INFANT INDUSTRY POLICY AND
INFORMATION REVELATION*

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Resumen: Se estudia el proceso de entrada a industrias de bienes duraderos bajo información imperfecta. Suponemos que antes de incurrir en costos de inserción a la industria, los inversionistas observan su tipo verdadero —rentabilidad— de manera imperfecta. Consideramos políticas donde el gobierno posee información más precisa que el sector privado, contemplando dos tipos de gobierno bien intencionados pero con objetivos distintos. Se demuestra que un tipo de gobierno puede señalizar su tipo con una política *second-best* que propicia una entrada mayor a la industria. Dicho resultado explica la selección frecuente de políticas de intervención subóptimas en apoyo de industrias crecientes (*infant industries*), en contraposición al stock de conocimiento económico establecido.

Abstract: We study domestic entry into an established durable good industry under imperfect information. Prior to making a costly entry decision, entrepreneurs observe their true type —profitability— only with some (common) noise. We consider policy when the government has finer information than firms about the common noise, allowing for two types of well-meaning government with different objectives. We show that one government may signal its type with a second-best policy to encourage entry. This result provides a rationale for the observed phenomena of governments choosing suboptimal "infant industry" interventions despite accepted economic wisdom.

1. Introduction

Since Baldwin's (1969) classic article on infant-industry protection it has been well-recognized that not only is the case for government assistance for young industries very weak, but that even when such assistance may be warranted, optimal intervention will very rarely take the form of trade protection. A number of papers since then have addressed the first prong of this attack and have identified circumstances of dynamic inefficiencies in new industries in which some intervention may be desirable. However, while tariffs and other trade policies may have beneficial effects, it is still generally the case that they are not first-best interventions. The reason is a simple consequence of the targeting principle that distortions are best addressed directly. In the infant-industry context, distortions motivating intervention are generally production related[1] so optimal corrective policy should be directly production related.

Despite this strong academic consensus, however, the tariff seems to be the instrument of choice for many governments aiming to encourage new industries. Part of this popularity can no doubt be explained by the political economy of endogenous policy formation, limitations on policy instruments, or policy inertia. We argue in this paper, however, that the choice of instrument may also be a means of signaling information about the policy-maker's type. That is, if governments differ in their objectives then their choices of intervention instrument may reveal valuable information about their goals and therefore about the government's type.

Following some recent models which have emphasized informational asymmetries as a cause of infant-industry inefficiencies,[2] we

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[1] Exceptions to this include information-based models such as Grossman and Horn (1988).

[2] Grossman and Horn (1988) consider a model of imperfect consumer information about new-product quality which leads to under-entry by domestic firms. Essentially, the presence of fly-by-night domestic firms imposes a negative externality on reputable firms by lowering the rationally expected average quality for consumers who buy the domestic product. Flam and Staiger (1989) and Desruelle (1990) both consider models of adverse selection in credit markets, the former emphasizing the possibility of under-entry as a consequence of this, the latter demonstrating that either under- or over- entry might occur, depending on the specific form of informational problem. While Flam and Staiger find that a small tariff is welfare-improving in their model, Desruelle demonstrates that this is a consequence of the particular information structure they use.

introduce a model in which potential firms receive an imperfect signal of their costliness in some industry and make some inference from that signal. We suppose each firm receives a signal that is a mixture of its true type and some white noise. Firms differ in true efficiency according to some known distribution but all receive a common shock —each signal differs from the true type by some common realization of the white noise shock.[3] Firms decide, on the basis of inferences made from this signal and any government policy announcement, whether or not to incur some fixed cost to enter the industry (before discovering their true type). A principal element in our model is our assumption that the government has better information regarding the shock than do firms[4] and this provides the crux of the government's problem: whether and how to disseminate this information? A recurrent example of this information structure is found in the high level of discretion permitted to central banks with respect to disclosure of information, a feature common in many developing countries. To the extent that a central bank controls the availability of foreign exchange, the evolution of the bank's foreign exchange accounts is highly material to the decisions of industries utilizing imported inputs. However, infant manufacturing industries inevitably rely heavily on imported inputs. Accordingly, the government agency (the central bank, in this example) has finer information than a private firm about variables that are of central importance to that firm. Other examples of common shocks —changes in world prices, technologies, cost of domestic inputs— can also be captured in this framework in that the government's finer information is not so much about the shock itself but about how the government will respond to that shock.[5]

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[3] For instance, a wage demand from a union in firm-union bargaining is just such a case: the firm does not know the extent to which a wage demand is firm-specific or across-the-board yet it is clearly of some importance re the firm's position against other rivals in the industry. And in this example the true individual cost efficiency is revealed by the actual pattern of wage arrangements that emerges, in response to your query as to what gives this information.

[4] In fact, we consider only an extreme case where the government knows the realized shock exactly.

[5] In some sense, the overall problem facing the government should include the decision to control foreign exchange, in the first example, or to react to other shocks in the other cases. By setting aside this aspect of the problem, we are essentially considering the more realistic context in which the decisions of one branch of a decentralized

There are three critical aspects of our model. The first is that we consider a two-period model in which, in the first period, firms produce a durable good which then requires some services in the second period. This provides a link between the present and future which is critical in any infant industry argument. Furthermore, this set-up accords with the empirical observation that most infant industries produce durable goods (a notable example is that of the South American import-substitution experience in the 1950s and 1960s, a strategy most prominently advocated by Raúl Prebisch). We have in mind here consumer electronics and other small manufactures, in particular (see Krueger and Tuncer (1982) as an example of infant-industry analysis that considers only manufacturing industries). The second critical feature of the model is that not only are firms "infants", potentially being unprofitable initially but becoming profitable over time, but also there may be "bad" entry of firms that having entered mistakenly, stay around for one period and then exit. These features are captured in our model by the assumptions that, for any firm, profits in the second period exceed first period profits net of the fixed cost and first period profits gross of the fixed cost are assumed to exceed second period profits.[6] The final critical aspect of the model is that we suppose the government may be one of two types —a myopic government that maximizes the welfare of the representative consumer in the first period only or a farsighted government that considers both periods. This can be thought of as a polarized example of governments endowed with different discount factors which in turn may reflect different subjective probabilities of political survival, different age profiles of political support groups or a number of other inherent differences.

Consumers may either purchase the good as an import, paying a given price but knowing that the good will be available for both periods, or purchase the good domestically and take the chance that the firm they

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government are made given the actions of the others. Such federalist structures of government branches can be more generally sustained as credible equilibrium outcomes in games of policy choice subject to time-consistency constraints (time-dependent supergames).

[6] In a sense, second period profits are endogenous here as a result of the firm's first period activity, if one thinks of "time" as being the activity: if the firm operates for one period then its very survival stems from learning-by-doing (or whatever other embodiment of dynamic efficiency gains one wishes to consider in the infant industry story).

deal with exits after one period leaving their purchase useless in the second period due to the lack of services —these are assumed to be proprietary and can only be provided by the original manufacturer. An example might be the production of computers (or consumer electronics generally) for which technical support, warrantied service and the provision of brand-specific parts can be characterized in this fashion. It is worth stressing that the two-period nature of this model is not particularly critical: the second period can be thought of as a present value representation of many future periods in which the firm provides services on the durable good sold initially. Each firm here is assumed to produce only one unit of the homogeneous good (and each consumer purchases only one unit).[7] In other contexts this restriction on a firm's quantity of sales has some significance in removing a potential means of signaling by a good firm —a low-cost firm can invest in productive capacity to signal its type. In our model this criticism has less weight as firms do not have perfect knowledge of their own type and so have less incentive to signal.

As in Grossman and Horn (1988) there is no signaling through prices in our model —a high price by a low-cost firm can always be imitated by bad firms, and there is no reason to signal low cost through a low price as any such "investment" in information by a good firm can only pay off in the second period by which time information is perfect anyway. The price of the domestic good will be such that the expected utility to the consumer from buying the domestic product (rationally expecting the density of "bad" firms in the market given the known distribution of shocks and true types) equals the known utility of buying the foreign product. There are potentially three types of firms who will enter immediately. There are "good" firms who are profitable in both periods and who will thus remain in the industry for two periods, there are "bad" firms who are profitable in the first period, once the entry cost is sunk, but who will then exit as they make losses in the second period, and there are "hopeless" firms which exit immediately on discovering

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[7] This asymmetry between domestic firms and the foreign firm (which can produce as much as is demanded) simply reflects the fact that this is a small country dealing with a large multinational corporation: it does not seem unreasonable that the latter will have greater capacity than an individual domestic firm and we normalize the latter to unity.

their true type —those for whom operating profits in period one are negative.

For different actual realizations of the shock the true density of bad and hopeless firms will differ and consumers will update their expectations (and thus affect the domestic price) if they observe any immediate exit of the hopeless firms. This complicates the analysis somewhat as firms are aware that a very good shock will induce entry by hopeless firms and therefore cause consumers to update their expectations —this leads to the perverse result that the very best firms will not enter the industry as they interpret their signal as indicating a large shock and so anticipate this behavior by hopeless firms and thus by consumers.

Section 2 of the paper describes the model in more detail and the equilibrium in the absence of any policy. In Section 3 we introduce a government and study a signaling equilibrium that may result. The targeting principle, assuming a good government, suggests that announcement is the optimal policy —simply sharing the information with firms induces the socially optimal amount of entry. But, with uncertainty about the policy maker's type, it turns out that, as in Rodrik (1989), a pure announcement policy will not be chosen by both governments. The myopic government wants less entry than the farsighted one in every case, because it is not concerned about second-period profits, so it would tend to announce less favorable conditions than had actually occurred. An announcement does not separate the governments, then, and firms cannot be sure if they are dealing with a truthful, farsighted government or an untruthful myopic one. We demonstrate that the final policy equilibrium may involve an announcement policy for the myopic government and a (costly) tax/ subsidy scheme for the farsighted government.

These policies signal the policy maker's type but do not identify the value of the shock exactly as each policy involves some mixing over a range of instrument values. For instance, if the myopic government made its first-best announcement assuming firms do not react to it, then firms could invert the announcement to determine the true value of the shock. There would then be under-entry from the government's viewpoint. So instead it announces a shock drawn from some interval (also announced) which prevents this inversion by firms and can induce a better outcome for the government. This time- consistency problem of revelation (that revelation is optimal if firms react to it myopically but,

if it occurs, firms will not react to it myopically) also plagues the farsighted government and so the final equilibrium reveals the government's type exactly but not the shock. Section 4 summarizes and concludes.

The main result here is that we may observe a farsighted, well-meaning government using a policy (a costly subsidy here) that is not an optimal intervention in the absence of uncertainty about the government's type. In our model both governments are well-meaning. As a result, the model introduced in this paper is general in that it lends itself to the analysis of a diversé set of questions, such as international policy coordination, in which players are well-meaning but endowed with different policy aims.

2. The Model

2.1. Description

Firms are indexed by i where a_i (distributed according to a normal density function $f(a_i)$, mean $\bar{a}$, variance σ_a^2) measures a firm's true "type". The firm only receives an imperfect signal of its type, however: $\sigma_i = a_i + z$ where z is a shock common to all firms (distributed according to a normal density function $g(z)$, mean zero, variance σ_z^2). Accordingly, each firm makes an inference, $\hat{a}_i$, about its type where $\hat{a}_i = \theta\bar{a} + (1 - \theta)\sigma_i$ and

$$\theta = \frac{\sigma_z^2}{\sigma_z^2 + \sigma_a^2}.$$

No agent observes the true firm-specific type a_i but all firms, consumers and government know its distribution. All agents know the distribution of the shock z but the government also knows the actual realization.

Firms produce a homogeneous durable good in period 1 and some services on that good in period 2. Production in 1 is necessary for activity in 2. As discussed earlier, each firm produces only one unit. Consumers can purchase the good in either period from an established foreign multinational at a fixed price of p and will therefore also be able to buy services in period 2 at price p_2. However, the foreign firm is assumed to act as a monopolist and so it will set $p_2 = p$: it cannot charge more than p for services as consumers would then buy the good anew,

and there's no incentive to charge less than p. Let the present value to the representative consumer of purchasing the foreign good be $V(p, p)$. For this small, open economy there is an infinitely elastic demand for the good in world markets at price p.

For a domestic firm, there is a fixed cost of entry, F, if the firm decides to enter in period $- 1$. There is also a cost of production in period 1 of $c(a_i)$ where $c' < 0$. That is, higher a_i firms are more efficient. Denote the price charged in period 1 by q_1 and the price of period 2 services as q_2 (credibly committed to in period 1). The following argument establishes that all domestic firms will charge the same prices. Suppose not, and each firm can set its own price —presumably lower the more efficient is the firm (to signal). Then, in equilibrium, we get some marginal price and all consumers buying from better firms get greater surplus. But each better firm has no incentive to charge the lower price— by raising it to the marginal price it increases profits with no effect on consumption. Thus we will not get signaling through prices, so we need only consider one price. Furthermore, in equilibrium, q_1 will be independent of the realization of z (although not of its distribution) because all firms make different inferences about z.

The price of second-period services on domestic goods, q_2, must be less than p if any consumers are to buy the domestic good. Furthermore, we suppose that q_2 is fixed.[8] In our earlier example of computers one could think of these services as technical support (intellectual property with zero marginal cost of dissemination) and warranted parts provision. These are both proprietary and cannot be provided by competitors but, when provided under warranty, the only cost of the latter is labor and this is determined on a competitive labor market and is the same for all firms.

A firm of type i thus would make *ex ante* profits of $\Pi_1(a_i, q_1) - F = q_1 - c(a_i) - F$ in period 1 and $\Pi_2(a_i, q_2) = q_2 - k(a_i)$ in period 2 where $k(.)$ denotes the cost of providing services, $k' < 0$ and $k(a_i) < c(a_i)$. The value of *ex ante* profits in period 0, assuming no discounting, is thus $\Pi_1(a_i, q_1) - F + \Pi_2(a_i, q_2)$. We assume henceforth that

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[8] This asymmetry between domestic and foreign products in the market structure for services is introduced without loss of generality. Allowing monopoly behavior by domestic firms as well (so long as the $q_2 < p$ non-degeneracy condition still holds) leaves our results unchanged except that the computation of equilibrium must now also include determination of q_2.

$$\Pi_1(a_i, q_1) - F < \Pi_2(a_i, q_2) < \Pi_1(a_i, q_1)$$

for each a_i and for any equilibrium q_1, q_2. Thus with full information there will be no firms for which first-period production is *ex ante* profitable but second-period production is not —i.e. fly-by-night firms who would enter for one period only. This configuration enables us to concentrate on the effects of uncertainty. For simplicity, we also assume henceforth that $\Pi_2(\bar{a}) = 0$ (where price arguments of the profit function are suppressed for clarity). Note that no firm would wish to commit to a second-period price that yields negative profits —i.e. pursue a strategy of subsidizing such losses through first-period profits to convince consumers that it will not shut down —because of the configuration of profits. Any firm that would make losses in period 2 at our equilibrium would also make losses in period 1: it cannot be in the interests of such a firm to commit to even greater losses in 2 as there are no profits in 1 to finance this.

We can represent the sequence of decisions and events diagrammatically:

Table 1

Time Period	Events and Actions
-1	• Firms get signal o_i, make inference $\hat{a}_i$ about type, make entry decision: enter if $\Pi_1(\hat{a}_i) - F + \Pi_2(\hat{a}_i) \geq 0$. • Firms incur fixed cost F if decide to enter. • Policy announced (if any). • Price q_1 is set.
0	• Truth is revealed. • Firms exit if $\Pi_1(a_i) < 0$.
1	• First-period consumption decisions and sales are made. • Remaining firms earn $\Pi_1(a_i) \geq 0$.
$\{1\frac{1}{2}$	• Firms exit if $\Pi_2(a_i) < 0.\}$
2	• Second-period consumption decisions are made. • Remaining firms earn $\Pi_2(a_i) \geq 0$.

Let p denote the actual propoition of domestic firms that are fly-by-nights: those that enter initially and sell in period 1 but will not stick around for two periods. Consumers will form (rational) expectations about p and, in equilibrium, will be indifferent between buying the known import and the average domestic good. Thus:

$$pV(q_1, p) + (1 - p)V(q_1, q_2) = V(p, p) \qquad (1)$$

where the left-hand side of this expression is the expected utility derived from purchasing the domestic good —there is a probability p of getting a bad firm and thus having to buy the import in the second period at a price p and a probability $1 - p$ of getting a good firm and so getting services at q_2 in the second period. While we discuss consumers as if they are all domestic, it should be borne in mind that this is a small open economy facing a perfectly elastic demand curve at price p so some of these consumers may be foreign. The significance of this is that the industry is never demand-constrained in this model.

For some shocks there will be entry of some firms who think they are profitable but find out that in fact $\Pi_1 < 0$ (and therefore $\Pi_2 < 0$ because $\Pi_2 < \Pi_1$ for all a_i, by assumption). Consumers then observe some exit at time 0 and thus get some information on the actual shock. So they update their expectations of p: if a firm of type a_i such that $\Pi_1 < 0$ perceived it as possible to enter, then, if any others did, it included some for whom $\Pi_1 > 0$ but $\Pi_2 < 0$ i.e. "bad" firms who will exit at time 1. So consumers will realize that the true share of bad firms in the total number of domestic entrants is *greater* than their *ex ante* estimate of p. But this *ex ante* estimate was such that the consumer was just indifferent between buying the import and taking a chance on the domestic firms so, because domestic price cannot adjust *ex post*, the consumer now strictly prefers the import and so will not purchase any of the domestic good.

This effect is exacerbated by firms' expectations: firms know that, given *ex ante* entry decisions and prices, there is some critical shock, say $\bar{\bar{z}}(q_1)$, such that this behavior by consumers will occur. So $\bar{\bar{z}}$ denotes the shock that just induces entry by the firm indexed a_i^E where $a_i^E(q_1)$ is defined by $\Pi_1(a_i^E) = q_1 - c(a_i^E) = 0$ (on entering it finds that it is not profitable, in fact, and so exits immediately). A firm infers from the signal σ_i that its true type is $\hat{a}_i = \theta\bar{a} + (1 - \theta)\sigma_i$ but it knows the signal is

$a_i + z$ so it implicitly infers a shock of $\hat{z} = \theta(\sigma_i - \bar{a})$. If $\hat{z} > \bar{\bar{z}}$ then it will not enter as it expects to sell nothing and so lose F. Thus for any shock z' there will be a range of the best firms, all $a_i > a_i^H$ where $a_i^H \equiv (\bar{\bar{z}} / \theta) + \bar{a} - z'$ who will not enter. Note that $\bar{\bar{z}}$ must be positive: a zero shock would only induce entry of some range of firms better than average (in *true* type) and therefore *all* profitable in period 2; any negative shock would only induce better entry than this. Denote the *true* type of the actual marginal entrant as a_i^c. Then in period 0 we may see exit of firms, depending on the comparison between a_i^H and a_i^E .[9]

Note that, if $a_i^H < a_i^E$, there are no domestic firms remaining (or p = 1 in a sense). Consumers can calculate both a_i^E and a_i^H so they know that if $a_i^E < a_i^H < \bar{a}$ then the true proportion of bad firms in the domestic market would be 1 (because $\Pi_2(\bar{a}) = 0$, recall, so all entering firms would face $\Pi_2 < 0$). And they know that if $a_i^E < \bar{a} < a_i^H$ then the true proportion of bad firms would exceed p, their *ex ante* expectation,[10] because p is an average over the entire distribution of z, including that portion of the density for which $z \ll 0$ and p = 0. (This latter observation comes from the fact that sufficiently large negative shocks make all firms think they are worse than they really are and leaves only good firms still willing to enter.) Note also that the ability of consumers to observe bankruptcies means they can infer z exactly for all $z > \bar{\bar{z}}$.

Jumping ahead a little, Figure 1 graphs the true proportion of bad firms in the domestic market against the realized shock.

Note that when z equals zero p must be zero: the truly marginal firm has $\Pi_2 > 0 > \Pi_1 - F$ and $\Pi_1 - F + \Pi_2 = 0$, but it perceives itself as worse (getting a signal equal to its true type but making an inference less than that because it is greater than $\bar{a}$). So the actual marginal entrant is one that is indexed above this one and so earns strictly positive profits over both periods. Also, because $\theta < 1$ and $\bar{\bar{z}} > 0$ so $p(\bar{\bar{z}}) < 1$. This

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[9] Exit will be $\text{Max}\left[0, \int_{a_i^c}^{a_i^E} f(a_i)da_i\right]$ if $a_i^H > a_i^E$ or $\text{Max}\left[0, \int_{a_i^c}^{a_i^H} f(a_i)da_i\right]$ if $a_i^H < a_i^E$.

[10] If $a_i^E < \bar{a} < a_i^H$ then the true proportion of bad firms would be:

$$\left[\int_{a_i^E}^{\bar{a}} f(a_i)da_i\right] \Big/ \left[\int_{a_i^E}^{a_i^H} f(a_i)da_i\right] \text{ (again because } \Pi_2(\bar{a}) = 0).$$

follows from the definitions of a_i^H and a_i^E. If the shock is $\overline{\overline{z}}$ then the lower marginal entrant is $a_i^c = a_i^E$ and the upper marginal entrant is a $a_i^H(\overline{\overline{z}}) = (\overline{\overline{z}} / \theta) + \overline{a} - \overline{\overline{z}} > \overline{a}$. The proportion of bad firms is then the measure over $(a_i^E, \overline{a})$ (those for whom $\Pi_1 > 0$ but $\Pi_2 < 0$) relative to the whole density of entrants: this proportion must be less than one because $a_i^H > \overline{a}$.

Figure 1
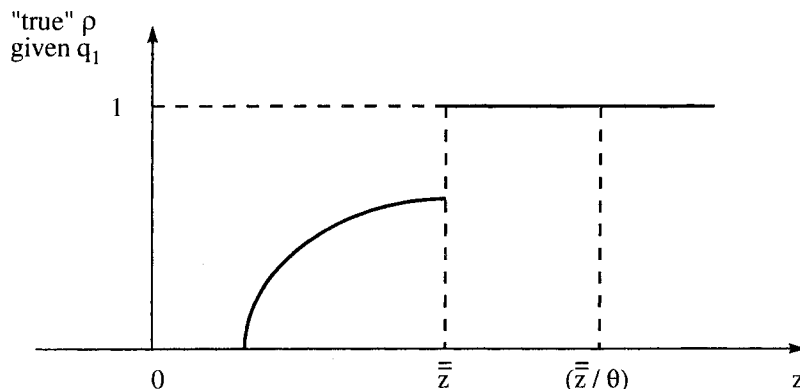
Integrating over $g(z)$, then, gives the expected ρ. Note that the true ρ equals 1 for some large enough shock: all the good firms realize it is a bad shock and only bad and hopeless firms will enter.

2.2. *Solution*

We now turn to the problem facing the firm. For some shock z' the firm of type a_i gets a signal σ_i and so infers a type $\hat{a}_i$ and a shock $\hat{z} = \theta(\sigma_i - \overline{a})$. As long as, $\hat{z} < \overline{\overline{z}}(q_1)$ i.e. as long as , $\sigma_i < (\overline{\overline{z}}(q_1) / \theta) + \overline{a}$ then the firm will consider entry. That is, the firm will consider entry if its *true* type is:

$$a_i < (\overline{\overline{z}}(q_1) / \theta) + \overline{a} - z' \equiv a_i^H(q_1, z') \qquad (2)$$

Beyond this, the firm only enters if its inferred type is *ex ante* profitable:

$$q_1 - c(\overset{\wedge}{a_i}) + q_2 - k(\overset{\wedge}{a_i}) - F \geq \theta \tag{3}$$

We can define the *actual* type of the marginal entrant as $a_i^c(q_1, z')$ implicitly by:

$$q_1 - c(\theta\overline{a} + (1 - \theta)(a_i^c + z')) + q_2 - k(\theta\overline{a} + (1 - \theta)(a_i^c + z')) - F = 0 \tag{4}$$

Then entry will occur of the following *actual* types of firms:

$$\int_{a_i^c(q_1, z')}^{a_i^H(q_1, z')} f(a_i) da_i$$

The *true ex ante* marginally profitable entrant is defined by $\tilde{a}_i(q_1)$ where:

$$q_1 - c(\tilde{a}_i) + \Pi_2(\tilde{a}_i) = F \tag{5}$$

and this can be calculated by firms, of course. The assumption that $\Pi_1 - F < \Pi_2$ for all a_i combined with the $\Pi_2(\overline{a}) = 0$ normalization together imply that $\tilde{a}_i(q_1) > \overline{a}$. Recall that any firms of true type less than a_i^E who choose to enter will exit immediately and any firms of true type less than $\overline{a}$ who choose to enter will exit after period 1. So the fly-by-night firms are any entrants between a_i^E and $\overline{a}$.

Case 1: When will there be *no* bad firms in the market? Only when the shocks are such that only firms for whom Π_2 is non-negative will enter. The largest shock that satisfies this is that where the firm of type $\overline{a}$ (for whom $\Pi_2 = 0$ and $\Pi_1 - F < 0$) thinks it's just *ex ante* profitable (i.e. that $\Pi_2 + \Pi_1 - F = 0$). That is, there will be no bad firms in the market when there is any shock less than (including negative shocks) or equal to $\underline{z}$ where $\underline{z}$ is implicitly defined by $a_i^c(q_1, \underline{z}) = \overline{a}$. Note: $\underline{z}$ must be positive.

Case 2: Now suppose there is a "large" positive shock z' where $z' > \overline{\overline{z}}(q_1)$. We now get some entry by firms who are actual types with $\Pi_1 < 0$. For this to occur they must think they are actually *ex ante* profitable, whereas they are not. Thus a_i^c (the actual marginal entrant) is less than a_i^E (the marginal firm for whom $\Pi_1 = 0$). So $\overline{\overline{z}}$ is defined by $a_i^c(q_1, \overline{\overline{z}}) = a_i^E$. Then we get entry for $z' \geq \overline{\overline{z}}$, some exit at time 0 and no purchases by consumers at time 1.

Case 3: Now suppose we have a "small" shock z' where $\bar{\bar{z}} > z' > \underline{z}$. Thus the type of the actual marginal entrant is $a_i^c > a_i^E$ so $\Pi_1(a_i^c) > 0$. So we get no exit at time 0, thus consumer demand is positive. Clearly a_i^c is less than $\bar{a}$ in this case, so we will get some bad firms entering initially. The mass of bad firms is $\int_{a_i^c}^{\bar{a}} f(a_i)da_i$ (as $\Pi_2(\bar{a}) = 0$). Total entry is $\int_{a_i^c}^{a_i^H} f(a_i)da_i$ so the proportion of bad firms is 1 if $a_i^H \leq \bar{a}$ and, if $a_i^H > \bar{a}$, is $[1/2 - F(a_i^c)] / [F(a_i^H) - F(a_i^c)]$ because $f(a_i)$ is normal (so $F(\bar{a}) = 1/2$).

Putting all these cases together we have the following:

- if $z \leq \underline{z}$ then there is no bad entry and so actual $\rho = 0$;
- if $\bar{\bar{z}} \geq z > \underline{z}$ then *(i)* if $a_i^c < a_i^H < \bar{a}$, actual $\rho = 1$;

$$(ii) \text{ if } a_i^c < \bar{a} < a_i^H, \text{ actual } \rho = \frac{\left[\dfrac{1}{2} - F(a_i^c)\right]}{\left[F(a_i^H) - F(a_i^c)\right]}$$

- if $z > \bar{\bar{z}}$ then actual $\rho = 1$.

From these we can derive the *ex ante* expected ρ over the distribution of z given q_1 (which determines $\bar{\bar{z}}$ and thus a_i^H, and a_i^E and thus a_i^c). Thus:

$$\rho(q_1) = 0 \text{ if } a_i^c(q_1) > \bar{a}$$

$$= 1 \text{ if } a_i^c(q_1) < a_i^H < \bar{a}$$

$$= \frac{\left[\dfrac{1}{2} - F(a_i^c)\right]}{\left[F(a_i^H) - F(a_i^c)\right]} \text{ if } a_i^c(q_1) < \bar{a} < a_i^H(q_1)$$

Equilibrium is a quadruplet $(\underline{z}, \bar{\bar{z}}, q_1, \rho)$ satisfying (E1), (E2), (E3) and (E4):

$$\rho V(q_1, p) + (1 - \rho)V(q_1, q_2) = V(p, p) \tag{E1}$$

$$\rho = \int_{-\infty}^{\underline{z}} 0 \, g(z)dz + \int_{\underline{z}}^{\overline{\overline{z}}} \frac{\left[\dfrac{1}{2} - F(a_i^c(q_1, z)) \right]}{\left[F(a_i^H(q_1, z)) - F(a_i^c(q_1, z)) \right]} g(z)dz$$

$$+ \int_{\overline{\overline{z}}}^{\infty} g(z)dz \qquad\qquad (E2)$$

where

$$a_i^c = \left\{ \frac{\xi^{-1}(q_1 + q_2 - F) - \theta\overline{a}}{i - \theta} - z \right\},$$

$$a_i^H(q_1, z) = (\overline{\overline{z}}(q_1)/\theta) + \overline{a} - z$$

and $\xi(a_i) \equiv c(a_i) + k(a_i)$

$$q_1 - c(\theta\overline{a} + (1 - \theta)(\overline{a} + \underline{z})) + q_2 - k(\theta\overline{a} + (1 - \theta)(\overline{a} + \underline{z})) - F = 0 \quad (E3)$$

i.e. $q_1 + q_2 - F = \xi(\overline{a} + (1 - 0)\underline{z})$

$$\overline{\overline{z}}(q_1) = \left\{ \frac{\xi^{-1}(q_1 + q_2 - F) - \theta\overline{a}}{1 - \theta} - c^{-1}(q_1) \right\} \qquad (E4)$$

where (E1) defines consumers' equilibrium from (1) (indifference between *ex ante* expected domestic good and known foreign good), (E2) defines the rationally expected *ex ante* ρ given firms' entry behavior, (E3) defines $\underline{z}$ from $a_i^c(q_1, \underline{z}) = \overline{a}$, and (E4) defines $\overline{\overline{z}}$ as being the shock such that firm a_i^E (for whom $\Pi_1 = 0$) thinks it is $\tilde{a}$ (for whom $\Pi_1 + \Pi_2 - F = 0$). It can be shown that there exists a unique equilibrium to this system.[11]

[11] Such a proof is provided in an appendix available from the authors on request.

3. Policy

3.1. *Government*

We now wish to introduce a government and consider its policy options. We suppose that the government may be one of two types —it is either myopic, maximizing the welfare of the representative consumer in the first period alone, or it is farsighted and so has the same objective but over both periods. This formulation can be thought of as a crude approximation of the common distinction between populist and reformist governments —the former tend to be short-sighted in that their objectives are defined in terms of the next election rather than over a long horizon.

There are any number of policy options available to governments here. A simple announcement of the shock is one obvious possibility —to share their information with producers and consumers— and a tax/subsidy is another. As far as traditional policy rankings are concerned, these will be first —and second-best respectively, followed by trade policies. We assume that there are no lump-sum taxes available to governments so any revenues raised to finance a subsidy impose deadweight losses elsewhere in the economy. We also assume that a consumption tax on the good in question here will never be part of any optimal taxation scheme (over any range of revenues the government would wish to raise). That is, raising revenue elsewhere is costly, but never as costly as raising it in this market. This assumption enables us to characterize a tariff policy as third-best as any beneficial effects it has through its production subsidy component are dominated by a pure production subsidy financed elsewhere. Any pure profits earned by firms accrue to the representative consumer in this partial equilibrium framework so the government's objective is to maximize the sum of ex ante profits and consumer surplus. Two aspects of this should be noted. First, both governments are well-meaning here and so an efficient separating equilibrium is more "likely", in a sense, as each pursues its optimal policy —we do not have a "bad" government mimicking the "good" government and so forcing it to signal.[12]

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[12] The reader unfamiliar with the recent literature on incomplete information and signaling is referred to Rasmusen (1989) for a useful exposition.

Second, each government has a different optimal degree of entry. Neither government wishes to encourage entry of what we have called hopeless firms because as these exit after period 0 they drive consumers to purchase none of the domestic good, thus causing the inefficient loss of the fixed entry cost even to profitable firms. For any interior equilibrium, the farsighted government, for instance, will wish for entry of all firms indexed no less than $\tilde{a}_i$, regardless of the shock realization because this firm earns zero net profits over both periods. Note that this coincides exactly with firms' best interests —with full information this would be exactly the marginal entrant. Suppose the government is identified as being farsighted. Then consumers know the true proportion of bad firms in the market will be zero, and condition (1) solves for an equilibrium price q_1. Consumers are then indifferent between domestic and foreign goods in equilibrium so, if the marginal actual entrant made strictly positive profits, for example, the government would wish to encourage entry —this has no consequences for consumers but raises aggregate domestic industry profits. On the other hand, if the marginal actual entrant was making losses, the government would wish to discourage entry for similar reasons— it has no consequences for consumers but reduces aggregate industry losses.

A complication here is that the myopic government has a different optimal degree of entry and wishes the marginal entrant to be the firm a $a_i^m(q_1)$ where $a_i^m(q_1)$ solves:

$$\Pi_1(a_i^m(q_1)) - F = 0 \qquad (6)$$

because this firm earns zero first period profits, net of the entry cost. If this is truly the marginal entrant then again there are no bad firms in the market as this firm, by assumption, earns strictly positive second-period profits. So consumers know both governments would choose policies that would leave p equal to zero if they were acting optimally. However, the myopic government has an incentive to fool firms —if they know they are dealing with a myopic government then they know there will be underentry compared to their own correct degree of entry (a_i^m exceeds $\tilde{a}_i$ by construction) and so more would enter than the government desired. So one thing that must be checked is the expected p consequent to the government's policy —even

though both wish to choose a policy that involves p = 0, they may not do so in equilibrium.

Figure 2 presents a simple representation of the various critical values of the shock parameter, illustrated for some particular positive shock z' and variance ratio. Note that $\tilde{a}_i$, a_i^m, $\bar{a}_i$ and a_i^E do not depend on z' whereas a_i^c and a_i^H do.

Figure 2
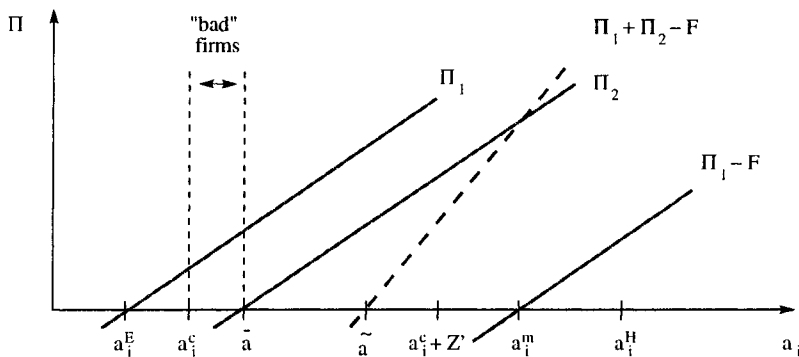
3.2. *Announcement Policy*

The targeting principle, ignoring the uncertainty about the government's type, would suggest that announcement is a first-best policy.[13] However, as an announcement does not distinguish between the types of government it cannot be an equilibrium. It is clear that there can be no separating

[13] Note that, under full information, $a_i^H \to \infty$ as all firms know the true shock and that p = 0. There would thus be infinite sales if a government could communicate the exact size of the shock to firms. Indeed, even if it only conveys some range within which the true shock lies (as is the case in the equilibrium we discuss below) this would still occur. This poses no problem on the demand side, given our small country assumption but would be a problem in a general equilibrium model of production. It is most easily

equilibrium here —the distribution of shocks is normal over $(-\infty, +\infty)$ so any announcement could be chosen by either government in response to some shock.

Now consider a pooling equilibrium in announcements. A heuristic argument follows to dismiss this equilibrium. Suppose there is some announcement regarding the size of the shock and suppose, initially, that each government would announce its "naïve" optimum —that shock which, if believed, would induce the policy-maker's optimal degree of entry. Firms, on hearing some announcement, would not know if the shock has truly been what is announced (if the government is farsighted) or something more favorable than the announcement (if the government is myopic). Firms would now have much better information regarding the true value of the shock but would not know it exactly. Their inference however, as an average of the two announcements, would leave overentry from the farsighted government's viewpoint and underentry from that of the myopic government, so the former would be tempted to announce *more* favorable conditions than had actually occurred and the latter even *less* favorable. However, these new announcements would leave the actual degree of entry unchanged as firms would again make an inference between them and, again, each government would have an incentive to exaggerate its announcement further. This reasoning implies that announcements would polarize regardless of the actual shock and therefore contain no information. There can thus be no equilibrium in announcements alone.

More formally, any such equilibrium would consist of an announcement rule for each government specifying the announcement z_j^A for $j \in \{$myopic, farsighted$\}$ as a function of the shock z, or $z_j^A = f_j(z)$, and a rule for firms making an inference $\hat{z}$ from the announcement, or $\hat{z} = h(z^A)$. These rules are best responses to each other and consistent with all entry and pricing decisions. Any such equilibrium would induce a marginal entrant $a^* \in [\tilde{a}, a^m]$ because if $a^* > a^m$ then both govern-

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avoided by assuming the distribution of a_i is truncated. This will affect the firm's optimal inference from a shock, but the same flavor of our analysis can be retained so long as a and z are orthogonal. In the simplest case, suppose that $f(a_i)$ is a truncated normal on some finite support $[-x, +x]$ and all other aspects of the problem are as in the text. Then the firm's optimal predictor of a_i is still a convex combination of $\bar{a}$ and σ_i (because of the linearity of σ_i in a_i and z) and the weight on $\bar{a}$ is still a ratio of the variance of z to the variance of σ_i.

ments agree there is too little entry and so, *given* the other's announcement for a particular shock, each would wish to announce a worse shock than the equilibrium dictates. Similarly, if $a^* < \tilde{a}$ both governments agree there is too much entry and so would wish to announce that the shock has been better than their equilibrium strategy dictates. So there can be no such equilibrium with a^* outside $[\tilde{a}, a^m]$. Now suppose $a^* > \tilde{a}$. Then, given the myopic government's decision rule, the farsighted government would like to announce that the shock has been *worse* than its equilibrium announcement, in order to encourage more entry. Such a deviation, given the firms' inference rule, would induce more entry and have no effect on ρ and therefore none on q_1, as $\rho = 0$ in the initial equilibrium (which fixes q_1 from (1)). So this deviation is in the farsighted government's interest and equilibrium fails. A similar story holds for the myopic government for any $a^* > a^m$.

3.3. *Tax/Subsidy Policies*

The next obvious policy to consider is a tax/subsidy policy, taxing production to discourage entry in some cases, subsidizing it to encourage entry in others. Note that neither government can credibly commit to a two- period policy - both governments desire to induce a marginal entrant that is strictly profitable in period two and so neither has an incentive to maintain a subsidy or tax in that period. By the same reasoning as in the announcement case, there can be no equilibrium where *both* types of governments use a tax/subsidy policy - a separating equilibrium cannot exist by virtue of the distribution of shocks and a pooling equilibrium in subsidies can be dismissed in the same way as was the pooling equilibrium in announcements.

There is one extra complication here, however. In the case of announcement policies, the policy has no effect on firms other than effects stemming from the information it conveys. When the policy is a subsidy or tax this is no longer the case —as well as the information content of some subsidy, for example, there is also a direct effect of the subsidy payment itself on a firm's profitability.

For instance, suppose a farsighted government announces some subsidy level which is designed to convey perfect information to firms regarding the size of the shock realization. The effect of the subsidy is not then to induce entry of only firms indexed greater than

$\tilde{a}$, the full information level of entry, but to encourage *more* entry than that —with the subsidy the zero-profit firm is one for whom net two-period profits are negative in the absence of a subsidy. There is then a sort of time-consistency problem —we would like to use a subsidy to encourage entry as long as firms infer nothing from it, but then it *does* convey information so firms *should* make an inference from it, but if they do then it is no longer optimal! This time-inconsistency aspect of revelation will be taken up more fully below, but it should be noted that it means *ex ante* efficient entry and *ex post* efficient entry differ.

3.4. A Policy Equilibrium

The problem noted above regarding the *ex post* inefficiency of information revelation through a subsidy is also one that plagues a myopic government in an announcement policy. Nevertheless, we shall demonstrate that there exists a policy equilibrium whereby a farsighted government employs a tax/subsidy policy and a myopic government an announcement. Both governments are then identified, but the time-inconsistency problem is avoided by a randomization strategy over announcements and subsidies by the respective governments. So there is revelation of the policy maker's *type* but not of the level of the realized shock.

   We assert that the following will constitute a policy equilibrium. In response to any shock, the myopic government announces (truthfully) that the shock belongs to some interval (to be determined) and firms and consumers believe it and refine their expectations, entry, pricing and buying decisions accordingly. A farsighted government, on the other hand, institutes a subsidy or tax on firms in response to shocks but chooses the level of the policy instrument randomly from some announced interval according to some distribution (and again firms and consumers will react accordingly). The following proposition states the governments' optimal interventions more precisely.[14]

PROPOSITION. The following behavior by governments constitutes an equilibrium:

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[14] The proof of this proposition is also available from the authors on request.

(i) For any shock z, the myopic government makes an announcement X drawn from a chosen distribution $h(X)$ on chosen support $J \subset \mathbf{R}$;

(ii) For any shock z, the farsighted government offers a subsidy s (tax if negative) drawn from a chosen distribution $\mu(X)$ on chosen support $I \subset \mathbf{R}$.

Facing a myopic government, other agents (consumers and firms) know the mapping $z \rightarrow (h(X), J)$ but, not knowing the actual z, can only form an expectation $E(z|X)$.

Equilibrium prices then follow from the *ex ante* solution to the problem in the absence of policy, but with $E(z|X)$ as firms' expectation of z. Similarly, facing a farsighted government, consumers and firms know the mapping $z \rightarrow (\mu(X), I)$ but, not knowing the actual z, form an expectation $E(z|X)$. Equilibrium prices in this case then follow from the problem's *ex ante* solution in the absence of policy, but again with $E(z|X)$ as firms' expectation of z and with s entering into profits.

Basically, one government must use a costly subsidy policy to signal its type because of the potential existence of the other type of government. It should also be noted that the question of *which* government is forced to use a subsidy/tax scheme is indeterminate in the sense that it depends on fundamental parameters of the model,[15] but in any particular case it is known to all agents: the policy actions are fully revealing of government types.

However, because of the time-consistency problem of policy noted earlier, it cannot reveal information about the shock exactly through its subsidy or tax. So each government uses a randomization strategy —the distribution of potential policy levels for any shock is known to all agents but, on observing some policy level, they cannot then infer what

[15] The government forced to signal is that for which the gains from breaking a pooling outcome are greatest. That is, suppose each pursued its naïve optimum policy (discussed more fully in the technical appendix available from the authors on request). Then other agents would not be sure if policies were being chosen to encourage the farsighted government's ideal marginal entrant or that of the myopic government. An expectation would yield some convex combination and whichever government has the most to gain from deviating from this outcome is the one which would choose to signal. We are thus supposing here that this naïve outcome lies closer to the myopic government's optimum than to that of the farsighted government so the latter has the most to gain from signaling its type.

the actual shock was, as any particular level may belong to the distributions chosen for any of a number of shocks. The equilibrium resulting from agents' expectations yields higher welfare to the policy-maker than a strategy whereby the government's type is unknown.

3.5. An Example

The following example demonstrates that random rules may dominate deterministic ones in some cases. Suppose, for some shock, that the optimal "naïve" deterministic subsidy for a farsighted government is X, and that using a subsidy perfectly identifies the government as being a farsighted one. Suppose the government chooses the following randomization strategy instead: it offers a subsidy $\tilde{X}$ drawn from some pair $\{X_1, X_2\}$:

$$X = \begin{cases} h_1(X_1) \\ h_2(X_2) \end{cases}$$

for known functions h_1 and h_2, and

$$\tilde{X} = \begin{cases} X_1 \text{ with probability } \omega \\ X_2 \text{ with probability } 1 - \omega \end{cases}$$

Knowing all this, the firm's inference (Q_i for $i = 1, 2$) is as follows: on seeing $\tilde{X} = X_1$, for instance, it knows there is an ω chance that the optimal naïve subsidy is $h_1(X_1)$ (and therefore that the actual shock was whatever corresponds to this optimal naïve subsidy) and that there is a $1 - \omega$ chance that the optimal naïve subsidy is $h_2(X_1)$ (and therefore a $1 - \omega$ chance that the actual shock was whatever corresponds to the choice of this subsidy). That is:

For $\quad \tilde{X} = X_1, Q_1 = \omega h_1(X_1) + (1 - \omega)h_2(X_1)$ \hfill (A)

For $\quad \tilde{X} = X_2, Q_2 = \omega h_1(X_2) + (1 - \omega)h_2(X_2)$ \hfill (B)

So the expected subsidy from the firm's perspective, on observing $\tilde{X}$, is $\omega Q_1 + (1 - \omega)Q_2$. Substituting in for Q_1 and Q_2, rearranging and using the fact that $h_i(X_i) = X$ for $i = 1, 2$, yields the following:

$$\omega Q_1 + (1 - \omega)Q_2 = X - \omega(1 - \omega)[2X - h_2(X_1) - h_1(X_2')]$$

Therefore, if the h_i functions are chosen such that $(h_2(X_1)) + h_1(X_2)) < 2X$, then $\omega Q_1 + (1 - \omega)Q_2 < X$. That is, firms infer an optimal subsidy less than the true optimal subsidy. A farsighted government would wish to offer a subsidy where there is otherwise underentry, e.g. in all cases of negative shocks. The larger the negative shock, the higher is the optimal naïve subsidy (but the lower is welfare once the subsidy is seen through). So using the randomization policy just described in this case will make firms believe the true shock is less negative than it is and thus that they are a worse true type than they really are. This will improve welfare by offsetting the incentive for overentry provided by the "real" effect of the subsidy.

The following numerical example illustrates this. Suppose $\theta = 1 / 2$, $\tilde{a} = 0$, $\tilde{a} > 1$ and $\Pi_1(a) + \Pi_2(a) - F \equiv \Pi^T(a) = 12(a - \tilde{a})$. Suppose a shock of $z = - (\tilde{a} / 2)$ occurs. Then true type $\tilde{a}$ gets a signal of $\tilde{a} / 2$ and infers it is a type $\tilde{a} / 4$ and would therefore make losses. So it does not enter. The naïve policy optimum is a subsidy of $X = 9\tilde{a}$ so that profits to the true type $\tilde{a}$ are perceived as being $12((\tilde{a} / 4) - \tilde{a}) + 9\tilde{a} = 0$. But offering that subsidy would fully reveal the size of the shock to all firms, they would all know their true type and the marginal entrant would be the true type $\tilde{a} / 4$. Social losses would be:

$$\int_{\tilde{a}/4}^{\tilde{a}} \Pi^T(a)da \text{ or } - (27 / 8)(\tilde{a})^2.$$

Now consider the following randomization strategy: suppose, with equal probabilities, the government will announce a subsidy chosen from one of the following two rules h_1: $X = 10\tilde{a} - \tilde{X}$ and h_2: $X = 3\tilde{X}$. Thus, for this shock, there is an equal chance of choosing $X_1 = \tilde{a}$ and $X_2 = 3\tilde{a}$. On seeing $\tilde{a}$ subsidy of $\tilde{a}$ the firm knows the true optimal subsidy is either $9\tilde{a}$ or $3\tilde{a}$ each with probability one half —the expected true subsidy is then $6\tilde{a}$. On seeing a subsidy of $3\tilde{a}$ the firm knows the true optimal subsidy is either $7\tilde{a}$ or $9\tilde{a}$ each with probability one half —the expected true subsidy is then $8\tilde{a}$. Take the first case (the second is directly analogous) —the announced subsidy is $\tilde{a}$ and the firm figures the optimal subsidy is thus $6\tilde{a}$. So firms solve $\Pi^T(a) + 6\tilde{a} = 0$ for $a = \tilde{a} / 2$ —the government apparently wishes to encourage entry by the firm that perceives itself to be a $\tilde{a} / 2$ type. But firms know the govern-

ment would like to induce the true $\tilde{a}$ type to be the marginal entrant, and they know that the $\tilde{a}$ type will only perceive itself to be a $\tilde{a}/2$ type if the shock was 0, so this is their inference: $z = 0$. Therefore they calculate that their signal, $a + z$, is actually their true type and the marginal entrant will be that firm that received a signal of $\tilde{a}/2$. But this is exactly the type $\tilde{a}$! So in this example the government achieves the first-best (at least in this case). When the random announcement is $3\tilde{a}$ it turns out the firm infers an optimum of $7\tilde{a}$, a desired marginal entrant of perceived type $(5/12)\tilde{a}$ and a shock of $z = -(\tilde{a}/6)$. Therefore the actual marginal entrant will be that which received a signal $\tilde{a}/4$ which is actually a true type $3\tilde{a}/4$. This is less than $\tilde{a}$ so there is overentry in this case, but the overentry is less than in the deterministic case where the marginal entrant was of true type $(\tilde{a}/4 < 3\tilde{a}/4)$. Overall, the expected welfare loss is

$$(1/2)(0 + \int_{3\tilde{a}/4}^{\tilde{a}} \Pi^T(a)da) = -(3/16)\tilde{a}^2$$

which is less than the losses of $-(27/8)\tilde{a}^2$ in the deterministic case.

Finally, we can illustrate this argument diagrammatically. In Figure 3 suppose the actual shock is such that the true desirable marginal entrant $\tilde{a}$ thinks it is type a'. The optimal naïve subsidy is then s', to just induce that firm to enter but, if offered deterministically, this would enable firms to infer the shock exactly and so infer their true types exactly. For instance, the true type $\tilde{a}$ would realize it is type $\tilde{a}$ and so realize that $\Pi_1 + \Pi_2 - F + s' > 0$. Hence the actual marginal entrant would be *true* type a' and social losses would be the area $a'\tilde{a}x$. However, a randomization strategy that led firms to believe the optimal subsidy was *less* than s', say s'', would make the *true* type a' think it is something less than $\tilde{a}$ and this would partially offset the profit-raising entry-inducing effect of the subsidy payment.

Suppose the announced subsidy, $\tilde{s}$, was actually s'. Then the marginal entrant would be a true type greater than a', say a'', and social welfare would be higher. (Note that the actual subsidy payment is a transfer and is irrelevant in the welfare calculus except insofar as it induces entry). To guarantee that this policy raises expected welfare, note a sufficient condition is that the government's expected subsidy, $\omega X_1 + (1 - \omega)X_2$, not exceed the naïve optimum X.   ■

Figure 3
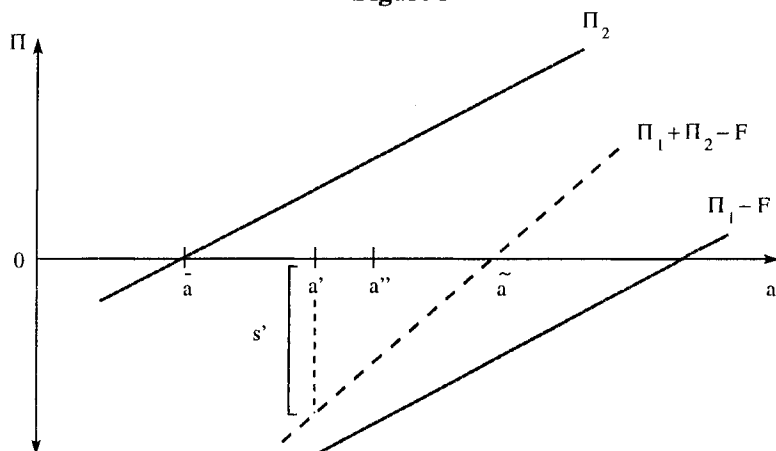
4. Summary and Conclusion

We study a model of firm entry in an industry producing a durable good where there is uncertainty about the firm's true type. Entrepreneurs know only imperfectly whether they will be profitable or not prior to making a costly entry decision —they observe their true type only with some (common) noise. Upon entering they discover their true type and may or may not be profitable for the entire life of the product. The durable nature of the good is important in that the good requires later service and if a firm exits its previous products become worthless. In the face of a well-established and known foreign producer of the good, consumers are wary of purchasing domestically because of the danger of a firm exiting before the product has expired.

We consider the question of policy when a government has finer information about the common shock than do firms themselves (a feature of particular salience in the context of LDCs). With only one type of government, optimal policy is trivial —it should reveal its information. We argue that in many cases the government is unlikely to be believed if firms cannot be sure it shares their interests. One of the novel features of our model is that we consider the possibility of two types of govern-

ment, both well-meaning, but with different objectives. We demonstrate that equilibrium may involve one of the governments being forced to use a second-best policy to encourage entry, a signaling outcome which fully identifies the *type* of the government but not the true level of the shock.[16]

Our result that a government may wish to signal its type through an otherwise suboptimal action is akin to that of Rodrik (1989) but in an infant industry context. In this setting the result provides a possible explanation of the observed phenomenon that governments seem to choose suboptimal interventions in the name of infant industry protection, despite a strong consensus amongst economists against such interventions. Another major contrast between our approach and Rodrik's is that our governments are both well-meaning so it is not clear which will be forced to signal.

One potential criticism of our model argues that a firm that will otherwise close down in period 2 could (and should) renegotiate its second-period price *upwards* with consumers. This will be to their mutual benefit so long as the price is less than the monopoly replacement price, p, and is such that the firm breaks even, or better, in period 2. While valid, the inclusion of renegotiation-proof contracts here would not affect the results but would severely complicate the analysis by further truncating the state space. So long as outsider verification is not feasible for all states of nature (a realistic feature, surely) Hart and Moore (1988) implies that whenever parties undertake relationship-specific investments (the package purchase of a durable good in our model) they will not generally be able to sustain efficient investment levels, even if messages are verifiable. In the context of our model, the results of Hart and Moore imply the non-degeneracy (non-zero measure) of the subspace of states of nature for which it would be mutually beneficial for the domestic infant and the consumer to renegotiate the second-period price, yet this would not occur even if messages are verifiable. This implies that the imposition of renegotiation-proofness on the class of admissible purchase contracts would *not* eliminate the subset of states in which mutually beneficial renegotia-

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[16] In fact, if the equilibrium were such that the farsighted government used an announcement policy and the myopic a subsidy, then the farsighted government would announce the truth and would be believed.

tions are not attained. So our results would be robust to renegotiation and we do not lose generality by omitting this complexity.

Other important aspects of our approach include the durable nature of the good, giving the industry its inherent dynamic aspect, and the fact that, for any firm, period-two profits exceed period-one profits: in this sense the industry is an infant and there are cases in which desirable entry does not occur. Further, the general model introduced in this paper can be applied in other cases (international policy coordination, for example) with well-meaning players with different objectives.

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