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## Knowledge spill-overs from F

Foreign direct investments (FDI) attract warm attention from governments in developed and developing countries alike. Prime reasons for this interest are the benefits FDI allegedly have for host economies. Apart from direct effects on employment and income, governments expect FDI to generate important spill-over effects, knowledge spill-overs being one of them. The academic literature on knowledge spill-overs from FDI seems to suggest that these spill-overs will be higher for FDI seeking market access than for FDI that is aimed at exploiting the host country's resources. In this article we argue that this is not certain when one also takes into account the absorptive capacity of the host economy and the fact that in view of potential losses due to spill-overs firms that engage in FDI decide to lower the knowledge content of investments abroad.

### Types of FDI and knowledge spill-overs

From an economic perspective spill-overs from FDI are a valid reason for government intervention. When spill-overs occur, the social benefits of FDI will be larger than the private benefits, leading to suboptimal levels of investment. Knowledge spill-overs from FDI form a classic example of market failure, thus legitimizing government intervention. Accordingly, the academic literature has devoted ample attention to knowledge spill-overs, finding it hard however to distinguish knowledge spill-overs from other sources of benefits from FDI (see

Smeets, 2008, for an excellent overview of the literature).

The basic case for government intervention is the same for developed and developing countries. But the extent to which knowledge spill-overs may occur in each type of country will differ. The reason is that developed countries attract a different kind of FDI than developing countries. FDI in developed countries is mainly meant to seek market access, aiming to serve local markets through local sales rather than through exports. In developing countries FDI typically aims to make use of cheap resources those countries offer, in order to reach efficiencies in the production chain. While the latter is referred to as vertical FDI, the former is known as horizontal FDI. Both types of FDI have in common that the investing firms generally originate from developed countries, though recently the share of developing countries in outward FDI has increased (e.g. UNCTAD, 2008) while also tapping into the local knowledge bases of developed countries has been mentioned as a reason to engage in vertical FDI (Smeets, 2009).

The argument that spill-overs from horizontal FDI are different from vertical FDI has been expressed in Driffield and Love (2007), who provide a first conceptual and empirical analysis on the link between productivity effects and the motivation of FDI. Also Beugelsdijk et al. (2008) study spill-overs from horizontal FDI and vertical FDI.

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In both studies, technological spill-overs from vertical FDI are expected to be smaller than technological spill-overs from horizontal FDI.

To understand why this could be the case, note that if a firm invests in a foreign country to gain market access, the competitive advantage it has over local firms should be sufficiently high to compensate its relative disadvantage regarding knowledge of local markets, consumer preferences and business practices – the well-known ‘burden of foreignness’. Accordingly, the firm engaging in horizontal FDI needs to transfer part of its knowledge capital to its subsidiary in the host country. This knowledge capital gives the firm’s subsidiary a competitive advantage, but to the extent that it involves knowledge that local firms do not have, it also increases the potential for knowledge spill-overs. The case of vertical FDI is somewhat different. Seeking efficiency gains, FDI only concerns transferring those parts of the firm’s value added chain abroad that will lead to efficiency gains. Less knowledge will be transferred, implying a lower potential for knowledge spill-overs than from horizontal FDI (Beugelsdijk et al., 2008). Moreover, in case of FDI flowing from developed to developing countries, the knowledge transferred will also be less technologically advanced, decreasing the potential for knowledge spill-overs even more (Driffield and Love, 2007).

This would be bad news for developing countries, since they mostly rely on

incoming vertical FDI. By contrast, it would make a stronger case for government intervention in developed countries, relying as they do on horizontal FDI mainly. Before making the final call, however, three issues require more attention. These are the absorptive capacity of local firms, the effectivity of spill-over channels, and strategic behaviour of FDI firms in the presence of potential knowledge spill-overs.

To make our point, we note that technological spill-overs only take place if local firms are able to absorb the technologies of the incoming FDI. Countries lagging behind in technological knowledge will be less able to absorb the more advanced technology of horizontal FDI (e.g. Cohen and Levinthal, 1990). From that perspective, the lower technological advancement of vertical FDI is actually an advantage. If local firms have low absorptive capacity, vertical FDI is bound to generate larger technological spill-overs than horizontal FDI. On the other hand, it is also true that the potential for technological spill-overs is higher in the case of horizontal FDI. There is simply more to be learned when the technological distance between FDI and local firms is higher (e.g. Findlay, 1978). Taking into account these effects of backwardness and absorptive capacity may therefore topple the clear ranking of horizontal over vertical FDI.

But there’s more. Vertical and horizontal FDI also differ regarding the

effectiveness of spill-over channels. These are the channels that have been identified in the literature as being of importance for generating knowledge spill-overs. Referring to Castellani and Zanfei (2006) for details, the main spill-over channels are imitation and demonstration effects, labour mobility effects, and linkage effects.<sup>1</sup> Vertical FDI will create less technological spill-overs through imitation and demonstration and through linkages. The reason is that technologies only spill over through these channels if the FDI is embedded in the country. By its nature, vertical FDI has a limited focus, for instance looking for cheap resources, and is therefore less likely to establish a local network (Lall 1980; Chen et al., 2004). As a result, horizontal FDI provide more spill-over channels for technologies to spill over than vertical FDI, increasing the likelihood that the potential for spill-overs transforms into actual spill-overs.

A final important aspect to consider is that the behaviour of the firms engaging in FDI is likely to change as a result of spill-overs. It is reasonable to argue that technological spill-overs are costly to FDI firms, encouraging them to take action. Such action may be a reduction of the level of technology to be transferred or an attempt to decrease the effectiveness of spill-over channels. Spill-overs are especially costly for horizontal FDI, as it may erode the firm’s competitive advantage on the product markets they enter. For vertical

FDI this is of less concern, as they compete with local firms on factor markets. As a result, firms engaging in horizontal FDI are likely to make a larger effort to reduce spill-overs than vertical FDI firms. Also the costs of reducing technology level to counter the spill-over hazard will differ between horizontal and vertical FDI. A lower technology level results in a smaller competitive advantage over local firms for horizontal FDI. In case of vertical FDI, lower technology levels imply lower quality of that particular part of production, degrading its competitiveness on world market.

Does horizontal FDI lead to higher knowledge spill-overs?

The above makes clear that a verdict on which type of FDI generates more spill-overs should be the outcome of a complex reasoning that involves differences in level of technology transferred, the absorptive capacity of local firms, the number of spill-over channels in operation and differences in strategic behaviour of FDI firms in the wake of the costs and benefits of reducing knowledge spill-overs. Moreover, several other aspects will play a role as well, such as intellectual property right protection in the host country and the extent of competition on product and factor markets. This implies that reasoning will not do to make the final call and that we will have to formalize matters to get a clearer view. We will not do this here but instead report on the findings of a

formal analysis we conducted in a NiCE Working Paper on this matter. The more technically inclined reader is therefore kindly referred to Roording and de Vaal (2010).

Our formal analysis confirms that it is by no means clear that horizontal FDI leads to higher spill-over than vertical FDI. For instance, while horizontal FDI implies a higher level of technology transferred abroad than vertical FDI, taking into account absorptive capacity and the potential for spill-overs implies that vertical FDI may still lead to higher spill-overs than horizontal FDI. This will be the case when local technology levels are below a certain threshold level. Above this threshold level, horizontal FDI will lead to higher spill-overs. This reflects the trade off between backwardness and absorptive capacity in relation to the difference in technological advancement of knowledge incorporated in both types of FDI. For both types of FDI the relationship between knowledge spill-overs and local technology levels is hump-shaped, but the hump for horizontal FDI lies to the right of that for vertical FDI.

If one also takes into account the reactions of FDI firms, it appears that it is optimal for horizontal FDI firms to reduce their technology levels to a much larger extent than vertical FDI firms would. This implies that even though the potential of knowledge to be transferred may be higher for horizon-

tal FDI, the actual levels transferred can actually be lower. Moreover, even though the initial effectiveness of spill-over channels is modelled to be higher for horizontal FDI than for vertical FDI, the optimal reduction of the effectiveness of spill-over channels is also higher for horizontal FDI than for vertical FDI. This implies that the maximum level of spill-overs to be reached from horizontal FDI – the height of the hump so to speak – will not be that much higher that is typically suggested in the literature. Attracting vertical FDI with lower levels of technology may generate as much spill-overs as attracting horizontal FDI with high levels of technology.

In our results the level of local technology is therefore of paramount importance. It determines the extent to which host countries can benefit from knowledge spill-overs from FDI as well as the extent by which FDI firms respond to the perceived threat of spill-overs. Moreover, it determines optimal policy responses for governments. Increasing local technology levels do not necessarily lead to higher knowledge spill-overs. Given the hump-shaped relation between knowledge spill-overs and local technology levels, it clearly depends on which side of the hump one is to what extent a local technology boost will increase spill-overs.

What's more, to benefit from spill-overs from FDI, it is not necessary

to increase technology levels, as the amount of spill-overs depends on the type of FDI. In fact, it can even be better not to increase local technology levels. For both types of FDI it holds that a relatively low technology level is advantageous since FDI firms will then put in less effort to reduce these spill-overs. This effect is strongest if intellectual property rights protection is weak and when the costs of spill-overs are high for the investing firms. In that case, the firm sees a higher technology level as a threat, and will therefore reduce the effectiveness of spill-over channels or its technology level. The result that emerges is that spill-over levels become lower at intermediate than at lower technology levels.

#### Conclusion

We have analyzed the difference in knowledge spill-over between horizontal and vertical FDI, finding that it is too easy to conclude that the allegedly higher knowledge content of horizontal FDI also implies higher knowledge spill-overs. One implication of the picture that emerges is that the technology level of the host country determines for a large part which type of FDI leads to the highest spill-overs. Countries with a low technology level are not able to absorb the advanced technologies of horizontal FDI, but are still able to benefit from technological spill-overs from vertical FDI. This is good news for developing countries, since vertical FDI is often targeted to exploit the cheap resources in these countries.

Countries with high levels of technology will benefit less from vertical FDI, but are instead better able to absorb spill-overs from horizontal FDI. This is good news for developed countries, since they mainly attract horizontal FDI. ☐

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#### Notes

- <sup>1</sup> If FDI would imply shared ownership as in a joint-venture, there is also a direct exposure effect for the local participating firm. We will ignore this possibility here and focus on fully owned subsidiaries.

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