Chapter 8

Introduction to Endogenous Policy Theory

In this chapter we begin our development of endogenous policy theory: the explicit incorporation of a model of politics in a model of the economy, permitting us to analyze the general political-economic equilibrium. In addition to the requirement of a well-specified model of general economic equilibrium (as developed in the chapters 4 through 6), we now need to develop a model of political interaction consistent (both philosophically and mathematically) with the economic model. The construction of such a model requires, minimally, explicit characterization of three fundamental causal relationships: the effect of policy outcomes on the welfare of households (a *theory of policy preferences*); the effect of policy preferences on political action (*a theory of political action*); and the effect of political action on policy outcomes (*a theory of state action*).

With respect to the theory of political preferences, the endogenous policy approach is quite straightforward: we use the structure of the economic model to identify the effect of any given set of policies on household welfare; and, via our assumptions of selfishness, materialism, and rationality, along with our assumptions on the structure of preferences, we generate household evaluations of policies directly from these effects. The main topic of this chapter will be the working out of this logic.

Just as characterizing household preferences over the space of possible consumption bundles does not yield a theory of consumer choice, the theory of political preferences is not sufficient to generate a theory of political action. We need to characterize the constraints on household political action. However, because the policy, once adopted, applies to the economy as a whole and thus affects all households, part of this characterization must come to grips with the fact that the choice is made collectively. In chapters 9 and 11 we consider two alternative technologies of political action: voting and lobbying. The most straightforward mechanism, with full information, is voting. If we assume that the tariff can be characterized as a one-dimensional issue and that there are no voting costs, the theory of political preferences immediately yields a theory of political action for the case of a tariff referendum. From there, we apply a result from formal political theory (Black's median voter theorem) to characterize the full political-economic equilibrium. From this simple base, we can incorporate a wide range of extensions including, for example, voting costs; partisan competition; uncertainty; and franchise restriction. Lobbying models are somewhat more complex because they necessarily involve expenditure of resources on politics. Furthermore, because lobbying fairly naturally entails collective action among agents with similar preferences, a fully satisfactory account would incorporate an explicit analysis of Olson-type collective action problems. Thus, chapter 10 discusses the problem of organizing for collective action.

The theory of state action is the most underdeveloped part of endogenous policy theory. Although existing research refers often to parties, politicians, bureaucrats, and elections, there is in fact very little explicit analysis of what is, in some sense, the supply-side of the political model. Most voting models treat policy determination by simple referendum, while most lobbying models treat policy determination through bribery of politicians with no personal interest in policy outcomes. The analytical virtue of these assumptions is that they permit solution of the general political-economic equilibrium using only information on effective political demand. In the chapters 9 and 11 we will draw on recent research to illustrate how politician preferences and institutional structure can be incorporated in endogenous policy models, and how their inclusion affects results.

The remainder of this chapter is concerned with the derivation of household preferences over tariff policy.

Household Welfare Effects of Commodity-Price Changes

We begin with the general (I-factor × J-good) neoclassical production economy of the sort described in Chapter 5, in which each household ($h \in H$) owns some portfolio of factors (z^h). Now we want to characterize the effect of a change in the commodity-price vector on household welfare. As we saw in chapter 2, economic rationality in the neoclassical model is taken to mean that choice is guided by "well-behaved" preferences as constrained by some budget set. In a description of the household choice problem where prices and income are known, we saw that such preferences may be represented by a real-valued *indirect utiltiy function* relating output prices and income to household welfare, $v^h(p_1,p_2,\ldots,p_N;\gamma^h)$, where each p_j is the price level in one of J industries and γ^h is the income level of the household. The important properties of this function for our discussion are that household welfare is non-increasing in prices, increasing in income, homogeneous of degree zero in prices and income together, and quasi-convex in prices. These properties combine to insure that if income increases proportionally more (less) than all output price levels, then the individual's welfare unambiguously increases (decreases).

The direction of the effects on the welfare of an individual from a marginal increase in any price level may be seen by signing the derivative of the indirect utility function with respect to the price level:

$$\frac{dv^h(\bullet)}{dp_j} = \frac{\partial v(\bullet)}{\partial p_j} + \frac{\partial v(\bullet)}{\partial \gamma^h}\frac{\partial \gamma^h}{\partial p_j}.$$

We may divide through by the marginal utility of income to remove utility units $\left(\text{i.e. } d\psi = \frac{dv(\bullet)}{\partial v(\bullet)/\partial\gamma}\right)$, and use Roy's identity $\left(-x_j = \frac{\partial v(\bullet)/\partial p_j}{\partial v(\bullet)/\partial\gamma^h}\right)$ to get

$$\frac{d\psi^h(\bullet)}{dp_j} = -x_j + \frac{\partial \gamma^h}{\partial p_j}.$$

Now multiply by p_j/γ^h to get an expression in elasticity form:[1]

$$\begin{aligned} \frac{d\psi^h}{dp_j}\frac{p_j}{\gamma^h} &= \frac{\hat{\psi}^h}{\hat{p}_j} = \left(\omega_j^h - \alpha_j^h\right) \\ \hat{\psi}^h &= \left(\omega_j^h - \alpha_j^h\right)\hat{p}_j, \end{aligned} \qquad \textbf{(1)}$$

where we have substituted $\omega_j^h = \frac{\partial \gamma^h}{\partial p_j}\frac{p_j}{\gamma^h}$ (the price j elasticity of nominal income), and $\alpha_j^h = \frac{p_j x_j^h}{\gamma^h}$ (the proportion of household income spent on j). Thus, if the expression in parentheses is positive, an increase in p_j increases household real income and good j is an *unambiguous friend* to the household. Alternatively, the expression in (1) gives *the percentage change in the income of household h that has the same welfare impact as a one percent increase in the price of good j*. Since the $\alpha_j^h > 0$, price increases reduce welfare through the consumption effect for all households, so the key to a welfare increase and differential welfare effects among households must come through the wealth effect.

[1]Ruffin and Jones (1977) develop an expression like this in their analysis of the effect of a tariff-induced price change on the real wage in a specific-factor model.

To understand the wealth effect better, we now express the effect of a price change on household income (ω_h) in terms of its basic components. Households derive their income from renting their factor-endowment to firms. Since we assume that there is no saving or leisure, household income is

$$\gamma^h = \sum_{i \in I} w_i z_i^h. \qquad \textbf{(2)}$$

With household endowment held constant, if we differentiate income with respect to p_j we get

$$\frac{\partial \gamma^h}{\partial p_j} = \frac{\partial r_1}{\partial p_j} z_1^h + \ldots + \frac{\partial r_I}{\partial p_j} z_I^h. \qquad \textbf{(3)}$$

Now multiply both sides by p_j / γ^h and manipulate the right-hand side to get an expression for ω_j^h in terms of Stolper-Samuelson (partial) elasticities and shares of household income derived from factors j $\left(\text{i.e. } \beta_i^h := \frac{w_i z_i}{\gamma^h} \right)$:

$$\begin{aligned} \omega_j^h = \frac{\partial \gamma^h}{\partial p_j} \frac{\partial p_j}{\partial \gamma^h} &= \frac{\partial r_1}{\partial p_j} p_j \frac{z_1^h}{\gamma^h} + \ldots + \frac{\partial r_I}{\partial p_j} p_j \frac{z_I^h}{\gamma^h} \\ &= \frac{\partial r_1}{\partial p_j} \frac{p_j}{r_1} \frac{r_1 z_1^h}{\gamma^h} + \ldots + \frac{\partial r_I}{\partial p_j} \frac{p_j}{r_I} \frac{r_I z_I^h}{\gamma^h} \qquad \textbf{(4)} \\ &= n_{j1} \beta_1^h + \ldots + n_{jI} \beta_I^h = \sum_{i \in I} n_{ji} \beta_i^h \end{aligned}$$

The β_{ij} are non-negative, so the sign of ω_j^h will depend on the signs of the Stolper-Samuelson elasticities (n_{ji}) and the relative magnitudes of the non-zero terms.[2]

If we suppose that every household owns only one factor of production, we can use this

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[2]Recall from Chapter 5 that the n_{ji} can be found as elements of the $N = \Theta^{-1}$ matrix.

framework to demonstrate that every household has at least one unambiguous friend.[3] From equation (3) we can see that, for a household that owns only factor h, the effect of a change in the price of good j on household income is $\omega^h = n_{ji}$ (since $\beta_h = 1$ and $\beta_m = 0 \; \forall \; m \neq h$). Thus, we can use equation (1) to write the effect of a change in the price of good k on the real income of household h as:

$$\hat{\psi}^h = \left(n_{jh} - \alpha_k^h\right)\hat{p}_k. \qquad \textbf{(5)}$$

The real position of household h improves if the term in parentheses is positive. We know, from the analysis in chapter 5, that all factors have (locally) unambiguous enemies, so this term must be negative for some k. So every household has at least one unambiguous enemy. But since N has unit row sums (see footnote 15 in chapter 5), and since all income is spent (so that $\sum \alpha_k^h = 1$), the sum of these coefficients over all k is zero. That is

$$\sum_{k \in J} n_{ki} - \sum_{k \in J} \alpha_k^h = 1 - 1 = 0.$$

But since the summation has at least one negative term, it must have a positive term as well.[4] Thus, the real position of any single-factor household can be raised by an appropriate commodity price rise: *every single-factor household has at least one unambiguous friend*. If there were no

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[3]This analysis is drawn from Cassing (1981).

[4]Note the difference between this result and the result from Jones and Schienkman (1977) presented in Chapter 5. In Chapter 5 it was shown that we cannot prove that every column of N contains an element greater than unity (i.e. that every *factor* has at least one unambiguous friend). What we show here, following Cassing, is that for every *household* there must be a good k such that $n_{kj} > \alpha_k^h$, which obviously does not require that $n_{kj} > 1$. Thus, every single-factor *household* does have at least one unambiguous friend.

costs of acquiring such a price change, household *h* would choose to have price *k* raised.

A satisfactorily general model should permit multiple price changes and households with multi-factor portfolios. At the level of formal representation, there is no particular problem with either of these. The expression for ω_j^h in (3) accommodates multi-factor portfolios, and with multiple price changes, the income equivalent welfare change for household *h* is just the sum of the individual net welfare effects for each sector experiencing a price change given in (1), weighted by the proportional price changes:

$$\hat{\psi}^h = \sum_{j \in J} \left(\omega_j^h - \alpha_j^h \right) \hat{p}_j . \tag{6}$$

What is difficult is saying anything definitive about the sign of (5) in the context of a general $I \times J$ model. As a result, we will generally use more restrictive models involving some combination of low dimensionality and/or strong structure on technology or household factor portfolio structure. However, before turning to such restrictive models, we first discuss the introduction of trade policy into this framework.

Household Preferences over Tariff Policy

We will model a single political outcome that affects the (non-prohibitive) tariff levels in all import industries of a **small, open economy.** Further, we will impose the restriction that relative import prices are held constant, so that a household's consumption of import industry goods (both imported and domestic import competing) may be represented by a composite commodity x_m (representing household spending on importable commodities). Note that this is consistent with our emphasis in the next chapter on change in the protectiveness of the tariff system, not in the dispersion within the system.

A change in policy will therefore affect a tariff level index t, which then affects a household's welfare through both price and income as follows

$$\frac{d\nu^h}{dt} = \frac{\partial \nu^h}{\partial p_M}\frac{\partial p_M}{\partial t} + \frac{\partial \nu^h}{\partial \gamma^h}\frac{\partial \gamma^h}{\partial p_M}\frac{\partial p_M}{\partial t}$$

$$\frac{d\psi^h}{dt} = \frac{\partial p_M}{\partial t}\left(-x_M + \frac{\partial \gamma^h}{\partial p_M}\right)$$

$$= \pi\left(-x_M + \frac{\partial \gamma^h}{\partial p_M}\right)$$

In the second line we eliminate utility units and use Roy's identity as in the derivation of equation (1). To get the third line we use the definition of p_m (=$\pi_m(1 + t)$), from which it follows that $\frac{\partial p_M}{\partial t} = \pi$. Noting that $p = \pi(1 + t)$ so $p/\pi = (1 + t)$, this may be rearranged to get

$$\frac{d\psi^h}{dt} = \gamma^h \frac{\pi}{p_M}\left(\omega_M^h - \alpha_M^h\right) = \frac{\gamma^h}{(1+t)}\left(\omega_M^h - \alpha_M^h\right),$$

where ω_M^h is the wealth effect (the import price elasticity of income) and α_M^h is the consumption effect (the proportion of household income spent on x_m) of a change in import prices. To get this in the same form as equation (3), divide both sides by γ^h and multiply by t:

$$\frac{d\psi^h}{dt}\frac{t}{\psi^h} = \frac{\hat{\psi}^h}{\hat{t}} = \frac{t}{1+t}\left(\omega_M^h - \alpha_M^h\right)$$
$$\hat{\psi} = \frac{t}{1+t}\left(\omega_M^h - \alpha_M^h\right)\hat{t}. \qquad \textbf{(7)}$$

The first term on the right hand side is positive, so the sign of equation (7) is dependent upon the sign of $(\omega_M^h - \alpha_M^h)$, which as we saw above is an income equivalent of the price change. If this expression is positive, and there are no other costs associated with inducing a change in the tariff, a one percent increase in the tariff raises the real income of household *h*. Under the assumptions of our model, household *h* prefers an increase in the tariff.

The alert reader will have noticed that equation (7) does not take account of tariff revenue. If this were the final form of the characterization of preferences over the tariff, we would be assuming implicitly that there is no benefit from increased government revenue.[5] For a variety of reasons this seems sensible. In most countries, the share of tariff revenue in government revenue is extremely small and might reasonably be ignored in the political calculus of most citizens. Alternatively, we might believe that government expenditure is sufficiently wasteful that there is no beneficial effect.[6] For example, we might imagine that tariff revenue is burned, used to construct monuments that yield no household utility to any household, or used to throw a party for politicians and bureaucrats (whose welfare receives a zero weight in social welfare).

At the other extreme, we might want to consider a case in which households benefit from the tariff revenue. For example, the government might provide public or private goods that are positively valued by households. Rather than develop a detailed model of government

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[5]In our political models we will generally not pursue issues related to active seeking of the revenues from the tariff. The main argument for the lack of a political connection is that tariff revenue goes into general revenue, so there is no reason to assume any connection between the politics of tariff-seeking and the politics of revenue-seeking. But note that this issue is distinct from that of whether or not to incorporate tariff revenue in household utility from a tariff.

[6]It should be recalled that our general equilibrium framework does incorporate any costs that derive from economic distortions created by the tariff.

production, we will adopt the simple expedient of assuming that the government simply redistributes the income back to households, without any waste.[7] If we denote by T^h the value of tariff revenue redistributed to household h $\left(\text{so total tariff revenue is } T = \sum_{h \in H} T^h\right)$ household income is now made up of two components: revenue from rental on its endowment of factors; and redistributed tariff revenue. That is:

$$y^h = \mathbf{w} \cdot \mathbf{z}^h + T^h. \tag{8}$$

A particularly convenient assumption is that every household receives a share of tariff revenue (ϕ^h) equal to its share of national income:

$$\phi^h = \frac{\mathbf{w} \cdot \mathbf{z}^h}{\mathbf{w} \cdot \bar{\mathbf{z}}}, \tag{9}$$

so

$$T^h = \phi^h T. \tag{10}$$

Substituting (9) and (10) into (8) allows us to write household income as a simple share of national income:

$$y^h = \phi^h \left(\mathbf{w} \cdot \bar{\mathbf{z}} + T\right) = \phi^h \Gamma. \tag{11}$$

Using equation (11) we can rewrite the household indirect utility function:

[7] Note that this is in no way a maximally positive assumption. We could assume that the government provides public goods that raise social welfare above that derived from simple redistribution. Similarly, the assumption of 100% waste is not maximally negative: the government could produce public bads that reduce welfare beyond that associated with total waste of revenue.

$$\mu_h = \nu^h\left(\mathbf{p}, \phi^h \Gamma\right). \qquad \textbf{(12)}$$

Equation (12) identifies three main channels through which the tariff affects household welfare: directly through its effect on the price vector; and indirectly through its effect on total national income and its effect on the share of household *h* in national income. Since household welfare is decreasing in ***p*** and increasing in household income, equation (12) makes it clear that the effect of the tariff working through ***p*** and Γ is qualitatively identical for all households. If the country is economically small, both of these effects are negative.[8] Thus, to the extent that households experience qualitatively different effects, it must be because household income shares are differentially affected. It is now easy to see that allocation of tariff revenue on the basis of pre-policy income share has the analytical virtue of allowing us to focus our analysis on effects that work through the effect of the tariff on return to household endowments.

In the next section we use a simple 2-factor × 2-good HOS model of the underlying economy to develop our intuition.

The Mayer Model of Household Tariff Preferences in an HOS Economy

Our analysis to this point suggests that, to get a usable characterization of household preferences, we will have to adopt more constraining assumptions. In one of the most important papers in the literature on endogenous trade policy, Wolfgang Mayer (1984) developed one such

[8]As we shall see in Chapter 13, if the country is economically large, then it must have an optimal tariff. Thus, from an initial position of free trade, Γ can be increased by a positive tariff. Of course, if the analysis begins with the government levying the optimal tariff, Γ must fall with a change from that policy. Furthermore, the Metzler paradox refers to a situation in which the imposition of a positive tariff causes the domestic price of the imported commodity to fall.

model.[9] The underlying economy is taken to be an internationally small, HOS economy. That is, there are two factors of production labor (L) and capital (K); fixed endowments of both; both factors are of uniform quality, and both are perfectly and instantaneously mobile between sectors.

$$\bar{\mathbf{z}} = \{\bar{K}, \bar{L}\}.$$

There are two sectors characterized by neoclassical production functions

$$y_j = f^j(K_j, L_j),$$

where both factors are essential and the functions are linear homogeneous, twice differentiable, and strictly concave. There is no joint production and no production externalities.

Recall from Chapter 4 that if there are only two goods, there is only a single relative price, and only relative prices matter to household and firm decision-making. Thus we assume, without loss of generality (relative to this very simple model), that good 1 is the importable in the initial equilibrium and we will write the relative price as $p = \frac{p_1}{p_2}$. Since we have assumed that the economy is small in international markets, the world price is fixed at π, so if the quantity of imports of good 1 is M, and protection is by *ad valorem* tariff at rate t [so $p = \pi(1 + t)$], we can write total tariff revenue as:

$$T = t\pi M. \tag{13}$$

Since our goal is to develop a model of political-economy driven by endowment differences among households, we will abstract from taste differences by assuming that all

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[9]We should also note that the representation of household preferences in equation (12) is also found in this important paper.

households share identical, homothetic preferences. This implies that, faced with the same relative price p, all households will consume goods 1 and 2 in the same proportions. This will dramatically reduce problems of aggregation across households. Furthermore, all households will share the same direct and indirect utility functions. Note, however, that because we are going to assume that households own differing portfolios of capital and labor, it will not be the case that utility is equalized across households, nor, more importantly, will it be the case that households share the same preferences with regard to the tariff.

With regard to household factor portfolios, we will assume that every household is endowed with one unit of L and some non-negative quantity of K

$$L_h = 1 \text{ and } K_h \geq 0, \forall\, h \in H.$$

Both factors are infinitely divisible and perfectly mobile between the two industries. Thus, as in the previous section, household income is derived from factor income and redistributed tariff revenue:

$$y^h = w + rK^h + T^h. \tag{14}$$

The share in tariff revenue is again given by household share in national income, and because there are now only two factors, we can rewrite equation (9) to read:

$$\phi^h = \frac{\left(w + rK^h\right)}{\left(w\bar{L} + r\bar{K}\right)}. \tag{15}$$

This allows us to rewrite equation (11) as:

$$y^h = \phi^h\left(w\bar{L} + r\bar{K} + T\right) = \phi^h\Gamma. \tag{16}$$

As a result, we can rewrite the indirect utility function as:

$$\mu_h = v^h\left(p, \phi^h \Gamma\right). \quad \textbf{(17)}$$

where the only difference between (17) and (12) is that p is no longer a vector.

When the tariff rate is changed, all households experience the same price and aggregate income effects, but if household factor endowments differ their income shares will be differentially affected. To find the effect of a tariff increase on household welfare, substitute $p = \pi(1 + t)$ into (17) and differentiate with respect to t to get:

$$\frac{\partial v^h}{\partial t} = \frac{\partial v^h}{\partial y^h}\left[-\phi^h \pi D_1 + \phi^h\left(\frac{\partial \Gamma}{\partial t}\right) + \Gamma\left(\frac{\partial \phi^h}{\partial t}\right)\right]. \quad \textbf{(18)}$$

To get this result: we use Roy's identity to substitute $-x_1$ for $\dfrac{\partial v^h / \partial p}{\partial v^h / \partial y^h}$; and then we use the fact that with identical homothetic preferences the demand of h'th household for a commodity is just the product of its income share and aggregate demand for that product (i.e. $x_1^h = \phi^h D_1$).

To get an expression for $\partial\Gamma/\partial t$, we need the national income identity:

$$\Gamma = w\bar{L} + r\bar{K} + T = py_1 + y_2 + t\pi M. \quad \textbf{(19)}$$

Now differentiate (19) with respect to t to get

$$\begin{aligned} \frac{\partial \Gamma}{\partial t} &= y_1 \frac{\partial p}{\partial t} + p\frac{\partial y_1}{\partial t} + \frac{\partial y_2}{\partial t} + \pi M + t\pi\frac{\partial M}{\partial t} + tM + \frac{\partial \pi}{\partial t} \\ &= \pi D_1 + t\pi\frac{\partial M}{\partial t}. \end{aligned} \quad \textbf{(20)}$$

To get the second line of (20) we: Substitute $p = \pi(1 + t)$ and differentiate w.r.t. t to get $\frac{\partial p}{\partial t} = \pi$, and use $D_1 = (y_1 + M)$, to get the first term; and use the fact that $\left[p\frac{\partial y_1}{\partial t} + \frac{\partial y_2}{\partial t} \right] = 0$, and the fact that $\frac{\partial \pi}{\partial t} = 0$, by the small country assumption, to get rid of the other terms.

Substitute (20) into (18) to get

$$\frac{\partial v^h}{\partial t} = \frac{\partial v}{\partial y^h}\left[\phi^h t\pi\frac{\partial M}{\partial t} + \Gamma\frac{\partial \phi^h}{\partial t} \right]. \qquad \textbf{(21)}$$

Thus, there are two channels through which household welfare is affected by a tariff increase: changes in the tariff-weighted value of imports, $t\pi\frac{\partial M}{\partial t}$; and changes in the household income share, $\frac{\partial \phi^h}{\partial t}$. We know that a tariff reduces imports, $\frac{\partial M}{\partial t} < 0$, so the first effect is negative, but the second effect depends on the household factor-endowment relative to the national factor endowment.

Unfortunately, there is not sufficient structure in the HOS model to ensure concavity of $v^h(\cdot)$ in t. Thus, *assuming that $v^h(\cdot)$ is strictly concave in t*, the household optimal tariff is found where $\frac{\partial v^h}{\partial t} = 0$. Rearranging (21), we get an expression for the household optimal tariff[10]

$$t^h = -\left[\frac{\Gamma}{\left(\pi\frac{\partial M}{\partial t} \right)} \right]\left[\frac{\left(\frac{\partial \phi^h}{\partial t} \right)}{\phi^h} \right]. \qquad \textbf{(22)}$$

Since - $(\partial M/\partial t) > 0$, the household optimal tariff is positive, zero, or negative as a higher tariff

[10]Appendix 1 develops this analysis for the general case, emphasizing the difficulties with getting determinate results.

raises, keeps constant, or lowers the household income share. Thus, we need to examine the link between t and the ϕ^h.

It should be clear that the relationship between t and ϕ^h will depend on the household endowment, the economy's aggregate endowment and the production structure that links these together. Using the HOS structure, we can differentiate (15) with respect to t to get[11]

$$\frac{\partial\phi^h}{\partial t} = \left[\frac{w\bar{L}}{\left(w\bar{L}+r\bar{K}\right)^2(1+t)}\right]\left[r\left(k-k^h\right)\frac{\left(\hat{w}-\hat{r}\right)}{\hat{p}}\right]. \tag{23}$$

We have used the definitions: $k=\frac{\bar{K}}{\bar{L}}$, $k^h=\frac{K^h}{L^h}$, and $\hat{x}=\frac{dx}{x}$. Given the HOS structure, the Stolper-Samuelson theorem tells us that $\frac{\left(\hat{w}-\hat{r}\right)}{\hat{p}}$ is positive (negative) if good 1 (the importable) is relatively labor (capital) intensive in production. From equation (23) we see that a tariff increase results in a higher (lower) income share for the h'th household if that household, compared to the nation as a whole, is relatively well (poorly) endowed the with import good's relatively intensively used factor of production. Using this result and (22), we can conclude that the household optimal tariff is positive (negative) for households that are relatively well (poorly) endowed with the factor used intensively in the production of the importable good. Furthermore, the greater the difference between the household and the national endowment ratios, the greater the deviation of the household optimal tariff or subsidy from the nationally optimal tariff. Note that the small country assumption means that the nationally optimal tariff is zero. If every household owned only L or K (the standard assumption in much endogenous tariff theory), there would be only two household optimal tariffs--one for all K-owning households and one for all L-

[11]The details of this derivation can be found in appendix 2.

owning households. The optimal tariff rate is zero for each household for which $k^h = k$.

We can represent the effect of a change in the tariff on real income as

$$B^h\left(k^h, t\right) = \frac{\partial v^h / \partial t}{\partial v^h / \partial \gamma^h}. \tag{24}$$

For any given level of t, we can find the Household endowment ratio for which that tariff is optimal. We will denote that Household endowment ratio $\tilde{k}^j$. Using (22) and (23), $\tilde{k}^j$ must be such that

$$t = -\left[\frac{\Gamma}{\pi\left(\frac{\partial M}{\partial t}\right)}\right]\left[\frac{w\bar{L}\left(\hat{w}-\hat{r}\right)}{\left(w\bar{L}-r\bar{K}\right)\hat{p}\left(1+t\right)}\right]\left[\frac{r\left(k-\tilde{k}^j\right)}{w+r\tilde{k}^j}\right]. \tag{25}$$

Now use (21) to get an expression for (24) as

$$B^h\left(k^h, t\right) = \phi^h\left[t\pi\frac{\partial M}{\partial t} + \Gamma\frac{\partial \phi^h / \partial t}{\phi^h}\right]. \tag{26}$$

Now substitute from (25) for t and from (23) for $(\partial\phi^h/\partial t)$, and manipulate to get

$$B^h\left(k^h, t\right) = -\left[\frac{\hat{w}-\hat{r}}{\hat{p}\left(1+t\right)}\right]\left[\frac{\Gamma w r}{\left(w+r\tilde{k}^j\right)\left(w\bar{L}+r\bar{K}\right)}\right]\left[k^h-\tilde{k}^j\right]. \tag{27}$$

Again, recall that the Stolper-Samuelson theorem tells us that $-\left[\frac{\left(\hat{w}-\hat{r}\right)}{\hat{p}}\right] > 0$ for a K-intensive importable good. Equation (27) tells us that a given tariff increase raises (lowers) the h'th household's real income as k^h exceeds (falls short of) the capital-labor endowment of the

Household for which the prevailing tariff is optimal--$\tilde{k}^j$. It is also straightforward to see that, if good 1 is relatively K-intensive, $\frac{\partial B^h}{\partial k^h} > 0$. Nothing in the first two bracketed terms varies with k^h, and the third term is increasing in it.

The logic of this is quite simple, and based on the Stolper-Samuelson theorem: As the price of the *K*-intensive importable is raised by the tariff, the rental rises relative to the wage. Think of this as exploitation of *L* by *K*: every unit of *K* extracts a benefit from every unit of *L*; households that own only *K* always gain from an increase in *t* and households that own only *L* always lose. All other households have a mixed relationship to an increase in the tariff: their units of *K* gain and their units of *L* lose. The household optimal tariff balances these gains and losses at the margin, while movements away from the optimum involve greater losses to one of the factors. Given the strict concavity of $v^r(\cdot)$ in *t* and the linear homogeneity in $\{x_1, x_2\}$, (27) also shows that $\frac{\partial B^h}{\partial t} < 0$. All of this tells us that household preferences are single-peaked over the tariff. Each household has a single most preferred tariff (i.e. the household optimal tariff); and household welfare declines monotonically away from that optimum.

In the next chapter we pursue the implication of this from the perspective of political-economic analysis: if the tariff is set by a referendum, the equilibrium tariff will be determined at the household optimal tariff of the median household. Mayer makes the extremely useful point that the median household is determined in part by the underlying economy (our analysis to this point) and in part by franchise rules. That is, the relevant median preference is the participating median preference. First we will examine the unconstrained median, and then we will consider some political structure-constrained medians.

We would expect an economically/politically rational individual to engage in two kinds of activities: **directly productive and political**. With costly political activity, an individual must make a trade-off between the gains from higher (or lower) industry price level and the cost of attempting to influence government output. An economically rational individual will devote resources to both directly productive and political activities until the marginal benefit from each equals its marginal cost. We have spent the last couple of lectures characterizing economic rationality and its implications in the context of simple general equilibrium models. In the next several lectures we characterize the implications of political rationality, first in voting models and then in lobbying models.

What Evidence Do We Have on Household Trade Policy Preferences?

Appendix 1

Single-Peakedness of Household Policy Preferences

The use of Black's theorem to establish an equilibrium at the most preferred tariff of the median voter requires that household preferences be single-peaked over the tariff. In the text we follow Mayer in assuming that the household indirect utility function is concave in *t*. In this appendix we show why this is not a general property of the neoclassical political-economy model. If tariff revenues are distributed to households, there are two sources of income: returns to factor ownership and ownership of a share of tariff revenues. Letting $\tilde{\omega}^h$ be the portion of the wealth effect coming from factor ownership (i.e., the import price elasticity of factor income), ϕ^h be the share of total tariff revenue going to the household (no longer assumed to equal the share of the household in national income), E_s be the elasticity of this share to changes in import prices, M be the quantity of imports, and E_m be the price elasticity of import demand, we have the following:

$$\frac{dv^h}{dt} = \frac{\partial v^h}{\partial y^h} \frac{y^h}{1+t} \left(\tilde{\omega}_m^h - \alpha_m^h + \frac{\phi^h p_m M}{y^h} \left(1 + \frac{t}{1+t} \left(E_m + E_s \right) \right) \right) = 0.$$

If a household's preferences are such either $\alpha_m > \omega_m$ or $\omega_m > \alpha_m$ for all tariff levels, then their optimal tariff level is simply 0 or 1, respectively, and preferences are obviously single peaked. Given the usual assumptions regarding household preferences for goods and services (as discussed above), the necessary condition for a household optimal general tariff level to fall between 0 and 1, at a given tariff level $\bar{t}$, is that $\omega_m = \alpha_m$. In the neo-classical production models

(Heckscher-Ohlin or specific factors), this could only happen when a particular household has just the right mix of ownership of factors of production, for any given tariff most households would prefer to move [???is this assertion dependent on concavity in *t*???]. The sufficient condition for a household optimal general tariff level is

$$\frac{d^2v^h}{dt^2} = \pi_m \left(\frac{\partial^2 v^h}{\partial p_m^2} + 2\frac{\partial^2 v^h}{\partial y^h \partial p_m}\frac{\partial y^h}{\partial p_m} + \frac{\partial v^h}{\partial y^h}\frac{\partial^2 y^h}{\partial p_m^2} + \frac{\partial^2 v^h}{\partial y^h \partial y^h}\left(\frac{\partial y^h}{\partial p_m}\right)^2 \right) < 0. \quad \textbf{(A1)}$$

We now show that this is true only if:

$$\left((2\omega_m - \alpha_m)(\eta_m - \rho) + e_m - \frac{\omega_m}{\alpha_m}\left(\omega_m(1-\rho) - (1-\Omega_m)\right) \right) > 0. \quad \textbf{(A2)}$$

Expression **(A1)** can be broken up into three parts as follows:

Consumption Effect: The term $\frac{\partial^2 v^h}{\partial p_m^2}$ represents the derivative of the consumption effect alone. By equation (21') of Turnovsky, Shalit, and Schmitz (1980), we know:

$$\frac{\partial^2 v^h}{\partial p_m^2} = \frac{\partial v^h}{\partial y^h}\frac{x_m}{p_m}\left(\alpha_m(\eta_m - \rho) - e_m\right),$$

where ρ is the Arrow-Pratt measure of relative risk aversion, a local measure of curvature, η_m is the income elasticity of import industry goods, and e_m is the own price elasticity of demand for imports[12],[13]

Wealth Effect: The term $\frac{\partial v^h}{\partial y^h}\left(\frac{\partial^2 y^h}{\partial p_m^2}\right)+\frac{\partial^2 v^h}{\partial y^h \partial y^h}\left(\frac{\partial y^h}{\partial p_m}\right)^2$ represents the derivative of the wealth effect alone. First, we can derive

$$\begin{aligned}\frac{\partial \omega_m}{\partial p_m} &= \frac{\partial^2 y^h}{\partial p_m^2}\frac{p_m}{y^h}+\frac{\partial y^h}{\partial p_m}\left(\frac{1}{y^h}-\frac{\partial y^h}{\partial p_m}\frac{p_m}{y^{h2}}\right)\\ &= \frac{\partial^2 y^h}{\partial p_m^2}\frac{p_m}{y^h}+\frac{\omega_m}{p_m}\left(1-\omega_m\right)\end{aligned}$$

which implies that

$$\begin{aligned}\frac{\partial^2 y^h}{\partial p_m^2} &= \frac{\partial \omega_m}{\partial p_m}\frac{y^h}{p_m}+\frac{\omega_m y^h}{p_m^2}\left(\omega_m-1\right)\\ &= \frac{x_m}{p_m}\frac{\omega_m}{\alpha_m}\left(\Omega_m+\omega_m-1\right)\end{aligned}$$

where Ω_m is defined as the elasticity of the wealth effect with respect to import prices.[14] Next,

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[12] We have defined: $\rho=-\frac{\partial^2 v^h}{\partial y^h \partial y^h}\left(\frac{y^h}{\partial v^h/\partial y^h}\right)$, $\eta_m=\frac{\partial x_m^h}{\partial y^h}\frac{y^h}{x_m}$, and $e_m=\frac{\partial x_m^h}{\partial p_m}\frac{p_m}{x_m^h}$.

[13] Also, note that since prices of non-imported goods are unaffected, the usual assumptions on preferences that result in the indirect utility function begin quasi-convex in all prices don't imply anything about the sign of the second derivative of utility with respect to import prices as long as some non-imported goods are consumed.

[14] That is, we define Ω_m as: $\Omega_m=-\left(\frac{\partial^2 y^h}{\partial p_m \partial p_m}p_m\right)/\left(\frac{\partial y^h}{\partial p_m}\right)$.

we have

$$\frac{\partial^2 v^h}{\partial y^h \partial y^h}\left(\frac{\partial y^h}{\partial p_m}\right)^2 = \frac{\partial v^h}{\partial y^h}\frac{\rho}{y^h}\frac{y^{h\,2}}{p_m^2}\omega_m^2$$

$$= \frac{\partial v^h}{\partial y^h}\frac{x_m}{p_m}\frac{\rho\omega_m^2}{\alpha_m}$$

so that

$$\frac{\partial v^h}{\partial y^h}\left(\frac{\partial^2 y^h}{\partial p_m^2}\right) + \frac{\partial^2 v^h}{\partial y^h \partial y^h}\left(\frac{\partial y^h}{\partial p_m}\right)^2 = \frac{\partial v^h}{\partial y^h}\frac{x_m}{p_m}\frac{\omega_m}{\alpha_m}\left(\Omega_m - 1 + (1-\rho)\omega_m\right)$$

Cross Effect: The wealth effect interacts with the consumption effect through the term $2\frac{\partial^2 v^h}{\partial y^h \partial p_m}\frac{\partial y^h}{\partial p_m}$. Using Roy's Identity, we know:

$$\frac{\partial^2 v^h}{\partial y^h \partial p_m} = -\left(\frac{\partial^2 v^h}{\partial p_m^2}\frac{1}{x_m^h} + \frac{\partial v^h}{\partial y^h}\frac{e_m}{p_m}\right).$$

Substituting equation (21') of Turnovsky, Shalit, and Schmitz (1980) and rearranging, we have:

$$2\frac{\partial^2 v^h}{\partial y^h \partial p_m}\frac{\partial y^h}{\partial p_m} = -\frac{\partial v^h}{\partial y^h}\frac{x_m}{p_m}2\omega_m(\eta_m - \rho)$$

Combined Effect: Putting the three above parts together, we have

$$\frac{d^2 v^h}{dt^2} = -\pi_m^2\frac{\partial v^h}{\partial y^h}\frac{x_m}{p_m}\left[(2\omega_m - \alpha_m)(\eta_m - \rho) - e_m + (1-\Omega_m) - (1-\rho)\omega_m\right].$$

All three terms directly following the negative sign starting the expression on the LHS are positive. Thus, the expression in square brackets, which is **(A2)** above, must also be positive for the entire expression to be negative. This is what we wanted to show.

If the sufficient condition is assumed to hold for all tariff levels[15], then preferences are single peaked. If we represented the production side of the economy by the generalized specific factors model with *n* industries, each industry employing a specific and a mobile factor, K_i and L, respectively, then a household's factor income is

$$y^h = wL^h + \sum_{i \in I} r_i K_i^h .$$

Where the factor quantities represent household ownership rather than economy endowments. Defining the proportions of household factor income coming from ownership of K_i and L as β_i and β_L, respectively, the portion of a household's wealth effect coming from factor ownership would be

$$\omega_m^* = \pi_m \sum_{i \in I} \beta_i \varepsilon_{im} + \beta_L \varepsilon_{wm} .$$

where the ε's are output price elasticities of factor returns.[16]

This raises an interesting issue when households are assumed to hold a fixed amount of a single specific factor (or either factor in the Heckscher-Ohlin model). Since all relative import prices are fixed, we may apply the composite commodity theorem to use price indexes p_m and π_m as if

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[15] This is the assumption used in Mayer (1984).

[16] That is, $\varepsilon_{im} = \hat{r}_i / \hat{p}_m$ and $\varepsilon_{wm} = \hat{w} / \hat{p}_m$, where hats (^) represent proportional changes. Note that for all import competing products j, we have $\omega_m = \sum_{j \in J} \omega_j$.

they were prices for single products. Since, in the specific factors model (or the Heckscher-Ohlin model), a household's ω_m^* must be less than zero or greater than one (unless the household's share of tariff revenue is so high that their revenue increase exceeds the lost income due to factor ownership), there will be no tariff level such that $\omega_m=\alpha_m$ and therefore no optimal general tariff level between 0 and 1. The optimal household tariff would be either zero or one, respectively. Without voting costs, each household must therefore be always for a higher tariff level or always for a lower tariff level. For the remainder of this paper, we will simply assume that some production model creates a cleavage where some households have $\omega_m > 0$ and other have $\omega_m < 0$. Further, at a given general tariff level individual households (or household members) will simply have preferences for a higher or lower general tariff level. We will depend upon assumptions regarding voting costs and the distribution of voter preferences (which will assumed to be monotonic) to insure a political/economic equilibrium.

Appendix 2

Using the HOS structure, we can differentiate (15) with respect to *t*, use the quotient rule and the chain rule to get

$$\frac{\partial \phi^h}{\partial t} = \frac{\left(\frac{\partial w}{\partial p}\pi + \frac{\partial r}{\partial p}\pi K^h\right)\left(w\bar{L} + r\bar{K}\right) - \left(\frac{\partial w}{\partial p}\pi\bar{L} + \frac{\partial r}{\partial p}\pi\bar{K}\right)\left(w + rK^h\right)}{\left(w\bar{L} + r\bar{K}\right)^2}$$

Now use: $k = \frac{\bar{K}}{\bar{L}}$ **and** $k^h = \frac{K^h}{L^h} = K^h$, and multiply out π to get:

$$\frac{\partial \phi^h}{\partial t} = \frac{\pi\bar{L}}{\left(w\bar{L} + r\bar{K}\right)^2}\left[\left(\frac{\partial w}{\partial p} + \frac{\partial r}{\partial p}k^h\right)\left(w + rk\right) - \left(\frac{\partial w}{\partial p} + \frac{\partial r}{\partial p}k\right)\left(w + rk^h\right)\right]$$

Now expand the expression in square brackets, cancelling and collecting terms to get:

$$\frac{\partial \phi^h}{\partial t} = \frac{\pi\bar{L}}{\left(w\bar{L} + r\bar{K}\right)^2}\left[\frac{\partial w}{\partial p}r\left(k - k^h\right) - \frac{\partial r}{\partial p}w\left(k - k^h\right)\right]$$

$$= \frac{\pi\bar{L}}{\left(w\bar{L} + r\bar{K}\right)^2}\left[\left(\frac{\partial w}{\partial p}r - \frac{\partial r}{\partial p}w\right)\left(k - k^h\right)\right]$$

Multiply and divide the term in parentheses by *p / w*, and use $\frac{p}{\pi} = \left(1 + t\right)$ to get:

$$\frac{\partial \phi^h}{\partial t} = \frac{w\bar{L}}{\left(w\bar{L}+r\bar{K}\right)^2 \left(1+t\right)} \left[\left(\frac{\partial w}{\partial p} \frac{p}{w} r - \frac{\partial r}{\partial p} p \right) \left(k - k^h\right) \right]$$

$$= \frac{w\bar{L}}{\left(w\bar{L}+r\bar{K}\right)^2 \left(1+t\right)} \left[r \left(\frac{\partial w}{\partial p} \frac{p}{w} - \frac{\partial r}{\partial p} \frac{p}{r} \right) \left(k - k^h\right) \right]$$

Finally, use the fact that the SS elasticities can be written as $\frac{\hat{w}}{\hat{p}}$ **and** $\frac{\hat{r}}{\hat{p}}$ to get:

$$\frac{\partial \phi^h}{\partial t} = \left[\frac{w\bar{L}}{\left(w\bar{L}+r\bar{K}\right)^2 \left(1+t\right)} \right] \left[r\left(k - k^h\right) \frac{\left(\hat{w}-\hat{r}\right)}{\hat{p}} \right]. \qquad \textbf{(23)}$$

This is the expression in the text.