Taxing and Subsidizing Foreign Investors

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Abstract

Many countries impose taxes on foreign investors while also having in place targeted subsidies that are designed to attract them. This paper shows that such a policy can be optimal for a host country. The government has an incentive to tax inframarginal firms because they are relatively immobile and an incentive to subsidize marginal firms because the economic activity generated by such a subsidy can increase domestic wages in excess of the fiscal cost. These policies improve domestic welfare at the expense of foreigners. Hence, this analysis can explain why tax coordination efforts can simultaneously entail reduced taxes and subsidies.

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1 Introduction

Many countries impose taxes on the income of foreign investors while also having in place subsidies and tax incentives that are designed to attract them. The subsidies and tax incentives are often targeted at the firm-level and negotiated on an individual basis. IMF et al. (2015) documents that the majority of countries make use of such discretionary incentives for FDI and that such policies are especially prevalent in developing countries. These policies are also common at the subnational level, with US states estimated to use discretionary incentives worth over $20 billion annually – an amount that accounts for the majority of the total state resources devoted to business incentives (Bartik, 2001).

The magnitude of the incentives and subsidies provided to attract individual businesses can be very substantial in practice. In one prominent example, Dow Chemical received a $6.8 billion subsidy from the German government in 1996 to invest in a petrochemical plant, a subsidy that amounted to an estimated $3.4 million per job (OECD, 2002). Under these types of policies, some firms effectively receive a net subsidy rather than merely paying reduced taxes, and so the government often loses net revenue (Peters and Fisher, 2002). Such policies are thus commonly motivated by the notion that the benefit to domestic workers generated by attracting mobile investors can exceed the fiscal cost to the government – something that would generally not be the case of subsidies in a closed economy.

The current paper uses a general equilibrium model with heterogeneous firms to explain why a policy of simultaneously imposing taxes and subsidies on foreign firms can be optimal for a host country. The government has an incentive to tax firms that are inframarginal in their decision to locate in the country because the tax burden will then fall on the profits of these firms. It also has an incentive to subsidize foreign firms that are close to the margin in their location decision because these subsidies increase domestic wages at a relatively low fiscal cost. A government can use a uniform tax across firms combined with targeted subsidies – a policy mix that is similar to what we see in reality – to ensure a net tax on inframarginal firms and a net subsidy on marginal ones.

The optimality of the subsidy in this setting provides a formalization of the notion that attracting mobile firms can generate benefits to workers that exceed the costs to the government in an open economy. The marginal subsidy is beneficial here for a combination of two reasons. First, a subsidy targeted towards marginal firms avoids providing windfall gains to inframarginal firms and so has a relatively low fiscal cost. Second, by attracting firms to the host country, the subsidy increases labor demand and thereby increases the domestic wage. Together, these two factors imply that the benefits to domestic workers of a sufficiently small subsidy exceeds the fiscal costs.

Underlying the wage increase in this setting is a type of terms-of-trade effect. In the model, the host and foreign country goods are differentiated in a manner similar to Armington (1969). Through FDI, foreign investors

can produce their home country good in the host country. Since the wage in the host country is tied to the price of its domestic good through a free-entry condition for domestic firms, an appreciation in the relative price of the domestic good allows the increase in labor demand to translate into an increase in the real wage. Importantly, as in the Armington model, even a small country has some power to affect its terms-of-trade because the goods produced by firms from the two countries are differentiated.

The taxes and subsidies discussed in this paper are optimal for the host country but they introduce inefficiencies from the standpoint of the world as a whole. Consequently, policy coordination in this setting could simultaneously lead to reductions in taxes and subsidies. This is consistent with some seemingly contradictory aspects of international tax coordination. Specifically, while countries and sub-national jurisdictions often discuss potential attempts to reduce harmful tax competition – and especially the use of targeted subsidies – bilateral tax agreements routinely involve reductions in the withholding taxes imposed on nonresidents. This effort to reduce both taxes and subsidies is particularly notable in the case of the EU, which has prohibited certain withholding taxes on dividends and royalties within the region, while at the same time setting up a state aid regime that curbs the use of preferential subsidies.

The emphasis of the current paper is on studying the incentives to target marginal vs. inframarginal firms, taking as given the government's ability to do so. The prevalence of discretionary incentives in practice suggests that

countries at least believe they can identify the extent to which individual businesses wish to site in their country well enough for it to be worthwhile to do so. It is in general difficult to assess the extent to which this is in fact the case, especially given the often secretive nature of deals between governments and businesses. Bartik and Erickcek (2012) provide some relevant evidence in the context of the MEGA tax credits, a programme of discretionary incentives in the state of Michigan. This programme required businesses to submit documentation that their investment would be more profitable in a non-Michigan location in the absence of the incentives, a requirement consistent with the desire to target marginal firms. Their results suggest that Michigan was able to target the correct firms well enough to be able to generate relatively large gains for the state.

In addition to explicitly discretionary policies, the framework developed in this paper can also help explain the use of incentives that are offered specifically to *new* firms that site in a country. Such policies are used in many countries, most prominently in the form of tax holidays. New firms that are attracted to a country specifically by these tax incentives would automatically be marginal firms. Hence, incentives provided to new investors could in part be self-targeted towards marginal firms. The analysis in this paper therefore implies that the basic rationale for a favorable treatment of new businesses could be similar to the rationale for using discretionary policies.

This paper is part of a growing literature that analyzes tax and subsidy

policies towards mobile firms in settings with firm heterogeneity. Most work in this literature studies uniform policies across the heterogeneous firms.[1] An exception is Langenmayr et al. (2015), who study incentives to differentially tax high- and low- productivity firms, and find that depending on the extent of profit-shifting opportunities, it may be optimal to discriminate in favor of either type of firm. As in much of the heterogeneous firms tax literature, their analysis emphasizes a corrective role for tax policies in the presence of imperfect competition. The current paper, by contrast, emphasizes endogenous wage determination in a model with perfect competition, and thus highlights quite distinct policy incentives and mechanisms.

This paper is also connected to a strand of the tax competition literature that studies the desirability of preferential regimes in the presence of mobile and immobile tax bases (e.g. Janeba and Peters 1999; Keen, 2001; Janeba and Smart, 2003). This existing work assumes that governments seek to maximize revenue, and so in contrast to the present paper, do not focus on whether taxes and subsidies can be optimal from the point of view of domestic welfare. This distinction is important especially in light of the fact that tax incentives offered to individual firms often lead to a net loss of revenue for the government. The current paper also differs from this existing work because it studies a setting with heterogeneous firms and is thus able to analyze the incentives to target policies at the firm-level.

[1]See, for example, Burbidge et al. (2006), Chor (2009), Davies and Eckel (2010), Pflüger and Südekum (2013) and Bauer et al. (2014).

The present work is also related to an international trade literature that studies the desirability of export subsidies. Particularly connected to the current paper, Itoh and Kiyono (1987) use a Ricardian model with a continuum of goods to show that export subsidies imposed on marginal sectors can improve domestic welfare. My paper shows that a similar logic applies in the case of governments seeking to attract FDI. Unlike in Itoh and Kiyono, however, what is important here is attracting firms rather than new industries or export products.

The rest of the paper is ordered as follows. Section 2 presents the model. Section 3 shows that a tax on inframarginal firms and a subsidy on marginal firms both improve domestic welfare. Section 4 discusses additional implications of the analysis as well as some extensions. Section 5 concludes.

2 Model

2.1 Basic Setting

I study a setting with two countries: the host (country 1) and the foreign country (country 2). The utility function of the representative household in country i is given by:

$$U\left(x_{i1}, x_{i2}\right),$$

where x_{ij} denotes the consumption in country i of the country j good.

The country 1 and country 2 goods are differentiated on the basis of the ownership country of the firm that produces the good. This is similar to Armington (1969) except that the differentiation is specifically based on who produces the good rather than where it is produced. This assumption can be motivated by the fact that firms in the two countries have access to different types of intangible capital and entrepreneurial characteristics that lead to a differentiation in products they produce. I assume that both goods are freely traded at prices p_1 and p_2, and good 2 will serve as the numeraire so that $p_2 = 1$.

The household in country i inelastically supplies its endowment of labor – the sole factor of production – at a wage of w_i, which is determined endogenously within the model. The household's endowment of labor is denoted L_i. As in much of the new trade literature, FDI is modeled in this paper in terms of firms choosing their location of production rather than as a transfer of a homogeneous factor of production.[2] In addition to wage income, the household also receives a lump sum rebate of government revenue, T_i, so that total household income is: $w_i L_i + T_i$. Note that T_i could be positive or negative depending on the type of policy the government chooses. Note also that due to free entry, there will be no pure profits that enter the household's budget.

I assume that preferences are identical and homothetic so that the demand functions can be written in the following form:

[2]Introducing mobile capital as an additional factor of production would not, however, alter the basic results in this paper.

$$x_{ij}\left(p_1, w_i L_i + T_i\right) \equiv \theta_j\left(p_1\right)\left(w_i L_i + T_i\right), \tag{1}$$

where $\theta_j(.)$ is a function defined by the above expression.

In order to illustrate the central point of the paper as clearly as possible, it will be convenient to work under the assumption that the host country is small. The small country assumption is not conceptually essential in this paper but will allow us to focus sharply on the key mechanisms that drive the results. The small country assumption means that the host country takes foreign prices as given. Importantly, however, due to the differentiation between the host and foreign country goods, even a small country does have some monopoly power in the market for its own good. As a result, as in a setting such as Armington (1969), it has the ability to affect its terms-of-trade despite being small. I discuss the nature of the small country assumption in greater detail 3.1.

2.2 Production

Each country has a mass of firms, M_i, that will be determined endogenously by free entry. Firms in each country produce their home country good under perfect competition. Individual firms are assumed to produce under decreasing returns to scale, reflecting the presence of an implicit firm-specific factor of production. The decreasing returns to scale allows us to incorporate fixed costs and firm-level heterogeneity without introducing imperfect competi-

tion.[3]

In order to focus sharply on the main point of the paper, I assume that only firms from the foreign country engage in FDI. To do so, they must pay a fixed cost that will permit them to produce in the host country instead of producing in their home country. These fixed costs, f, vary at the firm-level and are drawn from a probability distribution $G(f)$ with density $g(f)$. Since the fixed cost is the sole dimension of heterogeneity between firms, it will be convenient to index firms by their fixed costs f.[4]

A firm producing in country i that is from j solves the following problem:

$$\max_{l} \quad [1 - \tau_{ij}(f)] [p_j F_{ij}(l) - w_i l] + s_{ij}(f),$$

where $F_{ij}(l)$ is a production function satisfying $F'_{ij}(l) > 0$ and $F''_{ij}(l) < 0$, and $\tau_{ij}(f)$ and $s_{ij}(f)$ are the tax and subsidy rate, respectively, faced by a firm with cost f. The results in this paper will focus on showing that certain types of policies improve domestic welfare, and I will discuss these specific policy instruments in section 3. In order to avoid the presence of fiscal externalities that can complicate the interpretation of my results, I assume throughout that domestic firms receive no taxes or subsidies, i.e. $\tau_{ii} = 0$ and $s_{ii}(f) = 0$. I relax some of these assumptions in 4.3.

[3]See Dharmapala et al. (2011) for more about a setting with heterogeneous firms, decreasing returns-to-scale production functions and free entry.

[4]Unlike in much of international trade literature following Melitz (2003), I assume that the heterogeneity is in the costs of FDI rather than in marginal costs of production. This is not essential for the main point in the paper but will simplify the exposition.

The firm optimizes by setting the value of the marginal product of labor equal to the wage:

$$p_j F'_{ij}(l) = w_i$$

Note that given the nature of the policies here, the firm's problem conditional on location choice is undistorted. This problem gives rise to a pre-tax variable profit function, a supply function, and a labor demand function that we can define as $\pi_{ij}(p_j, w_i)$, $q_{ij}(p_j, w_i)$ and $l_{ij}(p_j, w_i)$, respectively.

A firm from the foreign country with FDI cost f has the option of producing in either country. The marginal firm that is indifferent about where to produce is defined by:

$$[1 - \tau_{12}(f^*)]\,\pi_{12}(w_1) + s_{12}(f^*) - f^* w_2 = \pi_{22}(w_2) \tag{2}$$

In the absence of taxes and subsidies, a firm with a lower FDI cost would have a higher incentive to engage in FDI than a higher cost firm. The policies that I consider in section 3 will be such that this will still be the case even with the taxes and subsidies. Thus, firms with $f < f^*$ will produce in the host country, while firms with $f > f^*$ will produce in the foreign country. Throughout this analysis, I study an equilibrium where at least some firms engage in FDI.[5]

[5]It can never be the case in equilibrium that all foreign firms engage in FDI because foreign labor would then be unused.

2.3 Equilibrium

The mass of firms from each country, M_i, will be endogenously determined by a free-entry condition which states that a potential entrant makes zero expected profits net of a fixed cost of entry ϕ_i. This fixed cost of entry is distinct from the fixed cost of FDI, and does not vary across firms since potential firms are identical ex-ante. Since FDI costs are the sole dimension of heterogeneity in the model, and domestic firms do not engage in FDI, the free entry condition for domestic firms simply states that profits are deterministically equal to the fixed costs of entry:

$$\pi_{11}(p_1, w_1) = \phi_1 w_1 \tag{3}$$

The condition for entrants in the foreign country is more complex:

$$\int_{f^*}^{\infty} \left[\pi_{22}\left(w_2\right)\right] g\left(f\right) df + \int_{0}^{f^*} \left[\left(1-\tau_{12}\right)\pi_{12}(w_1) - f w_2 + s_{12}\left(f\right)\right] g\left(f\right) df = \phi_2 w_2$$

The first term above captures the profits when a firm draws a high FDI cost and produces at home. The second term captures the profits when the firm has a sufficiently low FDI cost and is engaged in FDI.

To close the model, we need market clearing conditions for goods and factors. The market clearing conditions for good 1 and 2, respectively, are:

$$\theta_1(p_1)W = M_1 q_{11}(p_1, w_1) \tag{4}$$

$$\theta_2(p_1)W = [1 - G(f^*)]M_2 q_{22}(w_2) + G(f^*)M_2 q_{12}(w_1),$$

where W is world aggregate income. The left-hand side is the world demand for the good and is derived using (1). The right-hand side is the world supply. Since host country firms do not engage in FDI by assumption, the world supply for good 1 is entirely provided by the production taking place in the host country. Finally, the labor market clearing condition in country 1 and 2, respectively, are:

$$L_1 = M_1 l_{11}(p_1, w_1) + G(f^*)M_2 l_{12}(w_1) \tag{5}$$

$$L_2 = [1 - G(f^*)]M_2 l_{22}(w_2)$$

A point to be noted about this setup is that despite the fact that the goods are freely traded and the foreign good is produced in both countries in equilibrium, the wages in the two countries are not thereby fixed. In other words, the model does not exhibit factor price insensitivity. In a setting with perfect competition, constant returns to scale and a single factor of production, the wage would be mechanically pinned down by the price of the good that firms are producing and as a result, when a good is produced in

both countries, the relative wage of the two countries would be fixed. This does not happen in the current model because firms produce under decreasing returns to scale, and so the final good price no longer pins down the wage that firms are able to pay.

3 Inframarginal Taxes and Marginal Subsidies

This section will show that a tax on inframarginal firms and a subsidy for marginal firms both improve domestic welfare. To make it clear that these results do not derive from the interaction of the tax and the subsidy, or from potential fiscal externalities, I will initially analyze each policy separately. Thereafter, I will show that it is optimal to simultaneously employ taxes and subsidies of this kind.

3.1 Small Country

In order to illustrate the central point of the paper as clearly as possible, I assume that the host country is small. The small country assumption means that from the standpoint of the host country's policies, we can take the foreign wage, w_2, the mass of firms in the rest of the world, M_2, and world aggregate income, W, as given. The endogenous variables are then w_1, p_1, M_1, and f^*. The price of the domestic good p_1 is endogenous even for a small country here because of the Armington-style assumption of country-

level product differentiation.[6] These endogenous variables are determined by (2), (3), (4), and (5). Note that the small country ignores the foreign free-entry condition as well as the foreign market clearing conditions. The nature of the small country assumption here is similar to Demidova and Rodriguez-Clare (2009, 2013) and Bauer et al. (2014), but with perfect competition instead of monopolistic competition.

3.2 Inframarginal Tax

Consider an equilibrium without taxes or subsidies. Now consider introducing what I will call an inframarginal tax. An inframarginal tax is a tax on foreign firms with sufficiently low f that leaves the marginal foreign investor untaxed.[7] A tax will be inframarginal in this sense as long as the taxed firms have a low enough f and the tax rate is not too high. Of the conditions that determine the equilibrium in the host country, tax and subsidy policies only affect the marginal foreign investor condition, (2). Even the latter condition only depends on policies that affect the marginal firm. Thus, taxes on inframarginal firms have no effect on the equilibrium wage. Since these taxes do raise revenue, it follows that they increase domestic income and therefore

[6]Settings where small countries retain some market power in the goods they export are common in the international trade literature. In addition to the Armington model, this is a characteristic of monopolistically competitive models (see Helpman and Krugman, 1989) and Ricardian models with a continuum of goods (see Alvarez and Lucas, 2007) as well.

[7]In subsection 3.4, I show that the government can make use of a standard uniform profit tax combined with targeted subsidies to achieve the effect of an inframarginal tax. Hence, while the inframarginal tax by itself is unrealistic, it can be implemented as part of an overall tax system that corresponds well to what we see in practice.

improve domestic welfare.

Two points should be noted regarding this result. First, the profits of inframarginal firms are rents from the standpoint of the host country. They are, however, not true rents from a global perspective because they affect entry incentives in the foreign country through free-entry. The small country ignores this effect because the ex-ante probability of a potential foreign entrant locating in the host country is negligible.

Second, given the current setup, taxes can affect a firm's location choice but do not distort a firm's problem conditional on location. If there were an additional margin of distortion – perhaps arising from the imperfect deductibility of variable expenses – this proof would be more complex. Nevertheless, the key point that gives rise to an incentive to tax inframarginal firms is the fact that part of the tax burden falls on the profits of foreign investors, something that would be true even in the presence of intensive margin distortions.

3.3 Marginal Subsidies

We will now consider a policy whereby the government offers a subsidy to firms that are close to the margin in their location choice. Each subsidized firm will receive a fixed subsidy s. Under this policy, the marginal foreign investor condition becomes:

$$\pi_{12}(w_1) + s - f^* w_2 = \pi_{22}(w_2) \tag{6}$$

We will now define $\underline{f}$, which is a firm that is indifferent about locating in the country when it does not receive a subsidy, by the following condition:

$$\pi_{12}(w_1) - \underline{f} w_2 = \pi_{22}(w_2)$$

The type of policy I consider is one where the subsidy s is offered to all firms between f^* and $\underline{f}$. Importantly, this means that the rate of the subsidy is by design connected to the set of firms that are being subsidized. As the subsidy rate goes to zero, f^* approaches $\underline{f}$, meaning that the number of firms being subsidized also goes to zero. In contrast, as the subsidy gets larger, f^* and $\underline{f}$ diverge from each other, implying that a larger number of firms are being subsidized.[8]

With the subsidy described in this manner, we can first look at the effect of a small increase in the subsidy around $s = 0$ on the total subsidy bill. The subsidy bill is given by:

$$-T_1 = M_2 s \left[G\left(f^*\right) - G\left(\underline{f}\right) \right]$$

Differentiating with respect to s and evaluating at $s = 0$, we obtain:

$$-\frac{dT_1}{ds}\bigg|_{s=0} = M_2 \left\{ s \frac{d}{ds} \left[G\left(f^*\right) - G\left(\underline{f}\right) \right] + \left[G\left(f^*\right) - G\left(\underline{f}\right) \right] \right\}_{s=0} = 0$$

[8]The nature of the subsidy here is similar to Itoh and Kiyono's (1987) export subsidy.

The derivative above has two terms. The second term captures the mechanical increase in the subsidy bill when the rate is increased, while the first term captures the behavioral response. The fact that the effect of the behavioral response is equal to zero when $s = 0$ is unsurprising. What is special here is that even the mechanical increase in the subsidy bill is of second-order. This is the case because by construction, as the subsidy rate approaches zero, the subsidy base also vanishes. Intuitively, the closer to the margin one decides to target, the smaller the subsidy one needs.

The above analysis shows that the fiscal cost of a small subsidy increase around $s = 0$ is insignificant. With this result in mind, we can analyze the effect of the subsidy on household welfare. Welfare is given by the indirect utility function: $V_1(p_1, w_1 L_1 + T_1)$. We can furthermore write p_1 as a function of w_1, $p_1(w_1)$, using the domestic free-entry condition (3). The effect of the subsidy on welfare at $s = 0$ is then:

$$\begin{aligned}
\left.\frac{dV_1}{ds}\right|_{s=0} &= \frac{\partial V_1}{\partial p} p_1'(w_1) \frac{dw_1}{ds} + \frac{\partial V_1}{\partial w}\left(L_1 \frac{dw_1}{ds} + \left.\frac{dT_1}{ds}\right|_{s=0}\right) \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\left[-x_{11} p_1'(w_1) + L_1\right] \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[-x_{11} p_1'(w_1) w_1 + w_1 L_1\right] \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[w_1 L_1 - p_1 x_{11}\right]
\end{aligned}$$

The third line above is derived using Roy's identity, and the fourth uses

the fact that $p_1'(w_1)w_1 = p_1$ (see Appendix A.1 for the proof). Since the household spends some income on the foreign good, household income is greater than its expenditure on the domestic good: $w_1L_1 + T_1 - p_1x_1 > w_1L_1 - p_1x_1 > 0$. Thus, the sign of the effect of the subsidy on welfare is the same as the sign of dw_1/ds. The intuition for this is that a simultaneous increase in the wage and the price of the domestic good still implies greater purchasing power with respect to the foreign good.

To show that a small subsidy is optimal, it now suffices to show that $dw_1/ds > 0$. We can first reduce the equilibrium with this policy into a system of two equations and two endogenous variables. First, recall that we can use the domestic free-entry condition to write $p_1 = p_1(w_1)$. Next, we can combine the goods market clearing condition and the labor market clearing condition to eliminate M_1 and obtain a single augmented labor market clearing condition:

$$L_1 = \frac{\theta_1 \left[p_1 \left(w_1\right)\right] W}{q_{11} \left[p_1(w_1), w_1\right]} l_{11} \left[p_1 \left(w_1\right), w_1\right] + G(f^*) M_2 l_{12} \left(w_1\right) \tag{7}$$

The other remaining condition is the one that defines the marginal foreign investor, (6). Together, these two conditions will determine w_1 and f^*.

The augmented labor market clearing condition implies a relationship between f^* and w_1 that we can write as $f^* = \Gamma\left(w_1\right)$. Note that since the small country's share of global income is negligible, we can ignore the effect of T_1 on global demand. Appendix A.2 shows that $\partial\Gamma/\partial w_1 > 0$. The intuition for this result is that if there are more foreign firms (higher f^*), wages have

to rise to reduce the quantity of labor demanded and restore equilibrium.

The marginal foreign investor condition (6) implies a relationship between f^* and w_1 that we can write as $f^* = \Phi(w_1, s)$. Appendix A.3 shows that $\partial\Phi/\partial w_1 < 0$ and $\partial\Phi/\partial s > 0$. The intuition for $\partial\Phi/\partial w_1 < 0$ is that at a higher wage, firms would be less willing to locate in the host country, and so the marginal firm has to be one with a lower cost of FDI. $\partial\Phi/\partial s > 0$ because a higher subsidy will encourage more firms to enter at any given wage.

With these two functions defined, the equilibrium w_1 is determined by:

$$\Phi(w_1, s) = \Gamma(w_1)$$

Using the implicit function theorem, we obtain:

$$\frac{dw_1}{ds} = -\frac{\partial\Phi/\partial s}{\partial\Phi/\partial w_1 - \partial\Gamma/\partial w_1} > 0$$

The intuition is as follows. An increase in the subsidy attracts more firms, causing an increase in labor demand. In order to maintain equilibrium, the wage must rise. As discussed earlier, the sign of dw_1/ds also determines the sign of dV_1/ds for a small subsidy. Thus, it follows that a small subsidy improves domestic welfare.

Putting together the pieces of this proof, we see that the subsidy is optimal because of an interplay of two factors. First, a sufficiently small subsidy targeted towards marginal firms has a negligible fiscal cost. This is ultimately the case because such a subsidy is constructed so as to not provide

windfall gains to inframarginal firms. Second, the subsidy increases the domestic wage by attracting more firms to the host country. These two points together imply that the benefit to domestic workers exceeds the fiscal cost of the subsidy, leading to an overall improvement in the host country's welfare.

Note that the increase in labor demand that the improvement in welfare makes possible necessarily comes at the cost of decreased labor demand in the foreign country. The host country is thus "stealing" firms and the investment they embody from the foreign country through this policy. This leads to an increase in the relative wage of the host country w_1/w_2, a point that follows immediately from the fact that $dw_1/ds > 0$ and w_2 is unaffected by the host country.

Furthermore, the fact that $dw_1/ds > 0$ is essentially equivalent to $dp_1/ds > 0$ since the domestic free-entry condition has allowed us to write p_1 as an increasing function of w_1. Since the price of the foreign good is the numeraire, p_1 is the conventional terms-of-trade and $dp_1/ds > 0$ captures an improvement in the terms-of-trade. With this numeraire choice, w_1/w_2 is the single factoral terms-of-trade (Viner, 1937) and hence the increase in the wage as defined here can itself be thought of as a type of terms-of-trade appreciation.

If p_1 were fixed by the world market – so that there would be no terms of trade effects possible – w_1 would also thereby be fixed owing to free entry, and dw_1/ds would be equal to zero. Without terms-of-trade effects, the increased entry by foreign firms would not translate into an increase in labor demand because it would perfectly crowd out the labor demand of domestic firms.

This illustrates how the presence of terms-of-trade effects here is essential to ensure the intuitive property that a subsidy that attracts foreign firms will increase domestic wages. The assumption that the host and foreign country goods are differentiated – as discussed in 2.1 – ensures that even a small country does have some market power with respect to its own good so that p_1 is not, in fact, fixed by the world market.

3.4 Simultaneous Taxes and Subsidies

The results so far have shown that a tax on inframarginal firms and a subsidy to marginal firms each improves welfare separately. We will be able to establish that it is optimal for the host country to simultaneously impose taxes and subsidies through similar arguments. The earlier argument that inframarginal taxes improve welfare applies without modification even in the presence of a subsidy to marginal firms.

To establish the optimality of the subsidy, the analysis needs to take into account how the subsidy will affect tax revenue. In particular, by increasing wages, the subsidy will reduce the profits of foreign firms and thereby reduce tax revenues. In Appendix A.4, I show that a sufficiently small subsidy will improve welfare in the presence of inframarginal taxes despite this fiscal externality. It is thus optimal for the host country to simultaneously tax inframarginal firms and subsidize marginal ones.

As discussed in the introduction, countries generally use uniform taxes combined with targeted subsidies. Such a policy often leads to a net subsidy

on targeted firms combined with a net tax on untargeted firms. Provided the targeting is based on the marginality of a firm, this is essentially equivalent to the simultaneous tax and subsidy policy considered here.

4 Extensions

4.1 Incentives Offered to New Firms

In addition to targeted policies of the type discussed in the Introduction and analyzed theoretically in section 3, governments often offer statutory incentives specifically to *new* firms siting in a country or jurisdiction, most prominently in the form of tax holidays. The argument made in this paper regarding the optimality of targeted subsidies can also apply to these type of incentives. To see why that is the case, suppose that we start in equilibrium without any subsides. Next, offer a small subsidy only to new firms that site in the country. The new entrants – the firms that did not site in the host country prior to the subsidy being imposed but did so after – are automatically marginal firms. Thus, a policy of offering incentives to new firms that enter a country could in this sense be self-targeted towards marginal firms. As with discretionary incentives, such a policy would allow the host country to avoid providing windfall gains to inframarginal businesses.

Of course, such a policy will be effective only if the new entrants are in fact ones that are attracted to the country by the policy. To the extent that there are changes in economic conditions that make a country more attractive

to foreign investors or to the extent that a country is transitioning to a new equilibrium, new entrants will not necessarily be marginal firms. New entrants that are inframarginal in their location choice in this manner would still receive a windfall gain from this subsidy. Still, this type of policy would at the very least avoid providing windfall gains to existing inframarginal firms and so in that sense, would still be self-targeted to a certain extent.

While a more thorough analysis of these types of policies towards new firms would require a dynamic model of entry that is beyond the scope of the present paper, these considerations are clearly suggestive of a useful role for such policy instruments. More generally, these points suggest that the rationale for discretionary incentives and the rationale for providing incentives to new firms could be closely linked. Both of these policies can make sense in the framework of the current paper because they are both means to target subsidies towards marginal firms rather than providing windfall gains to inframarginal ones.

4.2 Global Distortions and Coordination

The results from section 3 explain why countries have incentives to tax inframarginal firms and subsidize marginal ones. Given the nature of these policies, they improve domestic welfare at the cost of foreigners. By reducing investment and labor demand in the rest of the world, subsidies hurt foreign workers. As discussed earlier, this is equivalent to an improvement in the host country's terms-of-trade, and so necessarily implies a deteriora-

tion of the foreign country's terms-of-trade. The inframarginal taxes here are also distortionary from a global perspective because by reducing the expected profits of foreign entrants, they would affect business creation incentives in the rest of the world.

Given that these are distortionary policies that improve domestic welfare at the cost of foreigners, the global first-best optimum would entail no such taxes or subsidies. The model thus suggests why tax coordination efforts could lead to reductions in both taxes and subsidies on foreign investors. This is consistent with the fact that countries often discuss coordination efforts to fight tax competition but are also routinely engaged in tax treaties that mutually reduce the tax burden faced by foreign investors.

Particularly notable in this regard, the European Union has prohibited the imposition of certain types of withholding taxes on foreign investors from member countries. At the same time, it has also issued directives curbing preferential regimes sustained by what it deems to be discriminating subsidies. The analysis in this paper provides an explanation that rationalizes this simultaneous effort to curb the imposition of taxes and subsidies.

4.3 Taxes and Subsidies in the Foreign Country

The results from section 3 are derived under the assumption that foreign investors would pay no taxes and receive no subsidies if they remained in their home country. This assumption was made to make clear that the results do not derive from the presence of potential fiscal externalities but is not

essential for any of the results. The conditions that the host country takes into account in setting its policies are (3), (4), (5), and (6). An inframarginal tax in the foreign country would not affect any of these conditions and so would not affect the optimality of the tax or subsidy for the host country.

In case of a marginal subsidy given by the foreign country to its own firms, a subsidy would change (6) to:

$$\pi_{12}(w_1) + s_1 - f^* w_2 = \pi_{22}(w_2) + s_2,$$

where s_1 and s_2 now denote the host and foreign country subsidy rates, respectively. The only change here relative to section 3 is that marginal firms would now receive a subsidy of s_2 in the foreign country. This s_2 is a constant from the point of view of the host country and so the analytics showing the optimality of the tax and subsidy would remain completely unchanged. Hence, a sufficiently small marginal subsidy is optimal for the host country regardless of the tax and subsidy policies set by the foreign country.

4.4 Many Countries

A natural question is whether the results in this paper will still hold when there are many countries rather than just two. To see how this type of extension will affect the analysis in section 3, we can consider a setting where firms can engage in FDI in N potential host countries. I will show that the N host country case can be collapsed to an analysis that is qualitatively almost

identical to the two country case so that the earlier results still hold. In order to save on notation, I still consider a case where the firms engaged in FDI are from a single residence country.[9]

I denote the country whose firms engage in FDI as country F. Firms in country F are now assumed to be heterogeneous in terms of a vector of fixed FDI costs $f = (f_1, ..., f_N)$ that is drawn from a multivariate distribution. Each component of the vector captures the fixed cost of engaging in FDI in a different host country. This form of heterogeneity can be motivated by the fact that individual firms will generally have idiosyncratic reasons to prefer one potential host country over another.

The profits of a marginal firm when it sites in a country i are now: $\pi_{iF}(w_i) + s_i - f_i w_F$, where s_i is the subsidy provided by country i. We will consider the optimal policy from the standpoint of a given country which is again assumed to be small so that it takes foreign policies and prices as given. Without loss of generality, this country will be denoted as country 1.

For a firm with a fixed cost vector f, the profits from siting in the best location *except* for country 1 can be written as: $\max_{j \neq 1} \{\pi_{jF}(w_j) + s_j - f_j w_F\}$. Based on this setup, the benefit to siting in country 1 net of the opportunity cost of siting elsewhere is then $\pi_{1F}(w_1) + s_1 - f_1 w_F - \max_{j \neq 1} \{\pi_{jF}(w_j) + s_j - f_j w_F\}$. We can define a variable $A \equiv \max_j \{\pi_{jF}(w_j) + s_j - f_j w_F\} - f_1 w_F$. Firms with a higher value of A have a lower incentive to site in country 1 than firms

[9] Apart from notational complexity, the analysis would be largely unchanged in case of multiple countries whose firms can engage in FDI.

with a lower value. While A depends on the entire fixed cost vector f , it is itself a scalar value.

The key step in extending the analysis from section 3 to the case with many countries will be to use the scalar A rather than the vector f to index the foreign firms that are engaged in FDI. Note that while A does depend on foreign prices and subsidies, it does not depend on any domestic prices or subsidies. Thus, for a small country that takes foreign prices and policies as given, the ordering of firms implied by A will not change when the country changes its own policies. A is therefore a consistent index.

With this re-indexing, marginal firms can be defined as satisfying the following:

$$\pi_{iF}(w_i) + s_i = A^*$$

We can also define the firms that will be indifferent about locating in country 1 in the absence of a subsidy as:

$$\pi_{iF}(w_i) = \underline{\mathrm{A}}$$

While marginal firms can have different values of f, by construction, they all have the same value for A. Instead of working with a multivariate distribution over f, we can now directly work with the probability distribution for A that we will denote $G(A)$.

Next, we re-derive the equations and conditions from section 3 that the

small host country treats as endogenous. The demand for the country j good in i, (1), becomes:

$$x_{ij}\left(p, w_i L_i + T_i\right) \equiv \theta_j\left(p\right)\left(w_i L_i + T_i\right),$$

where $p \equiv (p_1, p_2, ..., p_N, p_F)$ is a vector with the price of each country's good. We will continue to take the price in the country whose firms engage in FDI as the numeraire so that $p_F = 1$. Given the small country assumption, this means that prices other than p_1 will be fixed from the standpoint of country 1.

The domestic free entry condition (3) is unchanged. The goods market clearing condition (4) becomes:

$$\theta_1\left(p\right) W = M_1 q_{11}\left(p_1, w_1\right)$$

The only change here is that we again have the vector p now instead of a single price in the demand function. Finally, the domestic labor market clearing condition (5) becomes:

$$L_1 = M_1 l_{11}\left(p_1, w_1\right) + G\left(A^*\right) M_F l_{1F}\left(w_1\right)$$

The only difference relative to Section 3 is that we have a probability distribution defined over the new index and corresponding definition of marginal firms – $G\left(A^*\right)$ – rather than a probability distribution defined directly over the costs of FDI.

Other than some relabeling, the only substantial difference between the conditions that define the equilibrium now and those in the earlier sections of the paper is that we have a vector of prices p instead of a single price. However, as noted earlier, the only price in p that is not fixed from the standpoint of the small country is its own price, p_1. That being the case, the analytics showing the optimality of both the inframarginal tax and the marginal subsidy will be exactly the same here as in section 3. By re-indexing the firms in terms of A, we have effectively collapsed the multiple country case into something that is very similar to the two-country case. Thus, the presence of many countries does not qualitatively alter the fact that it is optimal in this setting to tax inframarginal firms and subsidize marginal ones.

This of course does not mean that the number of countries is unimportant. The number of potential host countries will affect the mass of firms that are marginal vs. inframarginal in any given country. To see how the number of host countries affects the equilibrium outcome in a simple way, assume that of the N potential host countries, one of the countries – country 2, without loss of generality – ceases to be a potential host country. Prior to the loss of country 2 as a potential host country, there would be some firms in country 1 who were close to the margin in terms of siting in country 1 and country 2 but strongly prefer country 1 to the third-best alternative, i.e.:

$$\pi_{1F}(w_1) + s_1 - f_1 w_F \approx \max_{j \neq 1} \{\pi_{jF}(w_j) + s_j - f_j w_F\} = \pi_{2F}(w_2) + s_2 - f_2 w_F$$
$$> \max_{j \neq 1,2} \{\pi_{jF}(w_j) + s_j - f_j w_F\}$$

The loss of country 2 as a potential host country would lead such firms – which were initially close enough to the margin to receive a subsidy – to become inframarginal firms that do not receive a subsidy.

Intuitively, when the number of countries is smaller, there are fewer margins along which firms can be indifferent in their location choice. This means there will be fewer marginal firms and more inframarginal ones. When there are a greater number of potential host countries, there will therefore be be less scope to generate revenue by taxing inframarginal firms and there will also be more firms that are close to a location choice margin and so are potentially worth subsidizing.

5 Conclusion

This paper shows that a policy of simultaneously taxing and subsidizing foreign investors can be optimal for a host country. A tax on inframarginal firms raises revenue at the expense of these firms' profits, while a subsidy on marginal firms can increase domestic welfare by attracting foreign firms at a relatively low fiscal cost. The optimality of the subsidy here provides

a formalization of the common notion that the economic activity generated in a jurisdiction by attracting mobile firms can have benefits to domestic workers that exceed the fiscal cost to the government.

These policies improve domestic welfare at the expense of foreigners and so are not optimal from the standpoint of the world as a whole. Consequently, the model is able to explain why bilateral treaties entail reductions on taxes on foreign investors while at the same time, policymakers are concerned about the harmful competitive effects of subsidies and tax incentives. Consistent with these considerations, the European Union in particular has abolished some types of withholding taxes on foreign investors within the region while also attempting to curb the use of preferential subsidies. The analysis in this paper can help make sense of such seemingly anomalous aspects of international tax coordination.

A Proofs

A.1 $w_1 p_1'(w_1) = p_1$

Differentiating the domestic free entry condition with respect to s, we obtain:

$$\begin{aligned}
\pi_{11}\left[p_1\left(w_1\right), w_1\right] &= \phi_1 w_1 \\
q_{11} p_1'(w_1)\frac{dw_1}{ds} - l_{11}\left(.\right)\frac{dw_1}{ds} &= \phi_1 \frac{dw_1}{ds} \\
w_1 p_1'(w_1) &= \frac{w_1\phi_1 + w_1 l_{11}\left(.\right)}{q_{11}} \\
w_1 p_1'(w_1) &= \frac{\pi_{11}\left(.\right) + w_1 l_{11}\left(.\right)}{q_{11}} \\
w_1 p_1'(w_1) &= \frac{p_1 q_{11}}{q_{11}} = p_1
\end{aligned}$$

A.2 Function implied by the augmented labor market clearing condition

The augmented labor market clearing condition is:

$$L_1 = \frac{\theta_1\left[p_1\left(w_1\right)\right]W}{q_{11}\left[p_1(w_1), w_1\right]} l_{11}\left[p_1\left(w_1\right), w_1\right] + G(f^*) M_2 l_{12}\left(w_1\right)$$

This relationship implies a function $f^* = \Gamma\left(w_1\right)$. To sign $\partial\Gamma(.)/\partial w_1$, we can use the implicit function theorem again. For clarity, it is useful to consider each relevant term separately:

1. $\partial\theta_1\left[p_1(w_1)\right]/\partial w_1 = \frac{\partial\theta_1}{\partial p_1} p_1'(w_1) < 0$

2. $\{\partial q_{11}\left[p_1(w_1), w_1\right]/\partial w_1\}\{w_1/q_{11}\} = \frac{\partial q_{11}}{\partial p}\frac{w_1 p_1'(w_1)}{q_{11}} + \frac{\partial q_{11}}{\partial w}\frac{w_1}{q_{11}} = \frac{\partial q_{11}}{\partial p}\frac{p_1}{q_{11}} + \frac{\partial q_{11}}{\partial w_1}\frac{w_1}{q_{11}} = 0$

3. $\{\partial l_{11}\left[p_1(w_1), w_1\right]/\partial w_1\}\{w_1/l_{11}\} = \frac{\partial l_{11}}{\partial p_1}\frac{w_1 p_1'(w_1)}{l_{11}} + \frac{\partial l_{11}}{\partial w}\frac{w_1}{l_{11}} = \frac{\partial l_{11}}{\partial p_1}\frac{p_1}{l_{11}} + \frac{\partial l_{11}}{\partial w}\frac{w_1}{l_{11}} = 0$

4. $\partial G(f^*) l_{12}\left(w_1\right)/\partial w_1 = G(f^*) M_2 \frac{\partial l_{12}}{\partial w_1} < 0$

5. $\partial G(f^*) l_{12}\left(w_1\right)/\partial f^* = g(f^*) M_2 l_{12}\left(w_1\right) > 0$

The derivations above repeatedly use the fact from Appendix A.1 that $w_1 p_1'\left(w_1\right) = p_1$. Points 3 and 4 rely on the homogeneity of the supply and factor demand function, respectively. These expressions imply that $\partial\Gamma\left(.\right)/\partial w_1 > 0$. The intuition is discussed in the main text.

A.3 Function implied by the marginal foreign investor condition

The marginal foreign investor condition is:

$$\pi_{12}(w_1) + s - f^* w_2 = \pi_{22}(w_2)$$

We can write this relationship as a function $f^* = \Phi\left(w_1, s\right)$, and use the implicit function theorem together with Hotelling's Lemma to obtain:

$$\frac{\partial\Phi\left(,\right)^*}{\partial w_1} = -\frac{-l(.)}{-w_2} < 0$$

$$\frac{\partial \Phi\left(,\right)^{*}}{\partial s}=-\frac{1}{-w_{2}}>0$$

Thus, $\Phi_{1}\left(.\right)<0$ and $\Phi_{2}\left(.\right)>0$. The intuition is again discussed in the main text.

A.4 Optimality of a subsidy in the presence of inframarginal taxes

This appendix shows the optimality of a small subsidy to marginal firms in the presence of inframarginal taxes.

Government revenue is now given by:

$$T_{1}=-M_{2}s\left[G\left(f^{*}\right)-G\left(\underline{f}\right)\right]+M_{2}\int_{0}^{f^{*}}\tau_{12}\left(f\right)\pi_{12}\left(w_{1}\right)g(f)df$$

The effect of the subsidy on revenue at $s=0$ is:

$$\begin{aligned}\left.\frac{dT_{1}}{ds}\right|_{s=0} &= M_{2}\left\{s\frac{d}{ds}\left[G\left(f^{*}\right)-G\left(\underline{f}\right)\right]+\left[G\left(f^{*}\right)-G\left(\underline{f}\right)\right]\right\}_{s=0}\\ &\quad -\frac{dw_{1}}{ds}M_{2}\int_{0}^{f^{*}}\tau_{12}\left(f\right)l_{12}\left(w_{1}\right)g(f)df+M_{2}\frac{df^{*}}{ds}\tau_{12}\left(f^{*}\right)\pi_{12}\left(w_{1}\right)g(f^{*})df\\ &= -\frac{dw_{1}}{ds}M_{2}\int_{0}^{f^{*}}\tau_{12}\left(f\right)l_{12}\left(w_{1}\right)g(f)df\\ &= -\frac{dw_{1}}{ds}\tau_{12}L_{12},\end{aligned}$$

where $L_{12} \equiv M_2 l_{12}(w_1)$ is the total labor used by foreign firms in the host country, and $\tau_{12} \equiv \int_0^{f^*} \tau_{12}(f)\, g(f) df$ is the average tax rate. We see from the above derivative that unlike in the case without taxes, the fiscal cost of a small subsidy increase is no longer equal to zero. This is because the subsidy reduces tax revenue by reducing the profits of foreign firms. We now need to take this fiscal externality into account.

The effect of the subsidy on welfare is:

$$\begin{aligned}
\left.\frac{dV_1}{ds}\right|_{s=0} &= \frac{\partial V_1}{\partial p} p_1'(w_1) \frac{dw_1}{ds} + \frac{\partial V_1}{\partial w}\left(L_1 \frac{dw_1}{ds} + \left.\frac{dT_1}{ds}\right|_{s=0}\right) \\
&\quad \frac{\partial V_1}{\partial p} p_1'(w_1) \frac{dw_1}{ds} + \frac{\partial V_1}{\partial w}\left[L_1 \frac{dw_1}{ds} - \frac{dw_1}{ds}\tau_{12} L_{12}\right] \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[-x_{11} w_1 p_1'(w_1) + w_1 L_1 - w_1 \tau_{12} L_{12}\right] \\
&> \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[-p_1 x_{11} + w_1 (L_1 - L_{12})\right] \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[-p_1 x_{11} + w_1 (L_{11} + M_1 \phi_1)\right] \\
&= \frac{dw_1}{ds}\frac{\partial V_1}{\partial w}\frac{1}{w_1}\left[p_1 M_1 q_{11} - p_1 x_{11}\right] > 0,
\end{aligned}$$

where L_{11} is defined as the total labor used in production by domestic firms. Since host country labor is used either by foreign firms, or by domestic firms, or in order to pay fixed costs of entry, $L_1 = L_{11} + L_{12} + M_1 \phi_1$. Furthermore, $w_1 M_1 \phi_1$ is equal to the variable profits of domestic firms because of free entry. Thus, $w_1 M_1 \phi_1 + w_1 L_{11}$ is the sum of profits and wages and so must be equal to firm sales, $p_1 q_{11}$. The term $-p_1 x_{11} + p_1 M_1 q_{11}$ gives the exports

(i.e. production minus consumption) of the domestic good in value terms and so is positive. Since the conditions determining the equilibrium are still the same, the earlier argument that $dw_1/ds > 0$ holds without modification and a small subsidy will necessarily improve welfare even in the presence of inframarginal taxes.

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