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## **Gravity model of outward FDI and trade in Agri-food in Denmark**

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### **Introduction**

Foreign direct investment (FDI) stock is one of the components that may contribute to the globalization process given that it is growing more rapidly than international trade. 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.

There are different views regarding the effect that foreign investment can have in the local economy. Alguacil and Orts (2003) stress that, theoretically either relationship (positive or negative) may exist between inwards FDI and imports. One view holds that FDI can have negative effects on receiving countries as a result of the local companies being pushed out of the market by big companies from outward FDI countries. Thus for a receiving country, a negative relation between FDI and trade will mean that its exports and imports reduce and increase respectively to diminishes the benefits of FDI. This leads economists to once considered FDI as a substitute for trade. Intuitively, when the main aim of outward FDI is to lower transaction cost or other trade barriers by induced investment for producing goods that are already exported from the host, then inflow FDI and imports in the home countries are expected to be substitutes.

Another view holds that the relationship between FDI and trade is complementary. FDI can be an important source of needed capital, knowledge and technology for the poorer countries'. A positive relation between FDI and trade may raise the opportunities of increasing the production of goods that otherwise need to be imported hence the increase in domestic manufacturing output reinforcing increased productivity (Alguacil and Orts, 2003). Furthermore as suggested by Rodriguez and Pallas (2008), trade and particularly imports, if linked to FDI, help economic growth through importing of ideas, intermediate goods and investments. Thus suggesting that increase productivity is the main focus for increase FDI and subsequently the complementary relationship between imports and FDI.

Pick and Warth (2005) suggested that cross border capital flows allows a company to acquire control of a subsidiary in another country. This seems to support the claim by Dries and Swinnen (2006) that most transition countries closer to the EU, received a large inflow of FDI in recent years. Thus, FDI avoids trade barriers and transportation cost allowing firm and farmers to increase their efficiency and their income by investing in foreign subsidiaries within distance and conducting transactions within the firm or farm rather than between them. Building factories in short distance foreign countries is one way of avoiding tariff barriers.

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.

Within the food industry, Gopinath et al. (1999) confirmed a small substitution effect between U.S FDI and the exports of the food processing goods of ten high-income countries. Onnen (1997) also for the U S found that FDI and food exports are complements indicating that foreign direct investment increases trade.

Overend et al. (1997), find both substitution and complementarity effect and categorize the development of relationship between trade and FDI as being exports alone in the first stage, complementary exports and FDI in the second stage, and a final stage of substitution at higher levels of FDI. The data used is firm level data from 1978 to 1983,

Malanoski et al.1997 find that exports may serve as a precursor to FDI, but they 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 host country.

The Danish FDI outflow started to grow in the late 1980s. 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). For this reason it is interesting to use Denmark as a case study and also because there is a decrease occurring in the FDI flows even though the size of inflow and outflow flows in any given year is continuing to be larger than the year before (Danmarks Nationalbank, 2004). Denmark seems to experience an outward capital flow that is larger than the inflow.

This paper investigates the factors that affect the expansion of the Danish Food-FDI outward 127 countries.

## **Methodology and data**

### **Specified regression model**

To investigate the relationships between Danish Food-industry FDI outward and trade, the gravity model using the translog functional form was specified and tested against a Cobb-Douglas functional form. The model accounted for receiving country accountability, political stability, production intensity and the population. The trade variables are represented by the exports and imports from Denmark to the 127 Food-FDI receiving countries as well as the exports of the 127 receiving countries to the world. The gravity variables are the physical distance and the common border /language between Denmark and the Food-FDI receiving countries.

$$\ln y_i = \beta_0 + \sum \beta_j \ln x_{ji} + \frac{1}{2} \sum \sum \beta_{jk} \ln x_{ji} \ln x_{ki} + \varepsilon_i$$

Where y is the Food-FDI outward, i = 1 to 127 countries, x<sub>j</sub> the 8 explanatory variables in question, and x<sub>ji</sub> x<sub>ki</sub> are the product terms and  $\varepsilon_i$  is error term expected to be N(0,1).

The explanatory variables are presented in text box below.

**Text box. List of the x explanatory variables and symbols used for the model parameter estimates**

**e** - is the food exports of home country (i) to host country (j)

**i** - food imports of home country (i) from host country (j)

**km** - is the physical distance between home country (i) and host country (j). The expected sign of b is positive

**g** - is the ratio of GDP per capital of the host country (j)/GDP per capital of home country (i). The sign of coefficients in GDP per capital are indeterminate.

**a** - is accountability, the first variable as a representative of the institutional distance of the host country (j)

**p** - is the political stability second variable representative of the institutional distance of the host 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

**eu** - is dummy variable for common border and common language. There is no an expected sign for the coefficient of this variable

**w** - is the food export of host country j to the world

**c** - is the population of the host country

Note: home country represents Denmark and host country represents the rest of the world

## Data

The data set comprises data on FDI of food industry and trade in 127 different countries over the same period 2004-2008. The sources include Statistics Denmark, World Trade Organization and International Monetary Fund. From Statistics Denmark it was possible to extract exports and imports for the food industry of the home country to the world. The trade data for import and export of food industry of the host countries to the world are extracted by World Trade Organization.

The GDP, GDP per Capita and Population was extracted by International Monetary Fund for all the countries. Current GDP is used as a deflator of other variables such as food FDI, food exports, and food imports whilst GDP per Capita and Population are used to represent the size of economy. All the variables except the physical distance, institutional distance and the variable for the common border used are in logarithms. There are 127 countries and 5 years considered in our sample. The endogenous variable in our model is the food-foreign direct investment outward and the exogenous variables are aggregated food imports of the host country to the world, aggregated food exports of the host countries to the world, voice and accountability, political stability, physical distance and (EU) the variable for common border.

## Results

A translog functional model was tested against Cobb Douglas one. The test suggests that the simpler Cobb-Douglas functional model is well suitable for describing the relationships between Food-FDI and the trade variables in question. Table 2 shows the parameter estimates for the Cobb-Douglas functional model.

**Table 2: Estimated parameters for the Cobb-Douglas functional form model**  
**Cobb Douglas**

Variable	Parameter estimate	Standard error
Intercept	-1.21 <sup>NS</sup>	1.24
e	0.82 <sup>*</sup>	0.33
i	-0.23 <sup>NS</sup>	0.17
a	0.29 <sup>NS</sup>	0.73
p	2.42 <sup>**</sup>	0.75
g	0.83 <sup>NS</sup>	0.55
w	0.59 <sup>*</sup>	0.24
c	1.36 <sup>**</sup>	0.41
km	0.00015 <sup>NS</sup>	0.00016
eu	1.78 <sup>NS</sup>	1.74
R-squared	0.55	

NS indicates no significance, \* indicates significance at 95% level, \*\* at 99% level

The parameter estimates for the imports of the home country to the host (*i*), the accountability variable (*a*), the gdp per capita (*g*), the physical distance (*km*) and the variable of the common border (*eu*) are not significantly different from zero ( $p > 0.05$ ) and hence do not affect outward food-FDI. However, parameters estimates for exports of the home country to the host country (*e*), political stability (*p*), food export of host country to the world (*w*) and population size (*c*) are significant ( $p < 0.05$ ). These parameters all have a significantly positive effect on outward Food-FDI. Looking at the magnitudes of the parameter estimates, these indicate that political stability has the largest influence on fdi outward, while common border has the second most influence, exports of home country to host country third and food export of host country to the world has the smallest parameter estimate.

The parameter estimate for exports suggests that a unit increase in exports of the home countries to host countries increases outward of Danish food FDI by 0.82 units.

## Discussion and conclusion

What is the reason for FDI from Denmark towards the rest of the world? If relationship between food FDI outflow from the home country and imports of food products to the host country is positive, so that FDI outflows and imports are substitute, the objective of FDI may be resource seeking. In contrary, a positive relationship between FDI outflow and exports indicate that FDI enhance exports and the objective is market seeking (Nagubadi and Zhang, 2008). If Danish exports a lot of goods to another country that means that in this country is already created a demand for the Danish goods. Therefore in order to support their goods they have to invest money. On the other side when the other countries export to Denmark their own goods, there is no initiative from the Danish side to invest to these countries.

Our results show the more the host countries export to the world the more Danish food companies invest to these countries. It is possible that Danish agri-food uses these countries as a

hub to export further to third countries. Also the institutions are very important in Danish Agrifood firm's decision to invest abroad. The more stable from political point of view is a country the more attracted this country became for the Danish food companies to invest. Danish agri-food firms also prefer to invest in large countries where local demand is high.

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