

COMMERCIAL POLICY AND AGGREGATE EMPLOYMENT UNDER RATIONAL EXPECTATIONS*

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Commercial policy is often advocated as a useful tool for combating such macroeconomic ills as unemployment and chronic balance of payments deficits. This paper examines the role of expectations in determining the output and employment effects of various commercial policies. In a rational expectations framework in which workers have incomplete information, it is shown that (i) the short-run output and employment effects of commercial policy changes depend crucially on the correlation between real and nominal wages and that (ii) the use of commercial policy as an instrument of short-run stabilization policy cannot be divorced from its long-run effects on real wages, output, and employment.

I. INTRODUCTION

One of the most persistent arguments against free trade is that tariffs, import quotas, and other protectionist devices are useful tools for combating such macroeconomic ills as unemployment and chronic balance of payments deficits. For example, it has been, and still is, argued that by shifting demand from foreign to domestic goods, a tariff will increase employment and improve the balance of payments. It was this kind of reasoning that led the U. S. Congress to enact the Smoot-Hawley tariffs in 1930 during the early stages of the Great Depression and that two years later resulted in Great Britain ending almost a century of free trade by adopting the Import Duties Act. In recent years, these sentiments have perhaps been part of the intellectual foundation for the "new protectionism." In light of this, it is important to reassess the theoretical basis of these macroeconomic arguments for protection.

The "employment argument" for protectionist policies has been discussed by Mundell [1961], Tower [1973], Boyer [1977], Chan [1978], Eichengreen [1981], and Krugman [1982]. One common element of all these papers, with the exception of Eichengreen [1981] and Krugman [1982], is that they do not discuss the role, if any, played by expectations in determining the output and employment effects of commercial policy. The importance of expectations for macroeconomic stabilization policy has been the

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subject of extensive research in recent years, as documented by Barro's [1981b] survey of the literature on the "new classical macroeconomics." The main focus of this literature has been on the implications of expectations for the conduct of monetary policy. However, recently the discussion has been extended to examine the role played by expectations in determining the effects of policies that directly affect relative prices such as government purchases, shifts between debt and tax finance, and investment tax credits.¹ These analyses, however, have all been carried out within the context of a closed economy. A natural extension of this line of thinking to the open economy is to examine the effects of economy-wide commercial policies that, of course, have a direct impact on relative prices. The aim of this paper, then, is to study the role of expectations in determining the aggregate output and employment effects of various commercial policies.

The significance of expectations for the macroeconomic effectiveness of commercial policy is illustrated by a discussion of the impact of the imposition of a tariff by a small open economy. It is assumed that the country produces two goods, with labor being the only factor of production that is mobile between sectors. This appears to be a reasonable assumption given that the short-run nature of stabilization policy implies that it is geared to take hold within a time span in which other factors of production, particularly capital, are likely to be sector-specific due to the presence of high adjustment costs.² In order to allow for a tariff to have an effect on output and employment at the aggregate level, it is assumed that the supply of labor is positively related to the real wage.³ In order to introduce expectations into the analysis in the simplest manner possible, it is assumed, as suggested by Friedman [1968], that at the time employment decisions are made, workers have only uncertain knowledge of the prices of the goods they will be buying with their wages. Hence the supply of labor facing firms depends on the *expected*, rather than the actual, real wage. Workers' expectations are assumed to be formed rationally in the sense of Muth [1961]. On the other side

1. These issues are taken up by Barro [1979, 1981a], Hall [1979], and Kydland and Prescott [1977, 1980].

2. It may be useful to think of the model outlined in Sections II through IV as an expectations augmented version of the specific-capital model developed by Jones [1971], Mayer [1974], and Mussa [1974].

3. The standard two-sector model of international trade theory is extended by Kemp and Jones [1962] and by Frenkel and Razin [1975] to allow for a variable labor supply.

of the market, firms are assumed to know their output prices at the time employment decisions are made, so that the demand for labor by firms depends on the actual real wage measured in units of their own output as implied by profit-maximizing behavior.

This simple framework yields two main insights into the macroeconomic effects of commercial policy. First, the short-run output and employment effects of commercial policy will depend crucially on whether shocks that have increased nominal wages have ultimately tended to be associated with increased, unchanged, or decreased real wages.⁴ This result arises due to the forecasting problem confronting workers. At the time employment decisions are made, workers do not observe current prices, but they do observe the current nominal wage offers being made by firms. These wage offers convey some information to workers about the current state of the economy and thus help to determine the price level workers expect to prevail in the current period, and hence the expected real wage workers associate with firms' nominal wage offers. Since the solution to this forecasting problem will depend on the nature of the shocks affecting the economy, the impact of commercial policy on employment will also depend on these shocks. The second main insight of the paper, which comes as no surprise in light of the recent literature on the effectiveness of monetary policy, is that the systematic element of tariff policy, and commercial policy in general, will be incorporated into workers' expectations. Therefore, when commercial policy is used as an instrument of short-run stabilization policy, its systematic element will have output and employment effects that are identical to its long-run effects. In the presence of rational expectations it is thus inappropriate for policymakers to dismiss as irrelevant the long-run effects of commercial policy—with such expectations there may be little merit to the frequently voiced claims that commercial policy can “buy time” for the economy to deal with its unemployment problem or for its industries to modernize. This view is in marked contrast to the position taken by the “Cambridge Economic Policy Group,” who claim that the only way many industrialized nations can attain full employment is through a package of policies involving import restrictions as an integral part.⁵

4. The short run is taken to be that period within which workers do not fully perceive price changes.

5. See Eichengreen [1979] for a discussion of the views of the “Cambridge Economic Policy Group.”

The remainder of the paper is organized as follows. Section II discusses the demand for and supply of labor. Section III characterizes labor market equilibrium, focusing on the determination of wages and employment in both the short run and the long run. Section IV lays out the solution to the forecasting problem facing workers and presents a closed-form solution for the short-run equilibrium. The fifth section of the paper examines the effects of a tariff on output and employment in both the short run and the long run and comments briefly on the effects of other types of commercial policies. The sixth section explores the implications of the analysis presented in Sections II through V for the use of commercial policy as a tool of stabilization policy.

II. THE DEMAND FOR AND SUPPLY OF LABOR

In order to derive the demand for labor by firms in a given industry, it is necessary to consider the profit maximization problem they solve. The output of good i at time t , X_{it} , depends on the industry's employment of labor N_{it} , which is assumed to be the only variable input, the state of technology and the employment of fixed factors, both of which are summarized by a parameter A_i , and random elements that affect the production process u_{it} . The random term u_{it} is assumed to be normally and independently distributed with mean zero and variance σ_{ui}^2 . All this is summarized by industry i 's production function:

$$(1) \quad X_{it} = A_i N_{it}^{\beta_i} e^{u_{it}}, \quad 0 \leq \beta_i \leq 1, \quad i = 1, 2.$$

The country in question is taken to be small so that world prices, P_{1t}^* and P_{2t}^* , are taken as given. Profit maximization on the part of competitive firms in industry i subject to the production function (1), the nominal wage W_t , and domestic prices, P_{1t} and P_{2t} , yields the demand for labor by industry i as⁶

$$(2) \quad n_{it}^d = \gamma_{it} - \eta_i(w_t - p_{it}); \quad i = 1, 2,$$

where lowercase letters represent the natural logarithm of their uppercase counterparts,⁷ $\eta_i = 1/(1 - \beta_i)$ is the elasticity of demand for labor by industry i , and $\gamma_{it} = (\ln \beta_i + a_i + u_{it})/(1 - \beta_i)$ reflects factors other than the own real wage, $w_t - p_{it}$, that influ-

6. For simplicity, it is assumed that firms are aware of the random elements affecting their own production function, the u_{it} 's, at the time this maximization problem is solved.

7. This convention is adopted throughout the paper.

ence the demand for labor such as the state of technology, the employment of fixed factors, and random elements affecting the production process.⁸

Given the demand for labor by each sector, it can be shown that the natural logarithm of the economy-wide demand for labor can be approximated by⁹

$$n_t^d = \lambda_1 n_{1t}^d + \lambda_2 n_{2t}^d,$$

where λ_i is the fraction of the labor force employed in sector i (note that $\lambda_1 + \lambda_2 = 1$) and n_t^d is the aggregate demand for labor at time t . Using (2) in this expression yields

$$(3) \quad n_t^d = k_t^d - \eta w_t + \lambda_1 \eta_1 p_{1t} + \lambda_2 \eta_2 p_{2t},$$

where $k_t^d = \lambda_1 \gamma_{1t} + \lambda_2 \gamma_{2t}$ and $\eta = \lambda_1 \eta_1 + \lambda_2 \eta_2$ is the aggregate elasticity of demand for labor with respect to the wage rate.¹⁰

In order to complete the model of the labor market, something needs to be said about the supply of labor. As noted in the introduction, it is assumed that the supply of labor is positively related to the real wage, but that workers have only uncertain knowledge of goods prices at the time they decide whether or not to accept a job offer. This means that the supply of labor facing firms depends on the expected real wage. The price level, or cost-of-living index, at time t is assumed to be a geometric average of the prices of goods one and two, with the weights given by the share of each good in domestic expenditure. Written in natural logarithms, the price level at time t , c_t , is given by

$$(4) \quad c_t = \alpha_1 p_{1t} + \alpha_2 p_{2t},$$

where α_i is the share of good i in domestic expenditure and $\alpha_1 + \alpha_2 = 1$. Thus, the supply of labor at time t , n_t^s , can be written as

$$(5) \quad n_t^s = k_t^s + \varepsilon [w_t - E(c_t | I_t)],$$

where k_t^s reflects random elements affecting the supply of labor (assumed normally and independently distributed with mean zero and variance $\sigma_{k_s}^2$), ε is the elasticity of the supply of labor, and

8. It should be noted that γ_{it} is a normally and independently distributed random variable with mean $(\ln \beta_i + a_i)/(1 - \beta_i)$ and variance $\sigma_\gamma^2 = \sigma_a^2(1 - \beta_i)^2$.

9. An appendix discussing this derivation is available from the author on request.

10. Note that k_t^d is a normally and independently distributed random variable with mean $\lambda_1(\ln \beta_1 + a_1)/(1 - \beta_1) + \lambda_2(\ln \beta_2 + a_2)/(1 - \beta_2)$ and variance $\sigma_{k_d}^2 = \lambda_1^2 \sigma_a^2 + \lambda_2^2 \sigma_a^2$.

$E(c_t|I_t)$ is the price level expected by workers to prevail during period t based on the information set available to them at the beginning of the period I_t . The information set I_t is assumed to include values of all lagged variables, denoted by Ω_{t-1} , and the current nominal wage rate w_t . Workers' expectations are assumed to be formed rationally.

III. A CHARACTERIZATION OF LABOR MARKET EQUILIBRIUM

The demand for and supply of labor was considered in the previous section, and it is natural at this point to examine the properties of labor market equilibrium in both the short run and the long run. The distinction between the two hinges on the definition of the short run as that time period within which workers do not fully perceive price changes. In the long run, however, both firms and workers have complete knowledge of all price movements. This means that workers' expectations regarding the current price level will be an important determinant of wages and employment in the short run, while only actual prices will play a role in the long run.

A. Wages and Employment

Labor market equilibrium at any point in time requires equality between the demand for and the supply of labor; that is, labor market equilibrium requires that

$$n_t^d = n_t^s.$$

With the help of (3) and (5), this condition can be solved to show that the equilibrium nominal wage rate at time t is

$$w_t = k_t + \pi_1 p_{1t} + \pi_2 p_{2t} + \pi_3 E(c_t|I_t),$$

where¹¹

$$\begin{aligned} k_t &= (k_t^d - k_t^s)/(\varepsilon + \eta), \\ \pi_1 &= \lambda_1 \eta_1 / (\varepsilon + \eta), \\ \pi_2 &= \lambda_2 \eta_2 / (\varepsilon + \eta), \end{aligned} \tag{6}$$

and

$$\pi_3 = \varepsilon / (\varepsilon + \eta).$$

11. It should be noted that $\pi_1 + \pi_2 + \pi_3 = 1$, which implies that if nominal prices change by the same proportion, and if these changes are fully perceived by workers, nominal wages will rise equiproportionately and hence real wages will remain unchanged.

The excess demand term k_t is a normally and independently distributed random variable with mean

$$\left[\frac{\lambda_1(\ln \beta_1 + a_1)}{1 - \beta_1} + \frac{\lambda_2(\ln \beta_2 + a_2)}{1 - \beta_2} \right] / (\varepsilon + \eta)$$

and variance $\sigma_k^2 = (\sigma_{kd}^2 + \sigma_{ks}^2)/(\varepsilon + \eta)^2$, where σ_{kd}^2 is as defined in footnotes 9 and 10.

Substituting (6) into (2) and (5) yields expressions for the equilibrium levels of employment in each sector and for the equilibrium level of aggregate employment. These expressions are:¹²

$$(7a) \quad n_{1t} = \gamma_{1t} - \eta_1 k_t + \eta_1(\pi_2 + \pi_3)p_{1t} - \eta_1\pi_2 p_{2t} - \eta_1\pi_3 E(c_t|I_t)$$

$$(7b) \quad n_{2t} = \gamma_{2t} - \eta_2 k_t - \eta_2\pi_1 p_{1t} + \eta_2(\pi_1 + \pi_3)p_{2t} - \eta_2\pi_3 E(c_t|I_t)$$

$$(7c) \quad n_t = \pi_3 k_t^d + (1 - \pi_3)k_t^s + \varepsilon(\pi_1 p_{1t} + \pi_2 p_{2t}) - \varepsilon(\pi_1 + \pi_2)E(c_t|I_t).$$

These expressions are not suitable for analyzing the short-run effects of various shocks because up to this point workers' price level expectations have been treated as exogenous; no account has yet been taken of their dependence on the current nominal wage, which is part of the workers' information set. However, (7a)–(7c) can be used to obtain closed-form solutions for the long-run equilibrium levels of sectoral and aggregate employment.

B. Long-Run Equilibrium

Recall that the long run is being defined as that time period in which both firms and workers fully perceive all price movements. Operationally, this means that in the long run,

$$E(c_t|I_t) = c_t,$$

where the actual price level is given by (4). Through use of this, the long-run equilibrium levels of employment can be found by substituting (4) into (7a)–(7c) for the expected price level. Let a

12. Expressions (7a) and (7b) could be substituted into logarithmic versions of the production functions given in (1) to obtain expressions for the output of each good at time t . However, this is not done explicitly in this paper because the bulk of the analysis is concerned with the effects of price fluctuations. Hence, in the absence of other shocks, the fact that labor is the only variable input implies that the output of good i will vary directly with the level of employment in that sector.

bar over a variable denote its long-run equilibrium (or full current information) value, and note that this yields¹³

$$(8a) \quad \bar{n}_{1t} = \gamma_{1t} - \eta_1 k_t - \eta_1(\pi_2 + \alpha_2 \pi_3)(p_{2t} - p_{1t}),$$

$$(8b) \quad \bar{n}_{2t} = \gamma_{2t} - \eta_2 k_t + \eta_2(\pi_1 + \alpha_1 \pi_3)(p_{2t} - p_{1t}),$$

and

$$(8c) \quad \bar{n}_t = \pi_3 k_t^d + (1 - \pi_3) k_t^s + \varepsilon(\alpha_1 \pi_2 - \alpha_2 \pi_1)(p_{2t} - p_{1t}).$$

Several features of (8a)–(8c) are noteworthy. The long-run levels of employment depend only on real factors such as (domestic) relative prices, tastes, and technology. The role of tastes and technology are reflected by the γ 's and the k 's, while the importance of relative prices is highlighted by the $p_{2t} - p_{1t}$ terms in expressions (8a)–(8c). It can be seen from (8a) and (8b) that a rise in the relative price of a good will lead to an increase in employment in that sector and a decrease in employment in the other sector. However, as shown by (8c), whether an increase in the relative price of good two or an increase in the relative price of good 1 increases aggregate employment depends on the sign of $\alpha_1 \pi_2 - \alpha_2 \pi_1$. π_1 and π_2 have previously been defined, so now it can be seen that an increase in the relative price of good 2, $p_{2t} - p_{1t}$, will increase or decrease aggregate employment as

$$(9) \quad \frac{\alpha_1}{\alpha_2} \cong \frac{\lambda_1 \eta_1}{\lambda_2 \eta_2}.$$

That is, whether or not an increase in the relative price of good two increases or decreases aggregate employment depends on a comparison of the ratio of sectoral expenditure shares α_1/α_2 to the ratio of share-weighted elasticities of labor demand in each sector $\lambda_1 \eta_1/\lambda_2 \eta_2$. The larger the share of good one in expenditure; the larger the fraction of the labor force employed in industry two; the smaller the elasticity of demand for labor in industry one, and the larger the elasticity of demand for labor in industry two; the more likely it is that an increase in the relative price of good two will lead to an expansion of aggregate employment.¹⁴

13. The corresponding solution for the long-run equilibrium nominal wage rate can be found by using (6) to be

$$\bar{w}_t = k_t + (\pi_1 + \alpha_1 \pi_3) p_{1t} + (\pi_2 + \alpha_2 \pi_3) p_{2t}.$$

14. The intuition behind (9) can be seen as follows: Suppose that a 1 percent increase in the relative price of good two occurs as a result of a 1 percent increase in the nominal price of good two on world markets. Whether or not employment increases or decreases depends on whether the nominal wage increase necessary

IV. THE WORKER'S FORECASTING PROBLEM AND SHORT-RUN EQUILIBRIUM

This section of the paper addresses the issue of the endogeneity of workers' price level expectations. The forecasting problem facing workers is solved and interpreted. Then, the solution to this forecasting problem is used to provide closed-form solutions for employment in each sector and for aggregate employment in the short run.

A. The Forecasting Problem

The forecasting problem confronting workers can be formalized by decomposing the current price level as

$$(10) \quad c_t = E(c_t|\Omega_{t-1}) + \xi_t,$$

where ξ_t is a least-squares disturbance term that by the orthogonality principle satisfies $E[\xi_t E(c_t|\Omega_{t-1})] = 0$ and $E\xi_t = 0$; that is, ξ_t is the "surprise" element of the price level. However, workers observe the current nominal wage rate, and the new information it conveys allows them to update their earlier price level forecasts that were based solely on Ω_{t-1} . Application of the recursive projection formula¹⁵ causes the result of this updating process to be written as

$$(11) \quad E(c_t|I_t) = E(c_t|\Omega_{t-1}) + E[\xi_t|w_t - E(w_t|\Omega_{t-1})],$$

where $w_t - E(w_t|\Omega_{t-1})$ is the new information contained in the nominal wage rate. Workers do this, conceptually anyway, by running a regression of ξ_t on the new information contained in the current nominal wage rate. This regression takes the form,

$$(12) \quad \xi_t = \phi[w_t - E(w_t|\Omega_{t-1})] + v_t,$$

to keep the aggregate demand for labor constant exceeds or falls short of that necessary to keep the supply of labor constant. As can be seen from (3), the aggregate demand for labor will remain unchanged only if the nominal wage rate increases by $\lambda_2\eta_2/\eta$ percent. For the supply of labor to remain unchanged, the nominal wage rate must rise by α_2 percent so as to keep real wages constant. Hence aggregate employment will increase or decrease when the relative price of good two rises as $\lambda_2\eta_2/\eta \geq \alpha_2$. Using the definition of η and the fact that $1 - \alpha_2 = \alpha_1$, one can manipulate this expression to yield (9). These results are similar to those found in Kemp and Jones [1962] and Frenkel and Razin [1975] but differ inasmuch as they assume capital to be perfectly mobile between sectors, whereas in this paper capital is taken to be sector-specific.

15. See Sargent [1979, pp. 206-08] for a discussion of this formula. The solution to the forecasting problem presented in this section parallels closely the discussion found in Sargent [1979, pp. 327-28] and is therefore brief.

where v_t is a disturbance term that is orthogonal to $w_t - E(w_t|\Omega_{t-1})$ and has mean zero, and ϕ is a least-squares regression coefficient about which more will be said shortly.

Under the assumption of rational expectations, workers' expectations are taken to be formed in a manner that is consistent with the model which, using (6), implies that

$$(13) \quad w_t - E(w_t|\Omega_{t-1}) \\ = z_t - E(z_t|\Omega_{t-1}) + \pi_3[E(c_t|I_t) - E(c_t|\Omega_{t-1})],$$

where $z_t = k_t + \pi_1 p_{1t} + \pi_2 p_{2t}$. Using (13) in (12), taking the expected value of this expression, and substituting the result into (11) yields

$$(14) \quad E(c_t|I_t) = E(c_t|\Omega_{t-1}) + [\phi/(1 - \pi_3\phi)] [z_t - E(z_t|\Omega_{t-1})].$$

As can be seen from the second term on the right-hand side of (14), which reflects the updating process, the new information conveyed by the nominal wage rate arises from the observation of the linear combination of k_t , p_{1t} , and p_{2t} described by z_t that it allows workers to make.

B. Interpretation of ϕ

As indicated by (14), and as will be brought out in the next two sections of the paper, the magnitude of the regression parameter ϕ plays a crucial role in determining the short-run output and employment effects of changes in commercial policy. For this reason, it is important to understand the factors that determine its magnitude. It is shown in the Appendix that¹⁶

$$(15) \quad \phi = [\alpha_1\pi_1\sigma_1^2 + (\alpha_1\pi_2 + \alpha_2\pi_1)\sigma_{12} + \alpha_2\pi_2\sigma_2^2] / \\ \{\sigma_k^2 + \pi_1(\pi_1 + \alpha_1\pi_3)\sigma_1^2 + [2\pi_1\pi_2 \\ + \pi_3(\alpha_1\pi_2 + \alpha_2\pi_1)]\sigma_{12} + \pi_2(\pi_2 + \alpha_2\pi_3)\sigma_2^2\},$$

where

$$\sigma_k^2 = E[k_t - E(k_t|\Omega_{t-1})]^2, \quad \sigma_i^2 = E[p_{it} - E(p_{it}|\Omega_{t-1})]^2,$$

and

$$\sigma_{12} = E\{[p_{1t} - E(p_{1t}|\Omega_{t-1})][p_{2t} - E(p_{2t}|\Omega_{t-1})]\}.$$

16. Substituting (15) into (14), one can show that the coefficient of $z_t - E(z_t|\Omega_{t-1})$ in (14) is simply the least squares regression coefficient that would be obtained by regressing ξ_t on $z_t - E(z_t|\Omega_{t-1})$. The forecasting problem facing workers could be approached more directly in this manner, but the approach adopted in the text seems to yield more insight into the economics of the problem.

This result can be used to obtain some insight into the factors influencing the magnitude of ϕ .

First, suppose that the only shocks affecting the economy are shocks to tastes and technology so that $\sigma_1^2 = \sigma_{12} = \sigma_2^2 = 0$. In this case (15) indicates that $\phi = 0$. This means that the new information contained in the current nominal wage rate has no effect on workers' price level expectations as shown by (12) or (14). Hence, any increase (decrease) in nominal wage offers that was not predictable based on Ω_{t-1} is taken by workers to represent an increase (decrease) in real wage offers. This makes economic sense because given that domestic prices are not changing, any changes in nominal wages do in fact represent a change in the real wage.

Second, suppose that the only shocks influencing the economy are monetary shocks. In this instance $\sigma_k^2 = 0$, and $\sigma_1^2 = \sigma_{12} = \sigma_2^2$.¹⁷ As can be seen from (15), $\phi = 1$ in this case. This means that any change in the nominal wage rate from its expected value based on Ω_{t-1} feeds one-for-one into the expected price level. Therefore, unexpected nominal wage changes are correctly perceived by workers to represent no change in real wages.

Finally, suppose that the only shocks are due to fluctuations in p_2 so that $\sigma_k^2 = \sigma_1^2 = \sigma_{12} = 0$. Expression (15) indicates that in this case

$$\phi = \frac{\alpha_2}{(\pi_2 + \alpha_2\pi_3)}.$$

Manipulating this expression and using the definitions of the π 's shows that

$$\phi \geq 1 \quad \text{as} \quad \frac{\alpha_1}{\alpha_2} \leq \frac{\lambda_1\eta_1}{\lambda_2\eta_2}.$$

Comparison of this with (9) shows that $\phi \geq 1$ as increases in the relative price of good two decrease or increase aggregate employment in the long run. However, from the labor supply function (5), it can be seen that the impact of changes in p_2 on aggregate employment reflect their impact on real wages. Therefore, it may be concluded that when the only shocks are due to variations in p_2 , $\phi \geq 1$ as increases in the relative price of good 2 are associated

17. The exchange rate regime will of course influence the size of these variances and covariances. Under a fixed exchange rate regime the economy will be subject to world monetary shocks in the long run and to domestic monetary shocks in the short run only to the extent that short-run sterilization is possible.

with long-run real wage decreases or increases. Similarly, it can be demonstrated that when the only shocks are due to variations in p_1 , $\phi \cong 1$ as increases in the relative price of good 1 are associated with long-run real wage decreases or increases. These results can be generalized to yield the reasonable insight that if price shocks are the only shocks affecting the economy, $\phi < 1$ if nominal wage increases triggered by these shocks tend to be associated with long-run real wage increases, and $\phi > 1$ if nominal wage increases triggered by these shocks tend to be associated with long-run real wage decreases.

Up to this point, the discussion of ϕ has focused on special cases where shocks to the economy are of only one kind. However, real world economies are subject to simultaneous shocks of both the real and the monetary variety. This greatly complicates the forecasting problem facing workers and means that, generally speaking, any analysis of the short-run employment effects of changes in commercial policy will depend on the nature of the shocks affecting the particular economy in question. As an empirical matter, it seems fair to say that for many small countries the major source of price fluctuations are the monetary shocks to which they are subject. As long as these monetary shocks are sufficiently important, it is reasonable to assume that nominal prices will tend to move together so that $\sigma_{12} > 0$. Expression (15) indicates that under this condition ϕ will be positive.¹⁸ The previous discussion also indicates that the presence of significant monetary shocks tends to push ϕ toward unity. However, the presence of real shocks means that nominal wage changes will tend, at least to some extent, to be associated with long-run real wage changes. Hence, if nominal wage increases tend to be associated with long-run real wage increases, $\phi < 1$ will hold; while if nominal wage increases tend to be associated with long-run real wage decreases, $\phi > 1$ will hold.

C. Short-Run Equilibrium

Now that the workers' forecasting problem has been solved and interpreted, closed-form solutions for the short-run equilibrium values of the variables of interest can be derived. Using (14) in (6) shows that the nominal wage rate at time t is

18. When $\sigma_{12} > 0$, it can be shown that the term $1 - \pi_3\phi$ appearing in (14) is positive. To see this, use (A7) to show that $1 - \pi_3\phi = \sigma_z^2 / (\sigma_z^2 + \sigma_{\epsilon z})$ and note that $\sigma_{\epsilon z} > 0$ when $\sigma_{12} > 0$.

$$(16) \quad w_t = [1/(1 - \pi_3\phi)] (k_t + \pi_1 p_{1t} + \pi_2 p_{2t}),$$

where for simplicity, it has been assumed that units are such that the predetermined part of the short-run equilibrium nominal wage rate is zero. Using (16) in (7a)–(7c) yields solutions for the short-run equilibrium levels of employment. They are

(17a)

$$n_{1t} = \gamma_{1t} - \frac{\eta_1}{1 - \pi_3\phi} k_t + \frac{\eta_1[\pi_2 + \pi_3(1 - \phi)]}{1 - \pi_3\phi} p_{1t} - \frac{\eta_1\pi_2}{1 - \pi_3\phi} p_{2t}$$

(17b)

$$n_{2t} = \gamma_{2t} - \frac{\eta_2}{1 - \pi_3\phi} k_t - \frac{\eta_2\pi_1}{1 - \pi_3\phi} p_{1t} + \frac{\eta_2[\pi_1 + \pi_3(1 - \phi)]}{1 - \pi_3\phi} p_{2t}$$

(17c)

$$n_t = \frac{\pi_3(1 - \phi)}{1 - \pi_3\phi} k_t^d + \frac{1 - \pi_3}{1 - \pi_3\phi} k_t^s + \frac{\varepsilon(1 - \phi)}{1 - \pi_3\phi} (\pi_1 p_{1t} + \pi_2 p_{2t}).$$

These expressions will be used in the following sections to discuss the short-run employment effects of commercial policy changes and to examine the implications of these results for the use of commercial policy as a tool of stabilization policy.

V. THE EMPLOYMENT EFFECTS OF COMMERCIAL POLICY

The general principles concerning the short-run and long-run employment effects of commercial policy can be illustrated by considering the imposition of a tariff under a fixed exchange rate.¹⁹ In order to introduce tariffs explicitly into the analysis, let good 1 be the home country's exportable good and good 2 be the home country's importable good. Written in natural logarithms, the domestic price of good 2 is

$$(18) \quad p_{2t} = p_{2t}^* + \tau_t,$$

where $\tau_t = \ln(1 + \text{tariff rate at time } t)$.

19. If the exchange rate is flexible, the forecasting problem facing workers may differ in a fundamental way from that outlined in Section IV. For example, suppose that workers observe the contemporaneous exchange rate as well as the contemporaneous nominal wage rate at the time hiring decisions are made. In this instance, their forecast of the current price level will be improved, and it is less likely that the short-run and long-run employment effects of commercial policy changes will differ. In particular, under flexible exchange rates the problem must be recast so as to incorporate workers knowledge about asset market variables. However, as long as workers continue to make forecast errors, the general principles emerging from the discussion of the fixed exchange rate case will continue to hold.

Using this in (17a) and (17b), one can show that when a tariff is levied, the exportable sector contracts, while the importable sector may either expand or contract. The reason for these results is that since nominal wages rise when a tariff is imposed, as shown by (16), the real wage in terms of exportables must rise, while the real wage in terms of importables may fall or rise. A necessary, but not sufficient, condition for the real wage in terms of importables to rise and employment in the importable sector to contract is that $\phi > 1$.

It can be seen by using (18) in (17c) that aggregate employment expands or contracts following the imposition of a tariff as $\phi \leq 1$. Hence if the shocks affecting the economy are such that nominal wage increases tend to be associated with long-run real wage increases ($\phi < 1$), the imposition of a tariff will result in a short-run expansion of aggregate employment. On the other hand, if the shocks affecting the economy are such that nominal wage increases tend to be associated with long-run real wage decreases ($\phi > 1$), the imposition of a tariff will reduce aggregate employment in the short run. Therefore, the short-run employment effects of tariffs and other types of commercial policies depend crucially on the nature of the shocks to which the economy is subject, for it is the nature of the shocks to which workers are accustomed that determines how workers perceive the nominal wage changes brought about by changes in commercial policy to be reflected in real wages.

In the long run the employment effects of a tariff can be found by substituting (18) into (8a)–(8c). Allowing the tariff rate to change yields

$$\frac{\Delta \bar{n}_{1t}}{\Delta \tau_t} = -\eta_1(\pi_2 + \alpha_2 \pi_3) < 0,$$

$$\frac{\Delta \bar{n}_{2t}}{\Delta \tau_t} = \eta_2(\pi_1 + \alpha_1 \pi_3) > 0,$$

and

$$\frac{\Delta \bar{n}_t}{\Delta \tau_t} = \varepsilon(\alpha_1 \pi_2 - \alpha_2 \pi_1) \geq 0.$$

In the long run the imposition of a tariff leads to an expansion of the importable sector and a contraction of the exportable sector. Aggregate employment will rise or fall in the long run as $\alpha_1 \pi_2 - \alpha_2 \pi_1 \geq 0$. This condition was discussed in Section IIIB. It

should be noted that a tariff may move aggregate employment in opposite directions in the short run and in the long run. All that is necessary for this to occur is for $1 - \phi$ and $\alpha_1\pi_2 - \alpha_2\pi_1$ to be of opposite sign.

Finally, it can be shown using (5) that the deviation of actual employment from its long-run level is given by

$$n_t - \bar{n}_t = \varepsilon(w_t - \bar{w}_t) + \varepsilon[c_t - E(c_t|I_t)].$$

From (6) and its long-run equivalent, $\bar{w}_t = k_t + \pi_1 p_{1t} + \pi_2 p_{2t} + \pi_3 c_t$, it can be shown that

$$w_t - \bar{w}_t = -\pi_3[c_t - E(c_t|I_t)].$$

Substituting this into the preceding expression yields

$$n_t - \bar{n}_t = \varepsilon(1 - \pi_3)[c_t - E(c_t|I_t)].$$

From this it can easily be seen that $E(n_t - \bar{n}_t|I_t) = 0$. This means that any change in commercial policy (and tariffs in particular) which is anticipated by workers, or revealed to them by the current wage, will have employment effects that are identical to its long-run effects. The upshot is that when the systematic use of commercial policy is incorporated by policymakers into their short-run stabilization program, it is the long-run results that are relevant. This result is, of course, an extension of Sargent and Wallace [1975], the main difference being that since a commercial policy change is a "real" policy change, it can alter output and employment even in the long run.

The employment effects of other types of commercial policies can be analyzed in much the same manner as those of a tariff. First, consider the employment effects of imposing an export tax. This can be incorporated into the analysis by writing the domestic price of good 1 as $p_{1t} = p_{1t}^* - v_t$, where $v_t = \ln(1 + \text{export tax rate at time } t)$. It can be seen from (17a)–(17c) that the short-run employment effects of an export tax will differ from those of a tariff. The reason for the short-run nonequivalence of export taxes and tariffs is seen most easily from (16). While the imposition of a tariff increases nominal wages in the short-run, the imposition of an export tax decreases nominal wages in the short run. Hence the short-run employment effects of the two will not be equivalent. However, from Lerner's [1936] symmetry theorem it is apparent that the long-run employment effects of an export tax will be identical to those of a tariff. Since a devaluation is equivalent to levying a tariff and an export subsidy at the same rate, the model

can also be used to examine the employment effects of an unanticipated devaluation. Quantitative restrictions on trade can also be studied in a qualitative manner using this framework. This follows from the equivalence theorems established by Bhagwati [1965]. However, a full-blown treatment of the employment effects of quantitative restrictions would require the explicit introduction of domestic (commodity) supply and demand conditions in order to calculate the tariff or export tax equivalent of import quotas and export quotas.

VI. POLICY CONSIDERATIONS

The basic policy conclusion emerging from this paper is that only the unanticipated component of commercial policy will have employment effects corresponding to the short-run effects discussed in Section V. Anticipated, or systematic, components of commercial policy will have effects described by the long-run results summarized by expressions (8a)–(8c). To the extent that major shifts in commercial policy are highly publicized and subjected to heated political debate, it is these long-run results that are relevant for policy discussions.²⁰ Also, to the extent that commercial policy is used in a systematic manner as part of a country's overall stabilization package, these long-run results are once again relevant, unless the government can react more rapidly to new information than the private sector does.²¹ For example, trigger pricing mechanisms might, at least in principle, act much like automatic stabilizers and hence allow commercial policy to respond to new information more rapidly than does the private sector, so that for policy purposes the short-run employment effects outlined in Section V would be relevant.

Before concluding, one word of caution is in order. Even though this paper has demonstrated that commercial policy can be used as a tool of stabilization policy, since, like any real policy, its

20. The model outlined in the body of the paper is applicable to issues other than commercial policy. For instance, the effects of terms-of-trade changes and technology changes on output and employment can be considered within this framework. Since some of these events can be foreseen in the same way that changes in commercial policy can (e.g., future world price trends can be forecast on the basis of the growing capacity of the newly industrialized countries), the long-run results may go a long way toward explaining their output and employment effects.

21. These ideas are of course suggested by Sargent and Wallace [1975] and by McCallum and Whitaker [1979] among others.

systematic element has long-run effects on aggregate employment, it *does not* follow that commercial policy *should* be used for stabilization purposes. This follows from the fact that no welfare-theoretic case has been presented in support of this position. Only if other distortions are present that prevent employment from reaching its optimum level, can the present framework even begin to be used to support arguments for using commercial policy to influence output and employment. This is simply another example of the well-known, but unfortunately often unheeded, result that for a small open economy free trade is the optimum policy—for small countries the only valid economic arguments for the use of commercial policy are (at best) second-best arguments.

APPENDIX

To see that (15) is the correct solution for the least squares regression coefficient ϕ , multiply both sides of (12) by $w_t - E(w_t|\Omega_{t-1})$, take expectations of the resulting expression, and use the orthogonality condition $E\{v_t[w_t - E(w_t|\Omega_{t-1})]\} = 0$, to obtain

$$(A1) \quad \phi = \frac{E\{\xi_t[w_t - E(w_t|\Omega_{t-1})]\}}{E[w_t - E(w_t|\Omega_{t-1})]^2}.$$

It can be shown from (13) that

$$E\{\xi_t[w_t - E(w_t|\Omega_{t-1})]\} = E\{\xi_t[z_t - E(z_t|\Omega_{t-1})]\} + \pi_3 E\{\xi_t[E(c_t|I_t) - E(c_t|\Omega_{t-1})]\}.$$

Under the assumption of rational expectations, (14) may be used in the preceding expression to eliminate $E(c_t|I_t) - E(c_t|\Omega_{t-1})$. This yields

$$(A2) \quad E\{\xi_t[w_t - E(w_t|\Omega_{t-1})]\} = \sigma_{\xi z}/1 - \pi_3\phi,$$

where $\sigma_{\xi z} = E\{\xi_t[z_t - E(z_t|\Omega_{t-1})]\}$. Let $\sigma_w^2 = E[w_t - E(w_t|\Omega_{t-1})]^2$, use (A2), and note that (A1) becomes

$$(A3) \quad \phi = \sigma_{\xi z}/(1 - \pi_3\phi)\sigma_w^2.$$

However, from (13) it follows that

$$\begin{aligned} \sigma_w^2 = \sigma_z^2 + 2 \pi_3 E\{[z_t - E(z_t|\Omega_{t-1})][E(c_t|I_t) - E(c_t|\Omega_{t-1})]\} \\ + \pi_3^2 E[E(c_t|I_t) - E(c_t|\Omega_{t-1})]^2. \end{aligned}$$

The term $E(c_t|I_t) - E(c_t|\Omega_{t-1})$ in the preceding expression can be replaced by using (14) to obtain

$$\sigma_w^2 = \left[1 + \frac{2\pi_3\phi}{1 - \pi_3\phi} + \frac{\pi_3^2\phi^2}{(1 - \pi_3\phi)^2} \right] \sigma_z^2.$$

When this is substituted into (A3), it can be seen that

$$\phi = \frac{\sigma_{\xi z}}{\{1 + \pi_3\phi + [\pi_3^2\phi^2/(1 - \pi_3\phi)]\}\sigma_z^2}.$$

The numerator and the denominator of the right-hand-side of this expression can then be multiplied by $1 - \pi_3\phi$, and the resulting expression rearranged to yield

$$(A4) \quad \phi = \sigma_{\xi z}/(\sigma_z^2 + \pi_3\sigma_{\xi z}).$$

From the definitions of ξ and z it can be shown that²²

$$\sigma_{\xi z} = \alpha_1\pi_1\sigma_1^2 + (\alpha_1\pi_2 + \alpha_2\pi_1)\sigma_{12} + \alpha_2\pi_2\sigma_2^2$$

and

$$\sigma_z^2 = \sigma_k^2 + \pi_1^2\sigma_1^2 + 2\pi_1\pi_2\sigma_{12} + \pi_2^2\sigma_2^2.$$

The expression for ϕ given by (15) can be obtained by substituting these into (A4).

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22. These derivations assume that there is no covariance between shocks to tastes and technology (the k 's) and shocks to prices. Given that commercial policy shocks affect domestic prices, this means that the initial equilibrium is taken to be a situation where the government is not using commercial policy in a systematic manner to offset the fluctuations in output and employment caused by variations in tastes and technology. Such policies could be introduced by specifying commercial policy reaction functions. One example of such a reaction function might be trigger prices on steel in the United States.

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