilon_{i,j,r}, \qquad (6)\end{aligned}$$

Where α_0 to α_{11} the parameters to be estimated. Table 1 describes the variables and their measurements. $Industry$ and $\mathrm{Re}\, gion$ denote, respectively, industry and region dummies.[6] The inclusion of dummies and the use of changes over time control for industry- and region- specific productivity differences – $\mathrm{Re}\, gion$ also corrects for agglomeration effects, since some foreign firms could be attracted to regions which benefit from agglomeration economies (Aitken and Harrison, 1999). In addition, both dummies are used to correct the omission of unobservable

Table 1: Variable definitions

Variables	Definitions
$\Delta LnY_{i,j}$	The log change in value-added in a firm.
$\Delta LnK_{i,j}$	The log change in physical capital, measured by gross capital income – firm level.
$\Delta LnL_{i,j}$	The log change in total number of employees at the firm level.
$FP_{j,r}$	The share of total sales in an industry j within the region r accounted for by foreign firms, calculated for 2001, $r = 1...R$, with $R = 7$.
$FP_{j,R-r}$	The share of total sales in an industry j outside the region r accounted for by foreign firms, calculated for 2001.
$HC_{i,j}$	The average labor cost of the firm (in 100,000 CHF) constructed as the ratio of the firm's labor costs to the number of employees, calculated for 2004.
$\Delta Comp_{i,j}$	The change in price markup in a firm measured by the difference between firm's total sales and costs over total sales.
Si ze_{ij}	The log total sales of the firm, calculated for 2004.
$GAP_{i,j}$	The ratio of the average labour productivity of foreign-owned firms to domestic firm's own labor productivity, calculated for 2001.
$INVEST_{i,j}$	The level of investment expenditures in new equipment and training activities for product/process innovation, within the period 2002-2004.

variables that might undermine the relationship between regional spillover variables and the productivity growth of domestic firms (Aitken and Harrison, 1999 and Narula and Marin, 2003).

We employ an interaction term between foreign presence and human capital to assess spillovers from the mechanism of worker mobility and we expect its sign to be positive. This implies that the effect of the entry and presence of foreign firms on the productivity growth of domestic firms is co-determined by the level of their human capital development (Borensztein et al., 1998 and Meyer and Sinani, 2002). Domestic firms that invest in upgrading the level of their human capital expect that the entry and the presence of foreign firms in their region increase their productivity growth. We argue that the heterogeneity of domestic firms according to their technological capacity impact the way of upgrading the level of their human capital. Since relatively high technology firms tend to benefit from spillovers through demonstration and/or competition effects (Mody, 1989 and Ben Hamida, 2007), they are likely to invest in learning by training their domestic employees. We expect that training activities would be sufficient in succeeding to absorb and implement foreign knowledg by this category of firms. However, small tech-

nological firms, which are not able to benefit from foreign affiliates via demonstration effects alone, tend to recruit domestic employees previously trained by or worked in foreign affiliates, by giving them better work conditions than foreign firms such as, higher salaries. By doing so, these firms can benefit from technical, managerial, etc. assistance which can help them to correctly decode and implement foreign knowledge – it is argued that when leaving MNCs these employees will take with them some or all of the firm specific knowledge (Blomström and Kokko, 2002).

We use price markup or the so-called Lerner index to assess competition-related spillovers (Baye, 2006), proxied by the difference between the firm's sales and its costs over its total sales (Narula and Marin, 2003 and Chung, 2001). When markup is high, a value near 1, competition is low. When markup is low, a value near 0, competition is high. Since competition-related spillovers are associated with the increase in the level of competition, resulting from the entry and the presence of foreign firms, we use the change in markup to measure the change in the level of competition. A negative estimated coefficient of the change in markup implies that decreased markup (increased competition) increases domestic productivity growth.

The existing technological capacity of domestic firm is measured by its existing technology gap, GAP, compared to its foreign counterparts.[7] GAP is equal to one – the technological frontier of the industry – if local firms operating at the same level of labour productivity as the average of their foreign counterparts. Values that are smaller than or equal to one are interpreted as signs of small productivity gaps or high existing technology capacity. Values which are higher than one but near the technological frontier of the industry are interpreted as signs of mid productivity gaps or mid existing technological capacities. Whereas, those which are far behind the technological frontier characterize high productivity gaps or low technology capacities. To test our hypothesis 2, we proceed to make various tests using equation (6) separately for local firms with high, mid, and small productivity gaps.

In addition, we control for the level of investment in new equipment and training for local firms when assessing spillovers in the region and outside. To do so, we divide our full sample of firms into two sub-samples characterized by small and high $INVEST$ and proceed to make various tests using equation (6) separately for both categories of domestic firms.

We test for the equality of coefficients across sub-samples using Chow-tests. All results are robust and refer to OLS estimations of equation (6). All standard errors are corrected for heteroskedasticity. Problem of multicollinearity between interacted variables (HC and FP) is eliminated by centering them (i.e. subtracting the full sample means). More meaningful interpretations of those estimates are then granted (Aiken and West, 1991). Simultaneity problem is reduced by the fact that all production variables are measured in differences from their logarithmic levels (Dimelis, 2005).

5. The evidence

Column 1 of table 2 reports regression results for the full sample of services/construction. The estimated coefficients of $FP_{j,r}$ and $FP_{j,r} * HC$ are positive and significant while $FP_{j,R-r}$ and $FP_{j,R-r} * HC$ are insignificant and even significantly negative. This result demonstrates that domestic firms gain from the presence of foreign firms in their region, but lose out if the firms are located in different regions. The benefit within the region seems to occur from demonstration and worker mobility mechanisms. The estimated coefficient of $\Delta Comp$ is positive and significant, indicating that the full sample data has not demonstrated that the increase in competition contributes to productivity growth of local firms. These findings confirms hypothesis 1 in which the distinction of regional spillovers according to the mechanism by which they are transmitted provides different effects in the services/construction industry.

The estimated coefficients of HC and ΔLnL, ΔLnK, and Si ze are positive and significant in columns 1, showing that the change in the level of human capital, employment, physical capital, and size of local firms significantly increase the productivity of domestic firms in the services/construction industry.

Tables 2 approximately here

Columns 2-4 of table 2 reports spillover results in the region and outside according to the diverse existing technological capacities of domestic (measured by the variable GAP). We find

that the size and the extent of regional spillovers according to the mechanism by which they occur depend on the level of domestic technological capacity, demonstrating the strong relationship between the mechanisms by which domestic firms benefit from spillovers and their capability of understanding and potentially decoding foreign knowledge. This finding confirms our hypothesis 2, in which different interactions between spillover mechanisms and existing domestic technological capacities provide different regional spillovers in the services/construction.

The estimated coefficient of $FP_{j,r}$ remains positive and significant for mid and low technology firms, indicating that both kinds of firms benefit from regional demonstration-related spillovers. In addition, it appears that domestic firms with mid technological capacities experience greater effects. This finding for the services/construction industry is consistent with that for manufacturing in Ben Hamida (2013). High technology firms in the services/construction industry do not need to absorb foreign knowledge to augment their productivity. FP outside the region "$FP_{j,R-r}$" is not significant for all the sub-samples indicating that domestic firms do not benefit from foreign presence outside their regions.

The estimated coefficients of $FP_{j,r} * HC$ are significantly positive for the high gap firms, indicating that the combined effect of these variables contribute to augmenting the productivity of low technology firms. The size of such interaction effect is larger than that of $FP_{j,r}$, suggesting that the influence of regional FDI on the productivity development of these firms is broadly co-determined by the level of their human capital – this could be evidence for worker mobility-related spillovers. Similarly to Ben Hamida (2013) for manufacturing, direct contact in the same region between low technology firms and foreign affiliates in the services/construction industry seems to be not sufficient for these kinds of domestic firms to successfully absorb and implement foreign knowledge. In addition, these firms do not seem to benefit from foreign firms located outside their region, since $FP_{j,R-r}$ is not significantly positive.

In addition, mid technology services/construction firms succeed in reaping spillover benefits from the interaction between $FP_{j,R-r}$ and HC; this implies that these firms need to upgrade their human capital level to benefit from foreign presence outside the region– this kind of interaction does not seem to have any significantly positive effects for other groups of firms. Surprisingly, small gap services/construction firms appear to benefit from the combined effects

of $FP_{j,r}$ and HC. These findings do not seem to corroborate those for manufacturing.

Regarding $\Delta Comp$, its estimated coefficient becomes negative and significant for small gap firms, while remaining positive for large gap firms and insignificant for mid technology firms. This indicates that only high technology firms appear to benefit from competition-related spillovers. This finding is consistent with the result for manufacturing in Ben Hamida (2013).

In columns 5 and 6 in table 2 we report the results of spillover effects in and outside the region for the sub-samples characterized by the values of the variable $INVEST$. We find that only domestic firms which have invested highly in absorptive capacity in terms of learning and investment seem to benefit from spillovers. Such benefits occur at regional level and result from technology transfer – according to Ben Hamida (2013), manufacturing firms seem also to benefit from outside the region since $FP_{j,R-r}$ is significantly positive; however, this benefit is, by far, smaller than that of $FP_{j,r}$. $\Delta Comp$ is negative but insignificant, demonstrating that the increase in competition does not appear to have any positive spillover effects on the productivity increase of both sub-samples.

The Chow tests soundly support our divisions (with respect to GAP and $INVEST$) of the services/construction sample.

6. Conclusions

This paper studies regional spillover effects from services/construction firms in Switzerland, whereas most existing studies analyze the manufacturing industry. It particularly examines the value of inward FDI in Swiss services/construction where foreign MNCs are expanding. It highlights the role of spillover mechanisms in determining regional benefit and controls for the existing technological capacity of domestic firms and their investment efforts in training and learning. It argues that possible interaction effects between spillover mechanisms and the technological capacity of domestic firms impact regional spillovers in the services/construction industry.

Our findings show that it is important to take into account diverse spillover mechanisms and their relationship with the level of technological capacity of the domestic firms when assessing regional inward FDI spillovers. Actually, similarly to manufacturing firms in Ben Hamida

(2013), competition-related spillovers seem to be totally absorbed by local firms with high technological capacities. Worker-mobility-related spillovers are, by a great extent, absorbed by low technology firms, while demonstration-related regional spillovers in the services/construction industry are absorbed by both mid and low technology firms with lager effects, found in mid technology firms. Unlike Ben Hamida (2013), there are also positive and significant interaction effects for the sub-sample of firms with small GAP, implying the importance of human capital in these kinds of firms to reap the benefit from foreign presence in their region.

Regarding the role of firms' investment in training and learning, our finding confirms that of Ben Hamida 2013), in which only firms with relatively high $INVEST$ level benefit from regional spillovers from demonstration and worker mobility effects.

Regarding policy prescriptions which follow our findings, we suggest actions that encourage foreign MNCs to establish affiliates near local counterparts. In addition, the Swiss government, particularly at the regional and cantonal levels, has to consider that the technological behavior of domestic firms plays a crucial role in determining whether they benefit from FDI regional spillovers. Firms do not benefit from regional spillovers using the same mechanism and that the level of their existing technological capacity guides the way they benefit from these effects. Furthermore, regional spillovers require sufficient level of human capital, especially for low technology firms, to be capable of decoding and implementing the best foreign knowledge in their existing technological process. Thus, actions to support learning and investment in these kinds of domestic firms and upgrade the level of their human capital are, in our view, necessary ingredients in a policy package to maximize regional FDI spillovers.

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Notes

[1]Furthermore, scholars analyzing spillovers at national level, measured by the share of foreign presence, reported controversial results. For example, Haskel et al. (2007), Karpaty and Lundberg (2004), and Buckley et al. (2007) found positive evidence for the existence of spillover benefits from FDI for the UK, Sweden, and China, respectively. While, Castellani and Zanfei (2007), and Tian (2007) reported, however, negative and significant spillovers for Italy, and China, respectively.

[2]Questionnaires can be downloaded from www.kof.ethz.ch (Industrieökonomik).

[3]Lemanic region includes the cantons of Vaud, Valais, and Geneva. Mittelland space includes the cantons of Bern, Fribourg, Jura, Neuchâtel, Solothurn. North West Switzerland includes the cantons of Aargau, Basel-Stadt, and Basel-Landshaft. Western Switzerland includes the cantons of Appenzell Ausserrhoden, Appenzell Innerrhoden, Glarus, Graubünden, Schaffhausen, St-Gallen, and Thurgau. Central Switzerland includes the cantons of Lucerne, Nidwalden, Obwalden, Schwyz, Uri, and Zug.

[4]The weights are used to correct for the selection bias resulting from "unit" non-response and for the deviations of the sample structure from that of the underlying population.

[5]The regression analysis makes use of a sample of only 226 services/construction firms because of missing data for some variables when matching the two data sets of 2002 and 2005 surveys.

[6]This study makes use of 19 services/construction industry dummies.

[7]Please use table 1 for GAP definition.

Table 2: Estimation results for services/construction: Spillovers from FDI and existing level of the technology gap between foreign and domestic firms

	1	2	3	4	5	6
Variables	Full	Small GAP	Mid GAP	Large GAP	High $INVEST$	Small $INVEST$
ΔLnK	0.01***	0.53***	0.36***	0.01***	0.36***	0.47***
	(0.004)	(0.05)	(0.05)	(0.002)	(0.05)	(0.1)
ΔLnL	0.69***	0.35***	0.64***	0.72***	0.54***	0.29**
	(0.03)	(0.05)	(0.05)	(0.05)	(0.1)	(0.1)
HC	0.38***	0.38***	0.41***	0.42***	0.29***	0.009
	(0.03)	(0.1)	(0.09)	(0.05)	(0.07)	(0.09)
$FP_{j,r}$	0.001***	0.0009	0.006***	0.002**	0.003***	0.002
	(0.0003)	(0.001)	(0.001)	(0.0003)	(0.001)	(0.002)
$FP_{j,R-r}$	-0.0005***	0.0002	0.0002	-0.0005	-0.0007	0.0003
	(0.0001)	(0.0004)	(0.0006)	(0.0002)	(0.0005)	(0.0004)
$FP_{j,r}*HC$	0.004***	0.017*	0.004	0.0035**	0.006*	-0.003
	(0.001)	(0.009)	(0.005)	(0.001)	(0.003)	(0.004)
$FP_{j,R-r}*HC$	-0.001***	-0.002	0.004***	-0.0033***	0.001	0.0006
	(0.0004)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.001)
$\Delta Comp$	1.06***	-0.4***	-0.46	0.86***	-0.24	-0.29
	(0.08)	(0.1)	(0.2)	(0.1)	(0.2)	(0.4)
$Size$	0.02***	0.001	0.038**	0.008	0.02	-0.02
	(0.004)	(0.02)	(0.01)	(0.005)	(0.01)	(0.03)
$\bar{R}^2$	0.59	0.96	0.96	0.45	0.72	0.88
$F-Chow$			8.41			6.6
N	226	28	64	134	52	34

Note: All estimations include industry dummies. All standard errors, in parentheses, are corrected for heteroskedasticiy.
Variables (HC and FP) used for interactions are centered by subtracting the full sample means, so that (1) multicollinearity between the variables and their product is reduced, (2) better estimates of (HC and FP) are ensured, and (3) more meaningful interpretations of those estimates are granted (Aiken and West, 1991).
*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.