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Should governments subsidise inward foreign direct investment?

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Abstract

We analyse the incentive for a government to subsidise inward FDI when labor markets are imperfectly competitive. Contrary to the traditional assumption in the literature, we allow the production in the multinational firm to either complement or substitute for local production. A new result is that the wage does not necessarily increase in the host country when production is moved to this country. The reason is that the union in the host country internalises product market externalities between the firms. Furthermore, it is shown that when a single country subsidises inward FDI, total world welfare might increase as well.

Keywords: Multinationals, International Trade, Subsidies, Trade Unions

JEL classification: F23, H71, J51

1 Introduction

Should governments subsidise production and in particular production taking place in multinational firms (henceforth MNEs), and should international organisations like WTO and EU oppose that? These are questions that have gained a lot of interest among economists as well as politicians.¹

In this paper we focus on subsidising *inward* foreign direct investment (henceforth FDI). There are many examples illustrating that governments do subsidise inward FDI. One example is that EU has recently accepted that the UK grants an investment subsidy in favour of Motorola for building a new production plant, i.e. for creating new jobs in the UK (EU Commission (2000)). Another example is how Hoover by moving a production plant from France to Scotland received a subsidy from the British government (The Economist, 6-12 February 1993). We can also find examples of subsidies to inward FDI in the United States. One of these examples is how Alabama offered Mercedes-Benz various subsidies for locating a new production plant in Alabama. These subsidies included the provision of the plant site with infrastructure and utilities and a school for German children (Haaparanta (1996)). Other examples of subsidies to multinationals can be found in Glass and Saggi (1999) and Haskel et al. (2001).

In this paper we seek to analyse when a country has an incentive to give a subsidy to inward FDI and how this affects world welfare. We will in particular focus on how the production in the MNE relates to the production in the host country. More specifically, we will take into account that the goods produced by the MNE and the host country firms

¹ For a further analysis and discussion of attitudes and policies towards production subsidies in EU and WTO, see Messerlin (1999).

can be either complements or substitutes in final demand. As far as we know, this has not been fully analysed before. In most of the literature concerning FDI (also the literature mentioned below) it is implicitly assumed that the goods produced by the firms are perfect substitutes. However, since governments in practice are concerned about the effects on related local production of attracting foreign production, this analysis reveals that it is relevant to consider the implications of various degrees of complementarity between final goods.²

Glass and Saggi (1999) also analyses the incentive to subsidise FDI. Firms become multinational when the wage (corrected for the subsidy) is lower in the host country. Firms continue to move until the wage corrected for the subsidy is equalized between the countries, which implies that the wage increases in the host country. This is of course a disadvantage for the local firms. Hence, when a government chooses what subsidy to offer, it has to weigh the two effects: workers benefitting from the higher wage, local firms getting hurt by the same higher wage. They show that unless there is some degree of cross-country ownership of the firms, it will never be optimal to give subsidies to inward FDI. Since there is no unemployment in their model, there is no effect from FDI on the level of (un)employment. In reality, though, it seems as if positive employment effects play an important role when a government considers subsidising FDI (cf. the cases described above).

An example of a model with employment effects is Barros and Cabral (2000). This paper analyses a subsidy-game between two governments that try to attract a firm from a third country.³ The incentive to attract FDI arises because of unemployment as they assume that

² The importance of the degree of complementarity has in a different setting been analysed in Horn and Wolinsky (1988a). Also in Naylor and Santoni (1998) does this play a role, but they only consider the cases where the goods are substitutes.

³ Haaparanta (1996) also analyses a game where two governments concerned about employment compete in attracting FDI by offering subsidies. This is modelled as a menu auction.

the shadow price of labor for the country is smaller than the nominal wage. However, they do not model how this difference arises, and they assume that the wage rate as well as the shadow price of labor are unaffected by FDI. Since there is empirical evidence that indicates that these variables will be affected by FDI (see e.g. Aitken et al. (1996)) it seems relevant to endogenise these variables.⁴

Leahy and Montagna (2000) also analyses welfare consequences of FDI. They assume that labor markets are unionised and the main focus in the paper is on the distinction between decentralised and centralised bargaining. Leahy and Montagna consider two cases: one where the goods produced by the local firms and the foreign firm are perfect substitutes and one where the demand for the goods are independent. One essential difference to our model is that they do not endogenise the entry decision of the MNE, i.e. they do not model the profit of the firm in the case where it is not multinational. Moreover, contrary to what is the traditional assumption in the literature regarding trade theory and multinationals, they assume that it is necessary to become multinational in order to serve the foreign market (see e.g. Markusen and Venables (2000), and Glass and Saggi (1999)). They conclude that in the case with "centralised firm specific bargaining", which we assume in this paper, attracting FDI will not improve welfare in the host country.

In the model presented in this paper, we try to integrate effects from both the "Glass-and-Saggi-model" and the "Barros-and-Cabral-model". Hence, we analyse a model where the government is concerned with both wage and employment.⁵ The government might face the

⁴ Theoretical work done on FDI and wages include Skaksen and Sørensen (2001), Zhao (1995,1998), Naylor and Santoni (1998) and Markusen and Venables (1997). The first four papers consider FDI and imperfectly competitive labor markets, while in the last paper a model with perfectly competitive labor market is analysed.

⁵ More specifically, the government is concerned about shifting employment from sectors with low wages to sectors with higher wages. The FDI sector is the one with the higher wages.

same trade-off as in Glass and Saggi (1999), i.e. that FDI increases the payoff to the workers, but at the same time hurts the local firm. We assume that the labor markets are characterised by imperfect competition, as trade unions bargain with the firms over wages. As already mentioned, we will specify the model sufficiently general, that the products produced by the multinational firm and the products produced by the local firm can be either complements or substitutes. This implies that, contrary to for example Glass and Saggi (1999), an increase in the wage is not always the result when attracting FDI. This of course also influences the impact of FDI on the local firm. More specifically, we find that whether there is a conflict of interests between the local firm and the workers regarding attracting FDI, depends on the degree of complementarity between the products produced by the local and foreign firms. Furthermore, we show that even when the final products are substitutes (similar to the case in Glass and Saggi (1999) and Leahy and Montagna (2000)), it might be a good idea to subsidise FDI, but the incentive to subsidise FDI is smaller when the goods are substitutes compared to the case where they are complements. Finally, it turns out that the interest of a single country can coincide with the interest of the international society regarding subsidising inward FDI.

Throughout the paper we will consider what we have chosen to term an investment subsidy. This subsidy is a fixed amount given to the firm conditional on investing in the country. Or to put it differently, the subsidy is "sunk" when the production is taking place. Alternatively, we could have analysed a subsidy per unit of production. It can be shown that when considering a per unit of production subsidy we get, with respect to the importance of the degree of complementarity, qualitatively the same effects on wages and profits, as when

we consider the investment subsidy.⁶ We choose to focus on an investment subsidy as it makes the analysis more simple, and it seems as if this kind of subsidy is often given in practice (cf. the Mercedes-Benz case described above). Other examples of an investment subsidy include: financial aid for buying buildings and machinery (cf. the Motorola-case), firms buy or rent public land at a price below market price, or firms get favorable loans compared to private investors.⁷

In section 2 the model is presented. Section 3 analyses the case where the foreign firm is being subsidised. In the following section the robustness of the results is discussed. Finally, in section 5 we conclude.

2 The Model

We consider a simple two sector general equilibrium model with two countries: a semi-small country and a large country that can be considered to be the "rest of the world". By "semi-small" we mean that the amount of the final good produced in the imperfectly competitive sector in this country influences the world market price, but there is no consumption of the good in this country. This is a good approximation for the cases where the production of a specific good is large compared to the consumption of this good in the country. This assumption is similar to assumptions often made in the literature on trade policy (see e.g. Brander and Spencer (1985) and Glass and Saggi (1999)), and it is convenient since we want to focus on what happens to the profit of the local firms and to the labor income. In the

⁶ A third type of subsidy is a reduction in profit taxes. Since a profit tax does not alter the behavior of the firms (and workers) in the model, we would be able to get qualitatively the same results in a model where the policy instrument is the tax-rate on the profit of the MNE.

⁷ Further information on types of subsidies and the rules regarding granting subsidies in the EU can be found in EU-Commission (1999).

sense that the semi-small country could be interpreted as a member state of the EU and the "rest of the world" as the rest of the EU, the model is well suited for analysing policy issues relevant for the EU, or for similar supranational institutions.

Sector 1 is a competitive sector producing a numeraire good. Sector 2 is an imperfectly competitive sector with one firm in each country. The government in the semi-small country is considering attracting the foreign firm in sector 2 by offering a subsidy. Let h denote the semi-small (host) country and f denote "rest of the world" (foreign countries). The goods produced in sector 2 are sold on the market in the "rest of the world".

The utility of a representative consumer in the "rest of the world" is:

$$V(q_0, q_h, q_f) = v(q_h, q_f) + q_0 \quad (1)$$

q_0 is a numeraire good and q_i , $i = h, f$ is the good produced by the two firms in sector 2.

$$v(q_h, q_f) = a(q_h + q_f) - \frac{1}{2}(q_h^2 + q_f^2 + 2dq_hq_f), \quad a > 1. \quad (2)$$

The parameter d , $|d| \leq 1$, describes whether the final goods are substitutes or complements: if $d > 0$ the goods are substitutes, if $d < 0$ the goods are complements. This specification of the utility leads to the following system of demand equations:

$$\begin{aligned} p_h &= a - dq_f - q_h \\ p_f &= a - dq_h - q_f. \end{aligned} \quad (3)$$

The production process in each firm in sector 2 consists of two activities: a headquarter activity that, by assumption, always will be located in the home country of the firm, and a production activity. The production activity only uses unskilled labor, while no unskilled

workers are employed in the headquarter activity. In the production activity the production function is as follows:

$$q_i = l_i \quad (4)$$

where l_i is employment of unskilled workers in firm i . The unit cost of production in firm i , c_i , is then equal to the wage, w_i . The costs associated with the headquarter activity is without loss of generality normalized to zero. There is a fixed cost of investing abroad, $F \geq 0$. In order to focus on the choice of the government of offering a subsidy or not, we will assume that F is sufficiently large that the firms do not choose to move production abroad unless a subsidy is offered. Moreover, we assume that if a firm moves the production activities abroad, the headquarter activity stays in the home country of the firm. In other words, using the terminology in the literature on MNEs, we are considering a vertical MNE. The importance of this assumption will be further discussed in section 4.

The two firms in the imperfectly competitive sector are assumed to compete in the familiar Cournot fashion. I.e. the firms maximize profits:

$$\Pi_i = (a - dq_j + q_i - c_i)q_i - F \quad i \neq j = h, f. \quad (5)$$

Solving for the equilibrium production levels yields

$$q_i = \frac{a(2-d) - 2c_i + dc_j}{(4-d^2)} \quad i \neq j = h, f. \quad (6)$$

The variable profit becomes:

$$\pi_i = q_i^2 = \left(\frac{a(2-d) - 2c_i + dc_j}{(4-d^2)} \right)^2 \quad i \neq j = h, f. \quad (7)$$

The numeraire good is produced in a perfectly competitive sector. It is a traded good (the trade cost is for simplicity assumed to be zero) and it is produced in both countries.

Only unskilled labor is used in this production, and the production function is:

$$q_i^0 = l_i^0, \quad i = h, f. \quad (8)$$

The subscript indicates in what country the numeraire good is produced. The price of the numeraire good is normalized to 1. This implies that the wage in this sector, \bar{w} , is also 1.

The wage to the unskilled workers employed in the imperfectly competitive sector is determined in bargaining between a trade union and a firm, and the outcome is given by the Nash Bargaining Solution. We assume that a centralised union in each country bargains with the firms separately, but simultaneously. The equilibrium is a Nash Equilibrium in the wage contracts.

The trade unions seek to maximize the wage sum, i.e. if the trade union bargains with the firm in the host country, the objective function is:

$$U_h = (w_h - 1)q_h. \quad (9)$$

Similar for country f . If the union and the firm do not reach an agreement, the workers will be employed in the competitive sector and get the wage $\bar{w} = 1$. Hence, when bargaining with just one firm the disagreement payoff is zero.

If the trade union in the host country bargains with both firms, i.e. if the foreign firm has moved production to the host country, it seeks to maximize:

$$U_h = (w_h - 1)q_h + (w_f - 1)q_f. \quad (10)$$

In this case w_f is the wage the foreign firm pays in the host country. Under these circumstances the disagreement payoff depends on which firm the union bargains with. When

bargaining with the firm with homebase in country h the disagreement payoff is:

$$\bar{U} = (w_f^{EQ} - 1) * q_f(w_i^{EQ}, w_j^{EQ}). \quad (11)$$

Similarly when bargaining with the foreign firm. "EQ" denotes equilibrium values. This specification was also used in Horn and Wolinsky (1988a). The reason for this choice can most easily be understood by referring to the well-known Rubinstein-game with alternating offers as the underlying dynamic model for the bargaining (see e.g. Osborne and Rubinstein (1990)). Then the disagreement payoffs corresponds to the payoffs as long as the bargaining parties is still bargaining and no offer has been accepted yet. I.e. the specification in (11) implies that when a firm and a union are in a conflict the other firm produces at the "expected" equilibrium level. Other specifications of the disagreement profit could have been used. One possibility is to use the quantity if a firm, in case of a conflict between the trade union and the other firm, behaves as a monopolist. The specification used in this paper is relevant if the firms are not capable of making large adjustments in production in the short run. The other possibility is relevant when the firms are capable of making such adjustments. However, both specifications give rise to qualitatively the same results regarding wages and profits. For simplicity we will in the rest of the paper use the specification in (11).

The total endowment of labor in each of the two countries is L_i , $i = h, f$, and in equilibrium total employment equals the endowment of workers. In other words, as mentioned above, if the workers are not employed in the imperfectly competitive sector they will always be employed in the competitive sector. We assume that L_i is sufficiently large to guarantee an interior solution.

The government in the host country is able to give a subsidy, S , if the foreign firm

moves production to the host country.⁸ This subsidy is financed through lumpsum taxes. Since there is no consumption in the host country of the good produced in the imperfectly competitive sector, this government is only concerned about maximizing the total income in the country. The income in the country basically stems from 4 sources: the profit of the host country firm, labor income of the workers employed in i) the host country firm, ii) the production activity of the foreign firm, and finally iii) the numeraire sector. However, if the government in the host country grants a subsidy to the foreign firm, this amount should be subtracted from the total income in this country. Hence, the objective of the government in the host country is to maximize the following welfare function:

$$W_h = \pi_h + (w_h - 1)q_h + (w_f - 1)q_f + L_h - S. \quad (12)$$

The model is a 4-stage game, and the timing of the game is as follows:

1. The government in the host country announces the level of the subsidy.
2. The foreign firm decides whether to become multinational or not.
3. Bargaining over wages.
4. The firms choose production plan (Cournot competition).

It is assumed that the government can credibly commit to offering the announced subsidy.

This is a common assumption in strategic trade policy (cf. Brander and Spencer (1985)).

Moreover, it is assumed that the potential multinational firm makes the investment decision,

⁸ The purpose of this paper is to explore various motives of a government to subsidise FDI and not the competition between governments regarding attracting FDI. Hence, as in Glass and Saggi (1999) we are only considering one-way FDI.

and, if moving production abroad, incurred the cost F before the bargaining with the trade union takes place.⁹

3 Incentives for, and effects of, offering a subsidy

We solve the game backwards, and since we already have solved the subgame at stage 4 we continue with the stage of wage bargaining.

3.1 Wage bargaining

Two national firms (the "nn-case") We have to solve two bargaining problems, one in each country. The bargaining problems are:

$$w_i^{nn} = \arg \max(w_i - 1) * q_i * \pi_i = (w_i - 1) * q_i^3, \quad i = h, f \quad (13)$$

where q_i is determined by (6) and π_i by (7). It is important to notice that q_i itself also depends on w_f and w_h . Using the two first-order conditions from the maximization problem we can solve for w_h^{nn} and w_f^{nn} .

The solution is:

$$w_f^{nn} = w_h^{nn} = 1 + \frac{(a-1)(2-d)}{(8-d)}. \quad (14)$$

One national and one multinational firm (the "nm-case") Again we have to solve two bargaining problems, but this time one is between the host country firm and the host country trade union, and the other one is between the foreign firm and the host country

⁹ It is implicitly assumed that it is not possible for the trade union to commit to a wage determined before the firm has actually located production in the country - at least not for a period of the same length as the investment horizon in the firm, which in practice seems to be much longer than the ordinary 2- or 3-years wage contracts we often observe.

trade union. The wages are determined as follows:

$$w_i^{nm} = \arg \max((w_i - 1)q_i + (w_j - 1)q_j - (w_j^{EQ} - 1)q_j^{EQ}) * \pi_i, \quad i \neq j = h, f. \quad (15)$$

Using the first-order conditions we find the wages to be:

$$w_f^{nm} = w_h^{nm} = 1 + \frac{(a - 1)(2 - d)}{(8 - 2d)}. \quad (16)$$

We will now compare the equilibrium in these two cases. More specifically, we find the effect on the wages, the variable profit of the firms, employment and the payoff of the union in the host country, of the foreign firm becoming multinational. The result of the comparison is summarised in the following proposition.

Proposition 1 *For $d < 0$, then $w_i^{nm} < w_i^{nn}$ and $\pi_i^{nm} > \pi_i^{nn}$ for $i = f, h$. For $d > 0$ these relations are reversed. Moreover, $l_f^{nm} + l_h^{nm} > l_h^{nn}$ and $U_h^{nm} > U_h^{nn}$ for all d .*

By comparing (14) and (16), it is easily shown that for $d > 0$ the wage increases and for $d < 0$ the wage decreases, if the foreign firm becomes multinational. The explanation is that when one union is bargaining with both firms it takes into account that the wage in one firm influences the production in the other firm. I.e. the union internalises a product market externality between the firms. If the goods are substitutes this internalisation creates an incentive for bargaining for a higher wage. The intuition is that, when the wage is higher in one firm, the production in this firm decreases. However, if the goods are substitutes the production in the other firm increases, making the total loss for the union smaller. In contrast if the goods are complements; a higher wage in one firm lowers production in the other firm too. Hence, in this case the union has an incentive to accept a lower wage. This effect, although in a different setting, has also been analysed in Horn and Wolinsky (1988a).¹⁰

With respect to the (variable) profits of the firms, it can be shown, by using (7), (14) and (16), that for $d > 0$ ($d < 0$) the profits for both firms decrease (increase) if the foreign firm becomes multinational. The reason is that the wages change as explained above. Hence, as seen in Glass and Saggi (1999) the government faces a trade-off: higher wages hurt the local firm but of course benefits the workers. However, as mentioned above, Glass and Saggi (1999) does not consider any employment benefits, but these turn out to be important in our model. Regarding employment,¹¹ it can be shown that the employment in the host country always increases if the foreign firm becomes multinational. This is so, even if production in the host country firm decreases. I.e. the employment in the foreign firm moved to the host country compensates for the loss in the host country firm.

We have so far shown that the wage increases for $d > 0$ and decreases for $d < 0$ and in both cases the employment increases. Hence, it is straightforward to conclude that for $d > 0$ the trade union is better off. For $d < 0$, on the other hand, the wage and the employment move in opposite directions. However, by using (10), (14) and (16), it turns out that the positive employment effect will always be the dominating effect. Hence, the trade union in the host country will unambiguously be better off if the foreign firm moves production to the host country.

If we combine the results regarding profits and the utility of the trade union we see that

¹⁰ As also pointed out in Horn and Wolinsky (1988a), the result regarding wages does in general not only depend on whether the goods are substitutes or complements in final demand, but also on whether the goods are strategic substitutes or complements (see Bulow et al. (1985)). However, in this specific model with linear demand functions it turns out that when the goods are complements (substitutes) in final demand they are also strategic complements (substitutes).

¹¹ In what follows employment refers to employment in sector 2.

it is only for $d > 0$ that there is a conflict of interests (like in Glass and Saggi (1999)). For higher degrees of complementarity between the final goods, the host country firm and trade union will agree that it is a good idea to attract production from the foreign country.

3.2 The subsidy

First we consider the size of the subsidy necessary in order to convince the foreign firm to move (i.e. solve stage 2 in the game). After that we consider whether it is optimal for the government to actually pay this subsidy in order to attract inward FDI (i.e. solve stage 1 in the game).

It can be shown that for $d < 0$ it is always profitable for the foreign firm to become multinational, unless the fixed cost of becoming multinational is too high. That is, if $F < (\pi_f^{nm} - \pi_f^{nn})$ it will be profitable to invest abroad - even if no subsidy is offered. In order to have an interesting case where a subsidy is necessary for attracting the foreign firm, we assume that F is larger than this difference in variable profits. In what follows, define $\bar{G}(a, d)$ as the gain in variable profits from becoming multinational. Using this definition we then have the following restriction on F :¹²

$$F > \bar{G}(a, d) = \pi_f^{nm} - \pi_f^{nn}. \quad (17)$$

This implies that in order to make it attractive for the foreign firm to move production, the subsidy has to be larger than F corrected for the gain in profit. Since in this model the subsidy only plays the role of attracting the foreign firm and does not have any additional (distortionary) effects on production, wages etc., it is never optimal for the government to

¹² The expression for $\bar{G}(a, d)$ and other expressions in the following sections are in the appendix. The expressions are also given for the special cases where $d = 1, 0, -1$.

offer a subsidy higher than the lowest possible subsidy such that the foreign firm chooses to move.¹³

$$S = F - \overline{G}(a, d).^{14} \quad (18)$$

By using (7), (12), (14) and (16) it can be shown that giving this subsidy gives rise to an increase in host country welfare if

$$F < \tilde{G}(a, d) = \widetilde{W}(a, d) + \overline{G}(a, d) \quad (19)$$

where $\widetilde{W}(a, d)$ is a function of a and d that describes the gain in host country welfare if both firms are located in this country (excluding the cost of the subsidy).¹⁵

The intuition is that as long as it is not too expensive for the government to do so, i.e. when F and therefore the compensation to the foreign firm for becoming multinational is not too large, the government has an incentive to attract inward FDI. This might happen even in the case where $d > 0$ and the local firms are hurt by higher wages. The reason is that the gain in employment combined with the higher wage may outweigh the loss to the local firm.

It can be shown that $\frac{\partial \tilde{G}(a, d)}{\partial d} < 0$. This implies that for a given F , it is more likely that the government will have an incentive to attract a firm that produces final goods that are complements to the goods produced in the host country than a firm producing goods that are substitutes. The reason can be found in the result presented in the section above: for $d < 0$ there is no conflicting interests between the workers and the firm.

¹³ For $S = F - \overline{G}(a, d)$, the foreign firm is indifferent about moving production to the host country. Hence, in order to guarantee a move the government should actually offer a subsidy equal to $S + \varepsilon$. For simplicity, we will ignore ε in the following.

¹⁴ Since we have assumed that $F > \overline{G}(a, d)$, $S > 0$. Hence, we have excluded the possibility that it might be welfare improving for the host country to tax the MNE. However, if we remove this assumption on F , it will be trivial to show that for F sufficiently small the host country has an incentive to tax FDI for $d < 0$.

¹⁵ It can be shown that $\tilde{G}(a, d) > \overline{G}(a, d)$.

3.3 World welfare

In the section above, we only looked at the welfare of the host country. But since the profit of the foreign firm, the price of the good produced in the imperfectly competitive sector, and therefore the utility of the consumers are influenced by the subsidy given in the host country, world welfare, $T = W_f + W_h$, is affected by the subsidy as well. W_f equals the utility of the representative agent in "the rest of the world". Using the budget constraint and substitute for q_0 yields:

$$W_f = v(q_h, q_f) - p_h q_h - w_f q_f^f - F + S + L_f. \quad (20)$$

By using (12) and (20) total world welfare turns out to be:

$$T = v(q_h, q_f) + (L_h - q_h - q_f) + L_f - F. \quad (21)$$

Now using (7), (14), (16) and (21), we find that $\Delta T = T^{mm} - T^{nn}$ will be positive, i.e. world welfare increases when a subsidy is given, if

$$F < \widehat{G}(a, d) = \widehat{T}(a, d) + \overline{G}(a, d) \quad (22)$$

where $\widehat{T}(a, d)$ is a function of a and d that describes the improvement of total welfare when production has been moved from the foreign country to the host country (again ignoring the cost of the subsidy).

It can be shown that $\widehat{G}(a, d)$ is monotonically decreasing in d . More importantly, it can be shown that for $d > 0$, $\widehat{G}(a, d) < 0$. Since we have assumed that $F \geq \max(0, \overline{G}(a, d))$, we conclude that for $d > 0$ it will never be welfare improving for the world as such, that one country subsidises FDI.

From the analysis above, we know that if $\widehat{G}(a, d) > \widetilde{G}(a, d)$ and $d < 0$, the host country will offer the foreign firm a subsidy and this will unambiguously lead to an improvement of welfare in the world as such. However, by using (19) and (22) we see that $\widehat{G}(a, d) < \widetilde{G}(a, d)$. Hence, there exists an interval for F , $F \in [\widehat{G}(a, d); \widetilde{G}(a, d)]$ where the host country is better off subsidising the foreign firm but the whole world as such is worse off. This implies that for F in this interval, there will be a conflict between the host country and the rest of the world.

These results and the results from the section above are summarised in proposition 2.

Proposition 2 *The incentives to, and effects of, subsidising the foreign firm are as follows:*

- i) For $F < \widetilde{G}(a, d)$ the foreign firm is being subsidised. Furthermore, $\frac{\partial \widetilde{G}(a, d)}{\partial d} < 0$*
- ii) For $F \in [\widehat{G}(a, d); \widetilde{G}(a, d)]$ the foreign firm is being subsidised and world welfare decreases*
- iii) For $F < \widehat{G}(a, d)$, which can only be the case for $d < 0$, the foreign firm is being subsidised and world welfare increases.*

Notice that for relative small F (and $d < 0$), the world welfare increases when the host country government attracts the foreign firm by offering a subsidy. The reason for this possible improvement in world welfare is that there are imperfectly competitive labor markets because of the trade unions, and when the goods are complements and the same union bargains with both firms the importance of this imperfection decreases, i.e. the wage approaches the competitive wage. A lower wage leads to an increase in production, and an increase in consumer surplus as well. This in turn gives rise to the increase in world welfare.

If the final goods are substitutes, the wage increases and the production decreases if the foreign firm moves production to the host country. Hence, consumer surplus decreases leading to a decrease in world welfare too.

4 Robustness

We have just shown that a government has an incentive to subsidise inward FDI and this incentive is stronger the higher degree of complementarity between the goods produced by the foreign firm and the host country firm. Furthermore, depending on the size of F , world welfare might increase due to this move of production.

Are these results robust? One could argue that it probably depends on the labor market structure. In other words, it depends on the degree of the centralisation of the wage bargaining. Obviously, if we have completely decentralised bargaining, i.e. firm-specific trade unions, it would not be possible for these unions to internalise any externalities between the firms. It is therefore more interesting to consider what happens if we instead assume industry-specific bargaining such that one common wage for both firms is determined in the bargaining. In this case, however, it can be shown that the results for wage, profits etc. are qualitatively the same regarding the parameter d . Hence, unless we have a fully decentralised labor market structure, it seems as if the results are robust to different assumptions regarding the labor market structure.

The second assumption one could suspect is important for the results, is the assumption regarding the structure of the MNE. In the section above we considered a *vertical* MNE where all the production activities are moved to the subsidising country, but in practice we often observe that a MNE has production activities in several countries.

A *horizontal* MNE is a MNE producing the same good in several locations. If we look at the overall production technology for such a firm, then it looks like the following:

$$q_i = l_i^j + l_i^i \quad i, j = f, h \quad (23)$$

where l_i^j is employment in a plant of the firm with home base in country i but located in j . I.e. the production activities located in different countries are perfect substitutes.

Applying the result for this case from Skaksen and Sørensen (2001), it turns out that the wage for the foreign firm will be competed down to the competitive wage, $\bar{w} = 1$. The intuition is that since the activities themselves are perfect substitutes, the workers employed in these activities will also be perfect substitutes. We can then use the familiar Bertrand-argument and show that the wage is competed down to 1. From this it can be shown that the conclusions resemble those from section 3.¹⁶ Hence, the main conclusions still holds.

Let us turn to the case where the activities located in the two countries instead of being substitutes, are complements. This implies that we are considering a vertical structure of a MNE that is different from the one analysed in section 3. More specifically, we assume that the production function is a Leontief production function with n different production activities:

$$q_i = n * \min(l_1, \dots, l_n) \tag{24}$$

where l_k is employment in activity k . Let m be the number of production activities moved to the host country. As shown in appendix A, for $m < n$ we find that the cost of production in the foreign firm increases leading to a decrease in the profit of this firm. For $d < 0$ the profit for the host country firm decreases as well, while for $d > 0$ the profit of the host country firm increases. This implies that for sufficiently *large* d the host country government has an incentive to subsidise the foreign firm. In this case world welfare always decreases if the

¹⁶ The only difference is that it is possible that world welfare increases for $d > 0$. However, in order to get this welfare improvement, F has to be so small that the firm does not need to be offered a subsidy in order to find it profitable to move production abroad. Furthermore, the host country will in that case be worse off.

foreign firm becomes multinational.

However, these results are very sensitive to the restriction $m < n$. If instead the host country government is able to condition the subsidy on the foreign firm moving *all* the production activities to the host country, it is optimal for the government to do exactly that. In this case the results are the same as the results in section 3.

Based on the discussion above, it seems fair to conclude that the results regarding subsidies and complementarity in final goods are quite robust.

5 Conclusion

In this paper we have addressed the issue whether it is welfare improving that a country subsidises inward FDI.

In doing this, we have analysed a model where the incentive to attract FDI arises because of potential higher wages and higher employment in a "high-wage" sector. Furthermore, we have considered different "types" of FDI: FDI in sectors producing goods that are complements and FDI in sectors producing goods that are substitutes to local production. It turns out that this is an important distinction, since the results are influenced by this degree of complementarity. Given the foreign firm moves all production to the host country, we have seen that if the final goods are complements then subsidising FDI might create a welfare improvement in the world, because it weakens the implications of the imperfectly competitive labor markets. The explanation is that the union internalises a positive product market externality between the firms. On the other hand, if the final goods are substitutes the implications of the imperfectly competitive labor markets become more severe, implying that world welfare decreases.

The results have important policy implications. First of all, supranational institutions like EU or WTO should not necessarily oppose that governments subsidise multinationals. But the analysis also showed that there are reasons for international coordination about when governments should be allowed to subsidise multinationals. Secondly, it is clear from the analysis above, that in order to make the subsidies as welfare improving as possible it is important that the subsidies are given to foreign firms producing goods that are complements to the goods already produced in the host country.

6 Appendix A: The production activities are complements

As explained in section 4 we consider a Leontief production function, i.e. the n production activities are complements and necessary for production:

$$q_i = n * \min(l_1, \dots, l_n) \quad (25)$$

where l_k is employment in activity k . Let m be the number of activities that are moved abroad. Define α as the share of the production that is moved abroad, $\alpha = \frac{m}{n}$. We allow the subsidy offered by the government to be conditional on α . Let s denote the subsidy given pr. activity. In this appendix we are only considering the case where $m < n$. Hence, it is not possible for the government of the host country to condition the subsidy on all production activities of the foreign firm being moved to the host country. For the analysis of the case with $m = n$, see section 2 and 3.

The unit cost of production is:

$$c_f = \alpha w_f^{nm} + (1 - \alpha) \widetilde{w}_f^{nm} \quad (26)$$

where w_f^{nm} is the wage in the activities of the foreign firm located in the host country, while

\widetilde{w}_f^{nm} is the wage for the production activities located in the foreign country. Since we are only considering one type of unskilled workers, we assume that all the unskilled workers in the same firm are paid the same wage regardless of what activities they are used in.

6.1 Wage bargaining

When both firms are national we can use the result from section 3. However, in the case where the foreign firm moves production abroad, we now have to determine 3 wages.

In the foreign country the wage is determined as:

$$\widetilde{w}_f^{nm} = \arg \max(\widetilde{w}_f^{nm} - 1)(1 - \alpha) * q_f^3. \quad (27)$$

In the host country the two wages are determined as follows:

$$w_f^{nm} = \arg \max((w_h^{nm} - 1) * q_h + (w_f^{nm} - 1) * q_f \alpha - (w_h^{nmEQ} - 1)q_h^{EQ}) * q_f^2 \quad (28)$$

$$w_h^{nm} = \arg \max((w_h^{nm} - 1)q_h + (w_f^{nm} - 1)q_f \alpha - (w_f^{nmEQ} - 1)q_f^{EQ} \alpha)q_h^2 \quad (29)$$

where q_i is determined by (6). Note that q_i is a function of w_f^{nm} , \widetilde{w}_f^{nm} and w_h^{nm} .

Using the first-order conditions and solving for equilibrium yields the following:

$$\widetilde{w}_f^{nm} = \frac{1}{16} \frac{48a + 20d - 240\alpha - 12d^2 - 20ad - 4ad^2 + 16\alpha d^2 - d^3 + 192 + d^3 a}{(1 - \alpha)(15 - d^2)} \quad (30)$$

$$w_f^{nm} = \frac{1}{32} \frac{d^3 - d^3 a - 32\alpha d^2 - 12ad^2 + 12d^2 - 20ad + 20d + 96a - 96 + 480\alpha}{\alpha(15 - d^2)} \quad (31)$$

$$w_h^{nm} = \frac{1}{16} \frac{-7d^2 - 9ad^2 + 12d - 12ad + 60a + 180}{15 - d^2} \quad (32)$$

As in section 3, we compare the equilibrium values of the two cases. Using (14), (30), (31) and (32) it turns out that for $d > 0$ ($d < 0$), the wage for the host country firm increases (decreases) when the foreign firm becomes multinational. This is similar to the result found in section 3.

However, for the *foreign firm* we get a different result. When comparing \widetilde{w}_f^{nm} and w_f^{nm} it turns out that for

$$\alpha > \underline{\alpha} = \frac{1}{16} \frac{d^3 + 6d^2 - 8d - 48}{d^2 - 15} \quad (33)$$

the wage for the foreign firm increases if this firm becomes multinational. I.e. if the employment in the foreign country is relatively small the wage in this country increases. For w_f^{nm} we get a similar result. For

$$\alpha < \bar{\alpha} = \frac{1}{32} \frac{d^3 + 6d^2 - 64d - 384}{d^2 - 15} \quad (34)$$

w_f^{nm} is larger than w_f^{nn} . This result can be explained by the fact that when the foreign firm splits up production, the trade unions in the two countries get stronger positions in the bargaining. The reason being, that the share of the total wage cost in the firm that one trade union bargains over becomes smaller. However, the trade union is still able to close down all production in case of a conflict since all the activities are complements. We have chosen to call this effect a "Horn-and-Wolinsky-effect" 2, henceforth HW2, since a similar effect, although in very different model, was analysed in Horn and Wolinsky (1988b). This effect has also been analysed in Skaksen and Sørensen (2001).

In section 3 we showed how the trade union internalises a product market externality, leading to lower wages if the foreign firm becomes multinational and the final goods are complements, and higher wages if the final goods are substitutes. We will call this effect a "Horn-and-Wolinsky-effect" 1, henceforth HW1, after Horn and Wolinsky (1988a).

It can be shown that $\bar{\alpha} > \underline{\alpha}$, i.e. $\nexists \alpha$ such that both wages decrease. Furthermore, $\frac{\delta \bar{\alpha}}{\delta d} > 0$. Since both the HW1 effect and the HW2 effect influence w_f^{nm} , the explanation for $\frac{\delta \bar{\alpha}}{\delta d} > 0$ is that for small d HW1 works in the opposite direction of HW2. Hence, the employment

in the host country has to be sufficiently small in order for the HW2 effect to dominate the HW1 effect. It can also be shown that $\frac{\delta\alpha}{\delta d} > 0$. The explanation is that for larger d , the wage in the host country increases due to HW1. This makes it harder for the union in the foreign country to succeed in bargaining for a higher wage, i.e. the employment share in the foreign country has to be sufficiently small (α large) in order for the HW2 effect to give rise to an increasing wage.

Using the expression for the wages in (26) we find that the unit cost in the foreign firm always increases if the foreign firm becomes multinational. Furthermore, it turns out that the unit cost of production in the foreign firm is independent of how large a share the foreign firm moves to the host country. That is, the effect of altering α , i.e. altering the weight of the wages in the expression for c_f , is exactly offset by the changes of the wages.

The rest of the results of the comparison are summarised in the following proposition.

Proposition 3 *For $d > 0$, $\alpha * q_f^{nm} + q_h^{nm} > q_n^{nn}$, $U_h^{nm} > U_h^{nn}$, $\pi_h^{nm} > \pi_h^{nn}$ and $\pi_f^{nm} < \pi_f^{nn}$. For $d < 0$, $\alpha * q_f^{nm} + q_h^{nm} > q_n^{nn}$ for $\alpha > \frac{1}{12}d\frac{d^3-6d^2-20d-120}{d^3-10d^2-8d+192}$, $U_h^{nm} > U_h^{nn}$, $\pi_h^{nm} < \pi_h^{nn}$ and $\pi_f^{nm} < \pi_f^{nn}$.*

It turns out that the employment in sector 2 in the host country always increases for $d > 0$, but for $d < 0$, α has to be sufficiently large to guarantee an increase in employment in sector 2. Furthermore, it can be shown that even if employment in sector 2 decreases, the payoff to the union in the host country unambiguously increases. Finally, since the unit cost of production of the foreign firm unambiguously increases if this firm becomes multinational, the variable profit of this firm decreases. This leads to an increase (decrease) in profits for the host country firm if $d > 0$ ($d < 0$). Finally, notice that since the unit cost of production in the foreign firm is independent of α (given $\alpha > 0$!) the employment, payoff of the trade

union and the profit of the host country firm is independent of α as well.

6.2 The subsidy

As before we start by finding the subsidy necessary for attracting production of the foreign firm.

Since \bar{F} (from (17)) is negative, we will for simplicity set $F = 0$.¹⁷ The total subsidy, $S^\alpha = s * \alpha * n$, necessary for making it profitable to become multinational can be found to be:

$$S^\alpha \geq \bar{H}(a, d) = \pi_f^{nm} - \pi_f^{nm}. \quad (35)$$

Notice that the total subsidy required is also independent of α . As in the section above, the government will choose to offer the smallest possible subsidy:

$$S^\alpha = \bar{H}(a, d). \quad (36)$$

Whether the increase in welfare is larger or smaller than the cost of giving the subsidy from (36) again depends on d .

Definition 4 Define d^* as the solution to:

$$-20\,720d^4 + 1889\,280d + 196d^6 + 13\,920d^5 + 31d^8 - 412\,608d^3 - 217\,152d^2 - 12d^7 + 552\,960 = 0$$

It can be shown that for $d > d^*$ the host country is better off by subsidising production of the foreign firm. Moreover, it can be shown that there only exist one d^* in the interval $[-1; 1]$ and this d^* is relatively close to -1. Hence, when the two final goods produced by the host country firm and the foreign firm are close complements then it will not be welfare improving for the host country to attract foreign production by offering a subsidy.

¹⁷ This does not qualitatively influence the results. If we included $F > 0$ we would just scale up the subsidy necessary for attracting production in the foreign firm, and the effect of F will be similar to the results in the section above.

Finally, it can be shown that, $\Delta T = W_f^{nm} - W_f^{nn} + W_h^{nm} - W_h^{nn} < 0$. In other words, world welfare unambiguously decreases when the foreign firm becomes multinational.

7 Appendix B

In the text there has been referred to the following expressions.

By using (7), (14) and (16) we find that:

$$\bar{G}(a, d) = \frac{1}{4}(d^3 - 192 + 148d - 28d^2) \frac{d(a-1)^2}{(-2d-8+d^2)^2(-8+d)^2}. \quad (37)$$

Using (7), (12), (14), (16) and (18) leads to

$$\tilde{G}(a, d) = \frac{(a-1)^2}{2(-1216d^2 - 32d^3 + 116d^4 + 1024d - 20d^5 + 4096 + d^6)} * \quad (38)$$

$$(-9d^4 - 448d - 4d^2 + 32d^3 + d^5 + 768). \quad (39)$$

By using (7), (16), (14) and (21) we find that

$$\hat{G}(a, d) = \frac{1}{4}(3d^4 + 236d - 8d^2 - 21d^3 - 320) * \quad (40)$$

$$\frac{d(a-1)^2}{d^6 - 20d^5 + 116d^4 - 32d^3 - 1216d^2 + 1024d + 4096} \quad (41)$$

Using (7), (14), (30), (31) and (32) leads to

$$\bar{H}(a, d) = \frac{-9}{64}(3904d^2 - 20d^5 + d^6 - 3072d - 20736 - 172d^4 + 544d^3) * \quad (42)$$

$$\frac{(a-1)^2}{(d^6 + 4d^5 - 26d^4 - 120d^3 + 105d^2 + 900d + 900)(d^2 - 16d + 64)}.$$

The following table shows the expression for $\bar{G}(a, d)$, $\tilde{G}(a, d)$, $\hat{G}(a, d)$ and $\bar{H}(a, d)$ in the special cases where $d = 1, 0, -1$:

d	1	0	-1
$\overline{G}(a, d)$	$-\frac{71}{15876}(a-1)^2$	0	$\frac{41}{900}(a-1)^2$
$\tilde{G}(a, d)$	$\frac{170}{3969}(a-1)^2$	$\frac{3}{32}(a-1)^2$	$\frac{13}{45}(a-1)^2$
$\widehat{G}(a, d)$	$-\frac{55}{7938}(a-1)^2$	0	$\frac{1}{15}(a-1)^2$
$\overline{H}(a, d)$	$\frac{57}{1792}(a-1)^2$	$\frac{81}{1600}(a-1)^2$	$\frac{295}{2304}(a-1)^2$

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