ISSN 1755-5361

University of Essex

Department of Economics

Discussion Paper Series

No. 710 April 2012

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March, 2012

Abstract

A national authority wishes to attract foreign direct investment (FDI) to create local jobs. We analyse the optimal national trade policy faced with the possibility that local authorities might offer subsidies to convince a multi-national enterprise (MNE) to invest in their jurisdiction. With centralised decision-making or with allocation of investment to particular localities, the central authority's optimal policy is to use a high tariff to avoid payment of any subsidy to the MNE. Despite this, some socially undesirable (but locally desirable) FDI cannot be avoided. If local authorities compete to offer subsidies to attract local investment, then the central government's optimal policy is to try to discourage FDI by choosing a low tariff. Again, despite this some socially undesirable – and even locally undesirable -- FDI prevails. We conduct our analysis both assuming an upper bound on tariffs, as would be consistent with trade liberalisation, and allowing tariffs to vary freely. The effect of this trade liberalisation depends heavily on the system of granting local subsidies: if the system is rather centralised, trade liberalisation decreases the range of parameters for which FDI occurs; if the system is decentralised and competitive, it increases this range.

Keywords: foreign direct investment, employment, tariff, tax, decentralisation, local public finance

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We would like to thank a variety of individuals and seminars for their contributions, including audiences at ERWIT, Gerzensee, Minnesota, the Summer Econometric Meetings, and Keele. We would especially like to thank Michael Riordan and Antoine Bouet for their comments. The paper represents opinions of the authors and not those of their organisations. All mistakes clearly are the authors'.

1. Introduction

Regional policy to attract foreign direct investment (FDI) and generate new jobs has been prominent in the recent discussion of how to stimulate local economies and relieve the effects of the global recession[1]. Jones and Wren (2008) note that, under European Union state aid rules, regional grants are one of the few means by which states can attract FDI. Where serious underemployment exists, for example, economic incentives are permitted to attract foreign firms as a way of resolving underemployment problems. Indeed, these authors comment that the UK and France devote half their regional policy budgets to financial incentives to attract FDI.

Many countries have similar local stimulus policies aimed at attracting foreign investment. A UNCTAD (2000) global survey notes that nearly all countries offered incentives targeted as specific sectors, while seventy percent of countries offered regional incentives. In many cases regional and sectoral incentives were integrated, so that only certain sectors received incentives in certain regions. More generally, these incentives take a variety of forms and may be offered over time or as a lump sum to assist with entry. Davies (2003) and OECD(2008) indicate that such incentive can affect FDI locations decisions significantly[2]. Offering more detail on this for the case of the UK, Ernst and Young (2011) notes that tax/subsidy benefits, supporting infrastructure investments, and low administrative requirements are all important factors in the decision of firms to locate in a region or not. A major reason, also singled out in the report, for a state to offer these policies is employment gains, with 21,000 jobs created by FDI in the UK in 2010.

As noted by the UNCTAD (2000) survey, in a federal system the package of incentives offered to the investor may include central as well as state-based incentives and the process of agreeing a package may involve differing degrees of competition among regions. Such competition can create windfall benefits for investors. The report cites a case in the United States where Mercedes-Benz wished to establish a new car plant and contacted six states before deciding to accept a (generous) location package from Alabama. Competition among states in Brazil to attract a Ford Motors assembly plant also is cited in the report. UNCTAD (2000) goes on to enumerate an exhaustive list of regional policies towards FDI, illustrating that different countries have chosen different degrees of centralisation. Roughly speaking, the US and Europe seem to take are relatively decentralised approach (although this varies by country), many developing countries seem to take the approach of designating a limited number of regions (sometimes only one) that are allowed to offer the incentives without internal competition among regions, and some smaller countries (such as Singapore) take a purely centralised approach. When a region is the designated destination, the

[1] See Ernst and Young (2011) or material from Scottish Development International at http://www.sdi.co.uk/ as examples of this.

[2] OECD(2008) finds in a review of studies on the effect of tax incentives that a one percent increase in effective tax rates results in up to a five percent decrease in FDI. Davies quotes findings on a similar degree of responsiveness of FDI in US states in response to changes in US state tax rates.

actual negotiations for the incentive package can be delegated to the local authority[3]. Jones and Wren (2008) note that centralisation and the degree to which competition is permitted among regions within a country can vary over time, documenting the vacillations in the UK system over the years[4].

FDI Location decisions are affected by more than just regional incentive policies, however. Trade policy is clearly a factor in the decision to conduct FDI or to export. Even in federalised countries, trade policy typically is in the hands of the central government. For federal governments concerned that competition among regions can dissipate the rents that would otherwise accrue to the country from FDI, trade policy as a tool to avoid this destructive competition is one way forward. Intuitively, trade policy can deal with the problem of excessive local bidding in two ways: first, in setting high tariffs the central government can decrease the "bargaining power "of the multinational enterprise (MNE). This policy does not discourage FDI, but it can decrease the rents captured by the firm in the bidding. Another approach is to lower the tariff so as to make the (local) incentives required to attract the FDI prohibitively high for the region(s). This policy potentially eliminates FDI entirely in favour of imports, but also eliminates costly subsidy competition in the process. Where local subsidies would mount to levels that outweigh the country's gains, this can be a better choice for the nation as a whole.

This paper explores this intuition. We study whether and how trade policy can be used effectively with an incentives policy when incentives can be decentralised by region and where regions may or

[3] The degree of delegation to the local authority can be a matter of intense debate. To give some examples, recent debate about how to set up an Enterprise Zone comprising Northern Ireland both has focussed on Enterprise Zones as a means of attracting FDI and on the degree of delegation of specific incentive negotiations to Northern Ireland as a local authority. See http://www.publications.parliament.uk/pa/cm201012/cmselect/cmniaf/558/55808.htm and http://www.publications.parliament.uk/pa/cm201012/cmselect/cmniaf/558/558we15.htm Belgium used to operate a centralised system, where typically, enquiries went through diplomatic channels to the central government, which then decided whether this opportunity would be for the "Flemish" or the "Walloon" region of the country, at which stage negotiations with the regional, provincial, or communal authorities could proceed. Interestingly, Belgium is now extremely decentralised, so that its two main regions would normally be trying to attract the same MNE's. China has followed a policy that has vacillated between larger and smaller local control of approval of foreign investment projects, even within the limited number of economic zones in which FDI has been permitted in the past. For some sectors, central approval is required whereas for others an "automatic"route allows entry with approval by a delegated board. See http://www.indianembassy.org.cn/DynamicContent.aspx?MenuId=17&SubMenuId=11 for a description of current procedures. The right to grant tax breaks to FDI has been centralised, so that different regions could be favoured. For example, central and western areas have been given the right to allow tax incentives recently, while this right has been reduced for coastal areas. See http://www.chinalawblog.com/2010/05/china_foreign_direct_investmen.html. India, too, has modified its policy over time from a system of industrial licensing, largely controlled by the centre and including locational restrictions, to one of largely decentralised policies at the state level. For discussion see Ahluwalia (2002).

[4] Following the abolition of the regional development agencies by the coalition government, responsibility for the promotion of the UK as an inward investment location was transferred to the national level whereas it was devolved before. See http://www.bis.gov.uk/policies/economic-development/englands-regional-development-agencies . For further discussion of recent changes in the degree of centralisation of FDI incentives in the UK and current policy implementation from a user perspective, see also http://www.coast2capital.org.uk/articles/foreign-direct-investment.html .

may not be allowed to compete for the FDI. Following Brander and Spencer (1987) and the sense of the literature we have quoted as motivation, we postulate that FDI can increase local levels of employment. A single MNE considers investment into a country (or group of countries). Local authorities try to attract the foreign firm by offering subsidies, which can be thought of broadly in our model as any package of incentives to attract the firm (involving tax breaks, infrastructure investments and so on). Trade policy takes the form of a per unit import tariff set by the central government. In choosing the tariff, the central authorities take into account its effect on the bidding behaviour of the local authorities and the investment decision of the MNE.

Our first result is that, if both the trade and FDI attraction policies are centralised, FDI only occurs when it raises the country's welfare. It is induced optimally through a high tariff so that no subsidies are paid. The intuition is the one we have specified: the tariff has the advantage of affecting the decision to locate but also the "bargaining position" of the firm. By this we mean that trade policy has the ability to affect the attractiveness of the alternative of exporting compared to FDI.

We next consider the intermediate case, perhaps the most typical case according to the UNCTAD survey, where the central authority allocates the investment project to a limited number (one in our model) of regions when then negotiations proceed with the MNE in a decentralised way. No competition occurs among regions, but the decision of precisely how to set the incentive package is delegated to the region. Again, all socially desirable FDI occurs and is induced by setting a high tariff in order to prevent the payment of subsidies by the region. On the other hand, there are cases where FDI is undesirable for the country as whole but desirable for the region. In this case, the region may be willing to subsidize the FDI despite its wider impacts. While one might expect that the central government would prevent this from happening by setting a tariff so low that the subsidy necessary to attract FDI would mount to unacceptable levels for the regional authority, we show that this cannot be the optimal policy. The reason is that the tariff must fall to such an extent that exports are no longer the preferred policy. Instead, the central government sets the best tariff given that FDI will occur. This is a high enough tariff that a local subsidy will not occur.

Finally, we consider the fully decentralised case where different regions compete for FDI. The crucial effect of this competition among regions is that the central government can no longer induce subsidy-free FDI by setting a high tariff. To the contrary, an increase in the tariff can increase the level of subsidy offered by the states in their attempt to compete for the jobs that the foreign firm has to offer. On the other hand, in this case the central government may find it optimal to avoid socially undesirable subsidized FDI by setting its tariff sufficiently low, and so provide an incentive for the firm to switch to exports. Hence, regional competition in incentives to attract FDI makes FDI more expensive. The central government curtails this excessively expensive competition by *lowering* the tariff and so encouraging imports.

Overall, when we compare regimes, we find that the range of levels of production efficiency for which FDI occurs under the optimal trade policies is larger with full centralisation or non-competitive bidding than with competitive bidding. Competitive bidding makes FDI socially less desirable because FDI is associated with the payment of positive subsidies. Since, for high cost levels, the government can effectively avoid undesirable FDI by setting a low tariff (so that the firm exports, by preference), the equilibrium range of FDI is curtailed. Unsurprisingly, competitive bidding leads to

higher levels of equilibrium subsidies. Centralisation or non-competitive bidding regimes are associated with an optimal tariff that is at least as large as that under decentralisation and competitive bidding: while a less competitive system relies heavily on higher tariffs to reduce subsidy levels, the ability to do this is curtailed under decentralisation with competition among regions.

The policies outlined so far rely on high tariffs to induce subsidy-free FDI. Clearly, tariffs cannot be set in an unconstrained way under WTO rules. It is important, then, to observe the effect that tariff caps place on the optimal policies we have outlined. We therefore proceed to impose a maximum tariff level and examine the effect of progressively reducing these tariffs on FDI and incentive levels. We find that the effect of trade liberalisation depends crucially on the institutional regime we consider. In the fully centralised case, a tightening of tariff caps leads to less FDI but higher subsidy levels for the FDI that occurs. Hence, both the amount of FDI and the instrument balance to induce it change. The case with decentralisation but no competition among regions yields similar results. With competition among regions, however, moderate caps affect neither subsidy levels nor equilibrium FDI patterns. On the other hand, more drastic trade liberalisation increases the range for which FDI subsidies are observed. Hence, the decentralised regime is more "robust" to moderate tariff caps precisely because high tariffs are less effective in such a regime at reducing subsidy costs. On the other hand, substantial tariff reductions can increase the range over which we observe FDI for decentralised regimes. This is because the dominant effect for a substantial reduction in tariffs is that the decreased tariff makes exports less attractive to the country compared to FDI because tariff revenues become negligible. On the other hand, it can decrease this range under centralised regimes or regimes without bidding because the dominant effect becomes that the subsidy to attract FDI increases a great deal when the tariff becomes very constrained. Taken in combination with the comparison of regimes, the effect of a lessening of tariffs is to bring the ranges over which FDI occurs closer under the various policies.

Trade policy, FDI, and tax competition have been treated extensively in the literature. Trade policy and tax competition have been examined jointly by Horst (1971) and Janeba (1996) but the tax competition occurs between two different countries that also can set their own trade policies. In contrast, we focus on regional tax/subsidy competition within a single tariff-setting country. Decentralisation in the presence of tax competition among countries has been studied by Wilson and Janeba (2005), with the result that decentralisation can improve welfare by serving as a commitment that changes the strategic behaviour of the competing countries, but this paper does not interact tax with trade policy[5]. While Brander and Spencer (1987) consider trade and tax policies in a setting where FDI generates local employment, they do not introduce competition among local authorities. Also, the timing of their policies differs from outs: while they assume that the decision to enter a market is made before tariffs and taxes are set, we assume the contrary in order to focus on the incentive effects on firm location of these policies[6].

[5] See also references in Wilson and Janeba for other papers on decentralisation of tax policy in the presence of international capital flows. Public good provision is a key element of many of these papers, but is not the focus of our work.

[6] A wide number of other issues relating to decentralisation have been discussed, many in the context of developing countries, including institutional weakness (Estache and Wren-Lewis (2009)), accountability and

The closest paper to ours if Raff (2004). While Raff examines the effect of customs unions and free trade areas on FDI, and so treats a context distinct from decentralisation of incentives within a country, the institutions he considers are similar in the sense that they progressively constrain – or centralise – an instrument. In his case, the instrument is tariff setting with respect to external countries. In his paper, states can also set a profit tax independently and non-cooperatively irrespective of the constraints on tariff setting so as to attract FDI. He then compares the effects of the various regimes on FDI creation, consolidation and destruction. The case of FDI creation clearly is most relevant to our work. Using the fully decentralised case as a baseline, he finds that free trade areas create FDI when production costs in the partner countries are in an intermediate range: large enough that without the free trade area, countries would prefer imports, and small enough that no country has an incentive to deter FDI.

Raff's mechanism, results and institutions are quite distinct from ours despite a shared theme of centralisation. First, the benchmark of complete centralisation from which we depart is not a relevant or explored case for his framework while it is for ours. Second, as there is always some form of (tax) competition at the local level in Raff's paper, the basic issue we consider of systems that reduce incentive competition among regions under a unified tariff policy is not a theme of the paper. Third, in our paper the tariff has a distinct effect on the "bargaining position" of the foreign firm compared to the incentive instrument. This can lead the tariff to dominate local incentives. As Raff does not exploit a bidding framework and so the tariff cannot have this distinct function. Finally, the main benefit of FDI in our model is job creation whereas it is revenues from profit taxes in Raff's framework. As employment benefits vary with firm efficiency differently from profit tax benefits, we can end up with cases where FDI is both efficient in terms of production costs and socially undesirable. In other words, efficient local production is associated with little employment creation even though it might result in high profitability. Hence, the fact that the main benefit of FDI differs and the analytical framework differs across the two models is key to generating the differing results in the two papers. The papers are complementary, however, in the sense that they deal with aggregation at different levels (national and international) and they deal with policy choice under different social goals for FDI (jobs or profit tax revenues).

The rest of the paper is organised as follows. The basic model is presented in section 2. The baseline case where trade and FDI policies are centralised is solved in section 3. Section 4 discusses a situation of partial decentralisation while section 5 analyses the cases of full-fledged bidding between local authorities. Section 6 revisits these three cases in the presence of tariff constraints. Section 7 examines the robustness of our results and proposes some directions for future research.

2. Basic Model

Our set-up follows Brander and Spencer (1987) closely. We consider one home country and one foreign MNE. Two goods are consumed in the home economy: good *y*, which can only be produced by the MNE, and a numeraire good, *x*, which is produced locally. The utility function of a representative home consumer takes the form:

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corruption issues (Bardhan and Mookherjee (2006)), and political economy issues (Besley and Coate (2003)). We abstract from these issues here.

$$U(x, y) = x + u(y)$$

In other words, utility is separable in the numeraire good. This means that the marginal utility of income is constant so that consumer welfare can be meaningfully measured as consumer surplus, defined as:

$$CS = u(y) - p_y y$$

Where p_y is the price of good *y*.

The MNE can either produce good *y* locally or it can export it from one of its foreign plants. The unit cost of producing the good abroad is assumed to be constant and equal to c_x, giving the firm a profit of $\pi(c_x)$. To produce a good *y* locally, the MNE would use local labour in the fixed proportion of a_L units of labour per unit of output.

An important feature of the model is that there is unemployment in the home country. This is consistent with the motivating studies we quoted in the introduction. Indeed, one of the main rationales for regional FDI incentives is precisely to provide jobs in areas with high unemployment. Following Brander and Spencer (1987), we model this unemployment s arising from the fact that the local wage *w* is set above its market clearing level. Hence, the profit function of a MNE that chooses to supply the market from local production is:

$$\pi^i = p_y y - w a_L y .$$

Solving this maximisation problem one can obtain the levels of output and employment chosen by the MNE as a function of the fixed wage rate of the home country. In other words, $L = L(w)$ and $y = y(w)$. To simplify our analysis, we will find it useful to define the unit cost of local production as $c^I \equiv w a_L$ so that we can write the firm's chosen output as $y(c^i)$ and its corresponding profits and employment levels as $\pi^i = \pi(c^i)$ and $L^i = L(c^i)$.

Good *x* is produced by *N* identical firms each using quantities $\frac{L^n}{N}$ of local labour and an industry-specific factor of production, *T*, which is in fixed supply and fully employed, enjoying a per unit return equal to ρ. This implies that L^n only depends on the fixed wage *w*, the fixed number of firms, *N*, and the fixed supply of *T*. In particular, L^n is independent of public policy and production decisions in the industry, *y*[7].

In the absence of any tariffs, taxes or subsidies, the welfare of the home country is $W^x = CS(c_x) + wL^x$ if good *y* is imported and $W^i = CS(c^i) + wL^i$ if good *y* is produced locally.

Public policy toward FDI takes the form of a lump sum subsidy, *S>0.* We think of this subsidy as representing the discounted values of tax breaks that can be credibly committed to or as the value

[7] See Brander and Spencer (1987), pp. 262-3 and 267 for details.

of infrastructure investments that the public authority has agreed to undertake on behalf of the MNE[8]. We will assume throughout that this subsidy cannot be negative and that it does not affect the marginal cost of production of the MNE[9]. The trade policy of the federal government consists of setting a unit import tariff/subsidy of *t*.

We will assume throughout that policy makers maximise the welfare of their constituency. Tariff revenues are redistributed to all citizens as a lump-sum transfer. Similarly, any subsidy is financed through a lump-sum tax. National welfare is, then, measured by the corresponding value of the utility function, $U(x, y)$. Since expenditure must equal income we have:

$$x + p_y^i y^i = w\left(L^n + L^i\right) + \rho T - S$$

if the firm invests and:

$$x + p_y^x y^x = w(L^n + L^x) + \rho T + t y^x$$

if the MNE serves the home market through exports. Substituting these into equation (1), and using $c^i = \alpha_L w$ and the definition of consumer surplus, one obtains:

$$W^i = CS\left(c^i\right) + \rho T + wL^n + c^i y\left(c^i\right) - S$$

And

$$W^x = CS(c_x + t) + \rho T + wL^n + t y(c_x + t)$$

We will assume that $CS(c^i)$, $\pi(c^i)$ and $y(c^i)$ are continuous and twice differentiable in c^i. We will also assume that the MNE faces a downward sloping marginal revenue function.

Comparing the two equations reveals the traditional trade-off faced by the home country: FDI yields employment benefits equal to $c^i y(c^i)$ but eliminates tariff revenues:

$$\Delta W \equiv W^i - W^x = CS\left(c^i\right) - CS(c^x + t) + c^i y\left(c^i\right) - t y(c_x + t)$$

or, more simply,

$$\Delta W = \Delta CS + c^i y^i - t y^x$$

If $c_x + t$ exceeds c^i, FDI also leads to lower domestic prices and hence to greater consumer surplus. This benefit of FDI is greater for lower values of c^i. On the other hand, the employment benefits of

[8] We do not consider the hold up problems of a failure to commit to public policy or the differential risks of hold up in centralised rather than decentralised system. For a discussion, see Kessing et al (2007).

[9] If *S* is related to taxes, then assuming that the "normal" tax regime is the same at home and abroad, a negative value would mean that the MNE faces a tax treatment that is worse than the one offered to an established (foreign or domestic) firm. Such discrimination might be illegal under local law and would certainly be frowned upon by the WTO. In fact, such behaviour would be banned under the OECD model tax treaty. The assumption that subsidies do not affect marginal cost is made to simplify the solution of the bidding game between local authorities. While it is reasonable if *S* represents future tax breaks or other lump sum incentives, one might expect that infrastructure investments or certain other policies to lower the marginal cost of production of the firm. The consequences of relaxing these assumptions are discussed in sections 7 and 8.

FDI are not monotonic in c^i: they must be increasing in c^i for c^i close to zero and must be decreasing in c^i for c^i close enough to the choke point where $y^i(c^i) = 0$. Intuitively, since labour is the sole cost of production[10], employment creation tends to be smaller if local production is very inefficient (in other words, either a_L or/and *w* is large) so that local production is low or if local production is so efficient that only few local workers need to be hired to serve the local market.

The timing of the game differs significantly from the timing in Brander and Spencer (1987), where the tax or tariff rates are set after the MNE has decided whether to serve the home market through FDI or through exports. Instead we assume, somewhat more traditionally, that local and federal governments can commit to their respective policies before the MNE decides where to locate its production facilities. The reason for this choice is our focus on internal tax competition. In order to compete for FDI, local authorities must clearly be able to offer credible (incentive packages) to the MNE before investment actually takes place. As we mentioned in the introduction, incentive packages seem to be empirically significant in firm location decisions. Moreover, commitment mechanisms do indeed exist. Firstly, the incentive packages can be written into a legally enforceable contract. Secondly, states hoping to ensure a steady flow of job-creating foreign investment cannot afford to destroy their reputation by reneging on previous deals.

We also assume that the federal government moves first, in other words that it anticipates the effects of its trade policy on the policies of local authorities and on the investment behaviour of the MNE. The main justification for this assumption is that local investment packages are individualised and, as such, are determined through more flexible institutional mechanisms than trade policy.

3. A Benchmark: The Fully Centralised Case

In this section we assume that tariffs and subsidies are both set by the central government. In such a case, the order in which *S* and *t* are determined does not matter.

We first need to determine under what conditions the MNE will prefer FDI to exports. In the absence of subsidies, quite trivially, the MNE invests if and only if $c^i \leq c_x + t$. In the presence of subsidies, we cannot avoid comparing profit levels. The MNE invests if and only if:

$$\pi(c^i) - S \geq \pi(c_x + t)$$

Let us define *t** as the optimum tariff/subsidy when FDI is not possible. Hence, *t** is the usual "optimum tariff" of the trade literature. Formally, we have:

$$t^* = argmax(CS(c_x + t) + ty^x(c_x + t))$$

It is useful to first look at the optimal tariff policy in the absence of any investment-related subsidy. We will take the unit cost of foreign production c_x as given and consider different ranges for the value of local production c^i. To clarify the terminology, we say that FDI is "socially desirable" if it leads to greater country-wide welfare than exports under the optimal tariff *t**.

[10] This intuition, and thus many of the results in the paper, holds for more complex production functions as long as labour cannot be substituted for too easily.

For $c^i = c_x + t^*$, welfare is higher under FDI than under the best possible trade outcome. As shown in figure 1, this is because FDI results in the same domestic price for good *y* as the best possible trade policy and generates employment benefits ABEF that exceed the tariff revenues ABCD of the optimal trade policy[11]. It is therefore optimal for the government to set $t \geq t^*$ to ensure that the MNE chooses to invest. We can then conclude that FDI is socially desirable and occurs in equilibrium.

In order to consider other values of c^i we need to make an assumption about the shape of the welfare function[12].

Assumption 1: $CS(c^i) + c^i y(c^i)$ is strictly quasi-concave in c^i for all $c^i \in [0, c_H^c]$, where c_H^c is defined such that $y(c_H^c) \equiv 0$.

Lemma 1: *If assumption 1 is satisfied and the unit cost of foreign production,* c_x *is low, then there exist two values,* c_L^i *and* c_H^i *such that FDI is socially desirable if and only if* $c^i \in [\max(0, c_L^i), c_H^i]$.

Proof: See Appendix

The main intuition behind lemma 1 is straightforward. A decrease in c^i has two effects on domestic welfare under FDI. On the one hand, it increases domestic surplus; on the other hand, it changes the total employment benefits obtained, i.e. $c^i y(c^i)$. For low enough values of c^i, this second effect becomes negatives so that, if exporting is sufficiently efficient, FDI can eventually become less attractive than exports. If, on the other hand, c^i becomes very large, FDI decreases consumer surplus and only offers small employment benefits as c^i approaches the choke point where $y(c^i) = 0$. The upshot of this lemma is that FDI is socially desirable in an intermediate range of local costs of production.

For the rest of the paper, we concentrate on the case where c_L^i is positive which occurs whenever export costs are low enough. This allows us to reduce the number of cases to be considered without significantly affecting the qualitative results of the paper[13].

Assumption 2: $CS(0) - CS(c_x + t^*) - t^* y(c_x + t^*) < 0$, i.e. c^x is low enough to ensure that $c_L^i > 0$.

[11] Formally, consider the equation for the change in welfare in the model section. We have $\Delta CS = 0$ and $y^i = y^x$ so that $\Delta W > 0$ if and only if $c^i > t^*$, which must be true for all $c^x > 0$.
[12] This assumption is verified for linear demands.
[13] A version of the paper where both cases are considered is available from the authors.

The optimal trade policy for the fully centralised case is described in figure 2.A.

For $c^i < c_x + t^*$, FDI is somewhat more efficient than exports, so that a tariff equal to t^* or even somewhat below would be jumped. From Lemma 1 we know that FDI is socially preferred to the best possible export regime as long as $c_L^i \leq c^i < c_x + t^*$ so that the optimal trade policy is to set tariff $t \geq t^s \equiv c^i - c_x$ and the MNE chooses to invest. For $c^i \leq c_L^i$ on the other hand, FDI is socially undesirable. Still, with $t = t^*$, FDI would occur since $c^i < c_x + t^*$. The only way for the government to prevent FDI is then to set a low enough tariff, namely $t < t^s \equiv c^i - c_x$. However, departing from the optimal tariff t^* also lowers the attractiveness of the export regime. Which of these two opposing effects dominates? At $t = t^s$, we have $\Delta CS = 0$ and $y(c_x + t^s) = y(c^i)$ so that $\Delta W > 0 \; iff \; c^i > t^s$…which must be true for all $c_x > 0$. This means that the best enforceable trade regime (i.e. the best tariff that leads the MNE to choose to export) is dominated by the FDI regime. Hence, for all $c^i \leq c_L^i$, FDI occurs in equilibrium even though it is not socially desirable.

Finally, we must consider the case where FDI is quite inefficient, in other words the case where $c^i > c_x + t^*$. Over this range, FDI leads to lower levels of output than export. This means that FDI lowers consumer surplus but yields employment benefits that can be higher or lower than the tariff revenues obtained under the optimal tariff, t^*. We know from lemma 1 that the second effect dominates as long as $c^i \leq c_H^i$. Therefore, the government optimally induces FDI by setting $t \geq t^s \; if \; c_x + t^* < c^i \leq c_H^i$. If $c^i > c_H^i$, the government sets $t = t^*$, ensuring that the MNE chooses to export.

The previous analysis is summarised in proposition 1. We call FDI "inefficient" if $c^i > c_x$.

Proposition 1: *With a centralised government, any socially desirable FDI occurs. Whenever FDI is inefficient but socially desirable, it is induced by setting a high enough tariff. High cost, socially undesirable FDI does not occur. However, low-cost undesirable FDI does occur, as it will not be prevented through a low tariff. In particular, if FDI is very efficient, it occurs in equilibrium even though it is socially undesirable.*

Reiterating our intuition, FDI brings the strongest employment benefits when it is "moderately" efficient. This means that, from the pure employment perspective, very efficient or very inefficient FDI has few benefits. Tariff revenues and consumer surplus have to be considered alongside employment benefits, however. Very inefficient FDI compared to export lowers consumer surplus. If FDI is inefficient enough, the employment benefits are so small and the consumer surplus effects are so large that tariffs are set so that the firm exports and tariff revenues are earned instead. As FDI becomes more efficient, the employment benefits grow and the consumer surplus effects become more muted so that FDI is induced via a large enough tariff that exports are effectively discouraged. As FDI continues to become more and more efficient, however, the employment benefits begin to fall off again so that FDI eventually becomes socially undesirable compared to exports and the associated tariff revenues. Unfortunately, the only way to prevent the firm from choosing FDI, given its efficiency, is to lower the tariff and so constrain tariff revenues . When FDI is

efficient enough, the tariff would have to be lowered to the point that it is better for the country to simply to accept FDI.

We have so far not allowed for the use of non-negative lump-sum subsidies. Allowing these does not modify the analysis at all: whenever FDI is socially desirable, it is more efficiently induced through a high tariff than through a subsidy (as the tariff is associated with revenues rather than a cost). Moreover, clearly positive subsidies cannot help prevent undesirable FDI. Hence, we can state:

Proposition 2: *If trade and FDI policies are centralised and the government is not tariff-constrained, positive subsidies never are observed.*

4. Decentralisation Without Tax Competition

In this section, we consider a country with *N* independent local authorities. The federal government sets the trade policy of the country but FDI related subsidies are only offered at the local level. Still, we consider here the case where *only one* of the local governments will be trying to attract the MNE. There are three reasons for proceeding in this way. First, this is a useful point of reference that allows us to separate the effect of the *externalities* that investment in one state generates for the other states from the effect of *bidding competition* between the states. Secondly, it is an appropriate model for federal countries where FDI enquiries are "allocated" to a specific region by the central government. As we showed above, this is a very common policy. Finally, it also provides a good approximation for cases where, because of heterogeneity across states, one of the *N* states is significantly more attractive to the MNE than the others. Indeed, studies of the determinants of FDI in a variety of countries suggest that this might not be an uncommon case, as local infrastructure and labour market conditions tend to play a large role in the decision of where to locate[14] , including notable historical dominance of Guandong among eastern provinces where FDI permitted over a long period. Similarly, the abundance of natural resources in inland regions in China suggests FDI ventures involving mining (see articles regarding Rio Tinto recently in financial times) would naturally be situated in areas local to the relevant resources.)

Let us call the lone bidding state "state 1". To define the welfare function of state 1, we assume that all employment benefits accrue to its residents. We then proceed as in section 2 to obtain the difference between the welfare of the state with FDI or export:[15]

$$\Delta W_1 = W_1^i - W_1^x = \frac{\Delta CS - ty^x}{N} + c^i y^i$$

[14] See http://www.oecd.org/dataoecd/57/23/1922648.pdf

[15] To be complete, we must also assume that the quality between revenue and expenditure holds on a state-by-state basis, in other words no state is running a "balance of payment" surplus or deficit with any other state.

Comparing this equation to the equation obtained in section 3 for the country as a whole allows us to identify two discrepancies between state 1's incentives to attract the MNE and the effect of FDI on the welfare of the entire country or set of states:

$$\Delta W - \Delta W_1 = \frac{N-1}{N}(\Delta CS - ty^x)$$

The employment effects of FDI are not an issue. Since state 1 fully appropriates such benefits, they appear identically in ΔW_1 and ΔW. There are, however, two sources of externalities. Firstly, whenever FDI leads to a lower or higher price for good *y* than exports (in other words, whenever $c^i < or > \ c_x + t$), the corresponding benefits or costs to consumers are spread equally across the *N* states. Secondly, the loss of tariff revenues due to tariff jumping is share evenly between the *N* states as well. In both cases, state 1 will then only consider *1/Nth* of the effect of FDI on national welfare.

We can now determine when state 1's incentives to attract the MNE are excessive or insufficient from the point of view of the country as a whole. If $c^i \geq \ c_x + t$, then, the price of *y* is higher under FDi and both externalities are negative. Hence, we have $\Delta W - \Delta W_1 < 0$ and state 1's incentives to attract FDI are excessive. If, on the other hand, $c^i < c_x + t$, then the consumer surplus externality is positive while the tariff revenue externality is negative. If $c_x + t$ is high enough, there will be positive values of c^i for which the consumer surplus externality dominates so that state 1's incentives to attract the MNE are "federally" insufficient. We define this critical value as $c_D^i < c_x + t$.

Lemma 2: *Under Assumption 2,* $c_D^i < 0$ *so that local incentives to attract FDI always are excessive from the point of view of the country as a whole.*

Proof: See Appendix[16]

As shown in figure 2B, lemma 2 already allows us to determine the optimal trade policy of the federal government for a broad range of values of c^i.

Whenever unsubsidised FDI is socially preferable to importing the good at the optimal tariff, t^*, the optimal policy consists of setting a tariff high enough to ensure that the MNE would decide to invest, even in the absence of any subsidy. Given such a trade policy, the local authority does not offer any subsidy, since the MNE will invest anyway. In other words, a high tariff is used to induce desirable FDI without the payment of any subsidy. Hence, for all $c^i \in [c_L^i, c_H^i]$, we have $t > t^s \equiv c^i - c_x, S = 0$ and the MNE chooses to invest.

For $c^i \in [0, c_L^i[$, subsidy-free FDI is socially undesirable. However, since the local authority's incentives to attract the MNE are socially excessive there is now a range of c^i , defined as $[c_z^i, c_L^i[$, for which the local authority is willing to subsidize FDI even though export is preferable for the country as a whole. The federal government can only try to prevent this inefficient and subsidy-wasting FDI by setting a tariff low enough that attracting the MNE becomes prohibitively expensive for state 1.

[16] Again, a version of the paper where the case of high unit cost of exports is fully treated is available from the authors.

We saw in section 3 that, with centralisation, such a policy could not be optimal because the decrease in tariff required to prevent FDI made social welfare with exports lower than with subsidy free FDI. The same conclusions must hold even more strongly in the current case because local subsidies force the trade policy authority to depart even more from *t=t** in order to convince the MNE to choose the export route. Since lower tariffs cannot usefully prevent undesirable FDI, the federal government can only use its trade policy to help minimise the social cost of FDI. Again, this is done by setting a high enough tariff to induce subsidy-free investment. Hence, the optimal trade policy still involves setting $t > t^s = c^i - c_x$ and leads to socially undesirable, but possibly locally desired, FDI without subsidy.

Finally, we must consider the upper range of c^i where FDI is socially undesirable. For $c^i > c_H^i$, FDI is socially undesirable but, at least for values close enough to c_H^i, it is locally desirable. Since $c_H^i > c_x + t^*$, FDI would not happen without subsidies if the federal government chose t^*. The relevant question then is whether the local authority is ever willing to pay a big enough subsidy to induce FDI at *t=t**. The following lemma shows that, in fact, over this range of values of c^i, local authorities never offer a subsidy large enough to convince the MNE to invest rather than export.

Lemma 3: *There is a range of $c^i > c_H^i$ for which the local authority would prefer FDI to exports even though exports would make the country as a whole better off. However, the local authority never is willing to offer a large enough subsidy to actually trigger FDI.*

Proof: See appendix.

We can now summarise the analysis of this section in a proposition.

Proposition 3: *For $c^i \in [c_L^i, c_H^i]$, FDI is socially and locally desirable and is induced by setting a high enough tariff to ensure that no subsidies are paid to the MNE. There is a range $[c_z^i, c_L^i[$ for which FDI is locally desirable but socially desirable. Over this range, the optimal trade policy is to set the tariff high enough that FDI occurs but the MNE does not receive any subsidy. For $c^i \in [0, c_z^i[$, FDI is neither socially nor locally desirable but it cannot be prevented in a manner that remains socially desirable. The optimal trade policy is again to set a tariff high enough so that FDI occurs in a subsidy-free manner. For $c^i \in]c_H^i, c_H^{iL}]$, FDI is socially undesirable but locally desirable. Since the local subsidy is too small to induce tariff jumping the federal authority sets t=t* and the MNE serves the market through exports. Finally, for $c^i \in]c_H^{iL}, c_H^i]$ FDI is both locally and socially desirable but can be avoided by setting t=t*.*

Figure 2B compares the equilibrium pattern of export and FDI for the fully centralised case and the case of one bidding state. Strikingly, the ranges over which FDI or exports are observed, the equilibrium tariff and the equilibrium level of subsidy are the same in the two settings. This reflects the power of high tariff policies to induce subsidy free FDI whenever FDI is socially desirable as well as the ineffectiveness of low-tariff policies to avoid socially undesirable FDI. Note, however, that the fact that the local authority is able to choose to subsidise when it views investment as locally desirable does affect policy: it forces the tariff to even lower levels as the central government attempts to discourage local subsidies.

5. Decentralisation with Tax Competition

We now consider the case of decentralised FDI policy with all *N* states bidding to attract the MNE. This case closely approximates the situation in a growing number of countries. While the US has a long tradition of states independently promoting themselves in the international business world, the trend towards greater "regionalisation" has brought such independent bidding behaviour to countries like Spain, Belgium and India or groups of countries like the European Union as we have discussed, above.

We will solve for the perfect equilibria of the tariff-subsidy-FDI game in three steps. First, we will determine the equilibria of the intra-state bidding game. We will see that the type of equilibrium that emerges depends crucially on the relative ranking of the three types of "critical" subsidies. The second step will be to analyse how this ranking is affected by changes in the relative values of c^i, c_x and t. We will then be able to characterise the optimal trade policy of the federal government.

5.1 Equilibria of the bidding game

We must define three kinds of limit subsidies. $S_{\max}$ is the maximum subsidy that a given state is willing to pay to have the MNE locate on its territory rather than serve the market through exports. Hence, we have

$$S_{\max} = \frac{CS(c^i) - CS(c_x + t) - ty(c_x + t)}{N} + c^i y(c^i)$$

S^s, on the other hand, is the maximum subsidy that a state is willing to pay to "steal" the MNC away from another state given that the MNE will invest in one of the *N* states. We have:

$$S^s = wL^y = c^i y^i$$

This expression says that, since FDI will occur anyway, the resulting loss of tariff revenue and the loss or gain in consumer surplus will occur whether the state wins or loses the bidding war. Hence, employment benefits are the only thing at stake. It is worth noting that:

$$S^s > S_{\max} \Leftrightarrow \Delta W < \Delta W_i$$

In other words, a state *i* is willing to pay more to steal FDI away from another state than to induce FDI in the first place if and only if individual states have socially excessive FDI incentives. Finally, we define $S_{\min}$ as the minimum subsidy required to induce FDI. In other words,

$$S_{\min} = \pi(c_x + t) - \pi(c^i)$$

Assumption 3: $S_{\max}$ and $S^s = c^i y(c^i)$ are quasi-concave in c^i for all $c^i \in [0, c_c]$ where c_c is such that $y(c_c) = 0$ [17].

To solve the bidding game, we must rank these three critical values of *S* for all values of c^i. This ranking is shown in figure 3, which is based on the following lemma:

Lemma 4: *The relative positions of* $S_{\max}(c^i), S^s(c^i)$ *and* $S_{\min}(c^i)$ *are such as described in figure 4. In other words:*

a. $S^s(c^i) > S_{\max}(c^i) \forall c^i \in [0, c_c]$

b. $S_{\max} \geq 0 \forall c^i \in [c^i_{LL}, c^i_{HH}]$ *and* $S_{\max} < 0 \forall c^i \in [0, c^i_{LL}[\cup]c^i_{HH}, c_c]$, *with* $c^i_{LL} < c^i_L < c^i_H < c^i_{HH}$.

c. $S_{\min}(c^i)$ *is increasing in* $c^i \forall c^i \in [0, c_c]$

d. $S_{\min}(c_x + t) = 0 \forall t$

e. There exists one and only one value of $c_f \in [c^i_L, c^i_H]$ *such that* $S_{\min}(c^i) = S_{\max}(c^i) > 0$.

Proof: See appendix

We can now determine the equilibrium of the bidding game for all values of c^i:

1. First consider $c^i \in [0, c_x + t^*]$ so that $S_{\min} < 0$. This means that FDI occurs regardless of the level of subsidy offered by the states. Since FDI occurs anyway, the relevant maximum subsidy is S^s, in other words, the maximum subsidy a state is willing to offer to "steal" the firm away from another state. Hence, the equilibrium subsidy is $S^* = S^s$ and FDI occurs.

2. For $c^i \in]c_x + t^*, c_c]$ we have $S_{\min} \geq 0$. Moreover, $S^s > S_{\max}$ (in other words, $\Delta CS < ty(c_x + t)$): since the net effect of FDI on tariff revenues and consumer surplus is negative, states are willing to bid more to "steal" the MNE from another state than to attract it to the country in the first place.

    a. For $c^i \in]c_x + t, c_f]$, we have $S_{\min} \leq S_{\max} < S^s$. Let us now determine what the highest equilibrium bid must be. Clearly, this bid cannot be lower than $S_{\max}$ because then it would be optimal for any state to bid $S_{\max}$. The highest equilibrium bid cannot belong to $[S_{\max}, S^s[$ either. Given such a bid, the MNE will invest in the country anyway, hence a state will always be willing to bid up to S^s. Of course, bidding beyond S^s always is a dominated strategy. Hence, the only possible highest equilibrium bid is S^s. We must of course check that there actually exists an

[17] Again, this assumption is satisfied for many demand functions, including linear functions.

equilibrium characterised by this highest bid. There are, in fact, many since – given that at least one state bids S^s -- every other state is indifferent among bids that are smaller than or equal to S^s. Therefore, over this range, FDI occurs in equilibrium and a subsidy of S^s is paid to the MNE.

b. Define c_{ms} as the value of c^i such that $S_{\min} = S^s$. Then, for $c^i \in]c_f, c_{ms}]$, we have $S_{\max} < S_{\min} \leq S^s$. Over this range, two kinds of equilibria can arise. One type is characterised by a highest bid of S^s and triggers FDI, while the other type features a highest bid below $S_{\min}$ so that the home market is served through exports. In the first type of equilibrium, every state bids S^s and FDI occurs. If at least one other state bids S^s then FDI will occur anyway so that state *i* is willing to bid up to S^s for a shot at stealing the MNE away from the other state(s). In the second type of equilibrium, every state bids below $S_{\min}$ so that FDI does not occur. If every other state bids below $S_{\min}$ then state *i* is no longer willing to bid above it since $S_{\max} < S_{\min}$.

c. For $c^i > c_{ms}, S_{\min} > \max(S^s, S_{\max})$. Bidding below $S_{\min}$ is a dominant strategy for every state so that FDI is not observed in equilibrium.

This analysis can be summarised in the following proposition:

Proposition 4: *The equilibrium subsidies offered by the states and the FDI behaviour of the firm are as follows. If the unit cost of local production is sufficiently low (in other words,* $0 \leq c^i < c_f$*) each state bids* S^s *and FDI occurs. If the unit cost of local production is sufficiently high (in other words,* $c^i \geq c_{ms}$*) FDI does not occur and no subsidy is paid in equilibrium. For intermediate levels of the unit cost of local production (in other words,* $c_f \leq c^i < c_{ms}$*), there are two equilibria, one involving a subsidy equal to* S^s *and FDI, and the other leading to exports and, therefore, no subsidies.*

The equilibrium pattern of FDI and subsidies is shown in figure 4. FDI occurs as the unique equilibrium outcome over the lower range of values of c^i. Since this range necessarily extends beyond $c^i = c_x + t$, one can conclude that FDI can (for *t>0*) be observed even though it entails significantly higher costs of production than exports. If FDI is somewhat less efficient, there are two equilibria, one involving FDI and the other involving exports. For still higher values of c^i, the unique equilibrium outcome is export. Whenever FDI is an equilibrium outcome, the MNE receives a subsidy S^s equal to the employment benefits it generates.

For the rest of the analysis, it will be convenient to only consider one of the two kinds of equilibria that arise over the interval $]c_f, c_{ms}]$. We focus on the equilibria without FDI. There are two reasons for this. Firstly, all states are better off in that equilibrium so that one might believe that

they will manage to coordinate on it[18]. Secondly, the multiplicity of equilibria obtained is an artefact of the complete simultaneity of bidding by all states. If one were to consider instead a sequential auction where the MNE asks each state in turn to make its bid before choosing a location and where previous bids are known to all payers, the equilibrium outcome would be that all states bid below $S_{\min}$ so that the MNE does not invest[19]. In that sense, the equilibrium without FDI is more robust to small changes in the modelling of the bidding game[20].

5.2 Optimal Trade Policy

In order to determine the optimal trade policy of the central government we must first establish whether equilibrium FDI and its accompanying subsidies are socially excessive or insufficient. We define the social benefits from FDI, net of "competitive" subsidies , S^s , as

$$\Delta W_N \equiv \Delta W - S^s = CS(c^i) - CS(c_x + t^*) - t^* y(c_x + t^*) .$$

Clearly, ΔW_N is decreasing in c^i . This is because the "competitive" subsidy, S^s completely dissipates the employment benefits of FDI so that c^i only affects the equilibrium price and, thus, consumer surplus. Hence, under our maintained assumption 2 that $CS(0) - CS(c_x + t^*) - t^* y(c_x + t^*) < 0$, ΔW_N is always negative. This means that subsidised FDI is always socially undesirable. This situation is represented in figure 5.

Interestingly, since the equilibrium subsidies compete away all employment benefits, all states have the same equilibrium welfare regardless of whether or not they manage to attract the MNE. This means that the effect of FDI on local welfare is just *1/Nth* the effect of FDI on national welfare. In this sense, local and national desire to attract FDI are perfectly aligned *ex post*. On the other hand, *ex ante* competition for employment benefits leads the states into a bidding war that can lead to welfare-reducing subsidised FDI. We can then state the following proposition to summarise the argument in the text:

Proposition 5: *Under assumptions 1 and 2, and for t=t*, there tends to be excessive FDI. For low values of* c^i *(in other words,* $c^i < c_f(t^*)$*), subsidised FDI occurs in equilibrium although it is harmful both socially and locally. Very cost-inefficient FDI (in other words,* $c^i > c_f(t^*)$*) is also socially and locally undesirable, but it never occurs in equilibrium.*

We can now determine the optimal trade policy of the central authority. It is important to underline at the outset a crucial difference between the case of inter-state competition and the case of

[18] It is worth noting, however, that some have found little reason to think that players would generally coordinate on Pareto dominant equilibria (See Fudenberg and Tirole, 1991, pp. 20-22 for example).
[19] We thank Michael Riordan for pointing this out.
[20] We have available a version of the analysis where we have picked the other type of equilibrium. The general nature of the results is not affected.

decentralisation without competitive bidding. In the latter, subsidies were never paid in equilibrium because FDI could always be induced subsidy-free by raising the tariff sufficiently. Inter-state competition makes such a powerful strategy ineffective: if the tariff is set so that FDI would occur even in the absence of subsidies the states still compete to attract the firm and are willing to offer subsidies up to S^s to win the bidding war.

Indeed, for high levels of c^i, increasing the tariff could actually trigger undesirable FDI. This is illustrated in figure 6, which is drawn for an arbitrary initial tariff *t.* First notice that $S^s = c^i y(c^i)$ does not depend on the tariff. On the other hand, both $S_{\min}$ and $S_{\max}$ do. An increase in *t* shifts $S_{\min}$ downwards since it makes the investment option more attractive to the firm. Since $S_{\max} = \frac{1}{N}[CS(c^i) - CS(c_x + t) - ty(c_x + t)] + c^i y(c^i)$ and $t^* \equiv \arg\max[CS(c_x + t) + ty(c_x + t)]$ an increase in *t* shifts $S_{\max}$ down if and only it *t<t** and up if and only if *t>t**. Hence, for *t>t** we have $\frac{dc_f}{dt} > 0$ so that an increase in the tariff actually enlarges the range of values of c^i for which undesirable subsidised FDI occurs. In other words, for a value of c^i a little above $c_f(t)$, a higher tariff could actually change the equilibrium from one with no FDI to one where socially undesirable subsidised FDI occurs. For *t>t**, on the other hand, the effect of a tariff increase on c_F is a priori ambiguous since both the $S_{\min}$ and $S_{\max}$ curves shift down. Still, it is possible to show that the net effect of an increase in *t* on c_f is again positive.

Lemma 5: $\frac{dc_f}{dt} \geq 0 \forall t$

Proof: See appendix

The question then is whether trade policy is on any use at all in avoiding some of the socially undesirable FDI or, at least, in reducing the excessive subsidies paid to the MNE.

If $c^i \geq c_f(t^*)$ the optimal policy clearly is to set *t=t** and allow the market to be served through imports. We now look at the case where $c^i < c_f(t^*)$. Over this range, setting *t=t** would actually trigger undesirable subsidised FDI. Let us first focus on the upper part of that range. One can show that, for c^i close enough to $c_f(t^*)$, setting a tariff slightly below *t** would improve welfare. This slightly lower tariff is enough to shift c_f to the left so that FDI is no longer an equilibrium in the immediate neighbourhood of $c_f(t^*)$. Moreover for a small change in tariff, the effect on welfare with exports is negligible so that the new export equilibrium must be preferred to the old FDI equilibrium. Intuitively, a small change in tariff has avoided the payment of a discrete subsidy. More formally, we have $\frac{dc_f}{dt} > 0$ and

$$\frac{dW^x}{dt}(t = t^*) = 0$$

By the definition of *t** as the traditional "optimal" subsidy. Hence, since we had $\Delta W(c_f(t^*)) < 0$, a switch from FDI to exporting must be socially beneficial.

One can also establish that this policy of setting *t* low enough to avoid subsidised FDI becomes less attractive for lower values of c^i -- in other words, for values further to the left of $c_f(t^*)$. This conclusion is based on a two-part argument. On the one hand, for a lower value of c^i the decrease in *t* required to prevent FDI is larger so that the corresponding trade regime is less attractive. ON the other hand, because competitive bidding dissipates employment benefits, social welfare in the FDI equilibrium increases as c^i decreases[21].

Turning now to the lower part of the range, one can show[22] that setting a tariff low enough to avoid FDI is not desirable: the required tariff would be so low (indeed, negative) that the central government prefers to tolerate the undesirable FDI. Since W^x, W^i and the level of tariff below which FDI occurs are all continuous in c^i, we can conclude that there is a critical value of c^i, defined as c_s so that the central government prefers to discourage FDI through a low tariff for $c^i > c_s$ but prefers not to interfere with FDI for $c^i \leq c_s$. We can now summarise these results in a proposition and in figure 7.

Proposition 6: *Define $t^0(c^i)$ such that $c^i = c_f(t^0)$. If FDI is very efficient, i.e. $c^i < c_s$, the optimal trade policy is to set $t \geq t^0$ so that subsidised FDI occurs even though it is neither socially nor locally desirable. For less efficient FDI, i.e. $c^i \in]c_s, c_f(t^*)]$, the optimal trade policy is to set $t = t^0 < t^*$, i.e. to lower the tariff to the point where the local authorities are no longer willing to offer high enough subsidies to induce undesirable FDI. Finally, for very inefficient FDI, i.e. $c^i > c_f(t^*)$, the central government sets t=t* and the home market is served through imports.*

Figure 8 shows the optimal tariff as a function of c^i. We have $t^0(c_f(t^*)) = t^* - \varepsilon$ as the federal government lowers its tariff just enough to discourage subsidised FDI. Since c_F is an increasing function of *t*, $t^0(c^i)$ which is the tariff just sufficient to discourage FDI at c^i must decrease as c^i decreases.

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[21] We have $W^i = CS(c^i) + c^i y(c^i) - S^s = CS(c^i)$ which is decreasing in c^i.

[22] At $c^i = 0$ the highest tariff avoiding subsidised FDI is t^0 such that $\pi(c_x + t^0) + \frac{1}{N}(CS(c_x + t^0) + t^0 y(c_x + t^0) = \pi(0) + \frac{CS(0)}{N}$. At $t^0 = -c_x$ the LHS is smaller than the RHS. Since the LHS is decreasing in *t*, this implies that $t^0(c^i = 0) < -c_x$. But $W^x(t < -c_x) < W^x(c_x) = S(0) - c_x y(0) < W^i(0) = CS(0)$.

6. Comparing Institutional Regimes

In this section we briefly compare the equilibrium pattern of FDI, levels of tariffs and levels of subsidies that prevail with tax competition to those observed under the fully centralised solution[23].

Let us compare figures 2 and 7. In the benchmark case, FDI occurs for all $c^i \leq c_H^i$. With decentralised bidding, FDI occurs for all $c^i \leq c_s$. Our first task is therefore to rank c_f and c_s.

Lemma 6: $c_s < c_x + t^* < c_H^i$. *In other words, the range of c^i for which FDI occurs under the optimal trade policy is smaller with competitive bidding than with centralisation.*

Proof: See Appendix.

Since FDI occurs for all $c^i \leq c_H^i$, under centralisation and for all $c^i \leq c_s$ under competitive bidding we can conclude that the range of c^i for which FDI occurs under the optimal trade policies is larger with full centralisation or non-competitive bidding than with competitive bidding. A rough intuition for this result is that competitive bidding makes FDI socially less desirable because FDI induces the payment of positive subsidies. Since, for high c^i, the government can effectively avoid such undesirable FDI by setting a low tariff, the equilibrium range of FDI is curtailed.

Since no subsidies were ever paid in the centralised setting, competitive bidding clearly leads to higher levels of equilibrium subsidies. The comparison of tariffs is less straightforward, and is illustrated in figure 8. The two equilibrium tariff schedules are quite different. For high values of c^i, it is optimal to set the "optimal" tariff, t^*, under both centralisation and competitive bidding. For values lower than c_H^i, the centralised solution is to start inducing FDI by a tariff $t \geq t^s$ where $\pi(c_x + t^s) = \pi(c^i)$, in other words $t^s = c^i - c_x$. For values lower than c_f but greater than c_s the optimal tariff under competitive bidding is t^0 such that $\pi(c_x + t^0) - \pi(c^i) - S^s = 0$. Clearly, we have $t^0 < t^s$ for all $c^i > 0$. Finally, for $c^i \geq c_s$ the optimal trade policy with competitive bidding is to induce FDI by setting $t \geq t^0$. Hence, we can conclude that for $c^i \geq c_s$ the optimal tariff under centralisation or non-competitive bidding always is at least as large as the optimal tariff under competitive bidding. For lower values of c^i, the lower bound of the optimal tariff is strictly greater with centralisation or non-competitive bidding.

7. Tariff Constraints

We saw that, in the absence of internal tax competition, using high tariffs to induce desirable FDI is a very powerful policy option. In the current context however, this is an option that might no longer be available to most governments. Under the GATT and the WTO, many tariffs have been bound to levels that are, on average, so low that they seem unlikely to trigger much "tariff jumping" FDI. In

[23] Remember that the equilibrium FDI pattern and equilibrium tariffs and subsidies are the same under the fully centralised setting and the decentralised setting without bidding.

this section, we quickly revisit our previous analysis under the assumption that the federal government is limited in setting $t \leq t_{\max} < t^*$. For each of the three institutional settings discussed in sections 3, 4 and 5, we briefly discuss how the optimal trade and FDI occurs as well as the size of the equilibrium subsidies paid to the MNE.

7.1 Fully Centralised Case and Non-Competitive Bidding

Let us begin with the fully centralised setting. The implications of bounding tariffs below *t** are quite straightforward. They are the result of two opposing effects. On the one hand, as the maximum allowed tariff is below *t**, the export option is now less desirable for the home country. This effect increases the range for which FDI is socially desirable. On the other hand, for relatively high values of c^j, some socially desirable FDI must now be induced through costly subsidies rather than through high tariffs. This effect tends to decrease the desirability of FDI.

More precisely, if $c^i \leq c_x + t_{\max}$, FDI occurs without subsidy. The only effect of a bound tariff is to reduce the lower range of c^j for which FDI is socially undesirable by reducing the desirability of the best possible trade regime. For $c^i > c_x + t_{\max}$ FDI can now only be induced through a subsidy. For values of c^j close to $c_x + t_{\max}$, the subsidy required is smaller than the loss of welfare in the trade regime due to the lower tariff. Hence, FDI still occurs but is subsidised. For larger values of c^j, however, the subsidy required to induce FDI is substantial enough to make it undesirable. In particular, one can show that for c^j close enough to c_H^i, export is now preferred to FDI so that the government sets $t = t_{\max}$ and the home market is served from abroad. Hence, we can conclude that:

Proposition 7: *A reduction in the maximum tariff allowed below the level of the optimal tariff t* reduces the range of values of c^j for which FDI is observed in equilibrium and increases the range over which equilibrium FDI is socially desirable. For intermediate values of c^j, FDI still occurs but the tariff reduction leads to the payment of positive subsidies to the MNE.*

We can now turn to non-competitive bidding. The main difference with respect to the fully centralised case is that for the range of c^j for which FDI no longer occurs unless subsidies are paid (in other words, $c^i > c_x + t_{\max}$) the decision of whether or not to trigger FDI is now in the hands of the local authority, which has socially excessive incentives to attract FDI. Still, one can again show that the local authority never wants to pay a subsidy of the size required to attract socially undesirable FDI so that the two institutional settings produce identical outcomes.

7.2 Decentralisation With Competitive Bidding

With decentralisation and inter-state competition, tariff constraints have only a limited impact for two reasons. First, the federal government could not use high tariffs to induce subsidy-free FDI in any case. On the contrary, they only "active" trade policy arose for high values of c^j, where the federal government chose to set its tariff just low enough to avoid FDI. Secondly, the subsidies

offered by local authorities only reflect the employment benefits of FDI and are therefore independent of the tariff level.

Still, tariff constraints do affect the equilibrium pattern of FDI, subsidies, and tariffs. Refer again to figure 8. Since $t_{\max} < t^*$ and $\frac{dc_f}{dt} > 0$, the upper range of c^j for which local authorities are willing to offer a subsidy sufficient to induce FDI shrinks. However, as long as the maximum tariff is not too low, the equilibrium pattern of FDI and exports is unchanged. This is because, for $c^i > c_s$, the central government avoids FDI anyway by setting a low enough tariff (in other words, $t = t^s$). Hence, as long as $t_{\max}$ is not too low, its only effect is to force lower equilibrium tariffs over the uppermost range of c^j. If, on the other hand, $t_{\max}$ were to fall below $t^0(c_s)$ then, for values close enough to c_s, the federal government would prefer subsidised FDI to importing at such a low tariff. Hence, drastic trade liberalisation will increase the range of values for which subsidised FDI is observed.

Proposition 8: *With decentralisation and competitive local bidding, lowering the maximum tariff below t* only affects the range of values of c^j for which FDI occurs in equilibrium if the maximum tariff is substantially below t*. At this point a further tightening of the tariff constraint increases the range over which equilibrium FDI is observed.*

8. Discussion and Conclusions

We have considered a model where a MNE must decide whether to serve a given market through FDI or through export. Following on much of the literature directed at users and policy-makers, we assume FDI's main benefit is to increase local employment, which is valued positively by the local authorities. The MNE's decision is affected by three factors: the height of the import tariff, the relative cost of production under export and FDI, and the level of FDI subsidy offered by the host country. Three distinct institutional arrangements are considered. In all three cases, policy makers are assumed to commit before the MNE chooses its mode of entry. In the "fully centralised" case, the central government sets both the tariff and the FDI subsidy. In equilibrium, any desirable FDI occurs and is induced by setting high tariffs. If FDI is very efficient, however, it occurs in equilibrium even though it yields lower welfare for the host country than exports. We then consider a setting where trade policy is set at the federal level while FDI subsidies are offered by one of *N* possible states that make up the country or group of countries. This case is meant to approximate situations where subsidy competition between local authorities is weak or where delegation to regions specifically rules out competition**.** Again, all socially desirable FDI is induced through high tariffs but there is now a range for which socially undesirable FDI is induced by setting a high tariff in order to avoid the payment of subsidies by the local state authority. Finally, we analyse a fully decentralised situation where the *N* local authorities can offer subsidies in order to attract the MNE to their confines. Since there is no differentiation among states in this setting, this case is meant to approximate situations where subsidy competition is intense. The crucial difference is that high tariffs can no longer deter the payment of subsidies to the MNE. In fact, the central government can now best fight undesirable FDI by setting a low tariff in order to make the FDI-inducing subsidy too high for the local authorities. Still, socially undesirable subsidised FDI can occur in equilibrium.

Since "high tariff" policies might be unrealistic in a WTO world, we also analyse the effect of tariff constraints on the equilibrium pattern of FDI, subsidies, and tariffs. If trade and tariff policies are centralised or competition between local authorities is weak, a tightening of the maximum tariff leads to less FDI but higher FDI-inducing subsidies. If competition between local authorities is intense, lowering the bound on tariffs does not affect the level of subsidies but it increases the range of parameters over which FDI is observed.

Overall, the message of our paper is as follows. When FDI comes at the cost of local subsidies, central governments attempt to avoid this cost by substituting a high tariff "stick" for local subsidy "carrots". If a high tariff "stick" is no longer available due to tariff controls, the "carrot" must be used, at a welfare cost to the government. If a decentralised and competitive system is in place for generating local subsidies, controlling subsidy costs becomes quite difficult for the central government. Indeed, these costs can effectively only be controlled by making exports a more attractive route for foreign firms. This is done optimally by lowering tariffs, so that only very severe tariff controls can make it unattractive to substitute exports for subsidised FDI. Hence, a decentralised competitive system, while costly, is more robust in its operation to tariff controls. Further, because a non-competitive subsidy system tends to generate incentives to raise tariffs whereas a competitive subsidy system tends to generate incentives to lower tariffs, the effects of imposing tariff limits on the range of costs over which FDI occurs differ: for non-competitive systems, the range tends to decrease whereas for competitive systems the range tends to increase.

Our emphasis is on how the tax and tariff system works, not on whether decentralisation is desirable. This has been discussed at length elsewhere[24] and is summed up by Bird (2006), "[whether it is good or bad for welfare] some degree of fiscal competition seems an inevitable fact of life." He goes on to say that the question is not so much whether, but how such systems work and how they can work well. Our paper is much in the same spirit. Our argument clearly does not indicate that decentralisation with competition among regions is good for either the country or the regions involved. Indeed, our argument suggests that foreign investors do very well by this competition, but that regions and countries receiving the investment could do better by coordinating their regional policy or centralising. Coordinated regional policy appears to be quite common, which is certainly consistent with our arguments. Indeed, regions could prefer such a system, as the implicit threat of regional subsidies forces the central government to adjust its tariff policy to the benefit of the region.

Although we mostly used a fairly standard trade model, two of our assumptions deserve further comment. We assumed that the local authorities could not use negative subsidies. While this makes a lot of sense when S is interpreted as the cost of public works, it is not as compelling if one thinks of S as the discounted sum of tax breaks granted to the MNE. Fortunately, allowing for negative subsidies would not change our results drastically. It would not affect the case with competitive bidding at all since equilibrium subsidies are uniquely determined by the non-negative employment benefits derived from FDI. In the fully centralised case, negative subsidies would enable the government to avoid socially undesirable low-cost FDI. Finally, with decentralisation but

[24] See Bird (2006) for discussion and a case study of Latin America.

no competitive bidding, negative subsidies would be irrelevant since local incentives to attract FDI are socially excessive in any case[25] .

We also assumed that subsidies were paid in a lump sum manner, in other words without affecting the local marginal cost of the MNE. Subsidies that lower the marginal cost of production of the MNE would have the additional advantages of increasing local consumer surplus and increasing the employment generated through FDI. Since the first of these two benefits is not fully appropriated by the local authority that pays the subsidy, local incentives to attract FDI could more easily be socially insufficient than in our analysis. We do not, however, expect that our qualitative results would be greatly affected.

An interesting, but formidable, task for future research would be to extend this analysis to a two-country framework. This would, for example, allow for the analysis of trade and FDI relationships between a federalised country (or group of countries) and a more centralised economy. Extending our model to the case of several MNEs and modelling the local bidding competition as a multi-lateral bargaining process in which trade policy affects the "bargaining power" of the parties would also be of some interest.

[25] Negative subsidies could emerge, in a somewhat perverse way, over the ranges where FDI is discouraged by setting a high tariff. Since a lump-sum tax is a more efficient tool than a unit tariff in squeezing surplus out of the foreign firm, the optimal policy would to set $t=0$ and prevent FDI by using $S<0$. Even if we allow for such policies, the ranges over which FDI occurs in equilibrium would not be greatly affected.

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10. Appendix

10.1 Proof of Lemma 1

Notice that only the first and second terms of $\Delta W = CS(c^i) - CS(c_x + t^*) + c_L^i y(c^i) - t^* y^x(c_x + t^*) = 0$ depend on c^i. Hence, assumption 1 that $CS(c^i) + c^i y(c^i)$ is quasi-concave in c^i guarantees that ΔW intersects at most twice with the horizontal axis. We know that this expression must be negative for c^i large enough as $CS(c^i)$ becomes greater than $CS(c_x + t^*)$ and y^i goes to zero. We also know from section 3 that the expression is positive at $c^i = c_x + t^*$. Hence, one of the two possible intersections must always exist and must be at $c_H^i \in]c_x + t^*, c_c[$. Moreover, assumption 1 guarantees that c_H^i is the only intersection to the right of $c_x + t^*$. The other possible intersection, which would define c_L^i, must lie to the left of $c_x + t^*$ and can only occur for a positive value of c^i if the intercept of ΔW at zero is negative, in other words if $CS(0) - CS(c_x + t^*) - t^* y(c_x + t^*) < 0$.

10.2 Proof of Lemma 2

c_D^i is defined as $CS(c_D^i) - CS(c_x + t^*) - t^* y^x(t^*) = 0$. Since this expression is decreasing in c^i, its graph can only intersect the horizontal axis if its intercept at zero is positive.

10.3 Proof of Lemma 3

First, consider $c^i = c_H^i$. The local government is willing to pay a maximum subsidy of

$$S_{\max} = \frac{CS(c^i) - CS(c_x + t) - ty(c_x + t)}{N} + c^i y(c^i).$$

At c_H^i, we have:

$$CS(c_H^i) - CS(c_x + t^*) + c_H^i y(c_H^i) - t^* y(c_x + t^*) = 0$$

So that, for $t = t^*$ and $c^i = c_H^i$, $S_{\max} = \frac{1-N}{N}[CS(c_H^i) - CS(c_x + t^*) - t^* y(c_x + t^*)]$ or

$S_{\max} = \frac{N-1}{N}[CS(c_x + t^*) \_ t^* y(c_x + t^*) - CS(c_H^i)] > 0$. Is this enough to induce the firm to invest? In other words is $S_{\max}$ greater or equal to $\pi(c_x + t^*) - \pi(c_H^i)$? Notice that the answer is negative for $N = 1$ and is most likely to be positive for $N \to \infty$. For that latter case, the subsidy is large enough to induce foreign direct investment if and only if:

$$CS(c_H^i) + \pi(c_H^i) \geq CS(c_x + t^*) + \pi(c_x + t^*) + t^* y(c_x + t^*)$$

But since $c_H^i > c_x + t^*$ and since total surplus (in other words, $CS + \pi$) decreases as unit costs increase this inequality cannot hold. Hence, close to c_H^i, the local authority will not be willing to pay enough to induce foreign direct investment. What about greater values of c^i? For such values, we have:

$$CS(c^i) - CS(c_x + t^*) + c^i y(c^i) - t^* y(c_x + t^*) < 0$$

so that $S_{\max} < \frac{N-1}{N}[CS(c_x + t^*) + t^* y(c_x + t^*) - CS(c^i)]$. On the other hand, $\pi(c_x + t^*) - \pi(c^i)$ is increasing in c^i. So, if the subsidy was not sufficient for $c^i = c_H^i$, neither will it be sufficient for larger values of c^i.

10.4 Proof of Lemma 4

a. Under assumption 2, $CS(0) - CS(c_x + t) - ty(c_x + t) < 0$. Since the expression $CS(c^i) - CS(c_x + t) - ty(c_x + t)$ also is decreasing in c^i, we must have $S_{\max} \equiv \frac{CS(c_x) - CS(c_x + t) - ty(c_x + t)}{N} + S^s < S^s \forall c^i$.

b. Because of assumption 1, $S_{\max}$ intersects the horizontal axis at most twice. Assumption 2 implies that $S_{\max} \geq \Delta W \forall c$. Finally, $S_{\max}(0) < 0$ and $S_{\max}(c_c) < 0$. Hence, since ΔW intersects the horizontal axis twice, so must $S_{\max}$. Moreover, the two points for which $S_{\max} = 0$, defined as c_{LL}^i and c_{HH}^i are such that $0 < c_{LL}^i < c_L^i < c_H^i < c_{HH}^i$.

c. $S_{\min}(c^i)$ is defined as $\pi(c^i) + S_{\min} - \pi(c_x + t) = 0$. Hence, $\frac{dS_{\min}}{dc^i} = -\pi'(c^i) > 0$.

d. $S_{\min}(c_x + t) = \pi(c_x + t) - \pi(c_x + t) = 0$.

e. From steps (c) and (d), any intersection between $S_{\min}$ and $S_{\max}$, occurring for positive values of *S* must occur for $c^i > c_x + t$. Define $H \equiv S_{\max} - S_{\min}$ and $E \equiv c^i y(c^i)$. We have $\frac{dH}{dc^i} = (\frac{1}{N})(CS'(c^i) + \pi'(c^i) + \frac{dE}{dc^i}$. $CS(c^i) + E + \pi(c^i)$ is the area under the demand curve to the left of the monopolist's output. With downward sloping marginal revenue, this area decreases as c^i increases. Since $CS(c^i) < 0$, this also implies that $\frac{dH}{dc^i} < 0$. As $H(c_x + t^*) > 0$ and $H(c_{LL}^i) < 0$, there must exist one and only one value of $c^i > c_x + t^*$ such that $H(c^i) = 0$. This value is defined as c_f.

10.5 Proof of Lemma 5

The critical value c_f is defined as

$\frac{CS(c_f) - CS(c_x + t) - ty(c_x + t)}{N} + c_f y(c_f) - \pi(c_x + t) + \pi(c_f) = 0$ so that, defining tariff revenue as $T \equiv t^* y(c_x + t)$, we get $\frac{dc_f}{dt} = -\frac{-\frac{1}{N}(CS'(c_x + t) + \frac{dT}{dt}) - \pi'(c_x + t)}{\frac{CS'(c_f)}{N} + \frac{dS^s}{dt} + \pi'(c^i)} = -\frac{Num}{D}$

Let us first show that *Num* is positive. First, notice that $CS(c_x + t) + T + \pi(c_x + t)$ is just the area between the demand curve and c^i up to $y(c_x + t)$. With decreasing marginal revenue (implied by the second order conditions of the MNE's profit maximisation problem), this area must decrease as $c_x + t$ increases, hence $CS'(c_x + t) + \frac{dT}{dt} + \pi'(c_x + t) < 0$. Since $\pi'(c_x + t) < 0$, the previous inequality also implies that $(\frac{1}{N})CS'(c_x + t) + \frac{dT}{dt}) + \pi'(c_x + t) < 0$ so that $Num > 0$. Now let us show that $D < 0$. Clearly, $CS'(c^i) < 0$. Hence, $\frac{dT}{dt} + \pi'(c_x + t) \le 0$ is a sufficient condition for $D < 0$. Also, $S^s + \pi(c^i) = c^i y(c^i) + \pi(c^i) = y(c^i) p(y) = R$, where *R* is the total revenue of the MNE. The first order conditions of the MNE's maximisation problem are $p(y) - c^i + yp'(y) = 0$. We can now compute $\frac{dR}{dc^i} = \frac{dR}{dy}\frac{dy}{dc^i}$. Clearly, $\frac{dy}{dc^i} < 0$ so that the sign of $\frac{dR}{dc^i}$ is the opposite of the sign of $\frac{dR}{dy}$. Hence, $\frac{dR}{dc^i} \le 0$ if and only if $\frac{dR}{dy} = p(y) + yp'(y) > 0$, which is satisfied since the first order condition of the monopolist profit maximisation problem implies that $p(y) + yp'(y) = c^i \ge 0$. Therefore, $D < 0$.

10.6 Proof of Lemma 6

The critical value c_s is the value for which the welfare from exports with $t = t^0$ is the same as the welfare with subsidised foreign direct investment. In other words, c_s is defined as:

$CS(c_x + t^0(c_s)) + t^0(c_s) y(c_x + t^0(c_s)) - CS(c_s) \equiv 0$.

Now, let us evaluate this expression at $c_s = c_x + t^*$. We get:

$CS(c_x + t^0(c + t^*)) + t^0(c_x + t^*) y(c_x + t^0(c_x + t^*)) - CS(c_x + t^*)$.

This expression is certainly positive if $t^0(c_x + t^*) < t^*$, which must be true since we know that, for $c^i = c_x + t^*$, the tariff *t** would be jumped even without subsidies. Hence, the expression is

positive and, therefore, $c_s < c_x + t^*$. Since we already know that $c_x + t^* < c_H^i$, we must have $c_s < c_H^i$.

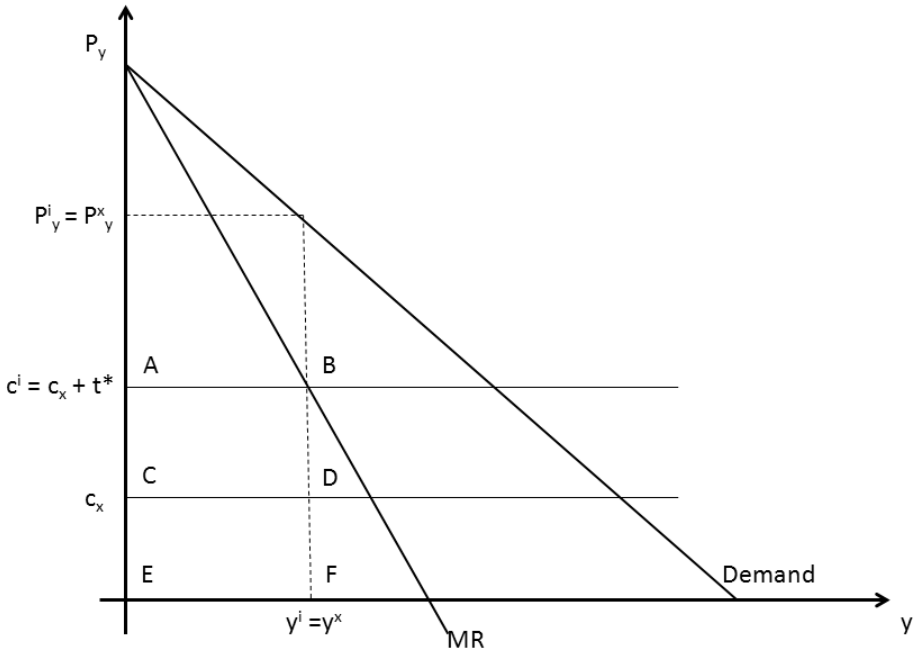

Figure 1: Tariff revenues are ABCD; Employment Benefits are ABEF

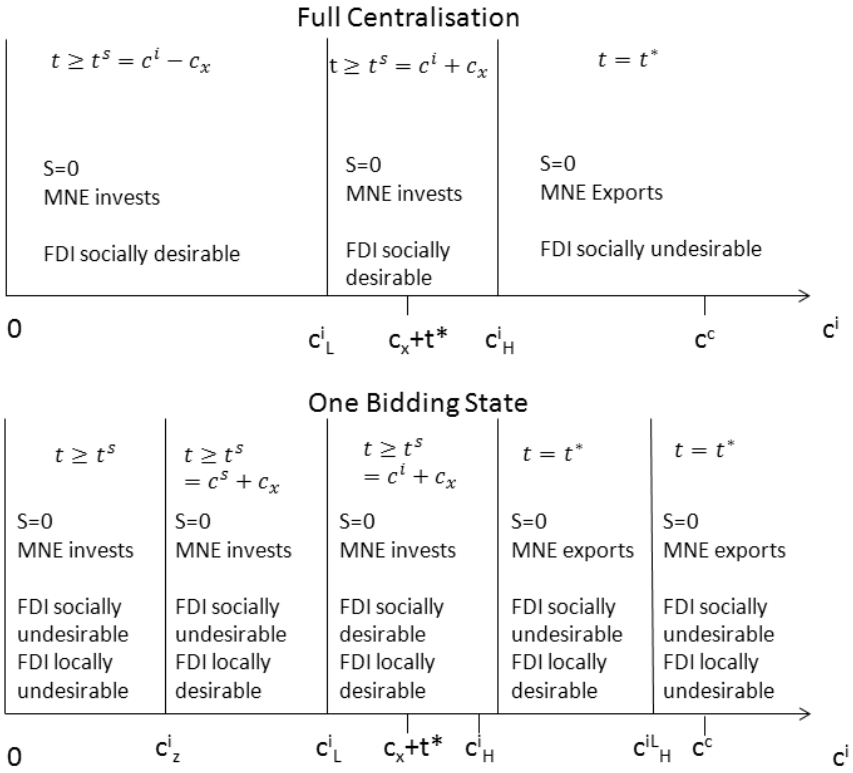

Figure 2: Pattern of FDI and Equilibrium Policies

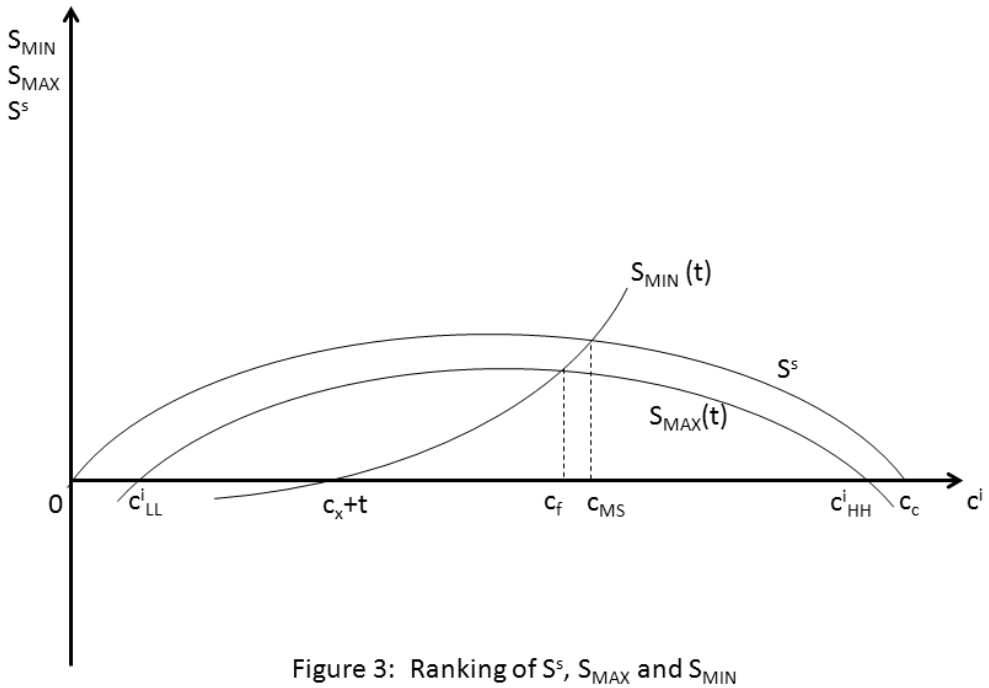

Figure 3: Ranking of S^s, S_{MAX} and S_{MIN}

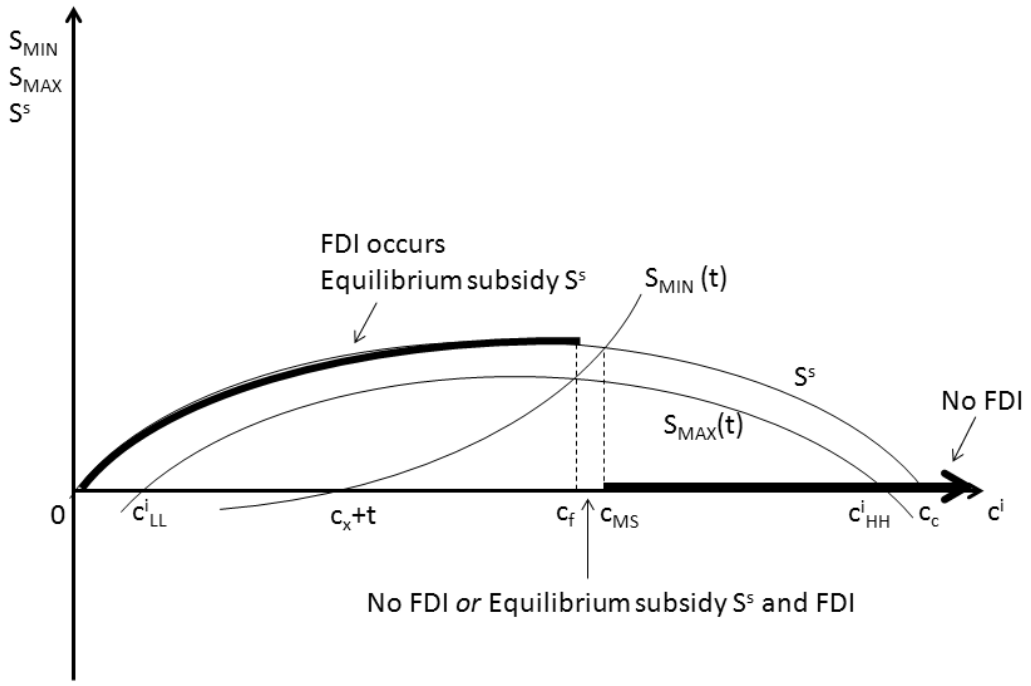

Figure 4: Equilibrium Pattern of FDI and Subsidies with Decentralisation and Bidding by All States

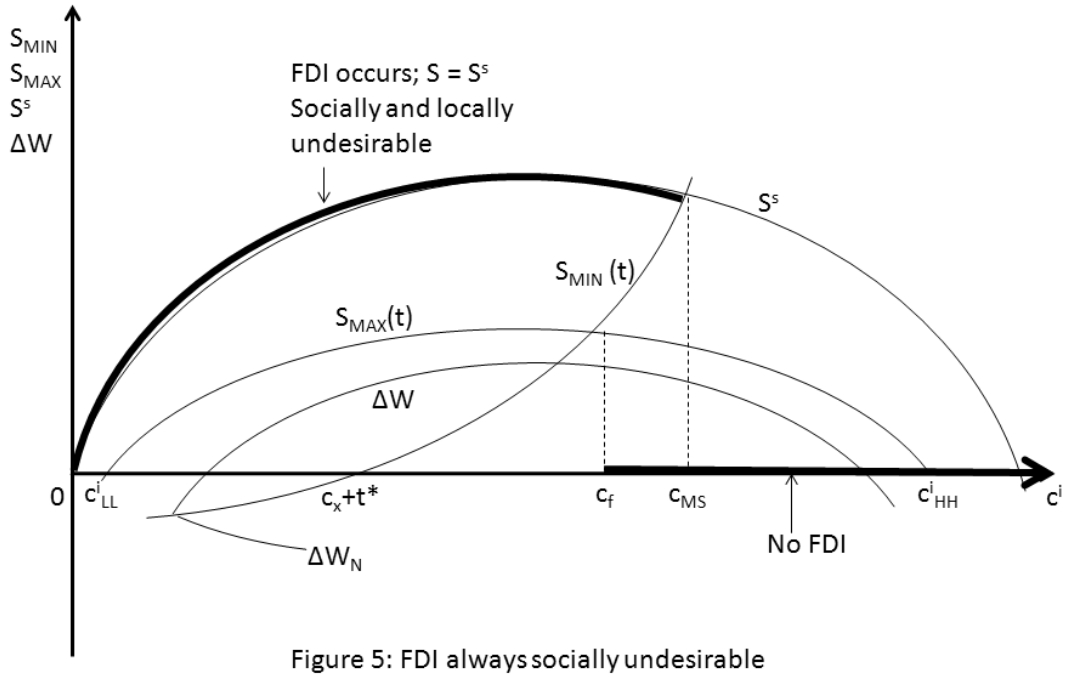

Figure 5: FDI always socially undesirable

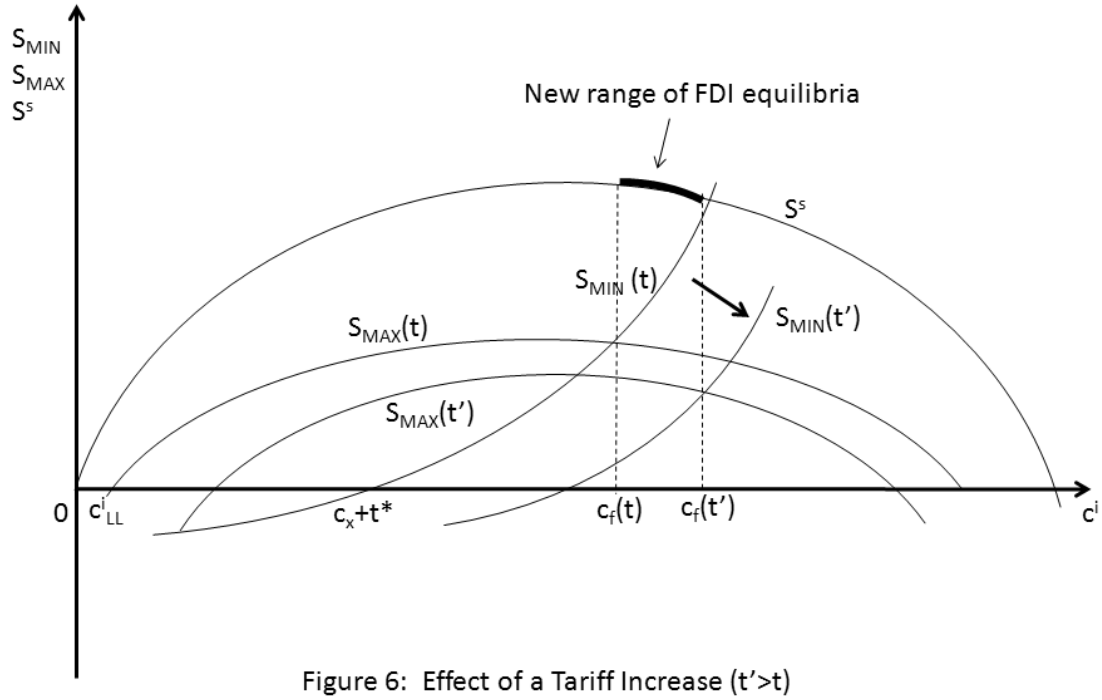

Figure 6: Effect of a Tariff Increase (t'>t)

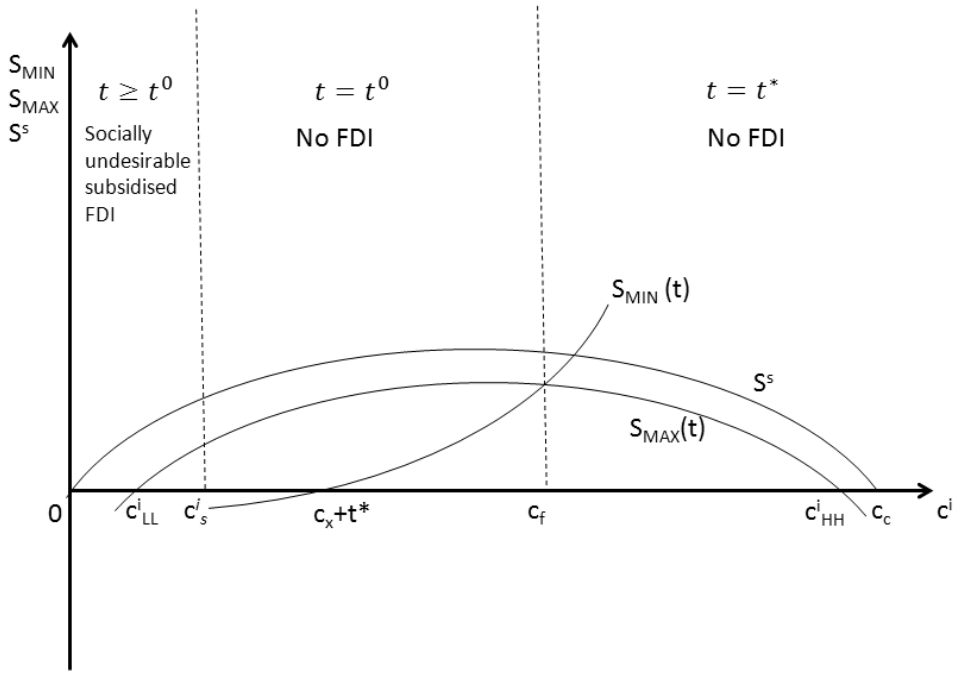

Figure 7: Optimal Trade Policy – Decentralisation and Bidding

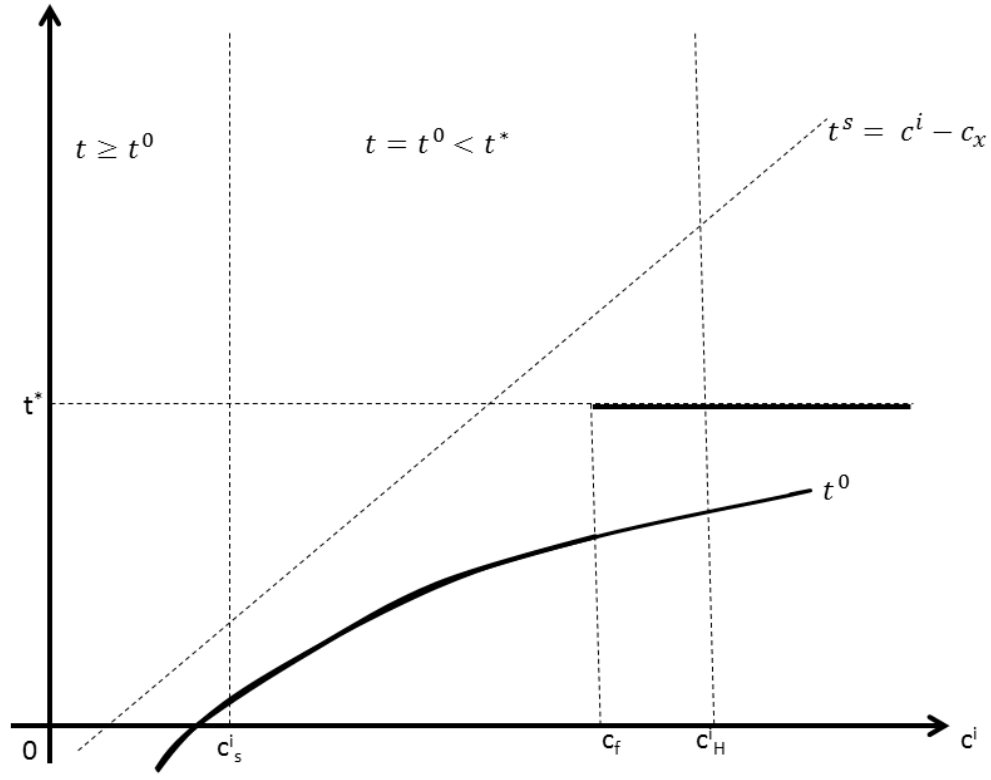

Figure 8: Optimal Trade Policy as a Function of c^i