

**Studies in
INTERNATIONAL
MACROECONOMICS**

Jagdeep S. Bhandari

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1 *Introduction*

This volume is not intended to be a textbook. It has arisen out of my work in international macroeconomics over the past few years. While the book does cover some topics normally dealt with in graduate international economics courses, it is quite selective with respect to both content and technique. My primary intention in this volume is to emphasize a model-building approach to selected policy-related problems in open economies. The range of problems addressed is, by necessity, limited; anything else would require an encyclopedic method. I have tended to use concrete examples of macroeconomic models to illustrate issues rather than to attempt generalization and abstraction. Consequently, any claim to a definitive treatment would be premature.

Throughout the book I have employed discrete-time models, since stochastic difference equations are now in the tool kit of most professional economists, whereas continuous-time stochastic methods apparently are not. I assume, moreover, that the use of the rational expectations hypothesis is no longer contentious. Thus, wherever expectations are incorporated, I have relied on the assumption of individual and collective rationality.

Because each chapter is fairly self-contained, it is not absolutely necessary to read every chapter in the order in which it appears. Nevertheless, the arrangement by chapters is not without some basis. For example, chapters 2, 3, and 4 deal with models that emphasize supply-based considerations in the economy either by explicitly incorporating labor markets or by introducing imported raw materials into the analysis. Chapters 8, 9, and 10 examine issues relating to economies that adopt alternative exchange-rate arrangements, such as multiple-tier exchange rates or currency composite systems. Other chapters examine assorted

issues of interest, such as the role of relative country size or the availability of spatially diverse information to agents in the economy and the question of whether or not speculative capital flows are destabilizing.

Plan of the Book

Chapter 2 constructs a model to analyze the short-run implications of various structural disturbances in a stochastic macroequilibrium model of an open economy. Three key features of the model presented here are that nominal wages are contractually determined, the trade balance is assumed to respond in J-curve fashion to a contemporaneous change in the real exchange rate, and the economy in question is open on both the demand and supply sides (i.e., it is presumed to import both final and intermediate goods). The framework is then utilized to investigate the nature of the optimal wage indexation-exchange intervention policy package that may be required to attain various policy targets, given alternative types of disturbances. It is seen that certain structural disturbances do pose formidable policy dilemmas for the authorities. In other cases though, a judicious combination of wage indexation and exchange intervention policies does permit the policymaker to achieve both “internal” and “external” targets jointly.

Chapter 3 continues the investigation of exchange market intervention in the context of a contractual wage-setting framework. As in Chapter 2, the effect of the exchange rate on the domestic price level is carefully modeled via an explicit representation of the production technology of the economy in question. In contrast to the previous chapter, however, nominal wages are determined by overlapping (staggered) settlements. The model is used to analyze the effects of intervention on the persistence of wage-price and output adjustments, as well as on price-output stability tradeoffs. Both first-period and asymptotic variabilities are considered for various types of structural disturbances, such as wage contract innovations, imported input price disturbances, and domestic monetary shocks. The results of the investigation indicate the presence of a price-output stability dilemma (except when domestic monetary disturbances are predominant). Specifically, as the degree of exchange market intervention increases, the (first period and asymptotic) variance of output declines monotonically, while both price and nominal exchange-rate variances increase. Consequently, there appears to be no reason to reject the view that there exists an optimum degree of intervention that minimizes a performance function based on output and price (or exchange rate) stability.

Chapter 4 retains the focus on supply-based considerations and

further explores the consequences of (both anticipated and unanticipated) externally occurring input price disturbances. In contrast to the usual small-country scenario, the present framework is two-country in nature. Specifically, the domestic economy is moderately sized and imports final goods from a larger foreign economy while importing all of its oil requirement from a third country (OPEC). The large foreign economy is effectively “closed” on the demand side, but it does import a portion of its own oil requirement. By explicitly constructing a two-country structure, the model discussed in this chapter is able to properly account for the full ramifications of the oil price increase, some of which operate via induced effects on world output, price, and interest rate levels. These induced effects on the non-OPEC partners of the domestic economy are necessarily ignored in conventional small-country analyses. By developing an explicit economic structure the analysis of this chapter is able to relate the severity of macroeconomic adjustments in both economies to certain key structural parameters, such as the extent of dependence on imported oil in the foreign economy and the degrees of supply-side or demand-side “openness” in the home economy. One section of the chapter addresses the issue of the bias that would result from ignoring foreign repercussions as is necessarily the case in conventional small-country analyses. The discussion also explores the optimal policy stance that should be adopted by domestic authorities as a “reaction” to the materials price shocks. It is found that from the viewpoint of both economies, unexpected oil price increases appear to be less detrimental than corresponding expected disturbances and that “stagflation” is not the inevitable consequence of these disturbances (as is commonly supposed). Nor is it true that increased openness necessarily enhances the vulnerability of the economy in question to the external disturbance; the outcome depends critically on whether the concept of demand-side or supply-side openness is utilized. It is seen that the neglect of foreign repercussion effects may lead to seriously misleading results; for example, such a scenario would predict nominal and real appreciation of domestic currency following the oil price increase, whereas the true results instead involve nominal and real depreciation. Finally, the optimal domestic monetary response (based on plausible parameter values) appears to be contractionary.

One important feature of the financial structure of the models discussed in each of the preceding three chapters is the assumption of perfect capital mobility. While analytically convenient, such an assumption is, of course, somewhat restrictive. Chapter 5 modifies this scenario by incorporating finite (imperfect) capital mobility. This modification results in the rehabilitation of the role of the balance of payments in short-run exchange-rate determination. To focus on the implications of imperfect

capital mobility and in the interest of analytical tractability, it does prove convenient to substantially abstract from the supply-side considerations of the economy that were stressed in the preceding three chapters. Despite these simplifications, the introduction of finite capital mobility does imply that all variables other than output now follow time-dependent paths governed by first-order stochastic difference equations. The principal focus of the analysis is on determining the sensitivity of the stability of the economy (as measured by the variability of certain variables of interest) to the degree of capital mobility. Both first-period and asymptotic variances are considered. It is seen that whether or not increased capital mobility (or increased capital flows in response to an uncovered interest differential) contributes to stability is a rather complex issue and one that is not independent of the time horizon under consideration. Thus, increased capital mobility can be either stabilizing or destabilizing, depending on the relevant indicator(s) of stability (i.e., whether output stability or price stability, etc.) and on the source of the underlying structural disturbances. Furthermore, the long-run effects of variations in the degree of capital mobility can be qualitatively opposed to the corresponding short-run effects of such variations. Consequently, any statement regarding the potential instability associated with speculative capital flows is to be viewed with considerable caution.

Chapter 6 restores the capital market assumption made in earlier chapters and is concerned with the issue of whether the economic size of a country is related to its degree of vulnerability to externally occurring disturbances. It is commonly supposed, for instance, that a small country is more severely affected by foreign economic events than is a larger country. In order to analyze the implications of country size for the transmission of external disturbances, this chapter constructs a three-country model. The model is hierarchical in nature. Specifically, it consists of three countries of varying sizes (i.e., a small country, a medium-sized nation, and a large economy). The model is used to investigate two types of questions relating to insulation. First, one may compare the relative responses of the small-country and medium-sized-country price (and price index) levels to (real and monetary) disturbances originating in the large economy. Second, is the price (or price index) level in the small country more susceptible to comparable disturbances originating in the large country or to those originating in the medium-sized economy? The answer to this question could provide some guidance regarding the potential comparative benefit to the small country of entering into a currency-union arrangement with either the large or medium economy. Some surprising results do emerge in this chapter, at least with regard to the first issue. If the vulnerability indicator is defined in terms of induced (absolute) movements in national price levels, then as a general proposi-

tion, floating exchange rates serve to insulate the smaller economy "better" than its medium-sized counterpart. This is true regardless of the type of disturbance being considered and irrespective of whether high or low (worldwide) wage indexation prevails. Further, the results of the analysis in this chapter also seem to suggest that a small country could achieve greater price-output stability by "internalizing" large-country-originating disturbances through a cooperative monetary (or exchange rate) arrangement with the latter, instead of with the medium-size economy.

An important ingredient of stochastic equilibrium models or stochastic business cycles models, such as those presented in this volume, relates to the nature of the informational assumptions usually made, and two alternative practices are common in this regard. One prevalent and simple assumption is that of full contemporaneous information, and each of the previous chapters involve this scenario. A polar assumption made by some authors rules out the availability of any current information; that is, the information set of agents is hypothesized to contain only lagged information. Prevailing evidence suggests, however, that the latter view may be too harsh an interpretation of economic reality and that contemporaneous information on at least some macrovariables is in fact currently available. For example, observations on "auction" market variables, such as exchange rates and interest rates, are available on a daily basis. A much longer lag does apply, of course, to information on "contract" market variables such as GNP or price data. These facts do suggest that the information set of agents in the economy is more appropriately modeled as containing differentiated rather than no current information. This is the task of the analysis of Chapter 7. Specifically, the chapter examines the implications of alternative informational regimes for the transmission properties of various structural disturbances and for the selection of an optimal exchange-rate policy stance. The framework of analysis is a two-country currency-substitution model. Four alternative informational regimes are considered: (a) the case of full current information (designed to serve as a benchmark case); (b) the case of incomplete but symmetrical information, in which agents in both countries observe the current exchange rate but no other variables; (c) the case of differentiated asymmetrical information, wherein, in addition to the exchange rate, agents in each country observe the current national price level in their respective countries; and finally (d) a scenario where the authorities are presumed to possess superior information with respect to the realizations of various random disturbances, as compared with private agents. It is seen that in general, closed-form solutions for the optimal degree of exchange intervention are available only for the full-information case. In all other cases, either closed-form solutions do not exist at all, or alter-

natively, difficult problems of nonlinearities may occur. More interestingly, comparison of the results obtaining under various informational regimes seems to indicate that the acquisition of progressively more complete current information by economic agents does not imply that the economy's behavior converges smoothly to that of the full-information state. From a policy point of view, therefore, the free provision of additional current information by the authorities may not be the best strategy to adopt if the objective is to eliminate the presumed "welfare" loss due to incomplete information.

The next three chapters in the book (8, 9, and 10) all deal with exchange-rate arrangements. It is common in most open-economy macro-models to assume that the authorities adopt a regime of unified flexible or (managed floating) exchange rates, and each of the previous chapters has employed this convention. In point of fact, however, alternative exchange-rate systems appear to be becoming increasingly widespread. The IMF reports, for example, that in 1983 no less than 53 member countries were setting their exchange rates according to the value of a currency composite. An additional 17 countries meanwhile were reported to have adopted multi-tier (or dual) exchange-rate systems over the same period. Examination of the properties of such systems is thus of obvious importance.

Chapter 8 proposes a multi-country stochastic equilibrium framework to analyze the behavior of an economy that pursues an exchange basket (or currency composite) policy. Previous theoretical work on the subject has failed to take account of the fact that at least two types of currency composite arrangements have been in use. In one set of countries, the currency basket arrangement is adhered to fairly rigidly, and only narrow margins of deviations around this rate are permitted. In another group of countries, however, the exchange-rate arrangement may be more appropriately described as the "flexible basket" type, and substantial margins around the middle rate are apparently permitted. The model proposed in this chapter is general enough to accommodate the special cases of multilateral floating (i.e., nonintervention) and rigid (narrow margin) basket regimes in addition to the general case of the flexible basket system. A key feature of the model is that it permits the simultaneous determination of currency shares as well as the optimal margin size. The chapter focuses on four important macroeconomic determinants of the optimal exchange basket. These include (i) the nature of domestic bilateral trade patterns, (ii) the relative size of foreign economies, (iii) the nature of the performance function, and (iv) the source of the underlying random disturbances and their relative variability. The results of the analysis seem to indicate that zero margins are likely to be substantially nonoptimal if the principal source of variability is real rather than monetary in nature.

Chapter 9 continues the examination of exchange-rate arrangements, but focuses instead on two-tier exchange-rate regimes. While there has been some attention directed to such systems in the literature, one critical feature has been the assumption that the two (i.e., commercial and financial) exchange markets are completely segmented. Such an assumption is analytically convenient, since the floating financial rate ensures that the capital account is always zero, hence ruling out one source of dynamics in the economy. In reality, however, cross-operations between the two exchange markets are widespread for two reasons. First, the existence of fraudulent ("black market") transactions is well documented, but more importantly, several important categories of current account transactions are officially assigned to the financial ("parallel") market by administrative fiat. In light of these institutional factors, it is important to construct and analyze a model of dual exchange rates that explicitly accounts for "leakage" between the commercial and financial exchange markets. Chapter 9 is a step in this direction. The model employed is of the usual small-country lineage, that is, the country in question enjoys no market power in world trade and its output is indistinguishable from world output. Two types of dual exchange-rate systems are discussed: in one variety, both exchange rates float in their own tiers, whereas in the second (more common) system, the commercial rate is pegged while the financial rate is flexible. The model is used to assess the consequences of various structural disturbances and to conduct sensitivity analysis with respect to the degree of officially sanctioned leakage and the penalty costs associated with engaging in illegal transactions. It is seen that, in general, the presence of inter-market transactions profoundly alters the properties usually associated with dual exchange-rate models.

The last chapter in this volume (Chapter 10) continues the analysis of two-tier exchange-rate regimes. The model employed here differs from that in the preceding chapter by permitting the domestic economy to possess market power in world trade, so that the purchasing power parity assumption is abandoned. It is thus possible to contrast and compare the implications of export leakage versus import leakage. Furthermore, the present chapter also pursues a detailed examination of dynamic stability of the economy, in addition to its stationary-state properties. The range of sensitivity exercises performed here is also wider in that perturbations in initial foreign reserve and foreign asset positions of the domestic economy are also considered at some length.

Without doubt, the selection of topics covered in this volume is but a sprinkling of the issues important in international macroeconomics today, and is unquestionably guided by my own interest in them. I have not attempted to defend the use of the rational expectations hypothesis or my use of equilibrium as opposed to disequilibrium methods. I remain

uninformed about the costs of adjustment, who bears them, and what difference government action can make. I assume, however, that adjustment is often less than immediate, even in “efficient” markets, but I have no knowledge as to how important this may be in the abstract circumstances hypothesized in this book. In any case, the controversy regarding disequilibrium macroeconomics and the “new” macroeconomics is likely to continue for some time.

I have also remained silent with regard to certain taxonomical issues that admittedly are of interest to some practitioners. Thus, I have made no attempt to categorize models as either neo-Keynesian or neoclassical. Those who pursue such issues will no doubt detect the appropriate (or desirable) flavor in any case. This ambivalence may not please all readers, but I remain convinced that an agnostic approach is preferable to a dogmatic one at the present time.

2 *Wage Contracting and Exchange-Rate Management in a Model with Imported Inputs*

I. Introduction

Much if not most of theoretical international macroeconomics is concerned with analyzing the aggregate behavior of an open economy in response to various structural disturbances of interest and with evaluating appropriate policy responses where applicable. As indicated in the introductory chapter, the work presented in this volume remains in this general methodological vein. By and large I have used the models I have constructed to investigate certain relevant issues that have either been neglected or else have received very scant attention in the previous literature.

The first model presented in this book develops a framework wherein the jointly stabilizing effects of exchange market intervention and wage indexation policies can be evaluated. Three key features of this model are that the economy in question is open on both the demand and supply sides, nominal wages are contractually determined, and that delivery lags in trade flows lead to a perverse short-run trade balance response to real exchange-rate changes. The latter phenomenon has already received some attention in the literature; for example, Niehans (1975) has questioned the efficacy of monetary policy in the Mundell-Fleming model. Niehans' argument is based on the presumed difference between the actual and "permanent" real exchange rate and the assumption that traders respond more properly to the latter rather than the former. Dornbusch (1976) extends Niehans' analysis to incorporate perfect capital mobility and introduces a time dimension into the framework by hypothesizing that exchange-rate expectations adjust slowly in the direction of actual exchange-rate changes. A short-run J-curve remains in Dorn-

busch's analysis, although in the eventual stationary state, the Mundell-Fleming equilibrium is restored.

The present model is in the spirit of the Dornbusch and Niehans lines of inquiry, but is cast in a stochastic rational expectations framework rather than in deterministic terms, as is the latter.¹ A central feature of the model is the inclusion of explicit supply-side considerations in a Niehans-type model amended to include interest-bearing assets and activist monetary intervention. Specifically, nominal wages are contractually determined, while commodity prices are determined by unit costs of both labor and imported inputs. In such a framework, neither fiscal nor monetary policy has predictable expansionary effects on output under floating exchange rates. However, if fiscal policy "works" (i.e., stimulates output), then monetary expansion necessarily involves perverse output effects and vice versa. Moreover, if expenditure expansion succeeds in raising income, then the output expansion is accompanied by wage-price deflation, along with nominal and real appreciation. An increase in the price of imported *final* commodities is potentially more damaging to the domestic economy than a corresponding increase in the price of imported *intermediate* goods. Thus, in the former case and provided that the J-curve effect is not dominant, the home economy experiences stagflation (i.e., rising prices coupled with reduced output). With an increase in the price of imported inputs, however, domestic output increases under the same conditions and the domestic price level may even decline. There are other detailed results of interest, and these are discussed in the text.

The framework is also used to address certain important policy issues. Specifically, I inquire into the nature of the optimal wage indexation and exchange intervention policy package that may be utilized in order to stabilize the domestic economy from various structural disturbances. While a detailed statement of the results is provided in the text, the following properties may be noted here. If the principal random disturbances in the model are monetary in nature, then a single policy instrument is sufficient to ensure perfect stabilization of all relevant domestic macrovariables. Specifically, a policy of pegged exchange rates fully stabilizes domestic wage-price-output and real exchange-rate levels, regardless of the degree of wage indexation. By contrast, domestic expenditure disturbances pose a much more difficult problem for the policy maker in the sense that perfect stabilization of all domestic variables is now impossible. For example, while it is possible to simultaneously stabilize domestic price and output levels via a judicious combination of wage indexation and exchange intervention policies, it proves impossible to simultaneously stabilize domestic output and (nominal or real) exchange-rate levels. Given predominately real disturbances, therefore, the availability of two policy instruments (i.e., wage indexation and exchange

market intervention) is not sufficient for the authorities to attain both domestic and external objectives. If foreign final output price disturbances are considered, then a unique policy package is capable of stabilizing price-output and real exchange-rate levels simultaneously. It is also possible to stabilize output and the nominal exchange rate in these circumstances. Finally, imported input price disturbances imply policy dilemmas similar to those noted for domestic expenditure disturbances. Specifically, neither simultaneous price-output stabilization nor (nominal) exchange rate-output stabilization is possible in this case.

The rest of the chapter is organized as follows. The next section describes the analytical framework, while Section III investigates the implications of various structural disturbances. Section IV analyzes the role of stabilization policy, and some final comments are offered in the concluding section. Details of the formal solution to the model are relegated to the Appendix.

II. A Model of Contractual Wage Setting

Consider a moderately sized open economy operating under a regime of managed exchange rates (a special case of which is the floating exchange-rate regime). This economy is small in the market for importables (which consist of a final good as well as an imported input) and is unable to influence the foreign currency prices of the latter. On the other hand, it does possess some degree of monopoly power in the market for exportables, and the domestic currency price of exportables as well as the yield on domestic currency-denominated securities is endogenously determined.

Domestic aggregate demand is definitionally composed of domestic absorption and the net trade balance. The latter is assumed to depend not only on the current real exchange rate (between final commodities), but also on the expected real exchange rate and expected income, in order to take import delivery lags into account. Home residents have free access to a worldwide capital market dealing in homogeneous, one-period, riskless government securities. There are no transaction costs, and domestic speculators regard securities denominated in either domestic or foreign currency as perfectly substitutable, given a proper premium or discount to offset anticipated depreciation or appreciation of domestic currency. Hence, "uncovered" interest parity prevails between domestic and foreign securities.

Domestic nominal wages are contractually determined and the one-period wage contract consists of two sets of factors, that is, the wage that was previously expected to clear the labor market in the current period

and an indexation clause which represents intraperiod adjustment based on unexpected movements in the consumer price index. Domestic output is produced according to a CES (constant elasticity of substitution) technology utilizing labor and an imported input (oil), and the domestic currency price of the home final good is set according to its unit cost of production. Imported oil is assumed to be denominated in terms of foreign currency and is in perfectly elastic supply at the prevailing world price. Continuous monetary stock equilibrium prevails, and there is no "currency substitution." Domestic monetary authorities intervene in the foreign exchange market according to a feedback control rule based on a target nominal exchange rate. There is no distinction between base money and bank credit and no physical growth. All expectations are determined rationally in the sense of Muth, and domestic agents have full contemporaneous information on all relevant random variables. There are other simplifying assumptions, and these are introduced as the analysis is presented.

Aggregate demand for the home good (the exportable) consists of domestic absorption plus the net trade balance:

$$Y_t^d = A_t + T_t \quad (2.1')$$

where A is private absorption, T the net trade balance, and the subscripts refer to the time period in question. Since the model is most conveniently specified in log-linear terms, it is necessary to log-linearize Equation 2.1'. As shown in the Appendix, a first-order, semi-logarithmic Taylor approximation to Equation (2.1') is given by

$$Y_t^d = a_1 a_t + a_2 T_t; \quad 0 < a_1 < 1, \quad a_2 > 0 \quad (2.1)$$

where lower-case letters denote logarithmic values of the relevant variables.² Private absorption is determined by the level of (log) real income, where the latter is defined in terms of a basket of domestic and imported final commodities,

$$a_t = \gamma_1 (y_t + p_t - q_t) \\ 0 < \gamma_1 < 1 \quad (2.2)$$

where y is gross output of the domestic good, p its price level, and q the price index (to be defined shortly). Equation 2.2 thus incorporates the well-known Laursen-Metzler effect, according to which real depreciation reduces total absorption.³ The real trade surplus is assumed to be given by