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The Silver Lining of Red Tape

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Abstract: An increasing number of international agreements require "non-discrimination" from their participants, i.e. the government of one country cannot treat foreign firms differently from domestic firms. This is at odds with a government's desire to benefit its own citizens rather than foreign citizens. I show that the use of red tape – a wasteful application process – can achieve de-facto discrimination. Key to this result is firm heterogeneity since, although the red tape cost is constant across firms, only those sufficiently benefiting from an incentive program will find it worth the cost of applying. If the benefits of targeting subsidies outweigh the burden of red tape on domestic firms, red tape will be used.

JEL Classification: H2; F2

Key Words: Red Tape; Firm Heterogeneity; Production Subsidies; Discrimination

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1. Introduction

Increasing globalization has challenged what is perhaps the fundamental motivation of policy makers – "protect your own". Whether a government acts to maximize the welfare of its own citizens, appease those with the greatest political power, or line its own pockets, the limit of those for whom it accounts rarely extends beyond its own borders. Nevertheless, the rise in globalization has given rise to both economic and political pressures to do so as the distortions from self-benefitting policies grow due to increased interdependence and government recognition that there are mutual gains from jointly removing such policies. With this in mind, many governments have pledged "non-discrimination", that is, it will treat foreign firms operating in its borders the same as domestic ones. This concept is a corner stone of the European Union, the North American Free Trade Agreement, and the OECD's and UN's model tax treaties.[1] Despite these provisions, it remains a fact that a government often unilaterally prefers to restrict government contracts, subsidies, tax breaks, and other incentives to domestic firms as this tends to provide a greater benefit to itself and/or its constituents. In this paper, I demonstrate how a government can use red tape – the wasteful requirements a firm must fulfil in order to participate in an incentive program – to achieve de-facto discrimination while making an incentive policy equally available to domestic and foreign firms.[2]

Red tape can take on many forms. First, there is the obvious filling out of complex paperwork. This, combined with the inevitable man-hours spent dealing with the

[1] Just a few of the examples in the Treaty Establishing the European Community (2003) include articles 12, 31, 75, and 184. NAFTA's (1994) Article 11 contains similar provisions. Article 24 of both the OECD's (2003) and the UN's (2001) model tax treaties also call for non-discrimination in taxation.

[2] The evidence of Hines (1988) and Hufbauer (1992) indicates that many tax rates are de-facto discriminatory because of different utilization rates between domestic and foreign firms, suggesting that red tape is indeed a method of discrimination.

bureaucratic process, can provide a significant barrier to a firm interested in applying for a government program. A second example is time itself. If a firm must wait on government approval of its application before choosing production levels or making other critical decisions, such delays create costs.[3]

An important aspect of these requirements is that they are the same across all firms, foreign and domestic. Since non-discrimination requires that all firms be offered the incentive, not that all firms actually apply for it, the common fixed cost of red tape creates a barrier so that only the firms that benefit most from the incentive actually apply. Thus, red tape creates de-facto discrimination since it stops the least benefitting firms from accepting the incentive. Note that this requires firm heterogeneity. If all firms are identical, then either all firms will apply for the incentive or no firms will. Further, if the goal is to target the incentive to domestic firms, it requires that domestic firms gain relatively more from the incentive than foreign firms do. It is important to note that even in this case, this does not imply that red tape will actually be used. This is because red tape is itself costly. Thus, the benefit of not providing the subsidy to foreign firms must be weighed against the cost of wasteful red tape. Nevertheless, under certain circumstances, red tape will indeed be used in equilibrium.

I demonstrate these conditions using a simple model in which a government offers production subsidies to firms within its borders. These firms include both foreign and domestic ones. This distinction is important because the subsidy provided to foreigners increases their profits, which are then repatriated to their country of origin whereas

[3] In addition to red tape, governments might require a firm to install green technologies, undertake added worker training, or the like before it can take advantage of a program. These do not fit my definition of red tape (which is a pure cost) since they would provide benefits such as a better environment or higher skill levels. See Davies and Ellis (2007) for a discussion of these "performance requirements".

domestic firm profits stay within the subsidizing country. Thus, the benefit of subsidizing domestic firms is greater than that of subsidizing foreign ones (and in fact if discrimination were possible, the home government would prefer to tax foreign firms). Red tape, however, can stop foreign firms from accepting the subsidy. If domestic firms have an advantage (modelled as either a home bias in demand or a production cost advantage) then they will be more apt to apply for the subsidy. As such, although implementing red tape is costly to the home government, it can benefit from doing so precisely because it stops foreigners from also taking advantage of the subsidy and then repatriating that surplus to their native country. Whether or not this works the home government's advantage depends on parameter values, especially the extent of the domestic firm advantage.

Although this use of red tape sounds similar achieving a separating equilibrium in mechanism design, there are four key differences between the current approach and the standard mechanism design approach.[4] First, the goal of a separating equilibrium in mechanism design is to get different firms to behave in different ways according to a privately-known type.[5] In my model, however, there is no private information. Second, in mechanism design, a menu of choices is offered to firms. This menu consists of combinations of per unit subsidies and lump sum taxes. Firms then choose their preferred choice from this menu. Separation is achieved because different types choose different choices from this menu. Under non-discrimination, however, a government must implement the same red tape for all firms, i.e. it cannot impose different fixed costs

[4] See Fudenberg and Tirole (1991) for a detailed discussion of mechanism design and separating equilibria.
[5] An alternative interpretation would be that governments may know firm types, but are forbidden to use this information.

across them.[6] While one could argue that as long as domestic and foreign firms are offered the same menu, this would count as non-discrimination, EU law makes it quite clear that disguised discrimination is a violation of the agreement. As such, if a menu were designed in such a way as to advantage only domestic firms, this would likely invite legal action. Third, the goal of the two part tariff under mechanism design is to allow the government to claw back surplus from the types that it does not want to subsidize as heavily. As such, the fixed cost is not lost to the economy. In contrast, red tape is wasted effort and a genuine loss to society. Finally, since the baseline option to firms in this setting is to opt out, i.e. receive no subsidy and suffer no red tape, the voluntary participation constraint would place additional constraints on the offered menu which are typically missing from the analysis.

The remainder of the paper is as follows. Section 2 lays out a baseline model with one domestic and one foreign firm. This highlights the interplay between firm heterogeneity and the usefulness of red tape in the simplest possible setting. Section 3 extends the model to many firms, including heterogeneity among firms of a given nationality. It also considers endogenous entry. Section 4 concludes.

2. A model with one domestic and one foreign firm

In this section, the goal is to illustrate the potential benefits of red tape and the conditions for its use in the simplest possible model. To this end, consider a home country with two imperfectly competitive firms: a domestic firm and a foreign-owned

[6] An additional reason for offering a "one size fits all" policy is the added burden to the government of coordinating and administering a complex menu of incentives and red tape combinations.

multinational firm.[7] Foreign variables are denoted with *. The economy has a representative consumer whose utility function is given by:

$$U(D, D^*, Y) = AD - \frac{BD^2}{2} + A^*D^* - \frac{B^*D^{*2}}{2} + Y. \quad (1)$$

This is a function of the domestic firm's output D, the foreign firm's output D^*, and a numeraire good Y.[8] The consumer maximizes this utility function subject to a budget constraint:

$$pD + p^*D^* + Y \leq I \quad (2)$$

where p is the domestic firm's price, p^* is the foreign firm's price, and I is income. Income comes from wages, the domestic firm's profits, and net tax revenues. Note that foreign firm profits are repatriated back to their home country. This is a key distinction between firms, one that drives the home government's desire to discriminate. This utility function yields inverse demand curves for the domestic and foreign firms:

$$p = A - BD \quad (3)$$

and

$$p^* = A^* - B^*D^* \quad (4)$$

respectively. Furthermore, the demand curve for the numeraire is simply the amount of income not spent on either of these two goods.

[7] Since all of the multinational's output is sold in the home country, this is horizontal FDI ala Markusen (1984). The evidence of Markusen and Maskus (2002), Blonigen, Davies, and Head (2003), and Davies (2008) suggests that this is the predominate form of FDI.

[8] This utility function has been used in the study of international taxation by Davies, Egger, and Egger (2010) among others. Its key advantage is that there is no competition among firms. Alternatively, one could use Dixit-Stiglitz preferences where there are general equilibrium competition effects that operate through the aggregate price level. This would not change the qualitative nature of the main results: red tape achieves discrimination and is desirable with sufficient heterogeneity. I return to this issue in Section 3.

All goods are produced using labor, which is exogenously supplied in amount L. The numeraire good is produced under constant returns to scale with a unit labor requirement of one. It is freely traded in a perfectly competitive market where the price is normalized to one. This implies that the equilibrium wage is one. I assume L is sufficiently large that all goods are produced and consumed in equilibrium.

The timing is as follows. First, the home government announces an incentive program that consists of a per-unit production subsidy s and red tape level R.[9] To receive the subsidy, the firm must pay this fixed red tape cost. This cost is intended to represent whatever hoops the firm must jump through in order to receive the program. This could be the cost of filling out forms, investing in a particular location, and so on. If discrimination is possible, then the government may set different subsidies and red tape values for the two firms. Note that it is also possible for the government to set $s = R = 0$, i.e. to offer no program at all. Given the incentive program announced, firms then decide how much to produce. Each firm chooses its quantity to maximize its own profit. Because of the analogous choices, I only present the problem for the domestic firm.

If the domestic firm chooses to become subsidized, its profit function is:

$$\pi = (A - Bq)q - (C - s)q - F - R \tag{5}$$

where C is its constant marginal cost and F is its fixed cost of entry (such as constructing its plant or the cost of coming up with its brand). This results in a profit-maximizing quantity and price of:

$$q = \frac{A - (C - s)}{2B} \tag{6}$$

[9] An alternative interpretation of the model is one in which the unit costs include labor taxes, in which case the subsidy could represent a payroll tax reduction.

and

$$p = \frac{A + (C - s)}{2} \tag{7}$$

resulting in equilibrium profits of:

$$\pi = \frac{\left(A - (C - s)\right)^2}{4B} - F - R\,. \tag{8}$$

Alternatively, should the domestic firm choose not to be subsidized, its equilibrium quantity, price and profits will be:

$$q = \frac{A - C}{2B}, \tag{9}$$

$$p = \frac{A + C}{2} \tag{10}$$

and

$$\pi = \frac{\left(A - C\right)^2}{4B} - F\,. \tag{11}$$

In order to guarantee equilibrium production, I assume that (11) is positive, requiring that *A* is sufficiently greater than *C*.

Comparing (8) and (11), two things become clear. First, the firm will only choose to be subsidized for a positive subsidy. This is obvious since no firm would submit to a voluntary tax, particularly one for which it had to pay an additional cost for the pleasure of doing so. Second, the maximum amount of red tape that the home firm is willing to endure to obtain a subsidy *s* is:

$$R(s) = \frac{\left[A - (C - s)\right]^2 - \left[A - C\right]^2}{4B}. \tag{12}$$

I assume that if (12) holds exactly, i.e. the firm is indifferent, then it does not apply for the subsidy. This is a reasonable choice if there is a chance for the application to be rejected or for the government to renege ex-post on its subsidy promise.

With firm profits in hand, this implies that equilibrium income is:

$$I = L + \pi - \left(sq + s^* q^* \right) \tag{13}$$

i.e. labor income plus profits of the domestic firm less subsidy costs. To derive equilibrium welfare, insert equilibrium prices, quantities, profits and income into (1). Note that (1) can be rewritten as:

$$U = AD - \frac{BD^2}{2} + A^* D^* - \frac{B^* D^{*2}}{2} + L + \pi - sq - s^* q^* - pq - p^* q^* . \tag{14}$$

or, plugging in the home firm's profits:

$$U = AD - \frac{BD^2}{2} + A^* D^* - \frac{B^* D^{*2}}{2} + L - Cq - s^* q^* - p^* q^* . \tag{15}$$

Since the domestic firm's profits enter income, the subsidy given to it is a wash (excepting its influence on the equilibrium quantity). Similarly, the expenditures on the domestic firm's good cancel out in the consumption of the numeraire. This is not true for the foreign firm, who repatriates its profits back to its own country. This is evidenced by the last two terms in (15). This difference is the source of the home government's desire to distinguish between the home and foreign firms.[10]

The exact expression for equilibrium welfare will depend on which firms, if any, applies for the subsidy. If neither firm applies for the subsidy, welfare is:

[10] There is a second distinction in that home firm costs are a negative in welfare whereas foreign firm costs are not. This is because, although both firms wage bills amount to labor income, only the home firm's profits accrue to home income. As such, home firm costs reduce welfare whereas foreign firm costs do not.

$$U = \frac{3}{8B}\left[A - C\right]^2 + \frac{1}{8B^*}\left[A^* - C^*\right]^2 + L - F\ . \tag{16}$$

If only the home firm applies for the subsidy, welfare is:

$$U = \frac{1}{8B}\left[3A - 3C - s\right]\left[A - C + s\right] + \frac{1}{8B^*}\left[A^* - C^*\right]^2 + L - F - R\ . \tag{17}$$

If both firms apply for the subsidy, welfare is:

$$U = \frac{1}{8B}\left[3A - 3C - s\right]\left[A - C + s\right] + \frac{1}{8B^*}\left[A^* - C^* - 3s^*\right]\left[A^* - C^* + s^*\right] + L - F - R\ . \tag{18}$$

We see here that red tape costs for domestic firms are indeed a loss to the home country because it takes away from production of the numeraire.[11] This is a distinguishing feature of it as compared to the lump sum tax in mechanism design which would re-enter welfare as income. As will become apparent shortly, there is no need to consider the case where only the foreign firm applies since such a situation would never be an equilibrium choice for the home government.

2.1 Discrimination

Suppose that the home government is able to discriminate between firms and offer them different subsidies. The subsidies and level of red tape that are offered are described in Proposition 1.

Proposition 1: *Suppose that the home government can discriminate between firms. Then it will set a positive subsidy for the domestic firm, zero red tape for the domestic firm, and any combination of subsidies and red tape such that the foreign firm does not file for the subsidy.*

[11] Note that, as with foreign firm costs, foreign firm red tape expenditures do not detract from home welfare.

Proof: Taking the derivative of (17) with respect to the domestic firm's subsidy, I find that the optimal subsidy is:

$$s = \left(A - C\right) > 0 . \tag{19}$$

Since welfare is falling in the red tape, the optimal $R = 0$. Taking the derivative of (17) with respect to the foreign firm's subsidy, I find that the optimal level of s^* is:

$$s^* = -\frac{\left(A^* - C^*\right)}{3} < 0 \tag{20}$$

i.e. it prefers to tax the foreign firm. Since the foreign firm would never apply for such a subsidy, the second best option for the home government is to not subsidize the foreign firm, either by setting $s^* = 0$ or choosing a positive s^* and an $R^* > R^*(s^*)$, i.e. a level of red tape sufficiently high that the foreign firm would not apply for the subsidy. ***Q.E.D.***

The intuition here is straightforward. Since the domestic firm applies monopoly pricing and subsidy expenses re-enter income through firm profits, it is optimal to subsidize the domestic firm. Since red tape is a pure cost and reduces home welfare, it is set to zero. While the foreign firm is also a monopoly, because its profits leave home, a strictly smaller subsidy is desired. In fact, for this particular setup, it is optimal to set a tax to recover some of those repatriated profits. Failing that, it is preferable simply to not subsidize the foreign firm, either by setting a zero subsidy or a level of red tape sufficiently high so that the foreign firm never applies for the subsidy. Note that even if the government is constrained to set $s = s^*$, it can still set $R^* > R^*(A - C)$ (the foreign version of (12)) and deter the foreign firm from accepting the subsidy. Finally, recognize

since that the government would never choose to subsidize the foreign firm only, hence, there is no need to derive welfare for that case.

2.2 Non-discrimination

Now suppose that the government is bound by non-discrimination, i.e. it is constrained to setting $s = s^*$ and $R = R^*$. In this case, the home government's optimal choice of subsidy and red tape are described in Proposition 2.

Proposition 2: *Suppose that the home government is bound by non-discrimination. If* $B^*\left[A-C\right] < B\left[A^*-C^*\right]$ *, the government will offer a combination of the subsidy and red tape such that no firm applies for the subsidy. If* $B\left[A^*-C^*\right] < B^*\left[A-C\right] < 2B\left[A^*-C^*\right]$ *a positive subsidy will be offered without a red tape cost, in which case both firms accept the subsidy. If* $B^*\left[A-C\right]$ *is sufficiently greater than* $2B\left[A^*-C^*\right]$ *a positive subsidy will be offered alongside a positive red tape cost that is sufficiently high so that only the domestic firm applies.*

Proof: As described in the discriminatory case, it is never optimal to subsidize the foreign firm unless the domestic firm is as well. This leaves three possible outcomes to be considered: one where no firm takes the subsidy, one where both firms apply for the subsidy, and one where only the domestic firm does so. I consider each of these in turn.

If neither firm takes the subsidy, i.e. $R \geq \max\left\{R(s), R^*(s)\right\}$, then welfare is given by (16).

Suppose that both firms apply for the subsidy, i.e. $R < \min\left\{R(s), R^*(s)\right\}$. In this case, the optimal subsidy is given by:

$$s = \frac{B^*\left[A-C\right] - B\left[A^*-C^*\right]}{\left(B^*+3B\right)}. \tag{21}$$

For this to be the case, the subsidy must be positive (even if there is no red tape). This requires that $B^*\left[A-C\right] > B\left[A^*-C^*\right]$, i.e. firms must be heterogeneous (more on this below). I refer to this difference as the domestic firm advantage. If the slope coefficients are the same, i.e. $B = B^*$, then it must be the case that $A-C > A^*-C^*$ which requires that the domestic firm either have a higher demand intercept (as would be the case if there is a home bias) and/or a lower per unit cost (as would be the case if the foreign firm is less productive or has some other disadvantage when producing overseas)[12]. If $B^*\left[A-C\right] < B\left[A^*-C^*\right]$ then (21) is negative. As such, neither firm would apply for this tax and welfare is independent of *s* and *R* and is again given by (16). If $B^*\left[A-C\right] > B\left[A^*-C^*\right]$ and both firms take the subsidy, which requires that

$$R < \min\left\{R\left(\frac{B^*\left[A-C\right]-B\left[A^*-C^*\right]}{\left(B^*+3B\right)}\right), R^*\left(\frac{B^*\left[A-C\right]-B\left[A^*-C^*\right]}{\left(B^*+3B\right)}\right)\right\},$$

since red tape is only welfare reducing, the optimal choice of red tape is zero.

Finally, suppose that only the domestic firm applies for the subsidy. This requires that $R^*(s) \le R < R(s)$. Again, since red tape is welfare reducing, the government is best off setting as low a level of red tape that still keeps the foreign firm from applying, i.e. by setting $R = R^*(s)$. This implies that the value for welfare is given by:

$$U = \frac{1}{8B}\left[3\left[A-C\right]-s\right]\left[A-C+s\right]+\frac{3}{8B^*}\left[A^*-C^*\right]^2+L-F-\frac{\left[A^*-\left(C^*-s\right)\right]^2}{4B^*}. \quad (22)$$

This yields an optimal subsidy of:

$$s = \frac{B^*\left[A-C\right]-2B\left[A^*-C^*\right]}{\left[B^*+2B\right]}. \quad (23)$$

[12] McCallum (1995) and others document the extent of the home bias empirically.

Again, for this to be a subsidy that the domestic firm wants to apply for, it must be positive, i.e. $B^*\left[A-C\right] > 2B\left[A^*-C^*\right]$. Note that this is a stronger domestic firm advantage than that implied by a positive subsidy that both firms would take ((21)), which only required that $B^*\left[A-C\right] > B\left[A^*-C^*\right]$. Furthermore, this case requires that $0 < R^*\left(\frac{B^*\left[A-C\right]-2B\left[A^*-C^*\right]}{\left[2B+B^*\right]}\right) < R\left(\frac{B^*\left[A-C\right]-2B\left[A^*-C^*\right]}{\left[2B+B^*\right]}\right)$, i.e. the level of red tape is not so high that the domestic firm does not apply. This in turn requires that:

$$B^*\left[A-C\right] > \frac{\left[B+2B^*\right]}{\left[3B+3B^*\right]}2B\left[A^*-C^*\right] \tag{24}$$

which as long as B and B^* are positive is true whenever this subsidy is positive. This then implies a level of red tape equal to:

$$R = \frac{\left[2\left[A^*-C^*\right]+\left[A-C\right]\right]\left[B^*\left[A-C\right]-2B\left[A^*-C^*\right]\right]}{4B^*\left[B^*+2B\right]^2} > 0. \tag{25}$$

We can now compare welfare levels and determine whether or not a subsidy or red tape will be used. If $B^*\left[A-C\right] < B\left[A^*-C^*\right]$, the government prefers not to subsidize any firm. Thus, in this case the equilibrium is any subsidy s and level of red tape $R \geq \max\left\{R(s), R^*(s)\right\}$. If $B\left[A^*-C^*\right] < B^*\left[A-C\right] < 2B\left[A^*-C^*\right]$, the government will offer the positive subsidy given by (21) to both firms with no red tape. Since it certainly could choose to offer a zero subsidy to both but does not do so, this dominates offering no subsidy.

Whether or not it is better to use red tape and in effect restrict the subsidy to only the domestic firm requires not only that $2B\left[A^*-C^*\right] < B^*\left[A-C\right]$ but that the welfare in

this case is greater than that when no red tape is used and the subsidy is taken up by both firms. Whether or not this is the case requires plugging the subsidy (23) and red tape (25) into (17) and subtracting (18) evaluated at the subsidy (21). Doing so yields an expression that is in general ambiguous. A simple numerical example demonstrates this. Set $B = B^* = A^* - C^* = 1$. Figure 1 illustrates the difference between the welfare levels when red tape is used and when it is not. As can be seen, although for the entire range $A - C > 2\left[A^* - C^*\right]$, it is not until the domestic firm advantage becomes sufficiently large that home is better off using red tape. ***Q.E.D.***

Thus, the home government's optimal policy is contingent on the extent of heterogeneity between the two firms. Subsidizing the domestic firm only has to benefits. First, it eliminates the cost of subsidizing the foreign firm. Second, it allows the government to reoptimize the subsidy used (i.e. use (23) instead of (21)). This restriction comes at the cost of the home firm's red tape cost. When this degree of asymmetry is relatively small, the cost of using a sufficient amount of red tape to stop the foreign firm from taking the subsidy is outweighed by the benefits. As the degree of asymmetry grows, however, so too do the benefits of using red tape. Thus, there is a critical value of the domestic firm advantage beyond which red tape will be used. Figure 1 analyzes where this cutoff occurs both for different values of $A - C$ as well as for different values of B^*.[13] As B^* grows, so does the domestic firm advantage, implying that a smaller difference between $A - C$ and $A^* - C^*$ is needed for positive red tape to be the desired policy.

[13] In this figure $B = A^* - C^* = 1$.

This highlights the importance of heterogeneity. If firms are homogeneous, no subsidy will be used. Further, as shown in Figure 2, holding $B = B^* = A^* - C^* = 1$ but increasing $A - C$ the desired subsidy increases. This then requires a greater level of red tape to prevent the foreign firm from applying for the subsidy. Therefore, firm heterogeneity is crucial if red tape will arise in equilibrium.

Finally, note that the desirability of red tape is purely from the home government's perspective. World welfare, which would include the profits of the foreign firm, would be maximized when the domestic firm is subsidized at rate $A - C$ and the foreign is subsidized at rate $A^* - C^*$. Thus, it must be kept in mind that the desirability of red tape is from the home perspective, not from the global perspective.

3. Many firms

In this section, I examine the extent to which the above results transfer to a setting with many domestic and foreign firms. To that end, let there be *N* domestic firms and N^* foreign firms, both of which are exogenous.[14] First, I demonstrate conditions for red tape to arise when all firms of a given nationality are identical to one another. Following this, I discuss how these results would extend to a setting with heterogeneity within nationalities. Finally, I consider the case where the number of domestic and foreign firms is endogenous.

3.1 Identical home and identical foreign firms

Suppose that all *N* domestic firms are identical to one another and that all N^* foreign firms are identical to one another. Since the decisions of a given firm are the

[14] There is a small literature on endogenous entry and exit in models of taxation including Becker (2009) and Davies and Eckel (2010). I discuss the implication of endogenous entry later in this section.

same as before, equations (6) through (8) the equilibrium quantity, price, and profit of a given subsidized domestic firm.[15] For future use, I will describe these as $q(i)$ and so forth when referring to a particular firm *i*. Similarly, (9) through (11) give the equilibrium values for an unsubsidized domestic firm. As before, it is straightforward to derive the analogous values for a foreign firm be it subsidized or unsubsidized. Note that since there are no changes in these values, this implies that there is no change in $R(s)$ or $R^*(s^*)$. Thus, the minimum levels of red tape at which a given set of firms will no longer apply for the subsidy do not change.

Although nothing has changed for individual firms, obviously there are differences in aggregate welfare. If no firm takes up the subsidy, welfare is:

$$U = N\frac{3}{8B}\left[A-C\right]^2 + N^*\frac{1}{8B^*}\left[A^*-C^*\right]^2 + L - NF\,. \tag{26}$$

If all firms apply for the subsidy, welfare is:

$$U = N\frac{1}{8B}\left[3A-3C-s\right]\left[A-C+s\right] + N^*\frac{1}{8B^*}\left[A^*-C^*-3s^*\right]\left[A^*-C^*+s^*\right] + L - NF - NR\,. \tag{27}$$

If only home firms apply for the subsidy, then welfare is given by:

$$U = N\frac{1}{8B}\left[3A-3C-s\right]\left[A-C+s\right] + N^*\frac{1}{8B^*}\left[A^*-C^*\right]^2 + L - NF - NR\,. \tag{28}$$

Given the results in the discriminatory case above, it is immediately apparent that the government would prefer provide all domestic firms a subsidy of $A-C$, tax all foreign firms at the level $\left[A^*-C^*\right]/3$, and have no red tape requirement. If discrimination is not possible, in the absence of red tape, home's preferred subsidy is:

[15] Again, this simplicity is one of the attractive features of the specified utility function since it results in no competition among firms.

$$s = \frac{NB^*\left[A-C\right]-N^*B\left[A^*-C^*\right]}{3N^*B+NB^*}. \tag{29}$$

As before, for this to be positive, it requires a certain degree of asymmetry between domestic and foreign firms. Note, however, that it no longer strictly requires a domestic firm advantage since it also depends on the relative numbers of domestic and foreign firms. Even when domestic and foreign firms are identical individually, if there is an asymmetry in terms of their numbers such that $N > N^*$ home will choose a positive subsidy. Since

$$\frac{ds}{dN} = \frac{N^*BB^*\left(3\left[A-C\right]+\left[A^*-C^*\right]\right)}{\left(3N^*B+NB^*\right)^2} > 0 \tag{30}$$

and

$$\frac{ds}{dN^*} = \frac{-NBB^*\left[A^*-C^*\right]-3NBB^*\left[A-C\right]}{\left(3N^*B+NB^*\right)^2} < 0 \tag{31}$$

the likelihood of this occurring is increasing in the number of domestic firms (since the net benefit of providing a subsidy rises) and falling in the number of foreign firms (since the cost of a given subsidy increases as more foreign firms receive it). For future use, note that:

$$\frac{d^2s}{dN^2} = -2B^*\frac{N^*BB^*\left(3\left[A-C\right]+\left[A^*-C^*\right]\right)}{\left(3N^*B+NB^*\right)^3} < 0 \tag{32}$$

i.e. the desired subsidy is increasing but concave in the number of domestic firms.

Therefore, suppose that $NB^*\left[A-C\right] > N^*B\left[A^*-C^*\right]$ and home will opt to provide some subsidy. Would it then choose to combine a subsidy with red tape in order to prevent foreigners to take up the incentive? If it does utilize red tape and prevent

foreign firms from applying for the subsidy, then the optimal subsidy is equal to (23), i.e. it the same as it was in the two firm case. The reason for this is that, since in this case no foreign firms apply for the subsidy, the government no longer must compare the domestic net benefit of the subsidy, which is a function *N*, with the cost of subsidizing foreigners, which depends on N^*. Further, as before, for red tape to work, it must be that $R^*(s) \le R < R(s)$ at this subsidy so that only domestic firms apply for the subsidy. In addition, since red tape beyond that needed to keep foreign firms from applying is wasteful, the optimal level of red tape would be as in (25). As before, for red tape to be positive requires that $2B\left[A^* - C^*\right] < B^*\left[A - C\right]$.

Therefore, for the home government to desire to subsidize firms requires either asymmetries (be it heterogeneity in demand/costs or differences in firm numbers) while for it to choose to use red tape I still require heterogeneity between the domestic and foreign firms. As in the two firm case, whether or not the government chooses to use red tape depends on how welfare compares between the cases. Unlike the two firm example, however, this requires more than just a sufficiently large domestic firm advantage.

To analyze this case further, Figure 3 illustrates the difference between welfare with red tape and welfare without it. This is done for $A - C = 20$, $A^* - C^* = B = B^* = 1$, and varying values of *N* and N^*. There are three key things to take away from this graph. First, when $N = N^*$, welfare is greater with red tape than without it. This is because in this case, it is possible to factor firm numbers out of the subsidy and welfare. As such, just as in the two firm case, what matters is the degree of heterogeneity across the two sets of firms, not the number of firms in each set. Second, given N^*, the difference in welfares has an inverted U shape, i.e. there is a finite level of *N* at which the benefit of

introducing red tape reaches a maximum. This results from competing impacts of a rise in *N*. As the number of domestic firms rises, so too does the desired subsidy if all firms are to be subsidized. This in turn raises the amount transferred to foreigners. The benefit of red tape is in preventing this, thus the benefit of red tape is increasing and concave in *N* (just as (32) illustrated that the optimal subsidy is increasing but concave in *N*). The cost of red tape, however, is linear in *N* since both the optimal subsidy under red tape ((23)) and the level of red tape ((25)) are invariant to the number of firms. Thus, when the number of domestic firms is relatively small compared to the number of foreign firms, a rise in *N* increases the difference between welfare with red tape and welfare without it. As *N* continues to rise, the added red tape cost for domestic firms reduces and eventually eliminates this advantage. Third, as the number of foreign firms rises, this increases the benefit of using red tape as that halts the subsidization of foreign firms. Therefore, as more and more foreign firms are active in the country, this increases the likelihood that the home government will institute red tape.

Figure 4 illustrates the welfare difference holding $N^* = 5$ for different combinations of *N* and $A - C$. As $A - C$ increases, this increases the desired subsidy, regardless of whether red tape is used or not. As a result, this both increases the cost of subsidizing foreign firms in the absence of red tape and the required level of red tape to stop those firms from applying. The net effect of these two changes is to make red tape even more valuable for those levels of *N* where red tape would be used. Thus, as the domestic firm advantage grows, as in the two firm case, we find that it is increasingly likely that red tape will be used. Now, however, it comes with the caveat that the number

of domestic firms is not too large relative to the number of foreign firms. As in Figure 3, this is due to the increasing cost of red tape as *N* grows.

3.2 Heterogeneity within nationalities

Now consider the case where home firms face the same demands but have individual unit costs where $C(i)$ is the cost of firm *i*. Let this be increasing in *i* and distributed according to c.d.f. $G(i)$. Similarly, let the cost of foreign firm *i* be $C^*(i)$ which is distributed according to c.d.f. $G^*(i)$. As above, it is clear that the home government prefers to subsidize domestic firms and tax foreign firms. If it were possible to set firm-specific subsidies, it would subsidize domestic firm *i* at rate:

$$s(i) = A - C(i) > 0 \tag{33}$$

which is decreasing in *i*. Furthermore, it will not charge them red tape. Similarly, it would choose to tax foreign firm *i* at rate:

$$s^*(i) = -\frac{\left(A^* - C^*(i)\right)}{3} < 0 \tag{34}$$

which is increasing in *i* (that is, it moves closer to zero as the index rises). If the home government is only permitted to set subsidies that applied to all domestic firms or all foreign firms, it would still subsidize domestic firms and tax foreign ones. Thus, as before, red tape potentially serves a useful purpose by deterring foreign firms to take up the subsidy.

When no red tape is used and the government cannot discriminate across firms at all, welfare is:

$$U = \int_0^N \frac{1}{8B}\left[3A - 3C(i) - s\right]\left[A - C(i) + s\right]di + \int_0^{N^*} \frac{1}{8B^*}\left[A^* - C^*(i) - 3s\right]\left[A^* - C^*(i) + s\right]di \quad (35)$$
$$+L - NF$$

Defining $\mu = \frac{1}{N}\int_0^N \left[A - C(i)\right]di$, i.e. the "average" value of $A - C(i)$ and μ^* similarly, maximizing (35) results in an optimal subsidy:

$$s = \frac{B^* N\mu - BN^*\mu^*}{B^*\int_0^N di + 3B\int_0^{N^*} di}. \quad (36)$$

Comparing this with (29), it is clear that whether or not (36) is positive again depends on the number of home and foreign firms. In addition, it depends on the distribution of firm types as embodied by μ and μ^*. Otherwise, the overall problem remains very similar to that before.

Turning to the case with red tape, the primary difference between this case with heterogeneity within nationalities and the one above is that it is not necessarily the case that all or no firms from a given country will avail themselves of the subsidy. Each firm *i* has a level of red tape for which it would no longer apply for the subsidy, which is found by substituting the firm specific cost $C(i)$ into (12). Note that this is decreasing in *i*. Since productive firms with low indices produce the most, they gain the most from the subsidy and are willing to pay the most red tape. With this in mind, for a given combination of subsidy and red tape $\{s, R\}$ there is a domestic firm λ for which the added cost of red tape wipes out the gain from the subsidy. This firm cutoff is given by:

$$R = \frac{2s\left[A - C(\lambda)\right] + s^2}{4B}. \quad (37)$$

This index is increasing in the subsidy:

$$\frac{d\lambda}{ds} = \frac{\left(\left[A - C(\lambda)\right] + s\right)}{sC'(\lambda)} > 0 \tag{38}$$

and decreasing in red tape:

$$\frac{d\lambda}{dR} = -\frac{2B}{sC'(\lambda)} < 0\,. \tag{39}$$

Likewise, the last foreign firm to apply for the subsidy is λ^*. With this in mind, welfare in this case is:

$$\begin{aligned} U = &\int_0^{\lambda} \frac{1}{8B}\left[3A - 3C(i) - s\right]\left[A - C(i) + s\right]di + \int_{\lambda}^{N} \frac{3}{8B}\left[A - C(i)\right]^2 di \\ &+ \int_0^{\lambda^*} \frac{1}{8B^*}\left[A^* - C^*(i) - 3s^*\right]\left[A^* - C^*(i) + s^*\right] + \int_{\lambda^*}^{N^*} \frac{1}{8B^*}\left[A^* - C^*(i)\right]^2 \\ &+ L - NF - \lambda R. \end{aligned} \tag{40}$$

Since the goal of red tape is to stop foreign firms from taking the subsidy, if red tape is used it must be the case that:

$$R \geq \frac{2s\left[A^* - C^*(N^*)\right] + s^2}{4B^*} \tag{41}$$

i.e. it keeps at least one foreign firm from taking the subsidy. From this, it is clear that, as above, red tape requires heterogeneity to be useful. This is because for it to serve its purpose, not only must it stop some foreign firms for taking the subsidy, but it must also be the case that at least some domestic firms still take advantage of the incentive, i.e. that:

$$R < \frac{2s\left[A - C(0)\right] + s^2}{4B}\,. \tag{42}$$

If the demand curves for foreign and domestic firms are the same (as would be the case in Dixit-Stiglitz preferences), this would then require that:

$$C^*(N^*) < C(0) \tag{43}$$

i.e. the least productive foreigner is less productive than the most productive domestic firm. Note that this is necessary, not sufficient, for red tape to be used. For red tape to be used not only must it "pay for itself" in terms of the savings from keeping out foreign firms relative to the red tape cost for domestic firms, but it must not drive out too many domestic firms. Similar to the above case, this will depend on the number of domestic and foreign firms as well as demand parameters. In addition, it will depend on the distribution of costs of the home and foreign firms since this will affect the total amount spent on the subsidy across the two groups.

3.3 Endogenous entry

In the above two cases, the number of firms from each country was exogenous. Alternatively, one could allow free entry. In this case, the last domestic firm to enter, firm *N*, would be the one that it earns zero profits by doing so. If this firm is not subsidized, this is where:

$$\pi(N) = \frac{\left(A - C(N)\right)^2}{4B} - F = 0\,. \tag{44}$$

If this firm is subsidized, this cutoff would be where:

$$\pi(N) = \frac{\left(A - \left(C(N) - s\right)\right)^2}{4B} - F - R\,. \tag{45}$$

in which case offering a higher subsidy or a lower level of red tape would encourage entry.[16] Similarly, the number of foreign firms would be impacted by the subsidy and red tape. Thus, in addition to manipulating the quantities of firms, the home government has the ability to use its policies to affect entry. Although this complicates the above problem,

[16] Lawless (2009) provides empirical evidence that red tape in tax filing is a significant barrier to entry.

three main results would carry through. First, since the profits of foreign firms are repatriated, the home government would choose to subsidize foreigners less than home firms if that were permitted. Second, if discrimination is not possible, whether or not a subsidy is used at all depends how much surplus is drawn off by subsidized foreign firms relative to domestic firms. Third, for red tape to work, there must be sufficient asymmetry between foreign and domestic firms otherwise only foreign firms will apply for the subsidy. Thus, the qualitative nature of the above results will survive.

The primary difference endogenous entry yields is that, if the optimal subsidy induces entry by low productivity domestic firms, it may well be utilized by all foreign firms depending on the distribution of types. Nevertheless, red tape might still be used to manipulate entry on the margin as would be the case if eliminating red tape would lead to a massive influx of foreign firms seeking subsidies but only slight entry by domestic firms. As in the case with an exogenous number of firms but a distribution of types, this will depend on demand parameters as well as the c.d.f.s $G(i)$ and $G^*(i)$. Now, however, these distributions matter not only for determining the distribution of types but also the rate of entry for domestic and foreign firms.

With this in mind, the usefulness of red tape in a Helpman, Melitz, Yeaple (2004) style model would depend on the parameterization of the model. The Helpman, Melitz, Yeaple model differs from mine in two key ways. First, they assume monopolistic competition, which yields general equilibrium effects by which firm choices are interrelated. Second, they allow firms to endogenously choose between foreign direct investment and exporting by foreign firms. Despite these added complications, since the profits of multinationals (including whatever subsidies they receive) are expropriated,

home would find it advantageous to discourage them from applying for the subsidy as compared to domestic firms. Red tape would therefore serve as a mechanism for doing so while sticking to the letter if not the spirit of non-discrimination. Whether or not this outweighs the red tape cost to domestic firms (both in terms of R and entry effects) will depend on the parameterization of the model.

4. Conclusion

The purpose of this paper has been to illustrate how wasteful red tape can be used as a de-facto method of achieving discrimination for a government offering a subsidy. To achieve this requires heterogeneity, and in particular, that (at least some) domestic firms have an advantage over foreign firms. This advantage can arise from a home bias or lower unit costs. This in and of itself is insufficient for red tape to be used since the benefit of restricting the subsidy since red tape is a cost. As such, the cost of this must be outweighed by the ability to target the subsidy to domestic firms. Nevertheless, there certainly exist situations in which red tape is used. Thus, although governments may pay lip service to "non-discrimination", the outcome of their policies can be very different.

Note that red tape is not the only way of targeting the subsidy. An alternative would be for governments to implement a "filing fee", that is, a fee to apply for the subsidy. This would achieve the same discrimination result with the added bonus that it would cancel out the red tape cost of domestic applicants and capture surplus from foreign ones. One argument against the use of such a fee would be that the obviousness of such a surplus extraction would draw the ire of the foreign participants in the agreement requiring non-discrimination.

Recognizing the role of red tape is important for two reasons. First, given the current economic downturn, one might expect that policy makers are particularly sensitive to the desire to benefit their own citizens while not subsidizing non-citizens. Second, as public finances become strained due to the downturn and increasing tax competition for FDI, this might increase the benefit of limiting overall subsidy expenditures.[17] Since red tape is wasteful and detrimental to world welfare as a whole, this suggests the potential need to coordinate across nations to limit its use. On this second point, since developing countries are those for whom the cost of raising funds is perhaps the greatest, one might expect them to use the most red tape in order to limit payments. This is consistent with the evidence of Gillanders (2010) who finds a negative correlation between per-capita GDP and an index on the cost of doing business which includes information on the number of documents a firm must fill out, the delay in the processing of paperwork and so forth. Similarly, Lawless (2009) finds that the complexity of taxes, one measure of red tape, is greatest for developing nations. Thus, an international agreement seeking to limit red tape may need to be cognizant of differences between the needs of developed and developing countries in this regard. In any case, it is my hope that by recognizing the use of non-tax instruments to target tax policy that this work adds to the already active debate on international taxation.

[17] Evidence of growing international tax competition is given by Redoano (2007) and Davies and Voget (2009).

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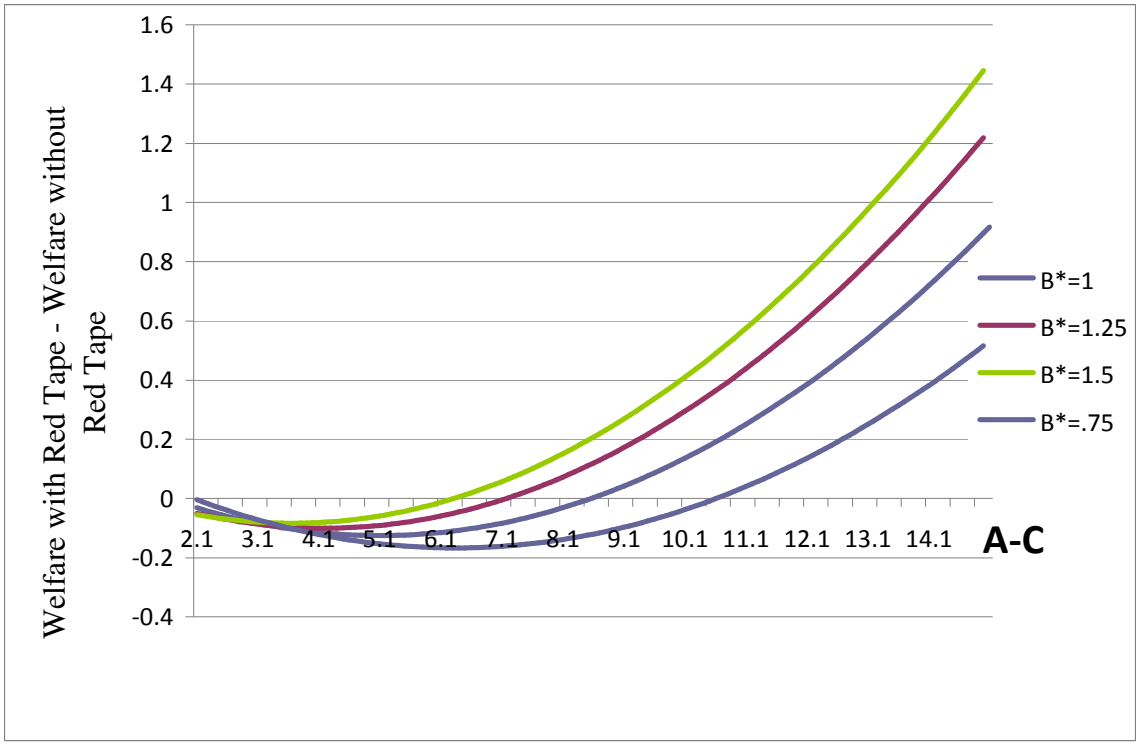
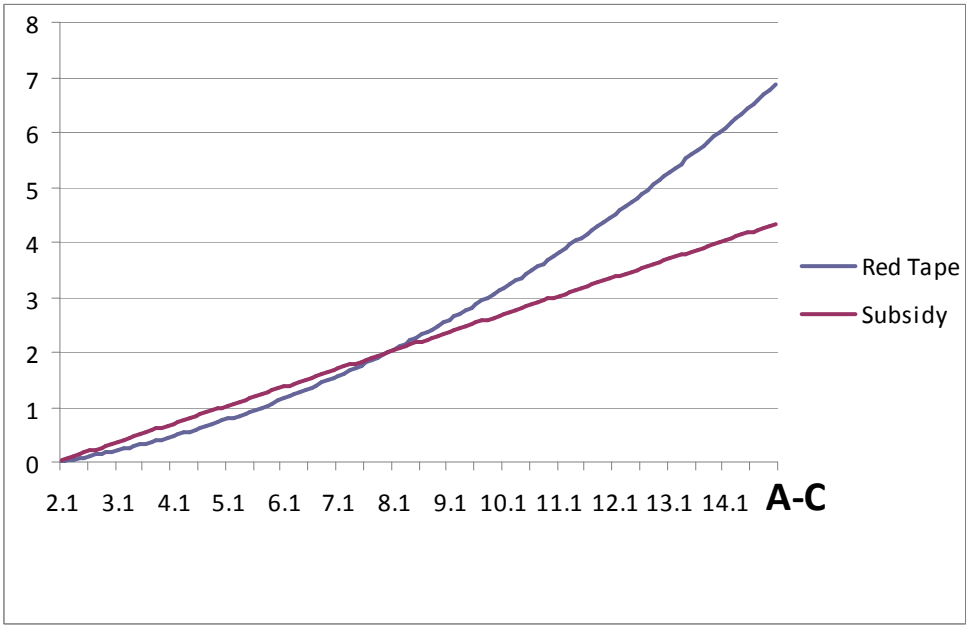
Figures

Figure 1: The Welfare Advantage of Red Tape



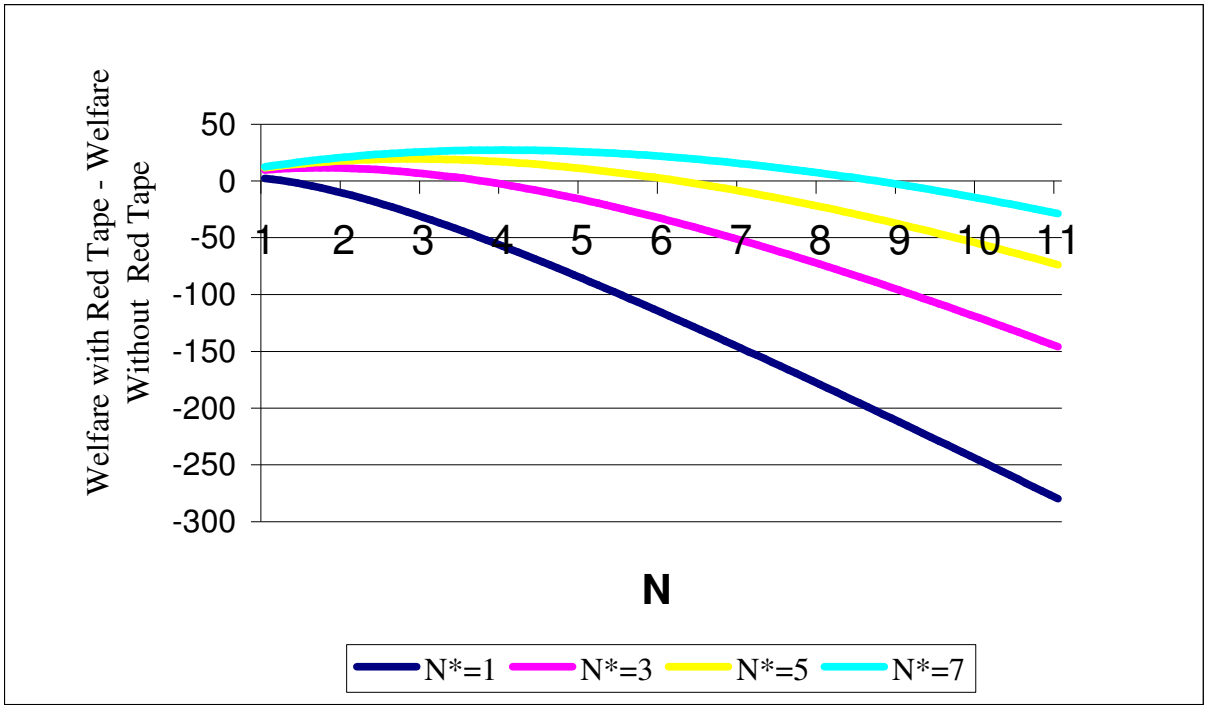
$B = A^* - C^* = 1$

Figure 2: The Subsidy and Red Tape as Functions of the Domestic Firm Advantage



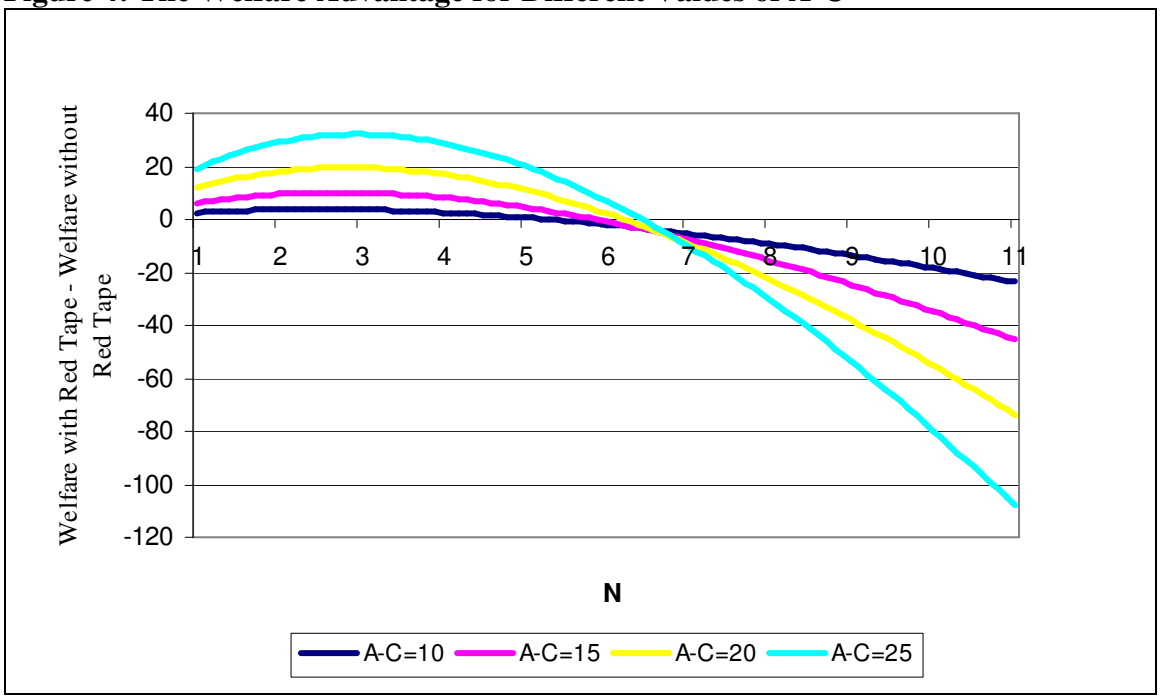
$B = B^* = A^* - C^* = 1$

Figure 3: The Welfare Advantage as it Depends on the Number of Domestic Firms



$B = B^* = A^* - C^* = 1,\ A - C = 20$

Figure 4: The Welfare Advantage for Different Values of A-C



$B = B^* = A^* - C^* = 1$