Habits and Durability in Consumption, and the Effects of Tariff Protection

by

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Abstract

Some recent empirical findings are used to motivate employing a model in which consumption exhibits durability, and habits develop over the flow of services provided by them, in order to study the effects of tariff protection on the current account. Durability leads to adjacent substitutability in consumption, while habits are assumed to lead to adjacent complementarity. If durability effects are dominant in the short run, and habit effects in the long run, then tariffs will lead to a current account surplus, which will be followed by a deficit. In the opposite case a deficit will be followed by a surplus.

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I. Introduction

An important empirical finding is that tariff protection has an ambiguous effect on the current account. This has been established by, for example, Ostry and Rose (1992), Papageorgiou *et al*. (1990), and Cordon (1987). A number of authors have recently used stylized models in order to point out the possible reasons for this ambiguity.

Razin and Svensson (1983) use a two period model in which the subutility function in each period is different. In their model a tariff affects aggregate savings and the current account by changing the consumption real rate of interest. van Wijnbergen (1987) introduces real wage indexation into the two period model. He shows that with this real wage indexation a tariffs will lead to a more unequal distribution of income over time, and thus impinge upon savings and the current account through the consumption smoothing motive. Ostry (1990) considers the case of *distortionary* tariffs,[1] which reduce real income in the periods in which they are in place, in the two period model with no price rigidities. He too emphasises the effect of such a tariff on savings and the current account coming through the consumption smoothing motive.

Engel and Kletzer (1990) consider the effect of a tariff on the current account in an overlapping generations framework. In that framework the effect of a tariff on the current account depends on how it shifts income among the factors of production, and on whether the tariff revenue is returned to asset holders or wage earners.

Sen and Turnovsky (1989), on the other hand, construct an infinite horizon model with capital accumulation and labour-leisure choice. In their model, tariffs affect the labour supply

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[1] For tariffs to be distortionary they should be large, or they should be in place before the policy change. This will clearly be the case if we are concerned with *trade liberalization*, which is perhaps the more prominent current policy issue.

and, therefore, investment. This, and not changes in savings, affects the current account in their model.

Mansoorian (1993) also uses an infinite horizon model, but in an endowment economy, in order to discuss the role of the intertemporal dependence of preferences through habit persistence (Ryder and Heal (1973)) in determining the effects of tariffs on the current account. In that model instantaneous utility depends not only on current real consumption but also on the habitual standard of living, which is a weighted average of past levels of consumption. As in Ostry, tariffs are assumed to be distortionary. A permanent increase in such a tariff reduces the permanent real income of the representative agent, requiring a fall in the steady state habitual standard of living. If consumption exhibits adjacent complementarity then after the increase in the tariff the representative agent will try to maintain his habitual standard of living, reducing his savings, giving rise to a current account deficit.[2] On the other hand, if consumption exhibits adjacent substitutability then after the tariff increase there will be an increase in savings and a current account surplus.

The principal motivation for the present paper arises from the argument that in order to improve our understanding of the effects of government policies, in general, it is important that the models we use should correspond as closely as possible to the models used in the empirically oriented literature. We use some recent empirical findings in order to improve our

[2] Adjacent complementarity has made the habit persistence model very popular in the asset pricing literature, as it gives rise to a very high degree of consumption smoothing motive. For example, Constantinides (1990) requires a high degree of adjacent complementarity in order to solve the Mehra-Prescott (1985) equity premium puzzle.

understanding of the effects of tariff protection. It is clear, however, that our results will apply to other policies as well.

One important finding is in the asset pricing literature, where it is discovered that models in which consumption exhibits durability, and habits develop over the flow of services provided by them, perform very well with regard to the predictions of the consumption based asset pricing literature (see, for example, Heaton (1995)). In these models durability tends to make consumption in adjacent dates substitutable, while habits tend to make them complementary. Heaton finds that the durability effects are dominant over a period of four months; but they are dominated by the habit effects after that. He concludes that "habit persistence substantially improve the model's ability to fit stock and bond returns *only if local substitution is also present"* (p. 683).

In the present paper we use a two good model with habits and durability in order to discuss the effects of tariff protection.[3] As in Ostry, and Mansoorian (1993), we will be concerned with distortionary tariffs. An increase in such a tariff will reduce the real permanent income of the representative agent. This requires his steady state standards of living, and the stock of durables that are needed to sustain these standards, to fall. With Heaton's findings we will have adjacent substitutability in consumption immediately after the increase in the tariff rate. Thus, immediately after the increase in the tariff there will be a sharp fall in expenditures, and a current account surplus. But this improvement in the current account will be short lived,

[3] Such a model has also been used by Mansoorian (1996) in discussing the well known J-curve phenomenon.

as there will come a time at which the habit effects become dominant. At this point savings will start to fall, and the country will run a current account deficit.

Heaton uses monthly data in his analysis. Equally important empirical findings have, however, been provided by Backus, Kehoe, and Kydland (1994), who document the co-movements between the current account and the terms of trade. They use quarterly (rather than monthly) data, and find that the trade balance is negatively correlated with current and future movements in the terms of trade, but positively correlated with past movements. In a recent paper, Mansoorian (1996) shows that Backus *et al.*'s findings indicate that the habit effects should be dominant in the short run and the durability effect in the long run. Thus, the results documented by Backus *et al.* suggest that an increase in a distortionary tariff should lead to a current account deficit. But this deficit will be followed by a surplus. Of course, it is beyond the scope of this paper to establish which one of these results is more plausible.

The paper is organized as follows. The model is presented in section II. The effects of tariff protection are discussed in section III. Some concluding remarks are made in section IV.

II. The Model

The objective function of the representative agent is a two good variant of that used by Heaton:

$$\int_0^\infty e^{-\theta t}\, U(s_t + \omega_t, h_t)\, dt, \tag{1}$$

where θ is the rate of time preference, and for any time t ω_t is a utility measure of the services provided by the agent's current purchases of the home and foreign goods, c_t^f and c_t^h. It is defined as

$$\omega_t = \omega(c_t^f, c_t^h), \tag{2}$$

where $\omega(\cdot)$ is a homothetic subutility function.

We model s_t as a weighted sum of ω_τ ($\tau < t$), with exponentially declining weights given to more distant values of ω_τ:

$$s_t = \int_{-\infty}^{t} e^{\delta(\tau - t)} \omega_\tau \, d\tau, \tag{3}$$

where $\delta > 0$.

In a one good model, s_t would be a weighted sum of past levels of consumption expenditures. Then, s_t would be the stock of durable goods available at time t, and δ the rate of depreciation of the durables. In the present two good model, on the other hand, ω_τ is a utility measure of the goods purchased at time τ. Modelling durability in this way, instead of durability in each of the two goods separately, will simplify the analysis. Alternatively, one can view this way of modelling durability as attempting to capture an important aspect of preferences, rather than modelling durability *per se*. Note that $s_t + \omega_t$ is the total services of the durable goods that are enjoyed at time t.

From (3) it follows that the evolution of s_t is given by

$$\dot{s}_t = \omega_t - \delta s_t \tag{4}$$

The habitual standard of living are developed over the flow of past consumption services. Thus, h_t is a weighted sum of $(s_\tau + \omega_\tau)$ ($\tau < t$), with exponentially declining weights given to more distant values of $s_\tau + \omega_\tau$:

$$h_t = \rho e^{-\rho t} \int_{-\infty}^{t} e^{\rho\tau} \left[s_\tau + \omega_\tau \right] d\tau, \tag{5}$$

where $\rho > 0$. From (5) it follows that the evolution of h_t is given by

$$\dot{h}_t = \rho \left[s_t + \omega_t - h_t \right] . \tag{6}$$

We maintain assumption (P.1)-(P.5) of Ryder and Heal (pp. 2-3), regarding the momentary utility function. Thus, momentary utility is assumed to be: (P.1) increasing in the current flow of services consumed, $U_1 > 0$; (P.2) non-increasing in habits, $U_2 \leq 0$; (P.3) increasing in uniformly maintained ω, i.e., $U_1(x, x) + U_2(x, x) > 0$ for all $x > 0$; (P.4) concave in its two arguments; and (P.5) $\lim_{x \to 0} U_1(x, h) = \infty$ and $\lim_{x \to 0} [U_1(x, x) + U_2(x, x)] = \infty$.

The production side of the model is kept as simple as possible. We assume that at any point in time the country is endowed with y units of the home good and nothing of the foreign good. The home good is taken to be the numeraire, while the price of the foreign good is fixed abroad at p. The per unit tariff imposed on the imports of the foreign good is γ, giving us $p + \gamma$ as the tariff inclusive price of the foreign good. The world rate of interest, r, and the price of the internationally traded bonds are also fixed abroad. Thus, the flow budget constraint of the agent is

$$\dot{B}_t = rB_t + y - Z_t + T_t, \tag{7}$$

where Z_t is aggregate expenditures at time t, inclusive of the tariff $(c_t^h + pc_t^f + \gamma c_t^f)$, B_t is the country's net foreign asset position, and T_t is the total tariff revenue at time t, which is returned to the representative agent in a lump sum fashion.

Finally, the intertemporal solvency condition,

$$\lim_{t \to \infty} e^{-rt} B_t \geq 0, \tag{8}$$

prevents the representative agent from borrowing without bound.

In what follows, it will be important to keep a clear distinction between aggregate expenditures (Z) and real consumption (ω). The former is the value of goods purchased, while the latter is a utility measure of the services provided by these goods.

The problem of the representative agent is to choose a sequence of consumption levels (c^f_t, c^h_t) in order to maximize his utility, subject to the constraints (4), (6)-(8), and the initial conditions, s_0, h_0, and B_0. As the marginal rate of substitution between the home and foreign goods at any point in time is independent of the consumption levels at other dates, and also the subutility function $\omega(\cdot)$ is homothetic, the agent's maximization problem can be done in two stages. In the first stage, for a given level of expenditures, Z_t, choose c^f_t and c^h_t to maximize $\omega(c^f_t, c^h_t)$ subject to $Z_t = c^h_t + (p+\gamma)c^f_t$. In the second stage choose the values of Z_t.

The first stage of the problem gives the indirect utility function $Z_t V(p+\gamma)$, where $V' < 0$. The second stage of the problem then is

$$\max_{\{Z_t\}} \int_0^\infty e^{-\theta t}\, U(s_t + Z_t V(p+\gamma), h_t)\, dt,$$

subject to (4), (6)-(8), and the initial conditions, s_0, h_0, and B_0. By Roy's identity the consumption of the foreign good at time t is $-Z_t V'/V$, and thus the total tariff revenue at time t is $-\gamma Z_t V'/V$. However, as these revenues are returned to the representative agent in a lump sum fashion, the agent takes T_t as given.

The Hamiltonian for his problem is

$$H = U(s_t + Z_t V, h_t) + \phi_t[Z_t V - \delta s_t] + \lambda_t[\rho(s_t + Z_t V - h_t)] + \mu_t[rB_t + y - Z_t + T_t],$$

where ϕ_t, λ_t and μ_t are the shadow prices of s_t, h_t and B_t, respectively.

The optimality conditions are:

$$H_Z \equiv U_1 V + \varphi V + \lambda\rho V - \mu = 0, \tag{10}$$

$$-H_s + \theta\varphi \equiv -U_1 + \varphi\delta - \lambda\rho + \theta\varphi = \dot{\varphi}, \tag{11}$$

$$-H_h + \theta\lambda \equiv -U_2 + \lambda\rho + \theta\lambda = \dot{\lambda}, \tag{12}$$

$$-H_B + \theta\mu \equiv -r\mu + \theta\mu = \dot{\mu}, \tag{13}$$

and the standard transversality conditions.

From (13) it is clear that a steady state can be reached only if

$$r = \theta. \tag{14}$$

This is a standard assumption that is made in the literature, and we will maintain it from now on. From (13) and (14) it follows that $\dot{\mu}=0$, and that μ is always at its steady state level.

Linearizing (10) around the steady state, using the fact that $\dot{\mu}=0$, we obtain

$$(Z_t - \bar{Z}) = -\frac{1}{V}(s_t - \bar{s}) - \frac{U_{12}}{U_{11}V}(h_t - \bar{h}) - \frac{\rho}{U_{11}V}(\lambda_t - \bar{\lambda}) - \frac{1}{U_{11}V}(\varphi_t - \bar{\varphi}), \tag{15}$$

where bars over variables denote steady state values.

Linearizing (6), (11) and (12) around the steady state, using (14) and (15), we obtain

$$\begin{bmatrix} \dot{h}_t \\ \dot{\lambda}_t \\ \dot{\varphi}_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ 0 & 0 & a_{33} \end{bmatrix} \begin{bmatrix} h_t - \bar{h} \\ \lambda_t - \bar{\lambda} \\ \varphi_t - \bar{\varphi} \end{bmatrix}, \tag{16}$$

where,

$$a_{11} = \frac{-\rho(U_{12} + U_{11})}{U_{11}}$$

$$a_{12} = \frac{-\rho^2}{U_{11}} > 0, \quad \text{by assumption (P.4)}$$

$$a_{13} = \frac{-\rho}{U_{11}} > 0, \quad \text{by assumption (P.4)}$$

$$a_{21} = \frac{(U_{12}^2 - U_{22}U_{11})}{U_{11}} > 0, \quad \text{by assumption (P.4)}$$

$$a_{22} = r + \frac{\rho(U_{11} + U_{12})}{U_{11}},$$

$$a_{23} = \frac{U_{12}}{U_{11}}, \quad \text{and}$$

$$a_{33} = 1 + r + \delta > 0.$$

In the differential equation system (16) h is a state variable, while λ and ϕ are both jump variables. Therefore, for saddlepoint stability of the system the coefficient matrix should have two positive and one negative eigenvalues. For this we need $a_{11}a_{12} - a_{12}a_{21} < 0$, which, given our assumptions (P.1)-(P.4), could be easily satisfied. If ξ is the negative eigenvalue of the coefficient matrix in (16) — that is,

$$\xi = \frac{r - \sqrt{r^2 - 4(a_{11}a_{22} - a_{21}a_{12})}}{2},$$

then the stable path to the steady state will be given by:

$$(h_t - \bar{h}) = (h_0 - \bar{h})e^{\xi t}, \tag{17}$$

$$(\lambda_t - \bar{\lambda}) = \frac{\xi - a_{11}}{a_{12}}(h_0 - \bar{h})\, e^{\xi t}, \tag{18}$$

$$(\phi_t - \bar{\phi}) = 0. \tag{19}$$

To obtain the solution for s_t linearize (4) around the steady state, and then use (15) and (17)-(19), to get

$$\dot{s}_t = -(1 + *)(s_t - \bar{s}) - \mathbf{S}(h_0 - \bar{h})e^{>t}, \quad (20)$$

where

$$\mathbf{S} = \left[\frac{U_{12}}{U_{11}} + \frac{\mathbf{D}}{U_{11}}\frac{> - a_{11}}{a_{12}}\right] = -(1 + >/\mathbf{D}).$$

The solution to (20) is

$$s_t = \bar{s} - \frac{\mathbf{S}}{1 + > + *}(h_0 - \bar{h})e^{>t} + \left[\frac{\mathbf{S}}{1 + > + *}(h_0 - \bar{h}) + (s_0 - \bar{s})\right]e^{-(1+*)t}. \quad (21)$$

To obtain the solution for B_t, first set $T_t = -(Z_t V'/V$ in (7), and linearize the resulting equation around the steady state, using (15), (17)-(19), and (21), to get

$$\dot{B}_t = r(B_t - \bar{B}) + \frac{\mathbf{S}}{V}\frac{> + *}{> + * + 1}\left(1 + (\frac{V'}{V}\right)(h_0 - \bar{h})e^{>t}$$

$$+ \left[\frac{(s_0 - \bar{s})}{V} + \frac{\mathbf{S}/V}{> + * + 1}(h_0 - \bar{h})\right]\left(1 + (\frac{V'}{V}\right)e^{-(1+*)t}.$$

The solution to this differential equation is

$$B_t = \bar{B} + \mathbf{7}_1 e^{>t} + \mathbf{7}_2 e^{-(1+*)t} + \left[(B_0 - \bar{B}) - \mathbf{7}_1 - \mathbf{7}_2\right]e^{rt}, \quad (22)$$

where

$$\mathbf{7}_1 = \frac{\mathbf{S}(* + >)(1 + (V'/V)}{V(1 + > + *)(> - r)}(h_0 - \bar{h}), \quad (23)$$

and

$$\mathbf{7}_2 = -\frac{\mathbf{S}(1 + (V'/V)}{V(1 + > + *)(1 + * + r)}(h_0 - \bar{h}) - \frac{(1 + (V'/V)}{V(1 + * + r)}(s_0 - \bar{s}). \quad (24)$$

Clearly, for (22) to converge we will need

$$\left[(B_0 - \bar{B}) - \mathbf{7}_1 - \mathbf{7}_2\right] = 0, \quad (25)$$

which for given values B_0, h_0 and s_0, shows how $\bar{B}$, $\bar{h}$ and $\bar{s}$ should be related for saddlepoint stability. With this condition, (22) reduces to

$$B_t - \bar{B} = \Omega_1 e^{\theta t} + \Omega_2 e^{-(1+\delta)t}. \tag{26}$$

Equations (17)-(19), (21) and (26) give us the stable path of the model to the steady state equilibrium.

III. The Effects of an Increase in the Tariff Rate

In this section we examine the effects of a permanent unanticipated rise in a distortionary tariff. First consider the steady state of the model, which is characterised by equation (10), and by equations (4), (6), (7), (11), (12), with $\dot{s}=\dot{h}=\dot{B}=\dot{\varphi}=\dot{\lambda}=0$. These are six equations in seven unknowns: $\bar{s}$, $\bar{h}$, $\bar{B}$, $\bar{Z}$, $\bar{\varphi}$, $\bar{\lambda}$, and $\bar{\mu}$. The seventh equation is obtained from (25), which gives us the following relationship for the changes in the steady state levels of the state variables, B, s, and h:

$$d\bar{B} = \frac{\sigma(r+\delta)(1+\tau V'/V)}{V(1+\delta+r)(\theta-r)}\, d\bar{h} - \frac{(1+\tau V'/V)}{V(1+\delta+r)}\, d\bar{s}. \tag{27}$$

Differentiating (4), (6) and (7) in the steady state, and using (27) we obtain

$$\frac{d\bar{h}}{d\tau} = (1+\delta)\frac{d\bar{s}}{d\tau} = \frac{(1+\delta+r)\,\tau\left(2\bar{Z}V'^2/V - \bar{Z}V''\right)}{(1+\tau V'/V)(\delta+r)\left[1-\dfrac{\sigma r}{\theta-r}\right]} \leq 0. \tag{28}$$ [4]

[4] If $E[p+\tau, \bar{\omega}]$ is the expenditure function corresponding to $\omega(c^h,c^f)$ at the initial steady state, then we will have $E_{pp} = [-\bar{\omega}VV'' + 2\bar{\omega}V'^2]/V^3 = [-\bar{Z}VV'' + 2\bar{Z}V'^2]/V^2$. Thus, the numerator of the right hand side of (28) is $(1+r+\delta)\tau VE_{pp}$, which is non-positive as $E_{pp}<0$. The denominator, on the other hand, is positive.

Thus, an increase in the tariff will lead to a fall in the steady state levels of the habitual standard of living ($\bar{h}$) and the stock of durables ($\bar{s}$), provided the tariffs were originally in place. The reason for this is that tariffs are distortionary. Hence, if they are already in place and are increased then the permanent real income of the representative agent will fall. To accommodate this the habitual standard of living, and the stock of durables that are required in order to maintain these standards, should fall.

To understand the resulting adjustment of the current account with both habits and durability it will be instructive to first consider the adjustment in the presence of each one of these effects in isolation. The effects of an increase in **(** in the presence of adjacent complementarity alone are fully worked out in Mansoorian (1993), when condition (22) in that paper is met. With adjacent complementarity the representative individual will want to maintain the habitual standard of living he inherited from the past. Hence, after the increase in the tariff rate savings will fall, and the country will run a current account deficit. The country's net foreign asset position will then decline gradually over time, as shown in Figure (1).

Now consider the adjustment of the model after an increase in the tariff with durability, and no habits. Then preferences will exhibit adjacent substitutability.[5] After the increase in **(** there will be an increase in savings and a current account surplus. The reason for this is as follows. The representative agent has a relatively large stock of durables when he experiences a decline in his permanent income. He, moreover, knows that his steady state stock of durable

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[5] The adjustment of the model in this case will be the same as in Mansoorian when preferences exhibit adjacent substitutability (i.e., when condition (22) in that paper does not hold), with the stock of durables in the present model (s_t) replacing habits in that model (which were denoted by S_t). Again, the reader is referred to that paper for a full discussion. (A sufficient condition for adjacent substitutability in Mansoorian, p. 203, is that an increase in S_t reduces the marginal utility of real consumption.)

goods should fall to accommodate the decline in his permanent income. It is optimal for him to consume the services from the relatively large volume of durables that he has inherited from the past, and to save in order to replace them when their stock has gone down by the appropriate amount. Hence, in that case, after the increase in **(** there is a fall in aggregate expenditures and a current account surplus. The country's net foreign asset position will then increase gradually over time, as shown in Figure (2).

Heaton finds evidence in favour of the durability effects being dominant in the short run (for a period of four months), and the habit effects in the long run. His findings, from Figures (1) and (2), suggest that after the increase in **(** there will be an improvement in the country's net foreign asset position (current account surplus), which will then be followed by a deterioration (current account deficit), as shown in Figure (3). Of course, with the simultaneous presence of both habits and durability the interaction between the two effects will add an additional twist to the dynamics of the model. But this will not alter the general properties of the adjustment process.

The adjustment of the country's net foreign asset position along the stable path is given by (26). The negative eigenvalue **>** in the present model is the same as the eigenvalue in Mansoorian (p. 202), where $(B_t ! \bar{B})$ was proportional to $e^{>t}$ (see equation (18) in that paper). Hence, the presence of the second term on the right hand side of equation (26) in the present paper is due to durability. Moreover,

$$\dot{B}_t \; ' \; > 7_1 e^{>t} \; \& \; (1 \% *) \, 7_2 e^{\&(1 \% *) t}.$$

If we regard the first term on the right hand side of this equation to be due to habits, and the second term due to durability, then we will need $7_1 > 0$ and $7_2 < 0$ in order for the habit effects on B_t to be negative, and the durability effects positive. Heaton's empirical findings suggest that $B_0 > 0$. For this we need $(1+*)7_2 < >7_1$. Finally, for the habit effects to be dominant eventually (i.e., $B_t < 0$ when t is sufficiently large) we will need $(1+*)$ to be much larger than ¦ > ¦. With these assumptions we will have the non-monotonic adjustment of the current account discussed above.

Backus, Kehoe, and Kydland document evidence from various countries which suggest that the trade balance is negatively correlated with current and future movements in the terms of trade, but positively correlated with past movements. In a recent paper, Mansoorian (1996) shows that Backus *et al.*'s findings indicate that the habit effects should be dominant in the short run, and the durability effects in the long run. These findings suggest that after an increase in (the country's net foreign asset position will deteriorate (current account deficit); but eventually it will start to improve (current account surplus), as shown in Figure (4).

IV. Conclusions

In this paper we have used some recent empirical findings in order to improve our understanding of the effects of tariff protection on the adjustment of the current account. Recent results in the asset pricing literature suggest that models in which consumption exhibits durability, and habits develop over the flow of services provided by them, perform well empirically.

Durability tends to make consumption in adjacent dates substitutable, while habits are assumed to make them complementary. We showed that if the durability effects are dominant in the short run and habit effects in the long run, then a tariff protection will lead to a rise in savings and a current account surplus. But this will be short lived, as over time when the habit effects start to become dominant savings will start to fall and there will be a current account deficit. On the other hand, if the habit effects are dominant in the short run and durability effects in the long run, then a tariff protection will lead to a current account deficit, which will then be followed by a surplus.

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