

## Incentives to Create Jobs: Regional Subsidies, National Trade Policy and Foreign Direct Investment

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### Abstract

A national authority wishes to attract foreign direct investment (FDI) to create local jobs. We analyse the optimal national trade policy when 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. 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 increasing trade liberalisation depends heavily on the system of granting local subsidies: if the system is centralised, trade liberalisation decreases the range of parameters for which FDI occurs; if the system is decentralised and competitive, it increases this range.

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## 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<sup>1</sup>. 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 at specific sectors, while seventy per cent 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 incentives can affect FDI location decisions significantly<sup>2</sup>. Offering more detail on this for the case of the UK, Ernst and Young (2011) finds 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 region-based incentives, while 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 the case of Mercedes-Benz, which wished to establish a new car plant in the United States and contacted six states before deciding to accept a (generous) location package from Alabama. Similar competition among states to attract a Ford Motors assembly plant occurred in Brazil. The UNCTAD (2000) report 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 a 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, where FDI packages can only be obtained from the national government. When a region is the designated destination, the actual negotiations for the incentive package can be delegated to the local authority<sup>3</sup>. Jones and Wren (2008) note that

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

<sup>2</sup> OECD(2008) finds in a review of studies on the effect of tax incentives that a one per cent increase in effective tax rates results in up to a five per cent decrease in FDI. Davies quotes similar findings for the responsiveness of FDI to changes in US state tax rates.

<sup>3</sup> The degree of delegation to the local authority can be a matter of intense debate. To give some examples, recent discussion about how to set up an Enterprise Zone comprising Northern Ireland has focussed on

centralisation and the degree to which competition is permitted among regions within a country can also vary over time, documenting the vacillations in the UK system<sup>4</sup>.

FDI location decisions are affected by more than just regional incentive policies, however. A recent OECD report stated that “Trade policy is one of the main determinants of foreign firms in their investment decisions...High barriers to imports can include tariff-jumping FDI – FDI as an alternative to trade.”<sup>5</sup> 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.

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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 more and less 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, while this right has been reduced for coastal areas. See [http://www.chinalawblog.com/2010/05/china\\_foreign\\_direct\\_investmen.html](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 location restrictions, to one of largely decentralised policies at the state level. For discussion see Ahluwalia (2002).

<sup>4</sup> Following the abolition of 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>.

<sup>5</sup> For a general outline of the many interactions among both tariffs and non-tariff barriers and foreign direct investment, including case studies and emphasis on developing countries, see Gage and Miroudot (2005). That paper outlines a host of interactions, including protectionist policies. Our goal is not to explore the interaction of trade and FDI policy in all its facets. Rather, we explore a part of the intuition in this type of work, making precise the interactions among the policies considered.

This paper explores this intuition. We study whether and how trade policy can be used effectively with incentives when incentives can be decentralised by region and where regions may or 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. FDI is induced optimally through a high tariff so that no subsidies are paid. This is consistent with the first of the two mechanisms outlined above: the tariff has the advantage of affecting the decision to locate but also the "bargaining position" of the firm, since it affects the attractiveness of the alternative of exporting.

We next 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, by fully committing the firm to the FDI route, a high tariff can increase the level of subsidy offered by the states in their attempt to compete for the jobs that the foreign firm surely will create in one of the local jurisdictions. In this case, then, the central government may find it optimal to avoid socially undesirable subsidized FDI by setting a low tariff, and so provide an incentive for the firm to switch to exports. By improving the outside option of the firm, the central government makes FDI a more expensive proposition for the localities, potentially making FDI prohibitively expensive. The central government curtails excessively expensive subsidy competition by *lowering* the tariff, which generates substitution into imports but reduces subsidy expense.

Finally, we consider the case where FDI is assigned to a unique zone within the country, which is allowed to provide subsidies for FDI but which does not compete with other regions. We find that in this case, the only difference with the fully centralised case may occur in the upper regions of costs, where the tariff may optimally be lowered to prevent subsidies' being offered.

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. On the other hand, tariffs with centralisation are at least as large as with competitive bidding: a centralised system relies on *high* tariffs to reduce subsidy payments, whereas a decentralised system relies on *low* tariffs to achieve the same end.

The recent debate about the benefits of a US-European free trade zone has brought into relief the continuing significance of even modest tariffs. While some markets involve much higher tariffs than

one finds between the US and Europe<sup>6</sup>, tariffs cannot be set in an unconstrained way under WTO rules. It is important, then, in order to broaden the scope of the paper beyond our object of exploring the interaction of unconstrained trade policy and FDI policy, to derive the effect that tariff caps place on the optimal policies we have just 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 higher subsidy levels for the FDI that occurs, as it reduces the effectiveness of tariffs as a tool to lower subsidy payments, but to less FDI overall since FDI becomes less attractive for the host country as it becomes more expensive in subsidies. Hence, both the amount of FDI and the instrument balance to induce it change. With competition among regions, however, moderate caps may affect neither subsidy levels nor equilibrium FDI patterns since the optimal policy involves lower tariffs in any case. On the other hand, more drastic trade liberalisation increases the range for which FDI subsidies are observed and can increase the range over which FDI occurs. This suggests that local governance is a factor to consider when determining whether trade liberalisation is likely to impact on FDI decisions. While the extension is useful, it is also important to realise that when we refer to “high” tariffs, we simply mean tariffs that are high enough to make a firm choose FDI over exports. Such “high” tariffs can therefore be quite small in absolute terms, in which case our main analysis without tariffs remains the most pertinent.

We also briefly consider how our results might change when we allow for the use of per unit subsidies rather than lump sum subsidies. Output related subsidies create two main additional effects. Firstly, higher subsidies lead to higher output and hence higher employment. This additional employment benefit is perfectly internalised by the authority that offers the subsidy, be it federal or local. As such, it does not affect the nature of our results. The second effect is that output related subsidies also lead to lower output prices, which benefits all consumers. Since local authorities only care about local consumers, this creates a tendency for subsidies to be *lower* with decentralised decision making than with centralised decision making. This mitigates the tendency for competing local authority to offer subsidies that are higher than would be optimal for the country as a whole.

Finally, we argue that the main conclusions of our analysis would still hold in a world where there are several MNEs that can serve the home market through exports and FDI. An interesting collateral result of this discussion is that, in the intermediate case where subsidy setting is decentralised but there is no competitive bidding between states, it is optimal to “steer” all firms that wish to invest in the same industry toward the same region. This offers a possible explanation for the often observed regional concentration of industries that does not depend on the existence of any favourable local conditions (such as vertical linkages or factor costs) or any network effect.

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

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<sup>6</sup> For a recent discussion of the still significant trade effects of even the *historically* low levels of existing tariffs between the US and Europe, see *The Economist* (27<sup>th</sup> April, 2013, p. 44). For tariff levels generally and their variance between markets, see [http://www.wto.org/english/res\\_e/booksp\\_e/tariff\\_profiles12\\_e.pdf](http://www.wto.org/english/res_e/booksp_e/tariff_profiles12_e.pdf) for the WTO summary of country and good categories for 2012.

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<sup>7</sup>. 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 ours: 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<sup>8</sup>.

Trade and FDI policies have been interacted in other papers<sup>9</sup>. Blanchard, in a series of papers (2007, 2010 and Blanchard and Matschke (2012)), explores this interaction both theoretically and empirically, although she does not investigate the role of federalism or employment objectives as we do<sup>10</sup>. Blanchard and Matschke (2012) provide some empirical support for a relation between offshoring and preferential trade agreements. Vézina (2010) argues empirically that unilateral tariff cutting in Asia, 1988-2006, was driven by FDI competition for intermediate goods, although she does not observe the same relation for consumer goods. Pflüger and Südekum (2009) also provide empirical results on the relation between entry subsidies and trade openness, where entry barriers are measured as non-tariff barriers and openness is measured as export plus import share relative to GDP. They find a U-shaped relation between trade openness and effective entry cost. Our setting generates both a potentially positive and negative relation between tariff level (“openness”) and

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<sup>7</sup> 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.

<sup>8</sup> 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 corruption issues (Bardhan and Mookherjee (2006)), and political economy matters (Besley and Coate (2003)). We abstract from these considerations here.

<sup>9</sup> Heterogeneity has been a main theme in the literature on FDI versus export choice and the observed pattern of trade. Cole and Davies (2011) and Davies (2005) focus on the role of firm heterogeneity in a setting where firms can choose between FDI and export, showing that non-cooperative tariff setting can promote entry by relatively inefficient firms. In our setting, in fact, inefficient firms are not necessarily bad for welfare, as the form of inefficiency is that the firm must hire more workers – which is good if hiring occurs locally. Hence, our welfare specification is important to our view on the advantages of inefficiency. Pursuing the theme of heterogeneous firms, Helpman, Melitz and Yeaple (2004) find that tax competition among states need not necessarily lower national welfare, as lowering state taxes can reduce a negative price externality across states. In our setting, a negative pricing externality occurs across regions as well. Indeed, a region may work hard to attract a firm for the employment benefits it generates locally but does not take into account the negative effect an inefficient firm might have on prices charged for the good in other regions. This potentially generates excessive entry; however, in our setting this excess entry is potentially dampened at the national level through tariff manipulation.

<sup>10</sup> See Albornoz and Crocos (2007) and Blanchard (2007) for complementary literature reviews. Blanchard (2010) points out that international ownership affects governments’ motives in trade legislation, although focussing on expropriation of profits in her own work. Blanchard (2007) notes that international capital mobility, through its downward effects on tariffs, can be thought of to “substitute” for WTO restrictions. Notably, we do not generate downward pressure on tariffs for all institutional settings: our results depend on the internal governance structure of the country. Note that Barros and Cabral (2000) investigate employment effects and their interaction with subsidies in a linear demand model but do not consider the interaction with trade policy or the effect of federalism.

entry cost (“subsidy”), but the sign of the relation depends on local governance suggesting that internal governance should be controlled for in this kind of empirical study.

The closest paper to ours is Raff (2004), who examines the interaction between a local tax instrument (profit taxes) and trade policy. Raff’s paper considers the interaction between tax and trade policy, deriving conditions on when FDI occurs and when it is or is not welfare-improving. While the two papers are similar at this general level, they depart substantially on their focus, institutional framework, and instrument choice. Raff examines the effect of customs unions and free trade areas on FDI, where his focus is on which system should be chosen in a first stage of his game among three countries. This difference yields a different modelling strategy where the baseline case is that of three completely independent countries that may set profit taxes and trade policy independently. Our fully centralised case is the polar opposite, then, of his point of departure, and at no point can the regions in our paper set an independent trade policy. While Raff’s question concerns what sorts of “constraining” agreements the countries should enter into and their relative advantages, in our framework the institutional structure is fixed and we ask how local and national policies interact. Hence, a main point of his paper is that a customs union can serve to coordinate local trade policy. This is not a concern of ours. In terms of instrument, states control a profit tax in Raff’s model, with the associated benefits from locally generated profits rising monotonically with lower costs of production; in our framework the local benefit is not profits but employment, which is related non-linearly to production costs. This generates a contrasting benefits profile, where lower cost production is not necessarily more beneficial since it could mean lower local employment. This tension between efficiency and desirability is not present in his framework. Further, he assumes that an initial asymmetry between the production costs is possible in the two states whereas we consider – in the first instance of the text – either very intense competition between symmetric states or very light competition where FDI is assigned to a single state. On top of this, our framework is that of bargaining rather than Nash equilibrium, so that the function of the tariff to affect the “bargaining position” of the foreign firm, which is an emphasis of our paper is not a concern of his.

Despite these differences, the papers can be linked: the fully decentralised case in our paper generates effects that could be present in a symmetric version of Raff’s customs union case, even though his actual emphasis is on asymmetric structures. Our decentralised case without bidding can be seen as generating effects that could be present in a highly asymmetric version of Raff’s customs union case, where one region is so high cost that it is irrelevant to the location of investment. Hence, while the structures of the two papers are different enough that full nesting would not be possible, the sense of this paper is to study cases that could be viewed as “limits” of the asymmetric structure adopted by Raff. Raff’s and our paper should be viewed as complementary, then, in the sense that they investigate the interaction of trade and tax policy under different combinations of the governmental level at which policy instruments are set, and different sources of local benefits from FDI.

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 analyses the cases of full-fledged bidding between local authorities, and section 5 compares the centralised and decentralised regimes. Section 6 analyses the case of decentralisation without bidding

competition. Section 7 revisits these three cases in the presence of tariff constraints. Section 8 examines the case of structured subsidies, which can affect both the efficiency of the firm under FDI and can even amount to a negative lump sum paid upon investment. Finally, section 9 discusses the robustness of our results and proposes directions for future research.

## 2. Basic Model

A single MNE can either produce a good  $y$  locally or it can export it from one of its foreign plants. Consistent with the motivating examples in the introduction, an important feature of the model is that there is unemployment in the host country. 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 as arising from the fact that the local wage  $w$  is set above its market clearing level. We can think of the MNE as producing  $y$  using  $a_L$  units of labour per unit of output so that  $c^i = wa_L$  is a constant marginal cost of production<sup>11</sup>. This will allow us to link costs tightly to labour use, below, but also will allow us to write the profits of the MNE when it produces locally in the straightforward form:<sup>12</sup>

$$\pi^i = [p(y) - c^i]y \quad (1)$$

where  $p(y)$  is inverse demand and  $c^i$  is the constant marginal cost of production. The MNE's chosen level of output and profits in the host country can be written  $y(c^i), \pi(c^i)$ , respectively.

If the MNE does not invest in the local economy, all production takes place abroad and instead the host country is supplied by exports, earning:

$$\pi^x = [p(y) - c^x]y \quad (2)$$

where  $c^x$  is the constant marginal cost of production abroad. The MNE's chosen level of output and profits in this case are  $y(c^x), \pi(c^x)$ .

Reviewing the stages of our model in reverse order, given its location decisions the MNE sets output and reaps its payoff in the final – third -- stage of our model. Anticipating the future profits it will earn, the MNE chooses in a second stage its location depending on where profits will be higher, selecting to invest in the host country if the profit from investing exceeds that of exporting.

The host government wishes to maximise its country's welfare given this potential location decision and has at its disposal two policy instruments that it can set prior to the MNE's location: a per unit tariff,  $t$ , and a lump sum investment subsidy,  $S$ . In the centralised benchmark case, both the tariff and subsidy are set at the federal level whereas in our decentralised analysis, subsidies are offered

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<sup>11</sup>As in Brander and Spencer, unemployment is obtained by assuming a binding minimum wage. This breaks the link between marginal productivity of labour and MNE efficiency, so that only the employment effect remains.

<sup>12</sup> 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.



by regions or states within the host country. By allowing the government to set these in the initial stage of the model, we are able to focus on internal subsidy competition and its effect on welfare and FDI. In order to compete for FDI, regional authorities must clearly be able to offer credible incentive packages to the MNE before investment actually takes place. As we have documented 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 renegeing on previous deals. When the federal government controls both trade and subsidy policy, it clearly does not matter whether tariffs or subsidies are set first. For the versions of the model where subsidies are offered by states whereas trade policy is set at the federal level, we assume that the federal government moves before the states and 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.

To abstract from the structure of incentive packages, we assume that the host government (or its states) may pay a lump sum subsidy,  $S > 0$ , to the MNE if it invests to produce good  $y$  in the local economy. We think of this subsidy as representing the discounted values of tax breaks that can be credibly committed to or as the value of infrastructure investments that the public authority has agreed to undertake on behalf of the MNE<sup>13</sup>. We will assume throughout that this subsidy cannot be negative and that it does not affect the marginal cost of production of the MNE<sup>14</sup>. The host government also can set trade policy towards the MNE, which consists of setting a unit import tariff/subsidy of  $t$ <sup>15</sup>. Tariff revenues are redistributed to all citizens as a lump-sum transfer. Similarly, any subsidy is financed through a lump-sum tax. Hence, the profits of the MNE under the two policies are:

$$\begin{aligned}\pi^i &= [p(y) - c^i]y + S \\ \pi^x &= [p(y) - c^x - t]y\end{aligned}\tag{3}$$

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<sup>13</sup> 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).

<sup>14</sup> 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 this is reasonable if  $S$  represents future tax breaks or other lump sum incentives, one might expect infrastructure investment or certain other policies to change the marginal cost of production of the firm. The consequences of relaxing these assumptions are discussed in section 8.

<sup>15</sup> Throughout we use per unit tariffs, but using *ad valorem* tariffs would not change the flavour of the argument. Since the roles of tariffs in our model are to affect the MNE’s tariff jumping decision and collect revenues, the analysis could in principle be conducted with either type of tariff without affecting the qualitative results. Because per unit tariffs affect only per unit costs they allow us to obtain results under fairly weak assumptions on the demand side of the model. If we used *ad valorem* tariffs, the precise shape of demand would matter, as the tariff would apply to the MNE’s revenues.

And a comparison of these two expressions determines the location decision of the MNE. Notice that if no subsidy is paid, the MNE invests if it is more efficient producing locally than abroad, i.e. if  $c^i < c^x + t$ .

We assume that the utility of a representative home consumer is separable in a numeraire good, which is supplied by  $M$  identical firms. We follow the framework of Brander and Spencer (1987) where the labour employed in the numeraire sector is independent of the public policy conducted toward sector  $y$ <sup>16</sup> so that we can effectively focus for the remainder of the analysis on sector  $y$  only.

Focussing purely on sector  $y$ , then, national welfare will be measured by the corresponding value of the utility function,  $u(y)$ , which can be written as the sum of consumer surplus and income from sector  $y$ <sup>17</sup>. If the host country imposes a tariff, then tariff income also enters into the welfare function. If it grants a subsidy, then this subsidy must be deducted from national welfare. Let  $W^i$  represent the welfare when the MNE invests and  $W^x$  represent welfare when the MNE exports. For  $S = 0$ , we have:

$$\begin{aligned}\Delta W &\equiv W^i - W^x = CS(c^i) + c^i y(c^i) - CS(c^x + t) - ty(c^x + t) \\ &= \Delta CS + c^i y(c^i) - ty(c^x + t)\end{aligned}\tag{4}$$

This expression summarises the trade-off faced by the host government in setting policy towards the MNE. If  $c^x + t > c^i$  then FDI leads to lower domestic prices and hence to greater consumer surplus. This benefit of FDI is greater for lower values of  $c^i$ . We also must consider the effects on employment, however. Using  $c^i = wa_L$ , we can see that the term  $c^i y(c^i)$  corresponds to the additional employment income created by FDI, i.e. it is a “rent” from creating employment. Since output is decreasing as marginal cost increases, there is a trade-off between attracting a very efficient MNE that has large output (and so a large workforce) and the fact that an efficient MNE needs few workers per unit of output. Hence, the employment benefits of FDI are not necessarily monotonic in  $c^i$ : indeed, they must increase in  $c^i$  for  $c^i$  close to zero and must decrease 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 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; alternatively if local production is so efficient that only few local workers need to be hired to serve the local market, the employment contribution also is low. Mild restrictions on the shape of our functions will allow us to resolve this trade-off and make conclusions about the optimality of different levels of decentralisation of the tax cum subsidy system that we analyse.

### 3. A Benchmark: The Fully Centralised Case

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<sup>16</sup> Local production requires a specific factor of production that is in fixed supply and fully employed at some per unit return along with labour input. For a full derivation of the implications of this structure, see Brander and Spencer (1987). Also see our working paper, Adams et al (2012), for more detail.

<sup>17</sup> We again follow Brander and Spencer (1987), who develop the details of this argument.

Let us define  $t^*$  as the optimum tariff/subsidy when FDI is not possible. We will call  $t^*$  the “optimum tariff” in the sense that it maximises national welfare under an import regime<sup>18</sup>:

$$t^* = \operatorname{argmax}(CS(c^x + t) + ty(c^x + t)) \quad (5)$$

It is useful to first look at the optimal tariff policy, when the MNE can choose between export and FDI but there are no investment-related subsidies. 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  $t^*$ .

First, for  $c^i = c^x + t^*$ , welfare is higher under FDI than under the best possible trade outcome. When this expression holds, FDI results in the same output and domestic price for good  $y$  as the best possible trade policy so that consumer surplus is the same under the two policies. FDI also generates employment benefits of  $c^i y(c^i)$ , however, which must be balanced against tariff revenues  $t^* y(c^x + t^*)$ . Since the outputs are the same, we must only compare  $c^i$  to  $t^*$ . We know, however, that  $c^i = c^x + t^*$  so that  $c^i < t^*$  must hold for  $c^x > 0$ . 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. Tariffs are set above the traditional “optimal tariff” level to ensure that this desirable FDI is chosen rather than the alternative of exports.

Figure 1 illustrates the argument. The top panel, figure 1(i) shows the profile of MNE profits under FDI and under exports as FDI falls in efficiency. When FDI is more efficient, profits are higher; where they are equally efficient, profits are the same and when FDI is sufficiently inefficient, profits and output fall to zero at  $c_{\max}^i$ . The equivalent profiles of consumer surplus are illustrated in figure 1(ii), where consumer surplus is higher for FDI when local production is more efficient, is equal to that of exports at equal efficiencies, and falls to zero when local production no longer pays at  $c_{\max}^i$ . The employment benefits are illustrated compared to tariff income in figure 1(iii). As we argued, above, when FDI and exports are equally efficient, it must be the case that employment benefits exceed tariff income. At the same time, we know that employment benefits are concave for non-convex demand with benefits equal to zero at  $c^i = 0$  and again at  $c^i = c_{\max}^i$ .

So far, we have only argued for the optimal policy at  $c^i = c^x + t^*$ . In order to determine the optimal policy for other values of  $c^i$  we need to make an assumption about the shape of the welfare function. This will ensure that the intuition we have developed so far – that employment benefits are sufficient to create a middle range of production efficiency levels for which FDI is attractive -- carries over into a larger parameter range. We make an assumption of quasi-concavity, which implies that the welfare function will intersect the horizontal axis at most twice. In order to concentrate on the case where the left hand intersection is positive we make an additional

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<sup>18</sup> Our “optimum” tariff is equivalent to the optimum tariff derived in Brander and Spencer (1984).

assumption that 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<sup>19</sup>.

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

**Assumption 2:**  $W^i < W^x$  at  $c^i = 0$  and  $t = t^*$ , i.e.  $CS(0) - CS(c^x + t^*) - t^* y(c^x + t^*) < 0$ .

One can easily check that these assumptions are satisfied for linear demands.<sup>20</sup>

**Lemma 1:** If assumptions 1 and 2 are satisfied, then there exist two non-negative 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

Figure 1(iv) illustrates these two assumptions and lemma 1.  $W^i, W^x$  are measured on the vertical axis, with the value of  $W^i$  at  $c^i = 0$  less than  $W^x$ , as required by assumption 2. We see non-negative values  $c_L^i, c_H^i$  illustrated in this figure, as assumption 2 ensures that  $c^x$  is low enough that  $c_L^i$  is positive.  $W^i > W^x$  occurs only between these two values of  $c^i$ , as derived in lemma 1. For no subsidy given, the welfare attainable is illustrated with the dashed line on the figure.

For low values of  $c^i \in [0, c_L^i]$  the MNE decides to invest because the tariff combined with production costs abroad makes exporting relatively unprofitable even though this is not the best decision for the host country. In other words, the firm “jumps” the tariff to obtain the lower cost of production associated with FDI. For intermediate levels of  $c^i \in [c_L^i, c^x + t^*]$  the MNE also chooses to invest, but this produces higher welfare than export. This is because the employment gains are much larger for this case. For range  $c^i \in [c^x + t^*, c_H^i]$  FDI also is the better decision for the host country, but export is chosen instead as soon as the cost of exporting falls below the cost producing in the host country. This causes a discrete fall in welfare at  $c^i = c^x + t^*$ . In higher ranges,  $c^i \in [c_H^i, c_{max}^i]$  the MNE’s decision to export coincides with the better decision for the host country, since employment gains would be small in any case. Indeed, above  $c_{max}^i$  local production would not occur.

Hence, the MNE’s investment reduces welfare *compared to export* for very efficient local production and improves welfare for intermediate levels of efficiency. While it may seem counter-intuitive that the MNE’s investment reduces welfare precisely when local production is very efficient, it is important to recall that the counterfactual for the host country is earning tariff revenue. Without

<sup>19</sup> A version of the paper where both cases are considered is available from the authors.

<sup>20</sup> If  $P = A - Bc$ , we have  $y(c) = (A - c)/2B$  so that  $CS(c) + c^i y(c^i) = c^i(A - c^i)/2B + (A - c^i)^2/8B$ .

significant local employment benefits, the loss of tariff revenue is not worthwhile for the host country.

We now need to consider what the optimal policy will be for the centralised government given this MNE behaviour. Notice that, as the tariff rises, the level of  $c^i$  at which the MNE is indifferent between exporting and investing rises, as is shown in figure 2(i). For example, at the higher level of tariff in this figure, the MNE invests when  $c^i$  is to the left of point H and exports when host country costs fall to the right of this point. Recall that for costs  $c^i \in [c^x + t^*, c_H^i]$ , the host country prefers FDI but the MNE chooses to export. If the host country raises the tariff above  $t^*$ , it can influence this choice by making exporting less attractive. This allows a discrete jump in host country welfare. For this range, then, it is best for the host country to set a tariff that induces the MNE to invest,  $t^s(c^i) = c^i - c^x$ . At  $c^i \in [c_H^i, c_{\max}^i]$ , of course, the host country should lower tariffs to their optimal level,  $t^*$ , to induce exporting since this produces higher welfare. Throughout this range, the host country can induce the MNE to invest without incurring any subsidy cost, so the subsidy can optimally remain zero.

At lower levels of host country production cost,  $c^i < c^x + t^*$ , it will be optimal to set the tariff equal to the optimal tariff,  $t^*$ . For the range  $c^i \in [c_L^i, c^x + t^*]$ , investment both occurs and yields higher welfare than exports. Hence, the tariff must be at least equal to the level that leaves the MNE indifferent between investing and not,  $t \geq t^s(c^i)$ . The best tariff level given this is  $t^*$ .

Referring to figures 2(iii) and 2(iv), for  $c^i \in [0, c_L^i]$ , investment is socially undesirable. With  $t = t^*$ , the MNE would choose to invest since  $c^i < c^x + t^*$ . The only way for the government to prevent investment is then to set a lower tariff,  $t < t^s(c^i) \equiv c^i - c^x$ . However, departing from the optimal tariff  $t^*$  also lowers the attractiveness of the export regime. Which of these two opposing effects dominates? At  $t = t^s(c^i)$ , we have  $CS(c^i) = CS(c^x + t^s(c^i))$  and  $y(c^x + t^s(c^i)) = y(c^i)$  so that welfare can only increase under the condition that  $c^i > t^s(c^i)$ . This must be true for all  $c^x > 0$  from the definition of  $t^s(c^i)$ . We conclude that best enforceable trade regime (i.e. the best tariff that leads the MNE to choose to export,  $t < t^s$ ) is dominated by the investment regime. Hence, for all  $c^i \leq c_L^i$ , investment occurs in equilibrium even though it is not socially desirable.

This completes the argument for proposition 1, below:

**Proposition 1:** *With a centralised government, any socially desirable FDI occurs. Whenever FDI is inefficient but socially desirable,  $c^i \in [c^x + t^*, c_H^i]$ , it is induced by setting a high enough tariff,  $t^s(c^i)$ . High cost,  $c^i \in [c_H^i, c_{\max}^i]$ , socially undesirable FDI does not occur. However, low-cost,  $c^i \in [0, c_L^i]$ , 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.*

*Proof:* The proof is the argument contained in text and figures that are discussed above the proposition and so is not repeated here.

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 is not attractive for the host country. 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 negative consumer surplus effects are so large that tariffs are lowered so as to induce the firm to export. 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 their associated tariff revenues. Unfortunately, the only way to prevent the firm from choosing FDI, given its efficiency, is to lower the tariff significantly and so constrain tariff revenues. When FDI is efficient enough, the tariff would have to be lowered to such an extent that it is better for the country simply to accept FDI.

We have so far constrained lump-sum subsidies to be zero. For this fully centralised benchmark case, allowing positive subsidies 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. Summarising this argument, 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 with Tax Competition

We now consider the case of decentralised FDI policy with all  $N$  states bidding to attract the MNE, each state holding  $1/N$  consumers. This case 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 consider an initial period where the central government sets trade policy and, given this policy, the  $N$  regions afterwards bid for the investment by the MNE. We will solve for the perfect equilibria of this tariff-subsidy-FDI game. 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  $c^j$ ,  $c^x$  and  $t$ . We will then be able to characterise the optimal trade policy of the federal government.

#### 4.1 Equilibria of the bidding game

First, notice that the bid of a region will depend on what happens when it cannot attract the MNE. If another region would otherwise attract the MNE, then the region gets no employment benefit but it gets its share of consumer surplus  $CS(c^i)/N$ . This means that the *net* benefit of actually attracting the FDI locally is just equal to the employment benefits  $c^i y(c^i)$ . Hence, the region 's maximum bid would be:

$$S^s = c^i y(c^i) \quad (6)$$

This is the maximum subsidy a region would be willing to pay to “steal” the MNE away from another region, given that the MNE will invest in some region.

On the other hand, if the alternative is that the MNE would export, then the region should be willing to bid up to the value of the employment benefits minus the share of the lost tariff revenues that the region would have obtained plus any difference between regional consumer surplus under FDI and under export, i.e.

$$S_{\max} = c^i y(c^i) + \frac{CS(c^i)}{N} - \frac{CS(c^x + t) + ty(c^x + t)}{N} \quad (7)$$

It follows from assumption 2 that:

$$S^s > S_{\max} \quad (8)$$

In other words, a region is willing to pay more to steal FDI away from another state than to attract and MNE away from exporting . The reason is that exporting carries a revenue benefit that is shared by the regions on top of the share received of consumer surplus, whereas investment in another state carries only a share of consumer surplus as a benefit. Hence, the alternative to local FDI is better in the case of exporting. This drives down the amount the region is willing to pay to “avoid” this alternative. Finally, we define  $S_{\min}$  as the minimum subsidy required to induce FDI. In other words,

$$S_{\min} = \pi(c^x + t) - \pi(c^i) \quad (9)$$

**Assumption 3:**  $S_{\max}$  and  $S^s$  are quasi-concave in  $c^i$  for all  $c^i \in [0, c_{\max}^i]$ <sup>21</sup>.

Given these bids, we solve the simultaneous bidding game and for the MNE’s acceptance or rejection of the bids. This involves deriving several critical cut-off values of  $c^i$ . These are stated formally and proved in the appendix as Lemma 2. We will derive them graphically in the text.

<sup>21</sup> Again, this assumption is satisfied for many demand functions, including linear functions as for demand  $P = A - Bc$  and marginal cost  $c^i$ , where  $S^s = c^i(A - c^i)/2B$  and  $S_{\max} = \text{constant} + c^i(A - c^i)/2B + (A - c^i)^2/8BN$ .

The bids can be ranked according to table 1. Since  $S^s > S_{max}$ , only rankings R1, R2 and R5 can arise.

The outcome is illustrated in figure 3 for the special case where the government sets the optimal tariff ( $t = t^*$ ). Figure 3(i) illustrates the MNE's investment decision, repeating figure 1(i). Figure 3(ii) illustrates the bidding profiles, derived in lemma 2 and capturing rankings R1, R2 and R5. Notice that for  $c^i = c^x + t^*$  we have  $S_{min} = 0$ , and at  $c^i = c_{max}^i$  we have  $S_{min} = \pi(c^x + t^*)$  from the definition of  $S_{min}$  and  $c_{max}^i$ . As derived in lemma 2(c) and 2(d),  $S_{min}$  increases through this range of  $c^i$ . The profile of  $S^s$  lies above the profile of  $S_{max}$ , as we have noted in the text, and both have the same humped shape, as we noted in the derivation of figures 1 and 2. Lemma 2 (in the appendix) derives and defines intersection points with the horizontal axis  $c_{LL}^i$  and  $c_{HH}^i$ . Lemma 2 also derives the intersection points,  $c_M^i$  and  $c_E^i$  that follow from the shapes and levels of the curves. With this graph in hand and working from left to right on the horizontal axis, we see that ranking R1 of the bids occurs for the range  $c^i \in [0, c_M^i]$ , ranking R2 holds for the range  $c^i \in ]c_M^i, c_E^i]$ , and ranking R5 holds for range  $c^i > c_E^i$ . The equilibrium bids for each of these ranges is stated in table 1, illustrated graphically in figure 3(iii) and re-stated formally in Proposition 3:

**Proposition 3:** *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,  $0 \leq c^i \leq c_M^i$ ) each state bids  $S^s$  and FDI occurs. If the unit cost of local production is sufficiently high (in other words,  $c^i > c_E^i$ ) FDI does not occur and no subsidy is paid in equilibrium. For intermediate levels of the unit cost of local production (in other words,  $c_M^i \leq c^i < c_E^i$ ), there are two equilibria, one involving a subsidy equal to  $S^s$  and FDI, and the other leading to exports and, therefore, no subsidies.*

*Proof:* See Appendix

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.

## 4.2 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 first derive this algebraically and then return to our graphical presentation.



We define the social benefits from FDI, net of “competitive” subsidies,  $S^s$ , as

$$\Delta W_N \equiv \Delta W - S^s = CS(c^i) - CS(c^x + t^*) - t^* y(c^x + t^*) \quad (10)$$

Clearly,  $\Delta W_N$  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  $CS(0) - CS(c^x + t^*) - t^* y(c^x + t^*) < 0$ ,  $\Delta W_N$  is always negative. This means that subsidised FDI is always socially undesirable compared to exports.

Interestingly, since the equilibrium subsidies compete away all employment benefits, all regions 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  $1/N$ th the effect of FDI on national welfare. In this sense, local and national desires 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 (compared to exports) subsidised FDI. We can then state the following proposition to summarise the argument in the text:

**Proposition 4:** *Under assumptions 1 and 2, and for  $t=t^*$ , there tends to be excessive FDI. For low values of  $c^i$  (in other words,  $c^i < c_M^i$ ), subsidised FDI occurs in equilibrium although it is harmful both socially and locally compared to exports. Very cost-inefficient FDI (in other words,  $c^i > c_M^i$ ) is also socially and locally undesirable compared to exports, but it never occurs in equilibrium.*

*Proof:* The proof is contained in the text above the proposition and so not repeated here.

Figure 3(iv) illustrates the welfare when the government applies the tariff  $t^*$  and the winning region pays the optimal bid to attract FDI over the range where this is an equilibrium, as shown in section 4.1. The graph illustrates the case where the equilibrium without investment is selected over the interval  $]c_M^i, c_E^i]$ , although this is not central to the graphical argument. Indeed, for the rest of the analysis it will be convenient to only consider one of the two kinds of equilibria that arise over this interval. We shall focus on the equilibria without FDI for a variety of reasons<sup>22</sup>. Proposition 4

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<sup>22</sup> This assumption does not materially affect the results but simplifies the analysis considerably. We choose to focus on the case of exports for many reasons. First, all regions are better off in the FDI export equilibrium so that one might believe that they will manage to coordinate on it despite concerns about whether this should be expected to occur generally (See Fudenberg and Tirole, 1991, pp. 20-22 for example). Second, the multiplicity of equilibria is an artefact of the complete simultaneity of bidding by all regions. If one were to consider a sequential auction where the MNE asks each region in turn to make a bid before choosing the location – and where previous bids are known to all players – the equilibrium outcome would be that all regions bid below  $S_{min}$  so that the MNE would not invest. Hence, the export equilibrium is more robust to small changes in the game. This looks more like the Mercedes-Benz example we cited in the introduction, in fact. We thank Michael Riordan for pointing this out.

restates the result of this graph that, compared to exports, the investment equilibrium generates lower welfare for the case of low  $c^i$ .

We can now determine the optimal trade policy of the central authority. It is important to underline at the outset that inter-regional competition makes a strategy of raising the tariff so as to induce FDI without the expense of a subsidy completely ineffective. With competition, even if the tariff is set so that FDI would occur in the absence of subsidies, the regions 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. We show this argument graphically in figure 4. 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. Taking first the case of  $S_{\min}$ , we note that a decrease in the tariff shifts the  $S_{\min}$  profile downwards. This moves the intersection point,  $c_E^i$  to the right along  $S^s$ .

Now, 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 if  $t < t^*$  -- since we would thereby increase  $t$  towards the maximum -- and up if and only if  $t > t^*$  -- since we would thereby increase  $t$  away from the maximum. If  $S_{\max}$  shifts down, then point M shifts left whereas if  $S_{\max}$  shifts up we have the contrary case where M shifts right. Hence, for  $t > t^*$  we have  $\frac{dc_M^i}{dt} > 0$

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, thinking of the intersection points E and M as functions of the tariff,  $t$ , for a value of  $c^i$  a little above  $c_M^i(t)$ , 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  $c_M^i$  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  $c_M^i$  is positive on balance.

**Lemma 3:**  $\frac{dc_M^i}{dt} \geq 0 \forall t$

*Proof:* See Appendix

The question then is whether trade policy is of 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  $c^i \geq c_M^i(t^*)$  the optimal policy clearly is to set  $t=t^*$  and allow the market to be served through imports. This is because the optimal tariff can be charged, maximising the benefits from imports, no subsidy is paid, and the firm chooses to export under this scheme. We now look at the case where  $c^i < c_M^i(t^*)$ . Over this range, setting  $t=t^*$  would actually trigger undesirable subsidised FDI, as we

saw in figure 3(iv). Let us first focus on the upper part of that range. One can show that, for  $c^i$  close enough to  $c_M^i(t^*)$ , setting a tariff slightly below  $t^*$  would improve welfare. Lemma 3 implies that this slightly lower tariff shifts  $c_M^i$  to the left so that FDI is no longer an equilibrium in the immediate neighbourhood of  $c_M^i(t^*)$ . Moreover, for this small change in tariff, the effect on welfare with exports is negligible. This means 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 from lemma 3 that  $\frac{dc_M^i}{dt} > 0$  and at the same time we know from the definition of  $t^*$  that:

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

Hence, the benefit of FDI compared to exports,

$\Delta W_N \equiv \Delta W - S^s = CS(c^i) - CS(c^x + t^*) - t^* y(c^x + t^*)$  must be negative at  $c_M^i(t^*)$  so that a switch from FDI to exporting must be socially beneficial. In order to effect this, the tariff is set at the highest level for which export just occurs, which we call  $t^0$ , this tariff is lower than our benchmark “optimal” tariff  $t^*$ , i.e.  $t^0 < t^*$ .

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  $c_M^i(t^*)$ . 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<sup>23</sup>.

Turning now to the lower part of the range, one can show<sup>24</sup> 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  $c_s^i$ , so that the central government prefers to discourage FDI through a low tariff for  $c^i > c_s^i$  but prefers not to interfere with FDI for  $c^i \leq c_s^i$ . We can now summarise these results in a proposition.

<sup>23</sup> We have  $W^i = CS(c^i) + c^i y(c^i) - S^s = CS(c^i)$  which is decreasing in  $c^i$ .

<sup>24</sup> At  $c^i = 0$  the highest tariff avoiding subsidised FDI and instead inducing export is  $t^0 \equiv t$  such that

$$\pi(c^x + t^0) + \frac{1}{N} (CS(c^x + t^0) + t^0 y(c^x + t^0)) = \pi(0) + \frac{CS(0)}{N}. \text{ At } t^0 = -c^x \text{ the LHS is smaller than}$$

the RHS. Since the LHS is decreasing in  $t$ , this implies that  $t^0(c^i = 0) < -c^x$ . But

$W^x(t < -c^x) < W^x(c^x) = CS(0) - c^x y(0) < W^i(0) = CS(0)$ . Therefore, at  $t^0$  exports occur but this tariff level is so low that the welfare ends up being lower than that of FDI.

**Proposition 5:** Define  $t^0(c^i)$  such that  $c^i = c_M^i(t^0)$  and hence the tariff is such that, at current production costs of the MNE, export occurs. For very inefficient FDI, i.e.  $c^i > c_M^i(t^*)$ , the central government sets  $t=t^*$  and the home market is served through imports. For more efficient FDI, i.e.  $c^i \in ]c_s^i, c_M^i(t^*)]$ , 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. If FDI is very efficient, i.e.  $c^i < c_s^i$ , 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.

*Proof:* The proof is contained in the text preceding the proposition, and so is not repeated here.

Figure 4(ii) shows the optimal tariff as a function of  $c^i$ . Since  $c_M^i(t)$  is an increasing function of  $t$   $t^0(c^i)$ , which is the tariff just sufficient to discourage FDI at  $c^i$ , must also increase as  $c^i$  increases.

We have  $t^0(c_M^i(t^*)) = t^* - \varepsilon$  as the federal government lowers its tariff just enough to discourage subsidised FDI. The corresponding equilibrium patterns of FDI and export are shown in figure 4(iii). The host country welfare under the optimal tariff policy, whereby a subsidy is paid to induce FDI for very efficient firms, a rising tariff is charged for intermediate efficiency levels, up to the optimal tariff, which is charged when FDI is very inefficient.

## 5. Comparing Institutional Regimes

We are now in a position to compare the centralised and decentralised institutional regimes, using figures 2 and 4 to compare the equilibrium pattern of FDI, levels of tariffs, and levels of subsidies that prevail.

In the benchmark case of centralisation, FDI occurs for all  $c^i \leq c_H^i$ . With decentralised bidding, FDI occurs for all  $c^i \leq c_s^i$ . Our first task is therefore to rank  $c_H^i$  and  $c_s^i$ .

**Lemma 4:**  $c_s^i < c^x + t^* < c_H^i$ . 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.

The intuition for this result is that competitive bidding makes FDI socially less desirable because FDI induces the payment of positive subsidies. For inefficient enough FDI, the government can avoid such undesirable FDI by setting a low tariff, so that the equilibrium range for which FDI occurs is curtailed under decentralisation.

Since no subsidies were paid in the centralised setting, competitive bidding clearly leads to higher levels of equilibrium subsidies. The comparison of tariffs is less straightforward. Indeed, we can see from figures 2(iii) and 4(ii) that the two equilibrium tariff schedules are quite different. For high values of  $c^i$ , it is optimal to set tariff  $t^*$  under both centralisation and competitive bidding. For values lower than  $c_H^i$ , the centralised solution is to induce FDI by a tariff  $t \geq t^s$ , which involves raising the tariffs above  $t^*$  for an intermediate range. For values lower than  $c_M^i$  but greater than  $c_s^i$ , however, the optimal tariff under competitive bidding is  $t^0$ , which is below  $t^*$ . Indeed, we have  $t^0 < t^s$  for all  $c^i > 0$ <sup>25</sup>. Finally, for  $c^i < c_s^i$  the optimal trade policy with competitive bidding is to induce FDI by setting  $t > t^0$ . Hence, we can conclude:

**Proposition 6:** For  $c^i \geq c_s^i$  the optimal tariff under centralisation always is at least as large as the optimal tariff under competitive bidding. For lower values of  $c^i$ , we can only say that the lower bound of the optimal tariff is strictly greater with centralisation.

*Proof:* The proof is contained in the text preceding the proposition and so is not repeated here.

## 6. Decentralised Policy without Bidding<sup>26</sup>

Not every country falls into the category of full centralisation or fully decentralised bidding among regions. The country might, indeed, contain  $N$  independent regions with local authority to set FDI incentives while the federal government sets the trade policy; however, all the local authorities do not bid for FDI. Instead, the possibility of attracting the firm to invest is delegated to a single local authority. There are three reasons for considering this case. 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 and so allows us to further clarify the intuition behind our results. Secondly, as we discussed in the introduction, it is not uncommon for a federal country to “allocate” FDI to a specific region. 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 uncommon, as local infrastructure and labour market conditions tend to play a large role in the decision of where to locate<sup>27</sup>, including the notable historical dominance of Guangdong among eastern provinces in China where FDI was permitted over a long period.

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<sup>25</sup>  $S_{min} = S_{max}$  cannot hold at  $t = t^s$ . Indeed,  $S_{min} < S_{max}$  at  $t = t^s$ , whereas they equal at  $t=t^0$ , implying that  $t^0 < t^s$ .

<sup>26</sup> To increase the paper’s readability and keep it to a reasonable length, all formal derivations have been omitted. They can be found in our working paper, Adams et al. (2012).

<sup>27</sup> See <http://www.oecd.org/dataoecd/57/23/1922648.pdf>

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. For state 1 the difference between welfare with FDI and welfare with export is given by:

$$\Delta W_1 = c^i y(c^i) + \frac{1}{N} [CS(c^i) - CS(c^x + t) - ty(c^x + t)] \quad (11)$$

If we compare this equation to equation (4), which gave us the same welfare difference for the country as a whole, we see that since state 1 fully appropriates the employment benefits, these are not a source of difference. On the other hand, we find that two externalities contribute to the misalignment of local and federal incentives. Firstly, whenever FDI leads to a lower or higher price for good  $y$  than exports (in other words, whenever  $c^i$  is lower or higher than  $c^x + t$ ), 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 shared evenly among the  $N$  states as well. In both cases, state 1 will then only consider  $1/N$ th of the effect of FDI on national welfare. If the price is higher under FDI, then, both externalities are negative and there are excessive incentives to attract FDI to the region. If the price under FDI is lower, then the consumer surplus externality is positive while the tariff revenue externality is negative; however, we can show<sup>28</sup> that under assumption 2 the local incentives to attract FDI always are excessive from the point of view of the country as a whole.

We can now compare the equilibrium pattern of export and FDI between the fully centralised case and the case where a single region is designated as the target for FDI. The optimal policy is very close to that with full centralisation. Notice that, while it does not have the same incentives as the country as a whole, the region’s incentives are nevertheless highly *aligned* with those of the entire country. First, the alternatives of either attracting FDI or receiving imports are the same for both the region and the country as a whole: we no longer have the possibility of another region “stealing” the business. Second, the employment gains are the same for the region and the entire country. Finally, while it receives less weight in the welfare of the region, the form of the consumer surplus and tariff loss when there is inefficient production under FDI is the same for the region and the entire country. Indeed, it is this loss that drives the bid of the region below the level necessary to attract the firm to invest when exporting is relatively more efficient.

For middle ranges of efficiency, where FDI is preferable to imports for the country as a whole at the optimal tariff  $t^*$ , the optimal policy consists in setting a tariff high enough to ensure that the MNE would decide to invest, even in the absence of a subsidy. Here, even though the locality is willing to pay a sufficient subsidy to attract FDI, the central government is able to use its commitment power on trade policy avoid this by raising the tariff. By raising the tariff, the central government avoids what is both a regional and country-wide welfare loss of paying the subsidy and achieves the same outcome. For very efficient FDI, the region need not pay any subsidy to attract FDI: the efficiency benefit is enough to attract the firm without subsidy. Furthermore, for the same reason as in the centralised case, the central government is unwilling to lower the tariff enough to avoid FDI. Hence, over this range FDI is socially undesirable but is not deterred, as in the centralised case. For FDI that is inefficient relative to exports, FDI will only occur if it is subsidised in some way when the tariff is set optimally at  $t^*$ . Furthermore, for  $c^i > c_H^i$  FDI is socially undesirable.

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<sup>28</sup> See Adams et al (2012) for a full derivation of this result, stated as lemma 2 in that paper.

For values close enough to  $c_H^i$ , however, FDI can be locally desirable since the loss associated with inefficiency is spread over  $N$  states. The question is, then, whether the local authority is ever willing to pay a big enough subsidy to induce FDI when  $t=t^*$ . We show<sup>29</sup> that this is never the case. The intuition is that given above: while the incentives for the region are not the same as those of the central government, they are aligned. Furthermore, the losses associated with inefficiency affect the region as well, driving down the amount it is willing to pay to attract FDI. Hence, we show that the ranges over which FDI or exports are observed, the equilibrium tariff and the equilibrium level of subsidy are the same in this setting as in the centralised case. This reflects the power of the 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. This also shows that the source of discrepancies between the policies of centralised and decentralised systems must be found in tax competition between local authorities and not in the consumer surplus and tariff revenue externalities discussed at the beginning of this section.

## 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. Under the GATT and the WTO, however, many tariffs have been bound at modest levels. Whether or not these bound levels leave enough room for the kind of “high tariff” policies that emerge from our analysis over some parameter ranges is ultimately an empirical issue: when we refer to “high” tariffs in our analysis, we simply mean tariffs that are high enough to make a firm choose FDI over exports. Such “high” tariffs can, therefore, be small in absolute levels and so compatible with existing WTO commitments. Still, it is worth asking how our conclusions would be affected if the host government could not set tariffs as high as it otherwise would like. Therefore, we quickly revisit our previous analysis under the assumption that the federal government is limited to setting  $t \leq t_{\max} < t^*$ . For the three institutional settings discussed in sections 3, 4 and 6, we briefly discuss how the optimal trade, FDI and the equilibrium subsidies change in a bounded tariff setting.

### 7.1 Fully Centralised Case and Non-Competitive Bidding

Let us begin with full centralisation. Here, 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  $c^i$ , 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 bounded tariff is to reduce the lower range of  $c^i$  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

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<sup>29</sup> See Adams et al (2012) for a full derivation and statement as proposition 4 of that paper and associated lemma 3.

values of  $c^i$  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  $c^i$ , however, the subsidy required to induce FDI is substantial enough to make it undesirable. In particular, one can show<sup>30</sup> that for  $c^i$  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  $c^i$  for which FDI is observed in equilibrium and increases the range over which equilibrium FDI is socially desirable compared to export. For intermediate values of  $c^i$ , FDI still occurs but the tariff reduction leads to the payment of positive subsidies to the MNE.*

*Proof:* The proof is omitted here as it is similar to that given for proposition 1.

The main difference between the fully centralised case and the case of decentralisation without competitive bidding is that the decision of whether or not to trigger FDI is now in the hands of the local authority for the range of  $c^i$  for which FDI no longer occurs unless subsidies are paid (in other words,  $c^i > c^x + t_{\max}$ ). Here, the incentives to attract FDI are socially excessive; however, 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 with bounded tariffs<sup>31</sup>.

## 7.2 Decentralisation with Competitive Bidding and Tariff Constraints

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, the only “active” trade policy arose for high values of  $c^i$ , 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 4. Since  $t_{\max} < t^*$  and  $\frac{dc_M^i}{dt} > 0$ , the upper range of  $c^i$  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  $c^i > c_s^i$ , the central government avoids FDI anyway by setting a low enough tariff. Hence, as long as  $t_{\max}$  is not

<sup>30</sup> Proof available from authors.

<sup>31</sup> The proof is omitted as the argument is similar to that contained in section 6. It is available from the authors.



too low, its only effect is to force lower equilibrium tariffs over the uppermost range of  $c^i$ . If, on the other hand,  $t_{\max}$  were to fall below  $t^0(c_s^i)$  then, for values close enough to  $c_s^i$ , 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  $c^i$  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.*

*Proof:* The proof is the argument preceding the proposition and so is not repeated here.

Hence, we have a significant difference in the effect of trade liberalisation in the two cases: for centralised or decentralised states without bidding competition, modest liberalisation has an effect on tariff and subsidy levels whereas it has no similar effect for the case of decentralisation with bidding competition. Only drastic liberalisation has an effect on the equilibrium tariff in the latter case.

#### 8. Robustness: Relative Commitment Power, Structured Subsidies, Multiple Entrants

Our model, while relatively general on some levels, does contain a specific structure to set out our points clearly. Some of our structure makes little difference to our effective results. For example, adding a fixed cost of entry, sunk and paid at the time of FDI, affects the levels but not the shapes of our profiles and so does not affect the flavour of our results. On the other hand, we need to consider some other modifications in some detail and will do so here. In particular, our model assumes a particular order of moves, we restrict subsidies to be positive lump sums, and we assume that at most a single MNE may enter the country. We now discuss these assumptions and the effect changing them could have on our results.

We make our assumptions on the order of moves for good reason. If the MNE does not move last, then it makes little sense to discuss the effect of trade and subsidy policy on location decisions. Even if we leave the MNE as the last mover, however, we can potentially consider the effect of changing the order of moves of regions and countries. We have taken the view that trade policy choices were harder to reverse than the design of specific subsidy packages. Still, one might wonder what the effect of switching the order of trade and subsidy decisions would be. Clearly, for a fully centralised state this makes no difference. More surprisingly maybe, reversing the order of policy decisions also makes little difference to the flavour of our results for decentralisation with bidding: whatever job-related benefits that would result given the anticipated trade policy decision of the federal government would still be competed away, to the detriment of national welfare, so there is still room for a trade policy that sets a low tariff *ex post* to induce the MNE to disregard the investment incentives that they have been offered by the states.

Although we mostly used a fairly standard trade model, two of our assumptions deserve further comment. Firstly, 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 does not change our results drastically. It does 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 have more of a role, as they enable the government to avoid socially undesirable low-cost FDI. Finally, with decentralisation but no competitive bidding, negative subsidies would be irrelevant since local incentives to attract FDI are socially excessive in any case<sup>32</sup>. Secondly, we also assumed that subsidies were paid in a lump sum manner, in other words without affecting the local marginal cost of the MNE. One observes a much wider variety of incentive packages in practice, some of which might include payments that are related to the level of employment or the level of production of the MNE. Let us therefore assume that, instead of a lump sum  $S$ , local or federal authorities used a per unit subsidy  $s$ . Besides influencing the location decision of the MNE, such a policy tool has the additional effect of changing the local and national benefits that would arise if the MNE did indeed choose the investment route: a higher rate of subsidy leads both to lower prices – to the benefit of local and national consumers – and to higher levels of employment – to the benefit of local workers. This changes the analysis in two respects.

The first issue is that, just as there is an optimal tariff  $t^*$  that maximises welfare under the assumption that the national market is served through exports, there is now an optimal subsidy  $s^*$  that maximises national welfare under the assumption that the MNE invests in the country. This clearly changes the ranges of parameters for which FDI is socially or locally desirable. On the other hand, once this basic “rescaling” is accounted for, the qualitative conclusions regarding the effectiveness of a “high tariff” or “low tariff” policy are not affected. The second, more important, issue is which of the two additional benefits introduced by a per-unit subsidy are appropriated by the authority that sets the subsidy policy and which are not. In the fully centralised case, the central government would fully consider the consumer and employment benefits stemming from a higher  $s$ . On the other hand, if subsidies are decentralised, then the local authority completely internalises the additional employment benefits from higher subsidies but it only factors in one  $N^{th}$  of the additional consumer surplus created. For the case of decentralisation without bidding between regions, then, local authorities would have an incentive to set  $s$  too low, making FDI less attractive than in the fully centralised solution. The range of parameters for which FDI would occur in equilibrium would therefore be smaller than under a fully centralised system. This might also create a range of low values of  $c^i$  for which a policy of low tariffs in order to discourage undesirable investment might now be desirable. Turning to the case with decentralisation and competitive bidding, notice that, assuming that the MNE would otherwise locate in another region, a given region’s incentives to attract the MNE are wholly captured by the employment benefits since any related consumer benefits would accrue anyway (and tariff revenues would be lost as well). This means that, even if

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<sup>32</sup> 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 be 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 are not greatly affected.

the per-unit subsidy can be used to optimise the level of employment benefits, those benefits will be fully dissipated through interregional bidding, leaving the nature of our analysis fundamentally unchanged.

Finally, it is worth discussing briefly how our analysis might change if we allowed for more than one firm in the relevant industry. This issue has two related aspects: the fact that some firms might already be established in the country at the time when the MNE considers how best to serve the national market, and the fact that there might be more than one MNE considering entry into the national market. The basic intuition for each of these two scenarios can be obtained within a simple framework where there are only two regions, A and B, within the country. All other assumptions are as in our basic model.

Let us assume that, at the time the MNE appears on the scene, there is already one firm operating in region B. Let us further assume that this firm is foreign-owned so that its profits are not part of either regional or national welfare. Nothing much is changed in the fully centralised regime except that the employment benefit considered is equal to the difference between the level of employment under duopoly and the level of employment under monopoly. On the other hand, the presence of an existing firm raises an additional issue when there is decentralisation but no bidding competition: to which of the two states should the newcomer be assigned? If it is assigned to state B, then the additional employment benefits considered by the local authority when granting its subsidy would be equal to the difference between total duopoly employment and monopoly employment and would therefore be aligned with the objectives of the federal authority. On the other hand, were the MNE to be directed to state A, then state A would consider employment benefits equal to half of duopoly employment, which is larger than the difference between total duopoly employment and monopoly employment. Intuitively, state A will not internalise the decrease in employment level at the existing firm located in the other state. State A would therefore have an excessive incentive to subsidise compared to a fully centralised authority. There is therefore a rationale for concentrating inward foreign direct investment in the same industry in a single region. Once this is done, the analysis proceeds as before. In this sense then, our model offers an explanation for the regional concentration of industries that is independent of the existence of any vertical linkages or network effects.

Let us now turn to decentralisation with competitive bidding where we know that maximum bids are equal to the expected local employment benefits. This means that state A is willing to bid up to the employment benefits offered by one duopoly producer. For state B, the maximum bid is equal to the total duopoly employment benefits (which B gets if it wins the bidding) minus half of those duopoly benefits (which B gets if it loses). Hence, A and B are willing to bid up exactly to the same level, as in our basic model, leaving the rest of the analysis qualitatively unchanged. Notice also that, with competitive bidding, we would not necessarily observe regional concentration of industries. On the other hand, any small idiosyncratic advantage for one of the regions would again lead to such concentration.

In the discussion above we assumed that the “existing” firm was foreign-owned. If the firm is domestically-owned instead, then the only difference is that the presence of a new foreign firm will

reduce the level of domestic profit, which lowers domestic welfare. Since domestic profits will be lowered more when the new entrant has lower costs, the relevant issue is not entry – which will occur anyway – but the marginal cost of the foreign firm that is implied by the chosen entry route. In other words, the domestic profit-dissipation effect creates an incentive to adopt policies that “raise the costs of the foreign firm” compared to the situation where both the existing firm and the entrant are foreign. So, referring back to figure 1, the range of parameters for which DFI increases domestic welfare would shift to the right. Once this shift is accounted for, the rest of the analysis proceeds as before and involves the same effects. Whether the presence of an existing firm actually affects the *relative* incentives to attract DFI under our three institutional regimes depends on the degree of localisation of the domestic firm’s profits. If these profits are captured only by residents of the state where the domestic firm is located *and* the foreign firm also locates in that state, then the incentive to raise the foreign firm’s cost is perfectly internalised under all three settings. If either of these two conditions fails then the local authority does not fully internalise this cost-raising incentives effect. That further increases the already excessive decentralised incentives to attract DFI over the lower range of parameters.

We can alternatively consider a situation where there are no existing firms in the host country but where there is a potentially large number,  $N$ , of MNEs that are interested in serving the country through exports or FDI. Importantly, we keep all other assumptions of the model unchanged. In particular, the host government sets its trade policy once and for all in a non-discriminatory manner at the beginning of the game. It cannot promise to let a number of MNEs in and then to raise its tariff to protect them from import competition.<sup>33</sup> Once there is more than one firm that chooses between exports and investment a variety of modelling approaches are possible depending, for example, on whether those decisions are taken simultaneously or sequentially and on whether the host country – including local authorities – have to offer the same deal to all or can instead discriminate between foreign firms. Clearly, considering how all of these approaches might affect our results goes well beyond the scope of the present paper and might deserve an investigation of its own. We will therefore limit ourselves to a simple set up that suggests that, under some conditions at least, the main insights from the analysis with a single foreign firm do generalise to the case of several potential investors.

As above, consider a country with two regions A and B and assume that there are three firms that will serve the home market either through FDI or through exports. The number of firm is chosen to be large enough so that – in a simple arithmetic sense at least – regions are on the “short side” of the market. This enables us to capture situations where the foreign firms are meaningfully “competing” for the favours of either the federal state or the regions. In the first stage, a tariff is chosen by the federal government. In the second stage, the authorities that handle subsidies set a single level of subsidy that is available to any firm that decides to settle in the relevant jurisdiction. In the fully centralised case, one can then think of the federal government as deciding the number of firms that it finds profitable to attract, taking into account the joint trade and subsidy policy that would attract this number of firms. Since the additional job benefits of having one more firm invest

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<sup>33</sup> This kind of policy would raise serious credibility issues. See K. Matsuyama (1990 ) for an analysis of a similar credibility problem.

into the country decrease with the number of firms investing, there will clearly be ranges of parameters for which the federal government finds it desirable to induce only some of the MNEs to choose the FDI route. The likelihood of such “mixed” entry route configurations would, of course, be further increased if MNEs faced heterogeneous cost conditions. Suppose then that the optimal configuration is one firm serving the home market through FDI and two through exports. How would such a configuration best be induced? With a single firm, the optimal policy was to set the tariff high enough to induce tariff jumping without the need to offer a subsidy. With our mixed configuration, however, such a policy has an extra cost: it increases the cost of production of the two firms that will export to the market. Any trade policy that involves setting a tariff that is higher than the relevant “optimal” tariff<sup>34</sup> is, therefore, somewhat less attractive than in the one firm case. As a result, even a centralised authority might find it necessary to use some positive subsidy in order to induce the amount of FDI that it desires.

This possible change in the optimal mix of instruments chosen under a fully centralised system is the main difference stemming from the presence of more than one MNE. In the case of decentralisation without competitive interregional bidding, we have already seen that the optimal policy will involve allocating all MNEs to the same region. Beyond this, the alignment between regional and national incentives to invite FDI is not modified. Finally, with decentralisation and competitive bidding between regions, the equilibrium level of subsidy will again fully dissipate the employment benefits created by whatever number of firms actually chooses the FDI route. Suppose, for example, that two of the three firms would choose the FDI route in equilibrium. Assume further that, in case of ties between the subsidies offered by the two states, the firms split their locations between the two regions. The maximum level of subsidy that a region would be willing to bid is then equal to half of the total employment benefits generated by an investing duopoly facing continued competition from the third firm that chose the export route. Hence there is again no net national benefit from employment creation in equilibrium and the discrepancies between local and federal incentives is essentially the same as in our one firm model. The fact that setting a high tariff has an additional welfare cost when some firms still choose the export route is of no relevance to this case since, as we have seen, “high tariff” policies are ineffectual anyway.

## 9. Discussion and Conclusions

We have considered a model where a MNE must decide whether to serve a 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 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

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<sup>34</sup> This is the tariff that maximises national welfare for a given mix of FDI and export choices by the MNEs.

it yields lower welfare for the host country than exports. We then 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. Finally, we 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.

Since constrained tariff policies might be more realistic 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 only has an effect if the liberalisation is drastic. It does not affect the level of subsidies but it increases the range of parameters over which FDI is observed.

Overall, the message of the paper both concerns FDI and regional competition proper and also makes a broader comment about the interaction between trade policy and regional governance. First, 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.

Second, our framework illustrates the impact upon trade policy of differing internal governance structures. This is a point raised indirectly by the tax competition literature but, hopefully, brought into focus by our work. Indeed, our model shows that certain governance structures can make modest trade liberalisation irrelevant to equilibrium policy while other governance structures can make the same modest trade liberalisation quite effective at changing behaviour. Internal governance has not been interacted with trade policy to our knowledge in a full and systematic way in the existing literature. It is a point that bears further investigation.

An ancillary result of our analysis in the case of multiple firms is that systems with non-competitive subsidy systems can be linked optimally and naturally to systems where inward foreign direct investment in the same industry is concentrated in the same region. In this sense, our model offers an explanation for the coupling of regional concentration of industries and non-competitive subsidy systems independent of vertical linkages, network effects or any underlying differentiation among regions.

That being said, our emphasis has been on how the tax and tariff system works, not on whether decentralisation is desirable or chosen in the first place. This has been discussed at length elsewhere<sup>35</sup> 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.

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 a fully developed case of several MNEs and modelling the local bidding competition as a full multi-lateral bargaining process in which trade policy affects the “bargaining power” of the parties would also be of some interest.

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<sup>35</sup> See Bird (2006) for discussion and a case study of Latin America.

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## 10. Appendix

### 10.1 Proof of Lemma 1

Notice that only the first and third terms of

$\Delta W = CS(c^i) - CS(c^x + t^*) + c^i y(c^i) - t^* y(c^x + t^*) = 0$  depend on  $c^i$ . By straightforward calculation, we have  $\Delta W > 0$  at  $c^i = c_x + t^*$ , calculation and assumption 2 imply that  $\Delta W < 0$  for  $c^i = 0$ , and we also have that  $\Delta W < 0$  at  $c^i = c_{max}^i$ . Assumption 1 that  $CS(c^i) + c^i y(c^i)$  is quasi-concave in  $c^i$  guarantees that  $\Delta W$  intersects the horizontal axis at most twice. Hence, one of the two possible intersections must always exist and must be at  $c_H^i \in ]c^x + t^*, c_{max}^i [$ . 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  $c^i$ , given assumption 2.

### 10.2 Statement and Proof of Lemma 2

**Lemma 2:** *The relative positions of  $S_{max}(c^i)$ ,  $S^s(c^i)$  and  $S_{min}(c^i)$  are such that:*

- $S^s(c^i) > S_{max}(c^i) \forall c^i \in [0, c_{max}^i]$
- $S_{max} \geq 0 \forall c^i \in [c_{LL}^i, c_{HH}^i]$  and  $S_{max} < 0 \forall c^i \in [0, c_{LL}^i] \cup [c_{HH}^i, c_{max}^i]$ , with  $c_{LL}^i < c_L^i < c_H^i < c_{HH}^i$ .
- $S_{min}(c^i)$  is increasing in  $c^i \forall c^i \in [0, c_{max}^i]$
- $S_{min}(c^x + t) = 0 \forall t$
- There exists one and only one value of  $c_M^i \equiv c^i \in [c_L^i, c_H^i]$  such that  $S_{min}(c_M^i) = S_{max}(c_M^i) > 0$ .

*Proof:*

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

$$S_{max} \equiv \frac{CS(c^i) - CS(c^x + t) - ty(c^x + t)}{N} + S^s < S^s \forall c^i.$$

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  $S_{max}(c_{max}^i) < 0$ . Comparing the expression for  $S_{max}$  to that of  $\Delta W$ , we see they have the same shape and since  $S_{max}$  is the larger of the two, it exceeds zero for some set of values between 0 and  $c_{max}^i$ . Indeed, since  $\Delta W$  intersects the horizontal axis twice, so must  $S_{max}$ . Moreover, it must be the case that 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 recall that  $S^s = c^i y(c^i)$ . We have

$\frac{dH}{dc^i} = \left(\frac{1}{N}\right)[CS'(c^i)] + \pi'(c^i) + \frac{dS^s}{dc^i}$ . Notice that  $CS(c^i) + S^s + \pi(c^i)$  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. This also implies that  $\frac{dH}{dc^i} < 0$ . As  $H(c_x + t^*) > 0$  and  $H(c_{\max}^i) < 0$ , 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  $c_M^i$ .

### 10.3 Proof of Proposition 3.

Given Lemma 2, 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 regions. 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  $c^i \in ]c_x + t^*, c_{\max}^i]$  we have  $S_{\min} \geq 0$ . Moreover,  $S^s > S_{\max}$ . Since the net effect of FDI on tariff revenues and consumer surplus is negative, this implies that regions 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  $c^i \in ]c_x + t, c_M^i]$ , 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 region to bid up to  $S_{\max}$ . 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 region 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 equilibrium characterised by this highest bid. There are, in fact, many since – given that at least one region bids  $S^s$  – every other region is indifferent among bids that are smaller than or equal to  $S^s$ . Despite this, we can still state that the outcome is that over this range FDI occurs in equilibrium and a subsidy of  $S^s$  is paid to the MNE.

- b. Define  $c_E^i$  as the value of  $c^i$  such that  $S_{\min} = S^s$ . Then, for  $c^i \in ]c_M^i, c_E^i]$ , 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 region bids  $S^s$  and FDI occurs. If at least one other region bids  $S^s$  then FDI will occur anyway; hence, region  $i$  is willing to bid up to  $S^s$  in an attempt to steal the MNE away from the other region(s). In the second type of equilibrium, every region bids below  $S_{\min}$  so that FDI does not occur and no subsidy is paid in equilibrium. If every other state bids below  $S_{\min}$  then region  $i$  is no longer willing to bid above it since  $S_{\max} < S_{\min}$ .
- c. For  $c^i > c_E^i$ ,  $S_{\min} > \max(S^s, S_{\max})$ . Bidding below  $S_{\min}$  is a dominant strategy for every region. In this case, FDI is not observed in equilibrium.

#### 10.4 Proof of Lemma 3

The critical value  $c_M^i$  is defined implicitly as

$$\frac{CS(c_M^i) - CS(c^x + t) - ty(c^x + t)}{N} + c_M^i y(c_M^i) - \pi(c^x + t) + \pi(c_M^i) = 0$$

so that, defining tariff revenue as  $T \equiv ty(c_x + t)$ , we get

$$\frac{dc_M^i}{dt} = - \frac{\frac{1}{N} (CS'(c^x + t) + \frac{dT}{dt}) - \pi'(c^x + t)}{\frac{CS'(c_M^i)}{N} + \frac{dS^s}{dc_M^i} + \pi'(c_M^i)} = - \frac{Num}{D}$$

Let us first show that  $Num$  is positive. First, notice that  $CS(c^x + t) + T + \pi(c^x + t)$  must decrease as  $c_x + t$  increases, since both consumer surplus and monopoly profits must decrease as effective costs increase and tariff revenue does as well as long as marginal revenue slopes downward. This means that  $CS'(c^x + t) + \frac{dT}{dt} + \pi'(c^x + t) < 0$  and, since  $\pi'(c^x + t) < 0$ , we also have

$$\left(\frac{1}{N}\right)CS'(c^x + t) + \frac{dT}{dt} + \pi'(c^x + t) < 0 \text{ so that } Num > 0. \text{ Now we turn to the sign of } D. \text{ Clearly,}$$

$CS'(c^i) < 0$ . Hence,  $\frac{dS^s}{dc_M^i} + \pi'(c_M^i) \leq 0$  is a sufficient condition for  $D < 0$ . Now, we can use the

monopolist's first order conditions to infer the sign of this expression since

$S^s + \pi(c^i) = c^i y(c^i) + \pi(c^i) = y(c^i) p(y) = R$ , where  $R$  is the total revenue of the MNE. We can

now compute  $\frac{dR}{dc^i} = \frac{dR}{dy} \frac{dy}{dc^i}$  in order to infer the sign of our sufficient condition. 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,  $\frac{dR}{dc^i} \leq 0$  if and only if

$$\frac{dR}{dy} = p(y) + yp'(y) > 0, \text{ which is satisfied since the first order condition of the monopolist profit}$$

maximisation problem implies that  $p(y) + yp'(y) = c^i \geq 0$ . Therefore,  $D < 0$ .

Combining this with our earlier result, this means that  $-\frac{Num}{D} > 0$ , which establishes the result.

#### 10.5 Proof of Lemma 4

The critical value  $c_s$  is the level of costs 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 implicitly by the following expression:

$$CS(c^x + t^0(c_s^i)) + t^0(c_s^i)y(c^x + t^0(c_s^i)) - CS(c_s^i) = 0.$$

Evaluating this expression at  $c_s^i = c^x + t^*$ , we get:

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

This expression is certainly positive if  $t^0(c^x + t^*) < t^*$ ; however, this latter inequality must be true since we know that, for  $c^i = c^x + t^*$ , the tariff  $t^*$  would be jumped even without subsidies because the firm could earn the same profit by performing FDI or exporting. Hence, the expression is positive and, therefore,  $c_s^i < c^x + t^*$ . Since we already know that  $c^x + t^* < c_H^i$ , we must have  $c_s^i < c_H^i$ .

Table 1: Subsidy Game Among Regions

Case	Inequalities	FDI/Export	Subsidy
R1	$S^s > S^{\max} > S^{\min}$	FDI	$S^s$
R2	$S^s > S^{\min} > S^{\max}$	ME*	$S^s$
R3	$S^{\max} > S^s > S^{\min}$	FDI	$S^s$
R4	$S^{\max} > S^{\min} > S^s$	FDI	$S^{\min}$
R5	$S^{\min} > S^s > S^{\max}$	Export	0
R6	$S^{\min} > S^{\max} > S^s$	Export	0

\*  $S^s$  if FDI occurs. Zero otherwise.

Figure 1

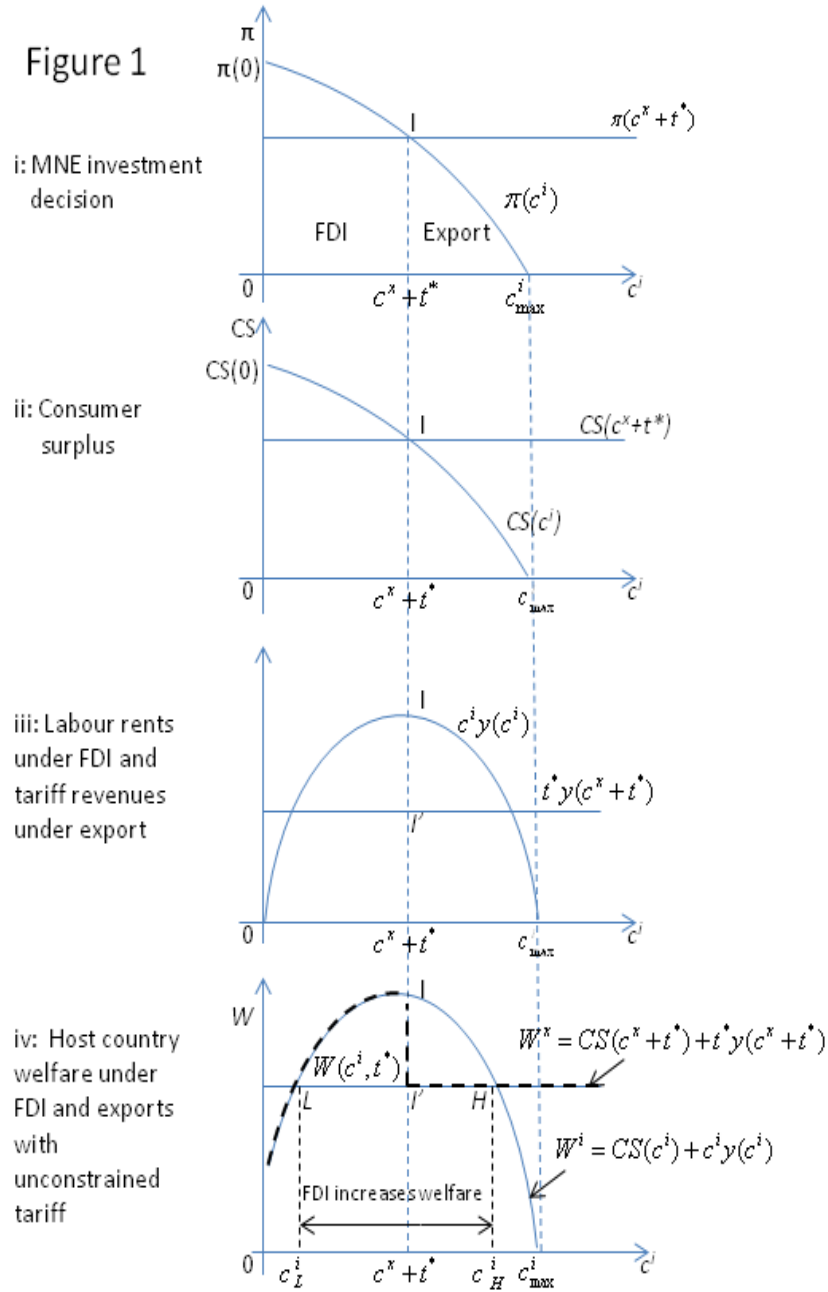




Figure 2

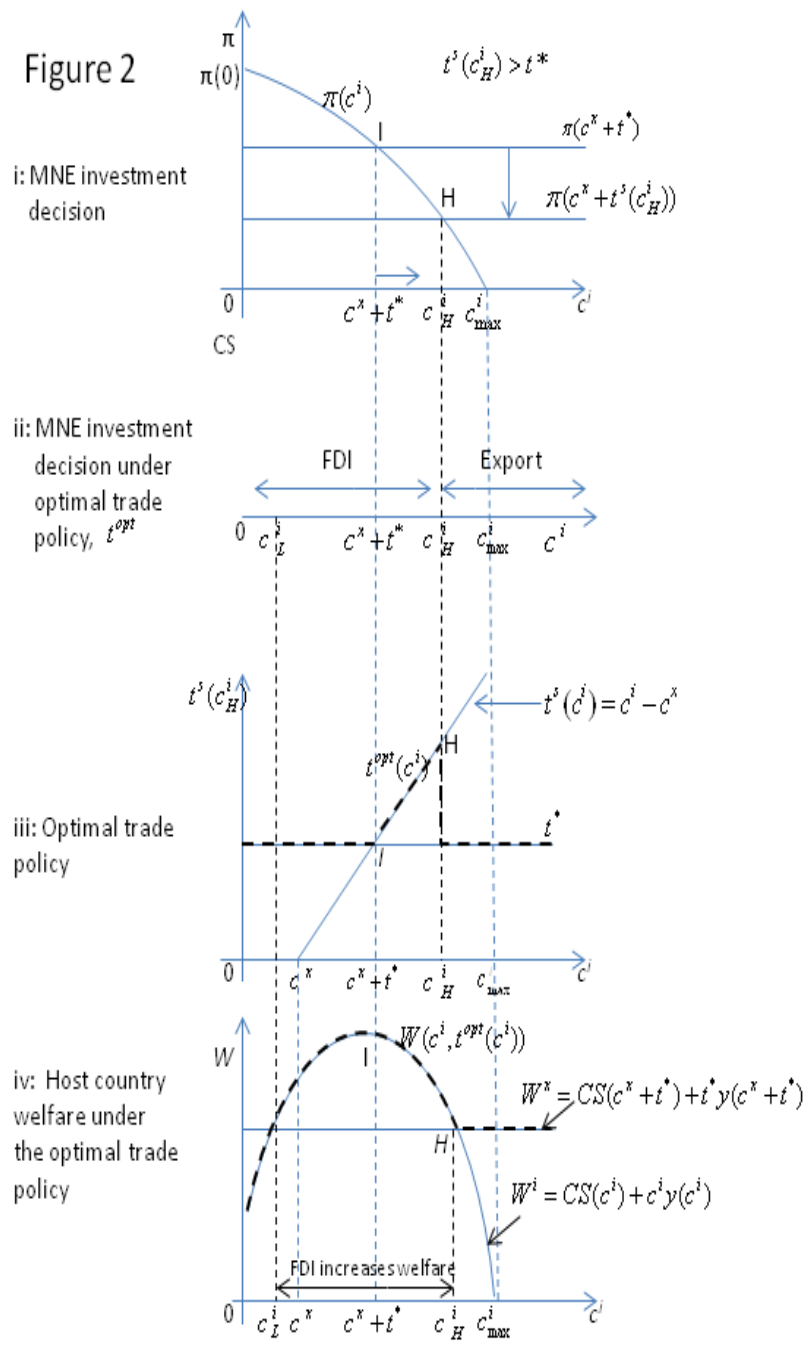


Figure 3

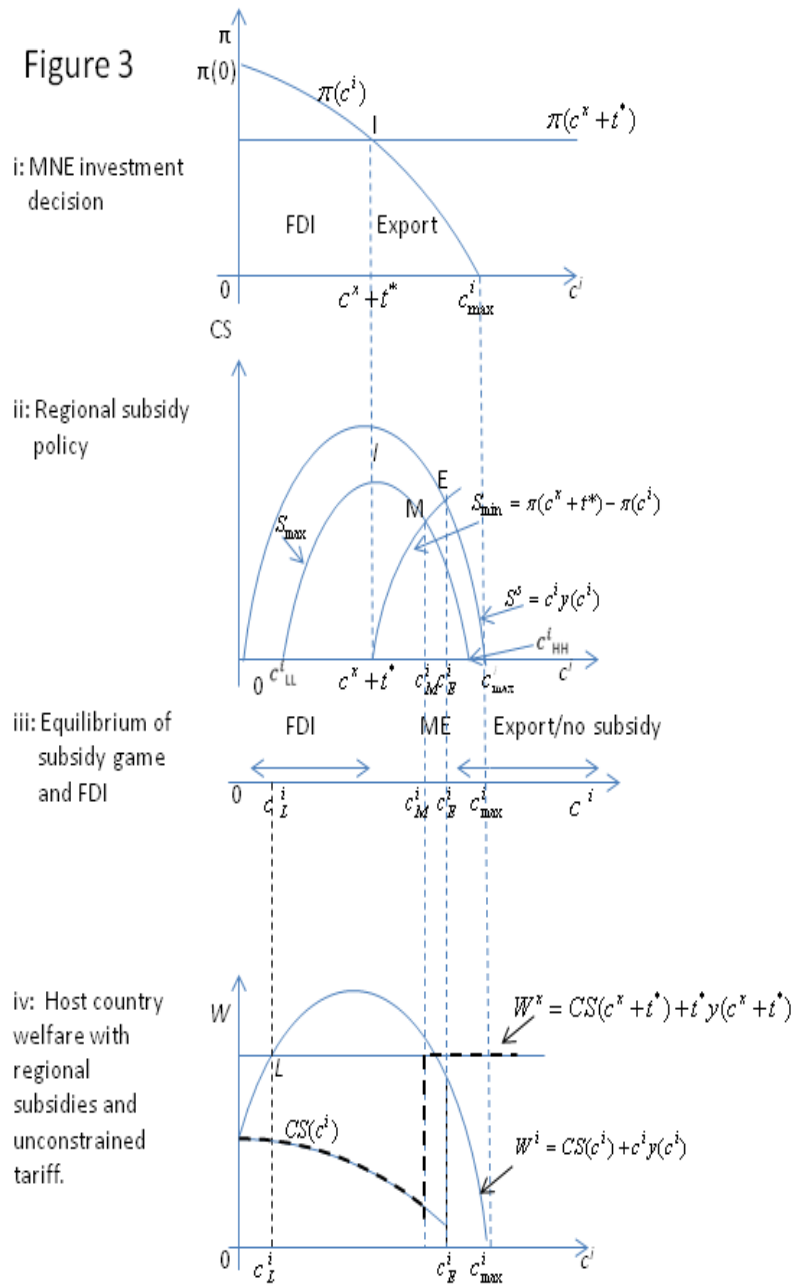


Figure 4

