Trade policy under endogenous credibility*

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Abstract: In a dynamic setting, if agents are skeptical of the government's motive, a benevolent government (one that maximizes utility of the representative individual) in a small country may choose to impose a tariff even though there are no other distortions in the economy. The lack of perfect information about the government's motives introduces a distortion that might require a tariff as an optimal response by the government. However, if individuals are Bayesian learners, the likelihood of a tariff is reduced when the government acts optimally. In a finite amount of time, free trade becomes optimal.

1. Introduction

Should a stable government committed to reform liberalize its trade policies? Neoclassical trade theory suggests that tariffs and other forms of protection cause distortions and lower economic welfare. Yet, a large body of literature points out that in the presence of other distortions, tariffs may be welfare-enhancing. We argue in this paper that lack of credibility of policy is an important distortion that could lead an optimizing government to choose protection. However, credibility can be enhanced by optimal policy choice because individuals in the economy can discover the intentions of the government through its policies.

Trade liberalization which is anticipated to be temporary creates a difference between the effective domestic rate of interest and the world rate of interest. In some recent papers, Calvo (1987, 1989) has demonstrated the

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second-best result that temporary trade liberalization, even in the absence of market power or distortions, may reduce welfare for a small country. [Froot (1988) demonstrates a similar result.] Because a tariff will be reimposed in the future, there is an intertemporal distortion when financial assets can be traded internationally which may dominate the welfare-increasing effects of temporary tariff reduction.

Calvo (1989) has argued that even though the government intends to liberalize trade permanently, if the private sector believes with some probability that a tariff will be imposed in the future, then free trade may not be optimal. Calvo takes the beliefs of the private sector as given exogenously.

In this paper we first formalize Calvo's argument and discuss the optimal policy for a government which seeks to maximize a representative household's welfare. The government's lack of credibility with the private sector is represented by a set of beliefs which the households hold about the type of government it faces. The households perceive the possibility of two types of governments, one of which is the true one. We assume that there is a single false type, which is believed to select a tariff with a positive probability. Households choose their consumption and saving plans to maximize expected utility, where the expectation is taken over the policies of the two types of governments, given their prior beliefs about the probabilities of which type they face. The true government also maximizes household expected utility; however, it knows its type, so that the expectation is taken using this information. The government would ideally always choose free trade. Because their policy objectives are incredible, tariff imposition (i.e., non-liberalization) may lead to a higher level of household utility than free trade.

We next endogenize learning by allowing the private sector to update its beliefs using Bayes' rule. Our approach is somewhat similar to that taken by Backus and Driffill (1985a, b), Barro and Gordon (1983), and Barro (1986) in their analyses of monetary policy. However, in our model the true government's objective is to maximize welfare for the economy rather than some arbitrary function. Furthermore, the true government does not increase its payoff by imitating another type – our equilibrium is not the Kreps–Wilson reputational type. The true government's payoff is greater the larger is the probability perceived by the private sector that they face the true type. In the presence of learning, Calvo's case for non-liberalization is weakened. If a government is committed to maximizing welfare, then we show that with learning, the private sector must be more skeptical initially (than without learning) for a tariff to be superior to free trade.

Section 2 presents a simple two-period model with a single consumption good. Calvo's argument is developed in the absence of learning. Learning about the government's type is introduced in section 3. In section 4 we extend the model to many periods and show that if the horizon is long

enough a permanent policy of free trade eventually becomes optimal. Section 5 concludes.

2. A model without learning

The effects of private sector incredulity about the objectives of the government are introduced in a simple two-period model of a small open economy. As in Calvo (1987) there is a single imported consumption good, which is not produced at home, and an export good (manna) which is not used domestically and is available in an exogenously fixed supply each period. The private sector is represented by a single household which maximizes the expectation of a discounted sum of utility of current consumption. The discount rate is constant and equal to the world rate of interest.

The government's only role is to set trade policy and redistribute any tariff revenue in a lump-sum fashion. The government seeks to maximize the welfare of the representative household. However, the government lacks credibility with the private sector: the household believes that the government is the true welfare-maximizing one with positive probability less than unity.

There are many possibilities for what the objective of the government could be if it were not maximizing household welfare. In the absence of a natural alternative we assume that the household believes the only alternative possibility is a government which adopts the rule: impose a tariff next period with probability q ($0 < q < 1$), or choose free trade for the next period with probability $(1 - q)$. The public believes that the probability that this government is in power is $1 - \lambda$. Our rationale for this modeling strategy is that there are a large number of possible alternative governments, some of which would impose a tariff next period, and some of which would not. There is uncertainty about whether the government in power is acting in their interest (there is a probability λ that it is), and there is uncertainty over whether the 'false' government would impose a tariff conditional on its being in power (which it would do with probability q).

Because we will introduce learning by the household about the government's true type, we restrict the policies which can be chosen in any period to a finite set. Otherwise, if the government selects a policy which has zero probability of being chosen by the alternative government, then the government's type will be fully revealed. For simplicity only two policies are assumed to be available – free trade or a fixed positive tariff rate. Furthermore, taxes on foreign borrowing or capital controls are unavailable (see below). Rodrik (1989) uses a similar approach to ours to show that a government which would choose free trade as a first-best policy might subsidize imports to signal its type to the private sector. Rodrik allows the government to choose from a continuum of tariff (or subsidy) rates, but

hypothesizes that there is a finite cost to deviating from free trade. Thus, there can be a pooling equilibrium with zero tariffs. (If the costs of a small tariff were small – as in our model – the true government could choose a small tariff and reveal itself completely with virtually no distortionary costs.)

The export good is chosen as numeraire. The representative household's utility is given by

$$V(c_1, c_2) = U(c_1) + \beta E(U(c_2)),$$

where c_1 and c_2 are consumption in periods 1 and 2, respectively. $U(c)$ is twice continuously differentiable, increasing and strictly concave and β is the discount factor. $U'(c)$ approaches infinity as consumption falls to zero and approaches zero as consumption rises toward infinity. The expectation is taken over the beliefs of the household about the government's type and respective behavior in period 2.

The household has access to an international capital market, in which it can borrow or lend at given rate of interest, r . Any debt incurred in period 1 must be repaid in full in period 2. We assume that the household's rate of discount equals the world rate of interest, so that $\beta = (1+r)^{-1}$. Units for the importables and exportables are chosen so that their free trade price is unity and the relative price of the import in terms of the export cum tariff is $p > 1$.

The household solves

$$\max_{c_1, x, \bar{c}_2, c_2} \{U(c_1) + \beta[\pi U(\bar{c}_2) + (1-\pi)U(c_2)]\},$$

$$\text{subject to } p_1 c_1 \leq y + x + R_1,$$

$$p\bar{c}_2 \leq y - (1+r)x + R_2, \quad \text{and}$$

$$c_2 \leq y - (1+r)x,$$

where π is the subjective probability that the tariff will be imposed in period 2 [$=q(1-\lambda)$], p_1 is the relative price of the import good in period 1, and R_1 and R_2 are the lump-sum transfers of period 1 and period 2 tariff revenue, respectively. If p_1 is one, then R_1 is zero. Planned consumption in period 2 is given by $\bar{c}_2$ in the event a tariff is imposed in the second period and by c_2 in the event of free trade in the second period. The first-period current account deficit is given by x , and y is the amount of manna available each period.

The household equilibrium conditions are:

$$U'(c_1) \cdot (1/p_1) = \pi U'(\bar{c}_2) \cdot (1/p) + (1 - \pi) U'(c_2), \quad (1)$$

$$c_1 + c_2/(1+r) = y(1 + 1/(1+r)), \quad \text{and} \quad (2)$$

$$c_2 = \bar{c}_2. \quad (3)$$

The equilibrium conditions $R_1 = (p_1 - 1)c_1$ and $R_2 = (p - 1)\bar{c}_2$ have been used in the second and third equations.

The government chooses trade policy in each period to maximize household welfare, which is expected utility. However, the government knows its true type, so that its objective function is

$$W = U(c_1) + \beta U(c_2).$$

In the second period, the true government is indifferent between free trade and a tariff because there is no static tariff distortion in this special model. There are only intertemporal distortions in the presence of international asset trading induced by the government's lack of credibility. We will assume that the true government always chooses free trade in period 2, because this choice would always be optimal in the last period for a small country if there were multiple consumption goods. The subjective probability that the tariff is imposed in period 2, π , is the product of the probability that the false government imposes the tariff, q , and the perceived probability that the government is the false type, $(1 - \lambda)$.

The true government's problem is to choose p_1 from the set $\{1, p\}$ to maximize the value of W , given the resultant expected utility maximizing consumption behavior of the household. Eq. (1) implies that if π exceeds zero and free trade is selected in the first period, then consumption in period 1 exceeds y and consumption in period 2 is less than y . That is, the country borrows from abroad since the effective market rate of interest faced by the household is less than the world rate of interest.

If π is zero, then free trade in the first period ($p_1 = 1$) achieves the first-best allocation of consumption over periods, and if π is unity, then the tariff achieves the first-best. In both these cases, the intertemporal terms of trade for the household are identical to the foreign terms, $(1 + r)$, so that there is no intertemporal distortion and consumption is the same in each period. When π is between zero and one, there is a welfare loss due to the intertemporal distortion created by the government's lack of credibility under either free trade or the tariff.

In this model, any policy which brings the effective rate of interest for households into equality with the world rate of interest eliminates the intertemporal distortion and achieves the first-best outcome. One such policy is an intermediate tariff which yields a domestic relative price of the

importable between one and p . However, our motivation is the problem of trade liberalization when the private sector is skeptical about the government's resolve to stay with the liberal regime. If the private sector assesses probability π to a return to the old status quo and probability $1-\pi$ that whatever liberalized regime is chosen will be maintained, then our set-up is a simple representation of the optimizing government's problem. The two possibilities perceived by households are simply normalized to yield relative prices, 1 or p . Therefore, we exclude the possibility that the true government can select a tariff rate other than one of the two rates the false government might select.

Other policies which alleviate the intertemporal distortion are capital controls, as noted by Calvo (1987). An optimal policy is to impose a tax on foreign borrowing (lending) along with free trade (tariff), so that consumption is just equal across periods. In the presence of a static distortion under a tariff (substitution in production or consumption), free trade and a tax on foreign borrowing of the appropriate magnitude can achieve a first-best allocation. For the remainder of this paper, we assume that capital controls are infeasible, or that taxes on international asset transactions can be evaded.

The government chooses between free trade and the tariff to maximize household utility, cognizant of how the household subsequently consumes and saves. The value of social welfare in the case of free trade in the absence of learning is given by a function of the household's prior beliefs, π :

$$W_1(\pi) = U(c_1) + \beta U(c_2) \quad (4)$$

such that

$$U'(c_1) = \phi \cdot U'(c_2), \quad \text{and} \quad (5)$$

$$c_1 + (1+r)^{-1}c_2 = y(1 + (1+r)^{-1}), \quad \text{where} \quad (6)$$

$$\phi \equiv \pi(1/p) + (1-\pi).$$

The function ϕ is the ratio of the world market discount factor to the domestic effective discount factor and is always less than or equal to one. $W_1(\pi)$ achieves a maximum for π equal to zero and is monotonically decreasing in π . To see this, note that differentiation of eqs. (4), (5) and (6) yields

$$dW_1/d\pi = [U'(c_1) - U'(c_2)]U'(c_2)((1/p) - 1)/[U''(c_1) + U''(c_2)(1+r)\phi].$$

Eq. (5) implies that $U'(c_1) < U'(c_2)$, so that, with strict concavity of $U(c)$, $dW_1/d\pi < 0$, for all $\pi > 0$.

Social welfare when the tariff is imposed is given by

Fig. 1

$$W_p(\pi) = U(c_1) + \beta U(c_2) \quad (7)$$

such that

$$U'(c_1) = p \cdot \phi \cdot U'(c_2), \quad \text{and} \quad (8)$$

$$c_1 + (1+r)^{-1}c_2 = y(1 + (1+r)^{-1}), \quad (9)$$

where $p \geq p \cdot \phi \geq 1$. $W_p(\pi)$ is monotonically increasing in π . This is derived from differentiation of eqs. (7), (8) and (9) which yield

$$\begin{aligned} dW_p/d\pi \\ = [U'(c_1) - U'(c_2)]U'(c_2)(1-p)/[U''(c_1) + U''(c_2)(1+r)p\phi]. \end{aligned}$$

Since in this case (8) implies that $U'(c_1) > U'(c_2)$, $dW_p/d\pi > 0$, for all $\pi < 1$.

The values of social welfare are depicted in fig. 1 for both the free trade and tariff cases. When $\pi=0$ (the case in which the public believes with certainty there will be no tariff next period), $W_1 > W_p$ because there is no distortion in the absence of a tariff, while a tariff introduces an intertemporal distortion. When $\pi=1$, $W_p > W_1$. In that case, the public is certain there will be a tariff next period, so that the distortion is eliminated if there is a tariff imposed this period. Note that the largest value that π can take on is q .

If the private sector's beliefs in period 1 are that the joint probability of the government being false and imposing a tariff in period 2 is greater than π^* (the value of π such that $W_1 = W_p$), then the true optimizing government will impose a tariff in the first period. Otherwise, free trade in the first period will be optimal. Hence, fig. 1 demonstrates the proposition that free trade is not necessarily the optimal policy if there is a distortion created simply by

the lack of credibility of government policy. However, if q is low enough, then all values of π may be less than π^* . If the false government imposes a tariff with low enough probability, free trade will be optimal initially.

Example 2.1. Let utility display constant relative risk aversion with the coefficient of relative risk aversion equal to two:

$$U(c) = -c^{-1}.$$

In this case, $W_1(\pi^*) = W_p(\pi^*)$ implies that $\pi^* = \sqrt{p}/(\sqrt{p} + 1)$, where p is the domestic price-cum-tariff of the consumable. For all $\pi > \pi^*$, $W_1(\pi) < W_p(\pi)$, and for all $\pi < \pi^*$, $W_1(\pi) > W_p(\pi)$. For example, if $p = 1.25$, then $\pi^* = 0.528$.

Up to this point we have merely formalized Calvo's (1989, pp. 218–219) brief argument that in the presence of imperfect credibility, a tariff in the initial period may be optimal. The lack of credibility causes an intertemporal distortion if it causes next period's expected price to be different from today's price. The government may choose a tariff to minimize that distortion. The model we have set up in this section can be easily amended to consider the effects of learning about the type of government. We turn to this in the next section.

3. Two-period, single consumable model with learning

We now introduce learning by the private sector about the government's type using Bayes' Rule. The household updates its beliefs about the type of government given the observation that if the government is the true one, it has acted optimally in the first period. The updating rules given that free trade or a tariff is optimal for the true government are straightforward. We assume that the government knows the household's prior beliefs and that the household recognizes that the true government chooses between the tariff and free trade optimally given the posteriors that will be formed by the household.

If the parameters of the economy are such that a tariff is optimal for the first period, then the prior probability that a tariff is imposed in period 1 is given by

$$q(1 - \lambda_0) + \lambda_0,$$

where λ_0 is the prior probability that the government is the true type. This prior comes from the facts that true government chooses a tariff with probability one (because we are talking about the case in which a tariff is optimal) and the false government chooses a tariff with probability q (it has

the same probability of choosing a tariff in period 1 and period 2). Using Bayes' rule, the posterior that the government is the true one once it is revealed that there is a tariff in place in period 1 is

$$\bar{\lambda}_1 = \lambda_0 / [q(1 - \lambda_0) + \lambda_0].$$

Therefore, the posterior π , the subjective probability that a tariff will be imposed in period 2, in this case is

$$\bar{\pi}_1 = q(1 - \bar{\lambda}_1) = q^2 \pi_0 / [q - (1 - q)\pi_0],$$

where π_0 was the prior probability of a tariff in period 2 [the subjective probability of a tariff in period 2 before the tariff in period 1 was revealed $= q(1 - \lambda_0)$]. This is because the probability that the true government will impose a tariff in the second period is zero, while the probability that the false one will is q .

In other words, households know what the true government would do if it were in power. They know the parameters of the model, so they know if a tariff is the optimal choice by the true government if it is in power. In this case it is optimal to put on a tariff. Prior to observing the tariff that is actually chosen by the true government, households have some prior probability that the true government is in power. After it is revealed that a tariff is imposed in period 1, they update their priors. Consumption decisions are made in period 1 after the tariff is revealed. Because the (true) government has full information, they make their tariff choice in period 1 knowing how consumers will update their priors.

If the parameters of the economy are such that free trade is optimal in period 1, then the prior probability that free trade will be observed is

$$(1 - q)(1 - \lambda_0) + \lambda_0.$$

The posterior probability that the government is the true one, after having observed free trade in period 1 is

$$\hat{\lambda}_1 = \lambda_0 / [(1 - q)(1 - \lambda_0) + \lambda_0].$$

Therefore, the posterior π , the subjective probability of a tariff being imposed in period 2, in this case is

$$\hat{\pi}_1 = q(1 - \hat{\lambda}_1) = (1 - q)\pi_0 / (1 - \pi_0).$$

For $0 < \pi_0 < q$, both $\bar{\pi}_1$ and $\hat{\pi}_1$ are less than π_0 . Note that $\bar{\pi}_1 \neq \hat{\pi}_1$ for a given prior π_0 , as long as λ_0 exceeds zero.

This model is a game of incomplete (one-sided) information between the true government and the household. A subgame perfect equilibrium exists without resort to specifying off-equilibrium path conjectures if q is between zero and one and λ_0 is less than unity (Bayes rule is applicable always).

There will be a prior π_0 , call it $\tilde{\pi}$, that gives rise to posteriors such that $W_1(\tilde{\pi}) = W_p(\tilde{\pi})$. This is the point where the government is just indifferent between putting on a tariff or not. For greater prior probabilities of a tariff it will definitely put on a tariff, and for lesser prior probabilities it will definitely not put on a tariff. The following proposition shows that $\tilde{\pi} > \pi^*$. That is, the prior probability that makes them indifferent between putting on a tariff and not with learning is greater than the prior probability that made them indifferent without learning. Hence, with learning, the household has to be initially more skeptical before the government is induced to put on a tariff in period 1.

Proposition 1. If $0 < \lambda_0 < 1$, the prior $\tilde{\pi}$ such $W_1(\tilde{\pi}) = W_p(\tilde{\pi})$ exceeds the prior π^* such that $W_1(\pi^*) = W_p(\pi^*)$ in the absence of learning.

Proof. See appendix.

The intuition behind this proposition is straightforward. The intertemporal distortion caused by lack of credibility is reflected in the fact that next period's expected price exceeds one by the expected tariff. If the expected tariff is high enough (which occurs in part because the perceived probability of the false government being in power is high), then it may be desirable to impose a tariff in the initial period in order to minimize the distortion. If the expected probability of a tariff next period is low, then next period's expected price is close to one. In that case, the true government imposes no tariff initially. When there is Bayesian learning, the belief that it is the true government that rules is always stronger than when there is no learning, since the true government's initial action always helps to reveal itself as the true government. This is true no matter what the true government's action is, so long as it is optimal, since households can calculate what the government would do optimally. Since the probability of a tariff next period is lower, the expected price next period is lower. Hence, there are fewer circumstances under which it is desirable to impose a tariff in the initial period.

This proposition implies that if the government chooses policy optimally, it becomes less likely that the government will need to impose a tariff. When government follows an optimal plan, that helps to signal to the public that it is acting on the public's behalf. The public becomes more convinced of the beneficence of the government merely by observing the government's actions. Calvo (1987) performs some calculations that demonstrate that liberalization that is believed to be temporary can be significantly costly. Our theorem

implies that those set of prior beliefs that would yield greater benefits from non-liberalization in the Calvo model could imply that liberalization is desirable in the learning model.

Example 3.1. Consider the utility function from the example in section 2: $U(c) = -c^{-1}$. With no learning, and $p = 1.25$, we had $W_p(\pi^*) = W_1(\pi^*)$ when $\pi = 0.528$. With learning, the prior π_0 for which $W_p(\bar{\pi}) = W_1(\hat{\pi})$ depends on q . Below are some possible values of q (note that q must be > 0.528 if $\pi_0 = 0.528$) and the associated values of π_0 that lead to $W_p(\bar{\pi}) = W_1(\hat{\pi})$: ($p = 1.25$, $r = 0$).

q	π_0
0.55	0.539
0.60	0.563
0.65	0.587
0.70	0.612
0.75	0.640
0.80	0.671
0.85	0.707
0.90	0.753
0.95	0.818

So, for example, if $q = 0.80$, then free trade is optimal for all prior probabilities of a tariff, π_0 , less than 0.671. In the absence of learning, a tariff would have been optimal for all priors greater than 0.528.

Remark 3.1 Expected utility is not necessarily higher in the world with learning than in the world without learning, for the same priors. Because the unconstrained first-best is unattainable, learning can exacerbate the distortion in resource allocation created by incredulity. If it is optimal for the true government to impose a tariff in the first period, so $p_1 = p$, without learning, and it is also optimal to impose a tariff (so $p_1 = p$) when there is learning, then welfare falls. With learning, the expected tariff falls, so the expected price in period 2 is closer to one. If it is still optimal to set the price at p in period 1, then the distortion is larger, since p now deviates more from the expected price. If free trade were optimal with no learning, then learning raises welfare. If $p_1 = p$ without learning and $p_1 = 1$ with learning, then the change in welfare is ambiguous.

4. Extension to many periods

The two-period economy can be extended to an arbitrarily long finite horizon model. With learning by the private sector, as the government makes its optimal choice each period, the prior probability that it is the false type is

reduced. This holds if the optimal choice is free trade or tariff imposition in every period (as long as the private sector places positive probability on the government being either type and q is between zero and one). When the household updates its beliefs about the government's type after observing the policy chosen each period, free trade will eventually become the optimal policy choice for all remaining periods, if the horizon is long enough.

The multiperiod extension of the model is straightforward. The household seeks to maximize

$$E\left(\sum_{t=1}^T \beta^t U(c_t)\right)$$

with respect to its consumption plan, $\{c_t\}_{t=1}^T$, subject to the budget constraint

$$\sum_{t=1}^T (p_t c_t / (1+r)^t) \leq \sum_{t=1}^T ((R_t + y) / (1+r)^t), \quad (10)$$

where $R_t \equiv (p_t - 1)c_t$ and $\beta = (1+r)^{-1}$. The expectation is taken over the sequence of domestic relative prices, $\{p_t\}_{t=1}^T$, which are random variables for the incredulous household. The household knows the objective of the true government (but assesses less than probability one to the government being this type), so it can calculate the sequence of policies that would be chosen by the true type.

At time τ , the true government's objective is given by

$$W^\tau = \sum_{t=\tau}^T \beta^t U(c_t), \quad (11)$$

where c_t is the actual consumption at time t of the household given the policies chosen. The government selects a policy response, $\{p_t\}_{t=1}^{T-1}$, which is the optimal time consistent plan given the updating rules and time 0 prior beliefs of the private sector, when free trade is chosen in the last period ($p^T = 1$).

Each period that the true government chooses the policy which is optimal, the household's prior belief, λ , that it is the true type increases. By the Bayesian updating rules, there is a finite number of periods needed until λ exceeds any particular value less than unity. Therefore, even if the tariff is an optimal policy initially, for a large enough T credibility rises enough so that

free trade becomes the optimal policy for every period after a bounded number of periods. This is summarized as:

Proposition 2. For the multi-period problem, if $\lambda_0 > 0$, then the number of periods such that the tariff is optimal is bounded. There is a horizon T such that there exists a number $K < T$ such that after K periods, free trade is the optimal time consistent policy for the remainder of the game. K will depend upon the parameters of the model.

Proof. See appendix.

Remark 4.1. The dynamic behavior of saving and the current account can be inferred. If tariff imposition is optimal given initial prior beliefs, then saving is positive since the private sector perceives a positive probability of a future switch to free trade. As the belief that the government is the true type increases with learning, the intertemporal distortion created by current tariffs increases because the perceived probability of future trade liberalization is larger. The current account surplus rises as the date of permanent (for the remainder of the horizon) liberalization by the true government is approached. Once tariff elimination is optimal (and implemented by the true government), dissaving begins because the household still places a positive probability on the existence of the false type of government (and, therefore, a possible reimposition of the tariff).

Remark 4.2. The proposition shows that there is a bound on the number of periods until the true government should optimally liberalize trade permanently (that is, for the remainder of the planning horizon). However, it does not show that the first period in which free trade is optimal is the beginning of permanent liberalization. The government's problem is non-convex, so there may be switches between free trade and tariffs. The result that free trade becomes optimal eventually for every remaining period holds despite this non-convexity. (Remark 4.1 applies to the dynamics immediately prior to and after the final liberalization.)

5. Conclusion

When a government is in power that wishes to maximize the welfare of consumers, but the consumers do not believe that is the government's goal, a distortion is introduced into the economy. In the models we have examined, the misperception is about future tariff policy. The incredulity of households creates an intertemporal distortion.

A first-best policy to remove this distortion – such as a tax on foreign borrowing – is not available to the government. As a second-best policy it

may be desirable to impose a tariff, if the atemporal distortion is smaller than the intertemporal distortion.

The optimizing government cannot reach the first-best solution under the constraints we have postulated. Therefore, even when it implements the best policy among the ones it has at its disposal, a distortion remains. However, we have shown that the mere act of choosing policy increases the government's credibility. This is true even if the optimal policy is to choose a tariff currently. A government cannot achieve credibility instantaneously – it must do so over time by choosing the policy which is best for the public. The public will begin to recognize the beneficence of the government, even if it is imposing a tariff, if that tariff is the best choice the government can make. (The irony is that the skepticism of the public is what forces the government to choose a tariff, and is what keeps the economy away from an unconstrained Pareto optimum.)

The presence of learning generally weakens the case for a tariff as a policy to deal with the intertemporal distortion caused by household's incredulity. The public must initially be more skeptical about the good intentions of the government (as compared to the case without learning) for it to be optimal to impose a tariff. In addition, eventually a policy of permanent free trade becomes optimal when there is learning. When there is learning, a government taking optimal actions will at worst reveal nothing about itself [as in the pooling equilibrium of Rodrik (1989)], but in general will raise the perceived probability that it is a government that is acting in the interest of households. When it does that, it reduces the distortion caused by lack of credibility and makes it more likely that policies that are closer to the non-distortionary first-best policies should be followed.

Appendix

A.1. Proof of Proposition 1

First we will consider the case of $q \neq 1/2$ (we will consider the special case of $q = 1/2$ below). In this case, $\hat{\pi} \neq \bar{\pi}$, since $\hat{\pi} = \bar{\pi}$ if and only if $q = 1/2$.

In the text we show that $W_1(\pi)$ is monotone decreasing and $W_p(\pi)$ is monotone increasing, and that for some $\pi = \pi^*$ between 0 and 1, $W_1(\pi^*) = W_p(\pi^*)$.

If $W_1(\hat{\pi}) = W_p(\bar{\pi})$ and $\hat{\pi} \neq \bar{\pi}$, then $\max\{\hat{\pi}, \bar{\pi}\} > \pi^*$. (See fig. 1.)

Recalling that $\bar{\pi} = q^2 \pi_0 / [q - (1-q)\pi_0]$ and $\hat{\pi} = (1-q)\pi_0 / (1-\pi_0)$, we see that $\hat{\pi} < \bar{\pi} < \pi_0$ if $q > 1/2$, and $\bar{\pi} < \hat{\pi} < \pi_0$ if $q < 1/2$.

Hence, $\tilde{\pi}_0 > \pi^*$ in this case.

Now take the special case of $q = 1/2$. Then $\hat{\pi} = \bar{\pi} = \pi^* = \tilde{\pi}_0 / 2(1 - \tilde{\pi}_0)$, or

$$\tilde{\pi}_0 = 2\pi^* / (1 + 2\pi^*).$$

Since $q = 1/2$, $\pi^* = q(1 - \lambda^*) < 1/2$. But then

$$\pi^* < 2\pi^*(1 + 2\pi^*) = \tilde{\pi}_0.$$

A.2. Proof of Proposition 2

The household solves a dynamic programming problem for its consumption plan, $\{c_t\}_{t=0}^T$, which can be written as

$$V_t(\lambda_t, p_t) = \max_{c_t} \{U(c_t) + \beta E[V_{t+1}(\lambda_{t+1}, p_{t+1}) | \lambda_t, p_t]\},$$

$$\text{s.t. } b_{t+1} = (1+r)b_t + y + R_t - c_t \quad \text{and}$$

$$\lambda_t = f(\lambda_{t-1}, p_t)$$

[with $b_1 = 0$, and the lifetime budget constraint (10)], where $f(\lambda_t, p_t)$ is just Bayes' rule, which is continuous in λ_t (for $0 \leq \lambda_t \leq 1$) for a given p_t . Because $U(c_t)$ is continuous and strictly concave, c_t is continuous in λ_t (by Berge's maximum theorem). By repeated application of Bayes theorem, λ_t is continuous in λ_0 given $\{p_s\}_{s=1}^T$. The government maximizes $W^1 = \sum_{t=1}^T \beta^t U(c_t)$, with respect to $\underline{p} = \{p_t\}_{t=1}^{T-1}$ (recall $p_T = 1$), which is therefore continuous in λ_0 . Hence, $W(\lambda_0) = \max_{\underline{p}} (W^1)$ is continuous in λ_0 (again by Berge's maximum theorem) for $0 \leq \lambda_0 \leq 1$.

Denote the value of a given policy choice $\alpha = \underline{p}$, given λ_0 , for the true government by $W_\alpha(\lambda_0)$, the discounted stream of current period utility attained when this policy is followed. For $\lambda_0 = 1$, $W_\alpha(1)$ is maximal for the policy $\hat{\alpha} = \{p_t = 1\}_{t=1}^{T-1}$ (with $p_T = 1$). For any different policy sequence, α , we have $W_\alpha(1) < W_{\hat{\alpha}}(1)$. By the continuity of W in λ_0 , there is an interval $I_T = [\lambda_0^*, 1]$ such that for the T horizon problem, if $\lambda_0 \in I_T$, then the optimal policy is $p_t = 1$ for all t . This policy is also time consistent.

Bayes rule relates the prior for period s to the prior for period $s-1$. The updating rules are the same as for the two-period problem because the probability of the true government imposing a tariff is always either zero or one, depending on the parameters, and the probability of the false government imposing a tariff is q .

$$\text{If } p_s = p, \text{ then } \lambda_s = \lambda_{s-1} / [q(1 - \lambda_{s-1}) + \lambda_{s-1}].$$

$$\text{If } p_s = 1, \text{ then } \lambda_s = \lambda_{s-1} / [(1-q)(1 - \lambda_{s-1}) + \lambda_{s-1}].$$

For $0 < \lambda < 1$, λ_t is strictly increasing. Therefore, for any initial value $\lambda > 0$, there will be a finite number of periods for which the true government makes

its policy choice until $\lambda_t \in [\lambda_0^*, 1]$. Call this number K ; now let the horizon be $T' = K + T$.

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