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FDI as an *Export-Platform*: A Gravity Model for the Danish Agri-Food Industry

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Abstract

We investigate factors affecting Foreign Direct Investment (FDI) outflow from Danish agri-food firms to the rest of the world. We develop a conceptual model and subsequently use a gravity model based on data from 127 countries receiving Danish FDI in agri-food in 2004-2008. We find higher Danish FDI towards countries with large exports of agri-food, thereby supporting the hypothesis that FDI is used as an *export-platform*. FDI is coupled with high exports from Denmark, probably of raw or semi-processed food products for further processing and exports. We also find that FDI is higher in countries with stable political regimes.

Keywords: FDI, export-platform, Danish Agri-Food, gravity model

JEL: F14, F23, Q17, Q13

1. Introduction

Foreign Direct Investment (FDI) is one of the components that may contribute to the globalization process given that it is growing more rapidly than international trade. As stressed by McCorriston and Sheldon (1998) the increased focus on FDI is “*due largely to the increased importance of direct investment flows in the world economy that occurred over the 1980s, when the rate of growth of FDI flows far out- stripped the growth of trade and income.*” (ibid. p. 1066) Stocks of FDI, aided by the removal of many national barriers to capital movements and measures to enhance integration within regional markets have expanded rapidly in recent years.

As was seen in the world economy, the Danish FDI outflow also started to grow in the late 1980s at rates higher than international trade (Patterson, 2004). The changes that are occurring in Denmark are the same as in the general global case (Danmarks Nationalbank, 2004). When comparing total inward and outward FDI of Denmark to the world, it is observed that FDI outward is higher than FDI inward.

The FDI outward from Denmark is lower compared to other countries of comparable size, both on an aggregate level and in relation to Gross Domestic Product (GDP) (OECD, 1995). As Patterson et al. (2004) states, the growth of FDI has decreased during the new millennium. UNCTAD (2011) report that global FDI inflows have fallen by 21% in 2008 and they expect that FDI will decrease more in the coming years. Different movements can be observed in Denmark since the size of inward and outward flows of FDI in any given year is larger than the year before.

The Danish economy is strong from an international trade point of view in the sense that imports and exports make up a large proportion of GDP. However, the Danish economy is mostly trading with traditional trading partners i.e. Germany, Sweden, US and the UK (Gjerding, 2005).

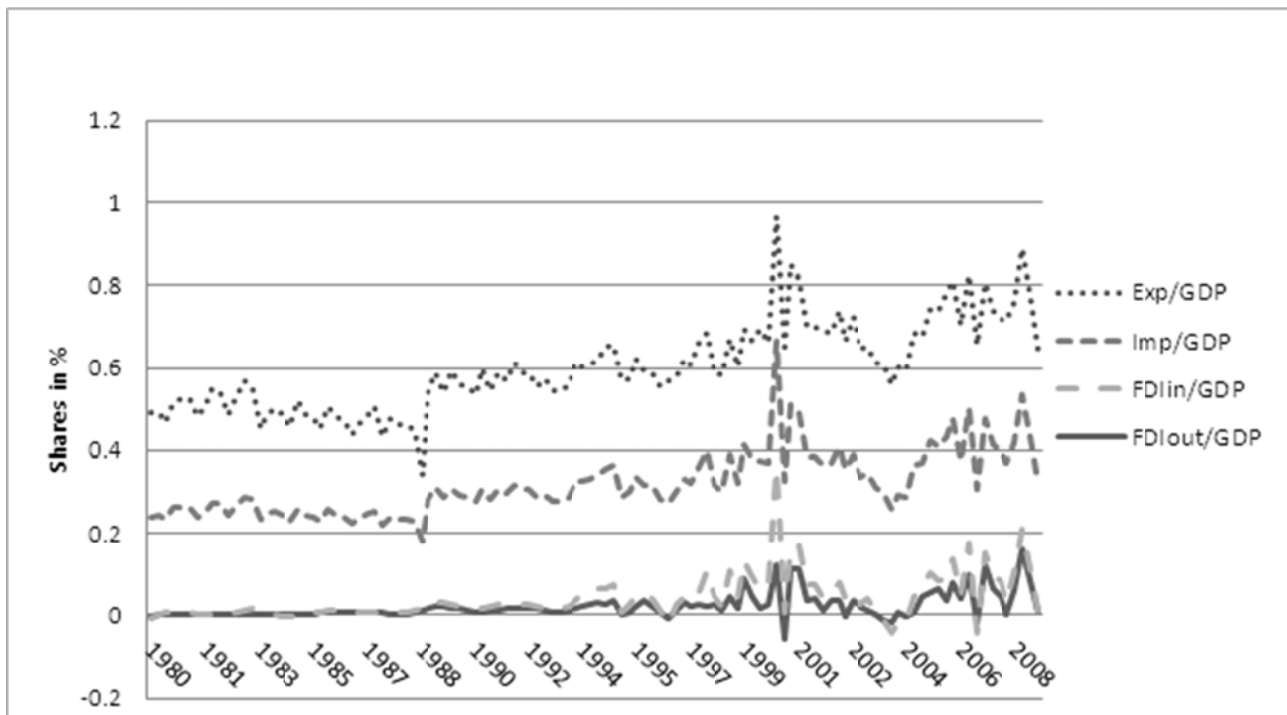
Generally the relationships between FDI and trade are aggregated to reflect investment and subsequent production and the trading activities that are expected to take place in an inflow country. However, FDI can be a useful measure of agri-food globalization, i.e. by focusing on the food industry FDI.

We have chosen to focus on Denmark as a case study since no one has looked at food FDI in Denmark even though Denmark has plenty of agricultural activity. Additionally, most of the literature on agri-food FDI focuses on USA (Handy et al., 1994, Overend et al., 1997; Gopinath et al., 1999; Morgan and Wakelin, 2001; McCorrison and Sheldon, 1998; Walkenhorst, 2001; Gopinath and Echeverria, 2004). Very little exists on agri-food FDI in the EU countries (see for instance Jansik, 2004; Giulietti et al., 2004; Herger et al., 2008). It would be of high interest to also investigate a developed EU country such as Denmark. Additionally we find some evidence that FDI is used as platform for exports to third countries. In this paper we develop a conceptual model and use an extended gravity model to investigate the determinants of Danish agri-food FDI.

The objective of this paper is to identify the main key drivers of Danish food FDI outward that goes to 127 foreign countries using a gravity model approach. Firstly, we answer the common question when it comes to the bilateral relationship between FDI and trade (i.e. whether we observe a substitution or complementary effect in the case of Denmark). We analyse whether the size factors such as GDP per capita and population are important factors affecting whether Danish agri-food companies invest overseas. We also investigate the outsourcing phenomenon which may affect the decision of Danish companies to expand abroad. To our knowledge this is the first paper to have investigated this issue.

1.1 Food FDI in Denmark

Figure 1 shows that total FDI outward, FDI inward, exports and imports generally increase through the years. The most noticeable periods are: 1988 where there is a decrease in exports and imports but the FDI outwards and FDI inwards constantly increase, while in 2004 all the variables decrease followed by an increase in the subsequent years.



Source: Statistics Denmark and our calculations

Figure 1. Share of total FDI outward, FDI inward, export and imports as % of GDP

We continue observing what is happening within the food industry regarding FDI and trade indicators such as exports and imports. Some of the patterns observed in overall Danish FDI and trade variables appear to be the same with regard to the food industry. Data on FDI show that direct investment abroad by the Danish agri-food companies have steadily grown over time. The inward agri-food FDI coming into Denmark seems to also be growing, but at a slower pace than FDI outward.

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As can be seen in Table 1 the agri-food FDI outward is greater than agri-food FDI inward. This indicates a tendency of Danish agri-food companies to invest more in the rest of the world.

Table 1. Danish food FDI outward versus food FDI inward and trade in DKK (billion)

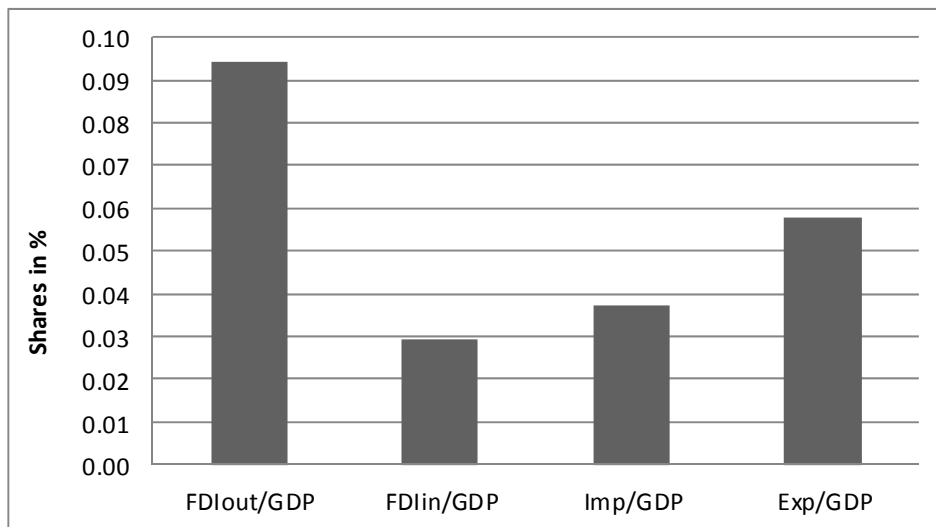
	2004	2005	2006	2007	2008
FDI outward	65.3	71.3	75.2	70.2	164.4
FDI inward	22.4	27.2	25.3	26.3	51.3
Exports	83.7	87.6	94.5	95.6	100.4
Imports	46.6	49.9	55.7	59.3	64.7

Source: Statistics Denmark, DKK: Danish Kroner

Table 1 shows that food FDI outward is much larger than food FDI inward and imports in all of the periods shown. All of the factors have also been generally growing from 2004 to 2007 with food FDI outward and inward more than doubling from 2007 to 2008. Food exports are larger compared to all the other factors but looking at the rate of growth from year to year, food FDI outward shows a higher growth rate compared to the other factors.

An interesting point to notice is that in 2008 food FDI outward also overtook exports. From Table 1 we can see the rate of growth is lower compared to the food FDI outward. One of the reasons for this big increase in FDI during 2008 is the big purchase by Carlsberg Breweries A/S of the British brewery Scottish and Newcastle. This is considered as one of the biggest Danish investments abroad. This investment has increased the stock FDI outward by 6% (Danmarks Nationalbank, 2008).

If measured in terms of GDP we can see from Figure 2 that food FDI outward is one of the main components (9.4%) of GDP compared with the food FDI inward (2.4%), food exports (5.7%) and food imports (3.7%).

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Source: Statistics Denmark and our calculations

Figure 2. Share of Food FDI outward, food FDI inward, food exports and food imports in terms of GDP (2008)

Within the food industry the largest recipients of Danish FDI in 2008 are Sweden (83 billion DKK), France (16.7 billion DKK), Finland (9 billion DKK), Germany (8.5 billion DKK), USA (7 billion DKK) and the UK (5 billion DKK). The main international traders of Danish firms are mostly the neighbouring economies such as the UK, Germany and Sweden. What we observe is that the Danish agri-food companies invest mostly with countries with which they also trade.

To summarise, it seems that food FDI outward from Denmark to the rest of the world is growing faster than FDI inward and faster than imports and exports. Therefore it may be very interesting and also important to analyse the main factors that drive these companies abroad.

2. Theory, Previous Literature and Hypotheses

Until recently, the most dominant approach for empirical FDI research has been the ownership, location and internalisation (OLI) framework, and though this literature has provided a stable foundation to explain why individual firms became international, the OLI paradigm has been lacking in explaining some of the key trends in FDI over the past thirty years or so (Brenton et al., 1999). A feature of some of the later theories using the OLI approach is that they demonstrate the role of countries' characteristics such as GDP (i.e. economic size) in explaining the pattern of FDI and trade flows (Brenton et al., 1999).

2.1 Gravity model

The gravity model has mostly been used to estimate trade flows (Anderson, 1979; Matyas, 1997; Matyas 1998; Feenstra et al., 2001), and to a smaller degree FDI flow/stock movements (Benassy Quereet et al., 2005; Mitze et al., 2008). However, as Brenton et al. (1999) stresses, the gravity model can also be very useful in modelling the pattern of FDI, given that the evolution of FDI over the past thirty years or so shares some common features with the evolution of trade, having become more intensive between countries with relatively high income levels and having grown faster than income.

The gravity model, relating bilateral trade flows to GDP, distance and other factors that affect trade, is one of the most successful and widely used in economics (Feenstra et al., 2001; Anderson and van Wincoop, 2003; Disdier and Head, 2008). The core variables of the gravity model (GDP and distance) are well explained and justified by the trade theories based on imperfect competition and the Heckscher-Ohlin assumption¹ (Deardorff 1998; Ghosh and Yamarik, 2004).

¹Following Helpman (1981), the Heckscher-Ohlin assumption says that under the standard assumption of no factor intensity reversal and identical homothetic preferences, the relative

The model is referred to as “gravity model” for its analogy with Newton’s law of universal gravitation where the Newtonian idea is seen from the perspective of trade between two countries, assuming that the trade between any two countries is positively affected by their GDP and negatively affected by their distance (representing transport costs). The other variables included in the standard gravity model that may affect the volume of trade flow are common borders, common language and whether the countries are members of the same union (such as the EU, NAFTA, etc.).

In its original form, the gravity model is proposed by Tinbergen (1964) and Linnemann (1966) to explain international bilateral trade, and it specifies that bilateral trade flows are defined by the economic sizes and the distance between two countries. However, both of these studies were criticised for lacking a theoretical foundation, which was eventually developed by Anderson (1979) who provided the theoretical explanation for the gravity equation that is applied to commodities. The gravity equation specified by Anderson (1979) is in the form of a Cobb Douglas function as follows:

$$M_{ijk} = \prod_i \prod_j \chi_{ij}^{\alpha_{ij}} y_{ji}^{\beta_{ji}} U_{ijk} \quad (1)$$

where M_{ijk} is described by Anderson (1979) as the dollar flow of good factor k from country i to country j , χ_{ij} are explanatory variables related to the exporting country i , $y_{ji}^{\beta_{ji}}$ are explanatory variables for the importing country j , α_{ijk} are parameters to be estimated and U_{ijk} is a log normally distributed error term with $E(\ln U_{ijk})=0$. Anderson (1979) derives the gravity equation stating Cobb Douglas preferences.

In the original gravity models, the explanatory variables χ_{ij} include the incomes and distance between countries i , and j . The other common variables that appear in the gravity model are common border effects, common language and common union (Frankel

commodity prices, relative factor rewards and factor endowments provide the same valid prediction of trade patterns (Helpman, 1981).

et al., 1998; Anderson and van Wincoop, 2003; Frankel and Rose, 2002; Feenstra, 2002; Melitz, 2007). The gravity model has been further extended in other studies by adding factors like availability of infrastructure as well as landlocked or island effects, economic development, and historical ties (Frankel and Rose, 2002). Other factors that have been investigated include currency or exchange rate risk (Gopinath et al., 1998; Rose and van Wincoop, 2001; Cho, Sheldon and McCorrison, 2002), trade or economic policy (Wilson et al., 2003; Baier and Berstrand, 2009), and relative factor endowment (Egger, 2001; Egger, 2004; Bergstrand, 1989; Deardorff, 1998). Additionally, the model has also been extended by including the variables of the institutional distance (Anderson and Marcouiller, 2002; Gopinath and Echeverria, 2004; De Groot et al., 2004) and the FDI stock variable (Di Mauro, 2000; Egger, 2001; Wang, Wei and Liu, 2010).

As emphasized by Ghosh and Yamarik (2004) and Wang Wei and Liu (2010) there is no consensus in the literature about the correct variables to include in the gravity model. In our paper we extend the original model by Anderson (1979) and Anderson and Wincoop (2003), by adding common border effects, governance variables (political stability, voice and accountability) and a new variable, *export-platform* which includes the fact that sometimes country i uses an FDI in a third country h to export to country j . This is discussed further in the next section.

2.2 FDI as an *export-platform*

When a country decides to invest abroad, is it aiming at the local demand or rather at customers neighbouring the host country, or both? This question is an unresolved issue in recent trade and FDI literature² and needs further investigation. The phenomenon where a multinational firm advances FDI into a host country to serve as a production platform for exports to a group of other importing countries is often referred to in the

²Ekhholm et al. (2003) treat this issue in great detail; for a review see Bloningen (2005)

literature as *export-platform* (Ekholm et al., 2003). A similar and more complex phenomenon is when a firm exports raw or semi-processed products to be further processed at its foreign affiliate “platform” and be re-exported abroad (Baltagi et al., 2004; Hanson et al., 2001). The evidence on this, however, is mixed. For example, Blonigen et al. (2007) estimate that the neighbouring-country FDI has a negative effect on the US FDI to Europe, while they estimate that neighbouring countries’ GDPs increase FDI. Head and Ries (2004) find that the GDP of neighbouring regions on Japanese FDI into Europe has a significantly positive correlation with FDI. Blonigen (2005) who reviews this literature concludes that choice of sample in space can substantially affect the estimated interdependencies.

In what follows, we derive a conceptual framework, based on a differentiated product model to capture the effect of an *export-platform* of Danish agri-food FDI. We further use data from 127 countries who have received Danish agri-food FDI to examine this effect empirically.

2.3 Conceptual model: Heterogeneity and trade

Modern theory of international trade attempts to integrate into its doctrine, and to explain the observation that firms use different modes of trade to access consumers in foreign countries. These modes include both direct sales (exports) and FDI (Helpman et al., 2004; Antràs, 2003). Often, the literature distinguishes between horizontal and vertical FDI, however, this distinction is not always useful (Hanson et al., 2001; 2005). In this paper we make use of the theory of differentiated firms in international trade, as it is developed by Melitz (2003), and Helpman et al., (2004), also applied recently in Ruan and Gopinath (2008). This general equilibrium model combines a Dixit and Stiglitz (1977) demand, and a simple one factor Ricardian production.

A utility function with constant elasticity of substitution between goods:

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$$\varepsilon = \frac{1}{[1 - \rho]} \quad (2)$$

This gives rise to the demand³:

$$X_i = A_i P^{-\varepsilon} \quad (3)$$

A firm in country i produces the differentiated product X_i with a single input (labour):

$$X_i = \lambda_i L_i \quad (4)$$

Where λ_i is the labour productivity and is drawn by each firm from a distribution $G(\lambda)$.

Entry requires a fixed cost f . These investments are often relation-specific and may give rise to additional transaction costs (TC) (Antrás, 2003). Other sources of transaction costs varying in different degrees between countries, may be related to political instability, possible corruption and even bribery charges, etc. (North, 1992; Vahabi, 2011). It was shown by Helpman et al. (2004) that in equilibrium, a firm will realize profit:

$$\Pi_i = [\tau \lambda_i]^{1-\varepsilon} B_i - F \quad (5)$$

Where⁴:

$$F = f + TC$$

$$B_i = [1 - \rho] A_i \rho^{1-\varepsilon}$$

$\tau = \textit{iceberg}$ transportation costs⁵.

A firm in this system has the following options:

- a. Produce and sell domestically in country i , with profit:

$$\Pi_i^D = \lambda_i^{1-\varepsilon} B_i - [f_D + TC_D] \quad (7)$$

³ This is a well-known result, see Dixit and Stiglitz (1977).

⁴ From the CES utility function follows the factor $A_i = \frac{\beta E_i}{\int_0^{n_i} p_i(v)^{1-\varepsilon} dv}$. Where E_i is the aggregate expenditure in country i , n_i is the number of varieties in country i , $p_i(v)$ is the consumer price of variety $v \in n_i$.

⁵ Transportation costs are of the “*melting iceberg*” type, i.e. are measured in terms of the transported product. In this case a fraction $\frac{\tau_{ij}-1}{\tau_{ij}}$ of a product is lost in transport, or in other words, τ_{ij} units of a product must be shipped in order for 1 unit to arrive at destination.

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b. Produce domestically and export to country j , with additional profit:

$$\Pi_{ij}^X = [\tau_{ij}\lambda_i]^{1-\varepsilon} B_j - [f_x + TC_X] \quad (8)$$

c. Invest into a subsidiary (FDI) in country j and sell to country j , with additional profit:

$$\Pi_j^I = \lambda_i^{1-\varepsilon} B_j - [f_j + TC_j] \quad (9)$$

d. Invest into a subsidiary (FDI) in a third (*export-platform*) country h and export from h to j realising additional profit:

$$\Pi_H^I = [\tau_{hj}\lambda_i]^{1-\varepsilon} B_j - [f_H + TC_H] \quad (10)$$

The four profit lines are illustrated in Figure 3. The horizontal axis depicts $\lambda_i^{1-\varepsilon}$ so that the profits are straight lines with positive slopes. Profits increase with λ : the higher the productivity of labour λ , the higher the profits. The slope of each line depends on the size of the demand B and on transportation costs τ .

Take option (a) first, where a firm produces and sells domestically in country i with profits Π_i^D , with slope B_i . The entry investment is at level f_D and relevant transaction costs TC_D , the firms that enter and have positive profits ($\Pi_i^D > 0$) are those with productivity greater than $\lambda_D^{1-\varepsilon}$.

With option (b), where firms from country i export to country j with *iceberg* transportation costs τ_{ij} , firms can achieve additional profit Π_{ij}^X . The additional investment f_x refers to the firm requiring to build a distribution network in country j (Helpman et al., 2004). Relevant transaction costs are TC_X . Assuming that the size of the demand in countries i and j is the same (hence $B_i=B_j$), the Π_{ij}^X has a lower slope than Π_i^D , given that: $0 \leq \tau_{ij}^{1-\varepsilon} \leq 1$, since $0 \leq \varepsilon \leq 1$. The cut-off productivity level is $\lambda_X^{1-\varepsilon}$, implying that exporting firms must be more efficient than those serving domestic markets ($\lambda_X^{1-\varepsilon} > \lambda_D^{1-\varepsilon}$).

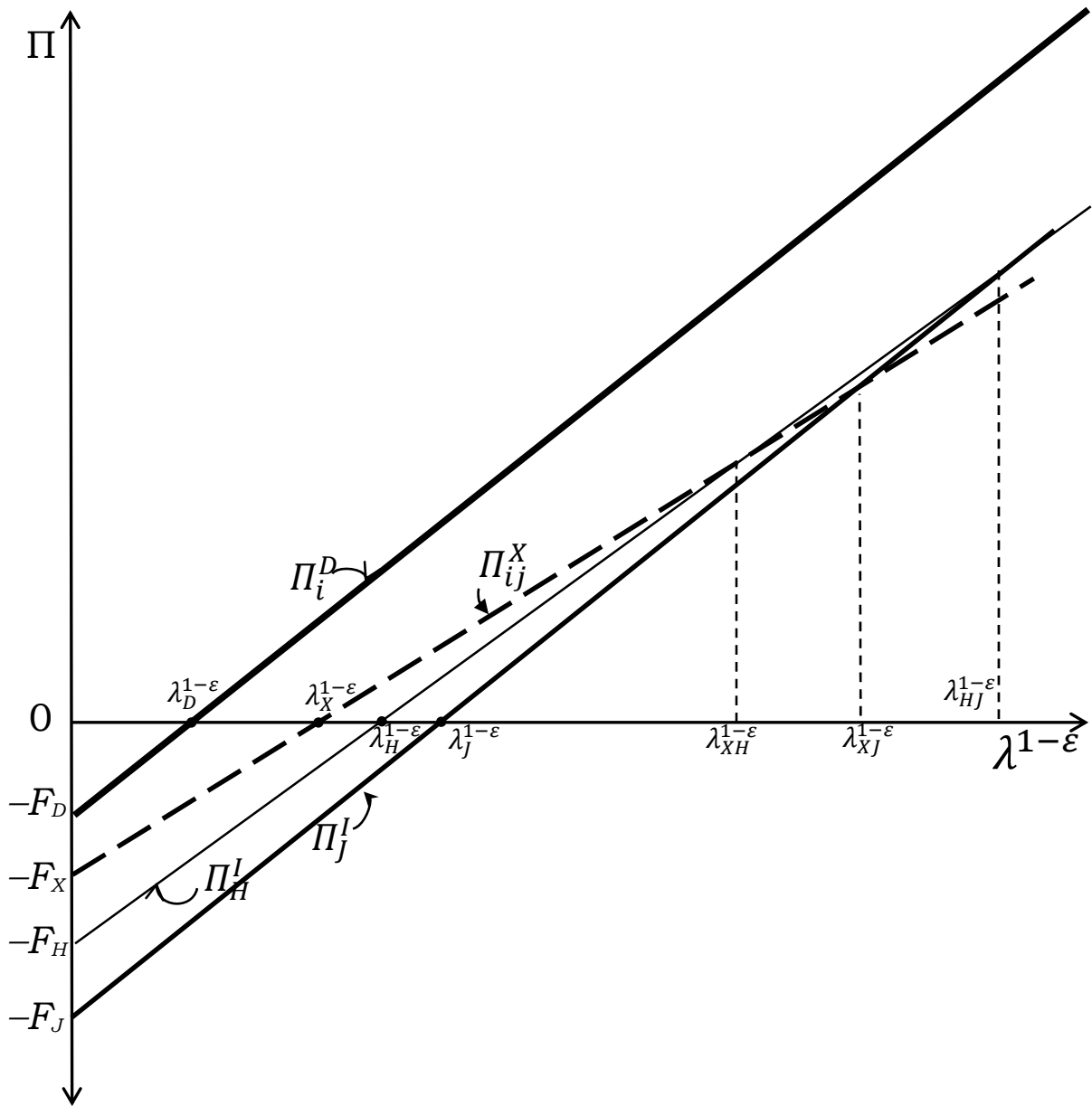


Figure 3. Profit lines for domestic sales, exports, and FDI

Alternatively, as in option (c), a firm may decide to invest in a subsidiary (FDI) to serve the local market in country j . In this case the firm incurs additional investment and entry costs f_j and the resulting profits are depicted by Π_j^I . Assuming similar market size between i and j (hence $B_i=B_j$), and *iceberg* transport costs $\tau_j = 1$ (since sales are domestic), the profit line Π_j^I is parallel to Π_i^D . With similar reasoning as above, the

transaction costs due to specific investments and political costs are TC_j . The firms involved in FDI must be more efficient ($\lambda_j^{1-\varepsilon} > \lambda_X^{1-\varepsilon}$) than the exporters from i to j . Note also that at productivity level $\lambda_{Xj}^{1-\varepsilon}$ the profits between the two activities, exports and FDI, are equal: $\Pi_{ij}^X = \Pi_j^I$, and firms with higher productivity than $\lambda_{Xj}^{1-\varepsilon}$ are more profitable with FDI than with exports: $\Pi_{ij}^X > \Pi_j^I$.

Finally consider option (d). If transaction costs of FDI are too high to invest and serve the market in country j , a firm may serve this market via another subsidiary in perhaps a neighbouring country h . Using country h as an *export-platform* for exports to j and perhaps to other neighbouring countries may be an option, especially if transaction costs in h are significantly lower than those in j , as depicted by total fixed costs $F_H < F_j$ in Figure 3 implying transaction costs $TC_H < TC_j$. Since the *export-platform* country h is closer to j than the home country i , transportation costs are lower: $\tau_{hj} < \tau_{ij}$ and the profit line Π_H^I is steeper than Π_{ij}^X but flatter than Π_j^I (where *iceberg* transport costs $\tau_j = 1$). The more favourable conditions in the *export-platform* country h attract even less efficient firms to sell to j ($\lambda_H^{1-\varepsilon} < \lambda_j^{1-\varepsilon}$), hence increase exports to j . We may also observe that firms with efficiency levels higher than $\lambda_{XH}^{1-\varepsilon}$ (the point where $\Pi_H^I = \Pi_{ij}^X$) make higher profits by exporting to j from their subsidiary in country h than directly from home i : $\Pi_H^I > \Pi_{ij}^X$. Note also that as long as labour productivity is within the interval $\{\lambda_H^{1-\varepsilon} \dots \lambda_{Hj}^{1-\varepsilon}\}$ it is more profitable to invest in the *export-platform* h and sell to j than to invest directly to j , since $\Pi_H^I > \Pi_j^I$. Only very efficient firms ($> \lambda_{Xj}^{1-\varepsilon}$) will find it more profitable to invest directly in j than h .

In summary, this model allows for the investigation of the variables that affect the choice to invest in a foreign country directly or via an *export-platform*. The variables include the usual gravity factors such as production and transportation costs, as well as

transaction costs. Some comparative statics analysis illuminates the effects of these variables on the decision to invest abroad and allows us to draw some relevant hypotheses.

2.4 Comparative statics and Hypotheses

The structure of this model allows some comparative structure results, predictions and formulation of hypotheses. In the spirit of equations (7) – (10) and Figure 3, any variables that shift the intercepts of the profit lines or the slopes will change the choice towards trade or FDI.

In most gravity models we find that demand in the host country attracts more FDI. From equations (7) to (10) it follows that the slope of the profit lines is positive with respect to B , the size of the demand. Hence increases in B will tilt the profit lines upwards. The intercepts of these lines with the horizontal axis will shift to the left, hence less efficient firms will be able to afford FDI and hence even more firms will involve themselves in this activity. We do not have enough data to estimate demand functions for all the host countries of Danish FDI. Instead, we can use commonly used demand shifters, such as relative GDP, and population. However, GDP is also an indicator of labour costs and as such may have negative impact on FDI. Hence GDP by itself is problematic in these kinds of models, but is worthwhile to use as a test. We can then put forward our first hypothesis:

H1: FDI from Denmark will increase as demand shifters, such as GDP and population in the host countries increases.

2.5 Complementarities and off-shoring

There are different views regarding the relationship between exports and foreign investment. Alguacil and Orts (2003) stress that, theoretically, either relationship

(substitute or compliment) may exist between FDI and trade. Within the food industry, Gopinath et al. (1999) confirmed a substitution effect between USA FDI and the exports of the food processing industry of ten developed countries. Marchant et al. (2002) on the other hand, found that food FDI and food exports are complements, demonstrating that FDI increases trade. Furthermore, Overend et al. (1997) show both effects (substitute and complementary), while Malanoski et al. (1997) find no strong support for either a complement or substitute relationship between FDI and exports. They conclude that the trade-FDI relationship differs depending on the level of economic development in the inflow country.

Furthermore, our model may contribute to the discussion of off-shoring, which has become an issue in Danish agri-food (Heiberg, 2007). One would expect that exports of Danish agri-food products, especially in the form of raw or semi-processed food, could be an indication of off-shoring, since exports of for example raw meat, could be used as raw materials to be processed in the *export-platform* country and re-exported abroad, even back to Denmark. Our data is not in this much detail, so we cannot distinguish raw from processed food trade. We can only use exports of all agri-food products as a proxy. As such, we can expect that exports from Denmark to a host country should have a positive sign in the FDI equation:

H2: The FDI from Denmark to a country will increase as exports from Denmark to this country increase.

From our conceptual model it follows that foreign direct investment in an *export-platform* country will depend on factors that shift the intercept F_H , and factors that shift the slope of the Π_H^I . The transaction costs TC_H in the *export-platform* country are a determinant of the intercept. The size of the demand B_J in the other countries is a shifter of the slope of Π_H^I . We do not have enough information to estimate demands for each country, instead,

we can use indicators, such as exports by the *export-platform* country as a very good proxy for the demand of goods from the world. Hence we can formulate the following hypothesis:

H3: The FDI from Denmark to a country are higher, the higher are the exports of this country to the rest of the world.

2.6 Governance matters

The intercepts in Equations (7) to (10) consist of investment and transaction costs (TC). The latter are either related to asset specificities and other agency and property rights problems (for example in the spirit of Antràs, 2003). The transaction costs may also arise from political and other uncertainties (for example as they are described in North, 1992; and reviewed in Vahabi, 2011, among others). Governance matters in trade and FDI, as found in many recent studies. For example, it is found that countries that have better institutions tend to trade more (Dollar, 2003). Similarly, Gopinath and Echeverria (2004) ascertain that governance affect the FDI-trade relationship.

In order to capture the transaction costs of the political system we use governance indicators as they are computed by Kaufmann et al. (1999). These indicators present the notion of governance through six different factors, such as democratic voice and accountability, political instability (violence, crime and terror), government effectiveness, regulatory burden, rule of law and graft. Democratic voice and accountability refers to different indicators relating to the political process such as civil rights and institutions that facilitate citizen control of government actions, such as independence of the media. Political instability measures the likelihood that the government will be destabilised or overthrown by unlawful or violent means, including domestic violence and terrorism. Government effectiveness and regulatory burden relate to the ability of the government to formulate and implement policies. Rule of law and graft, refer to respect, on the part of

both citizens and the government, for the institutions that resolve their conflicts and govern their interactions.

In lieu of our conceptual model, the existence and level of transaction costs may change the relative costs of a firm entering in country i , j or h . For example, a decrease of transaction costs TC_H or TC_j due to political stability in country h or j respectively, will shift the curves Π_H^I and Π_j^I upwards shifting the cut-off points $\lambda_H^{1-\varepsilon}$ and $\lambda_j^{1-\varepsilon}$ to the left. The implication of this is that more firms will find it more profitable to invest in FDI. Hence we can formulate the following hypothesis:

H4: FDI from Denmark will increase with improvement of political stability in the host countries.

3. Methodology

To investigate the relationships between Danish food-FDI outward and trade, we use the gravity model. The model accounts for host country institutional distance (accountability and political instability), production intensity (ratio of host country GDP/Danish GDP) and population size. The trade variables are represented by the food exports and food imports from Denmark to 127 *export-platform* countries as well as the food exports of the 127 *export-platform* countries to the world. Additionally, the model accounts for physical distance and common border factors.

The endogenous variable in our model is the FDI outwards and the exogenous variables are the food imports of the home country (Denmark) from the 127 *export-platform* countries, food exports of the home to the *export-platform* countries and food exports of the *export-platform* countries to the world. The gravity variables are the ratio between *export-platform* countries' GDP and the GDP of Denmark, population, physical distance and common border/language between Denmark and the *export-platform*

countries. The operational gravity model was formulated using the Cobb-Douglas functional form, which is specified as:

$$\ln y_i = \beta_0 + \sum \beta_j \ln x_{ji} + \varepsilon_i \quad (11)$$

Where y_i is the food-FDI outward, $i = 1$ to 127 countries, x_j the 8 explanatory variables in question and ε_i is the error term expected to be normally distributed, $N(0,1)$.

The sampled data for the 127 countries was for the years 2004 to 2008. However, the food-FDI values provided by Statistics Denmark included zero values, which represent food-FDIs with less than 50,000 DKK. In light of this, all variables are averaged for the period 2004 through 2008. All the variables except the physical distance, institutional distance and the variable for the common border are natural logarithms transformed and normalized by the Danish GDP. The normalization by Danish GDP was done to remove the possible correlation with population and hence all the trade variables. The food-FDI may also be considered shares relative to the Danish GDP. The countries included in the analysis are all the countries that have a value for most of the explanatory variables.

3.1 Data

The dataset comprises data on FDI of the food industry and trade in 127 different countries over the period 2004 to 2008. The data sources include Statistics Denmark, the World Trade Organization (WTO) and the International Monetary Fund (IMF).

From Statistics Denmark we extracted food-FDI outward for Denmark, Danish GDP, Danish exports of the food industry and Danish imports of food industry at current prices. We used the IMF database to extract GDP and population for all of the host countries. The trade data on current imports and exports of the food industry of the host countries to the world are extracted from the WTO. The 127 host countries are those for which we have information for more than one variable. All variables were in Danish

kroner (DKK) (including the exports of the export platform countries to the world) and because we normalised these variables using the Danish GDP there was no need to deflate these values.

In this paper we use stock data given that the key variable for multinational firms is the position of FDI they hold in the inflow country. In a cross-sectional analysis the stock data should be the variable of interest in order to understand the locational decisions, rather than the FDI flows (OECD, 2002).

The proxies for governance are the voice and accountability variable and political stability chosen out of six variables computed by Kaufmann et al. (1999). The six institutional variables seem to be correlated with each other, so focus is placed on the variables that do not show a high level of correlation. These are political instability and voice and accountability. The governance indicators have a standard normal distribution with mean zero and standard deviation one ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes. The explanatory variables and their symbols used in the results are presented in Text Box 1.

Table 2 below includes descriptive statistics of the variables used. There are a total of 635 observations (127 countries and 5 years) with a number of zeros, mainly for food FDI outward and food imports. As we have mentioned above the zeros in food FDI outward are transactions of less than 50,000 DKK.

Text Box 1. List of variables and symbols used in the model

f	Log of Danish food-FDI outflow to host country (j)/Danish GDP (i)
e	Log of food exports of Denmark to host country (j)/Danish GDP (i).The expected sign of this variable is positive
i	Log of food imports of Denmark (i) from host country (j)/ Danish GDP (i). The expected sign of this variable is positive
w	Log of food export of host country (j) to the world / Danish GDP (i). The expected sign for this variable is positive
g	Log of GDP of the host country (j)/ Danish GDP (i). The sign of coefficients in GDP per capital are indeterminate
a	Accountability, the first variable as a representative of the institutional distance of the inflow country (j)
c	Log of the population of the host countries
p	Political stability second variable representative of the institutional distance of the inflow country (j). The expected sign of the coefficient in P is positive since many of the governance indicators are measured in a positive sense, meaning larger values indicate greater quality
km	Physical distance between Denmark and host country (j).The expected sign of b is positive
eu	Dummy variable for common border and common language. There is no expected sign for the coefficient of this variable

Note: Home country represents Denmark and host country represents the *export-platform* countries

Table2. Descriptive statistics of all the variables

	Mean (in '000s)	St. dev. (in '000s)	Min (in '000s)	Max (in '000s)	No. of obser- vations	No. of missing values
Food FDI outward ^a	678	3,698	0 ^c	82,700	635	412 ^d
Food Exports ^a	612	1,937	0.002	15,303	635	6
Food Imports ^a	313	1,045	0.001	10,216	635	117
Export host ^b	6,543	13,441	0.9	112,631	635	37
Population	47,097	155,051	71	1,324,655	635	0
GDP per capita host	77	100	0.5	576	635	6
KM from DK	5.6	4.5	0.5	18	635	0

^a Danish food industry

^b Export host is in US dollar and other variables in Danish kroner (DKK).

^c Zeros equivalent to a transaction of less than 50,000 DKK.

^d Number of zeros.

4. Results

Table 3 shows the parameter estimates. The parameter estimates for the imports of the home country to the *export-platform* country (i), the accountability variable (a), the GDP per capita (g), the physical distance (km) and the variable for the common border (EU) are not statistically significantly different from zero ($p > 0.05$) and hence do not affect Danish outward FDI. In the model the significant parameters (at a confidence level $p < 0.05$) are exports of the home country to the export platform countries (e), political stability (p), food export of export-platform country to the world (w) and population size (c). These parameters all have a significant positive effect on FDI outward.

Table 3. Estimated parameters for the Cobb-Douglas model

Exogenous variables	Endogenous variable Danish food-FDI(i) / Danish GDP (i)		
	Parameters	Parameter estimates	Standard error
Intercept		-0.98 ^{NS}	1.24
Log of food Export of Denmark/Danish GDP(i)	E	0.94*	0.33
Log of food import of Denmark/Danish GDP(i)	I	-0.21 ^{NS}	0.17
Log of food export of host country (j) to the world / Danish GDP(i)	W	0.54*	0.21
Log of GDP of the host country (j) / Danish GDP(i)	G	-0.07 ^{NS}	0.35
Log of population of the host country	C	0.76*	0.38
Accountability	A	2.42 ^{NS}	0.47
Political stability	P	2.58*	0.72
The physical distance between Denmark and host country (j)	Km	0.00012 ^{NS}	0.00016
Dummy variable for common border	Eu	1.18 ^{NS}	1.67
R-squared	0.55		

^{NS} indicates no significance, * indicates significance at 95% level.

Our first hypothesis ($H1$): *FDI from Denmark will increase as demand shifters, such as GDP and population in the host countries increases* is partially confirmed. The population

variable is positive and significant indicating that gravity of the host country's demand is an important factor for FDI. The GDP variable, however, was not significant, but had the right sign. As we discussed earlier, the GDP variable may be also a proxy for labour costs which should have the opposite sign.

The second hypothesis *H2: The FDI from Denmark to a country will increase as exports from Denmark to this country increase*, is also corroborated by the data. The positive sign on the exports of Denmark to the inflow countries supports the export complement argument. A positive relationship between FDI outflow and exports indicate that FDI enhance exports with the objective of market seeking (Nagubadi and Zhang, 2008). Additionally, this may well be in favour of the *export-platform* argument, in that Danish exports of raw or semi-processed goods will be processed in the *export-platform* and re-exported, which is further supported by the results confirming the third hypothesis.

The third hypothesis, *H3: The FDI from Denmark to a country are higher the higher are the exports of this country to the rest of the world*, is supported by our findings. This, together with the previous hypothesis *H2* is a strong indication that Denmark is using FDI to some countries, not only to be consumed to the host country, but also to use it as an *export-platform* and export to other neighbouring countries. The food imports of Denmark from the host countries is, however, not significant. This weakens the argument for off shoring, i.e. that the Danish products abroad are re-imported processed into Denmark.

This was an important result of our analysis. The coefficient on the exports of inflow countries to the world has the expected positive sign and also is significant at the 5% level. This result proves our hypothesis of the *export-platform*, or in other words, the Danish FDI to 127 countries is used from Danish agri-food companies to reach further

customers abroad and beyond the FDI host countries. To our knowledge, this result has not been reported before.

The fourth hypothesis, *H4: FDI from Denmark will increase with improvement of political stability in the host countries* was also supported by the data. We find that the quality of institutions has positive effects on FDI. The variable with the largest impact on Danish food FDI while also being highly significant is political instability, which as defined by Kaufmann et al. (1999), captures factors such as government stability, internal conflicts, ethnic conflicts and terrorism. The democratic voice and accountability was positive as we expected, but did not appear significant. Nevertheless, the impact of the institutional variables is positive and significant. Institutions matter for the location of the Danish agri-food FDI and they are attracted to the countries that have government stability and no conflict or terrorism. A foreign Danish investor may be more worried about violence, terrorism and less worried about the democratic voice of the media.

The dummy for common border in EU is positive, though not significant. Similarly, the coefficient for distance is positive and not significant. We may conclude that distance is not a significant variable for Danish agri-food FDI, nor is there a preference toward EU countries. The impact of these gravity variables on FDI are not supported by the data. It is possible that this result is due to the fact that Denmark traditionally trades mainly with a small number of neighbouring countries (see discussion in Section 1), hence there is no much variation in this variable. We would not be hasty to reject that distance, or EU membership may be important before further analysis. This, however, is not within the scope of this study.

5. Summary and Conclusions

We have investigated the factors affecting FDI outflow from Danish agri-food firms to the rest of the world. We extended a conceptual model based on Helpman et al. (2004) to derive hypotheses concerning the determinants of FDI. We used a gravity model using a Cobb-Douglas functional form with data from 127 countries which have received Danish FDI in agri-food. Our main findings were mostly supportive of the hypotheses and they are in line with previous literature. Our main contribution to the on-going research on FDI is that FDI is often used as an *export-platform* to further promote exports by the home agri-food firm. In our case, it is found that Danish firms will invest more in countries that have large exports of agri-food products, as well as to countries where Danish exports of agri-food products is large. Our interpretation of this result is that Danish agri-food firms will use an *export-platform* country in order to reach further to other importing countries, instead of exporting directly from Denmark. The fact that Danish exports to the FDI recipients are high, are probably raw or semi-processed food products that are further processed by the FDI subsidiary for further exports.

Our findings also support the hypothesis that FDI will find a place in countries with stable political regimes. This is a result very much discussed in the trade literature. Transaction costs have been long put forward as a key determinant of trade and FDI, and our results also support this.

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