

MONASH

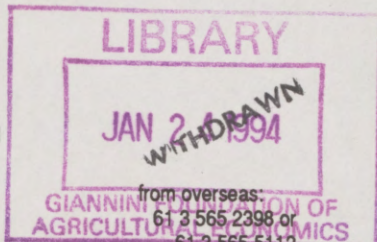
CENTRE of  
POLICY  
STUDIES and  
the IMPACT  
PROJECT

Eleventh Floor  
Menzies Building  
Monash University, Wellington Road  
CLAYTON Vic 3168 AUSTRALIA

Telephone:  
(03) 565 2398, (03) 565 5112

Fax numbers:  
(03) 565 2426, (03) 565 5486  
e-mail

from overseas:  
61 3 565 2426 or 61 3 565 5486  
impact@vaxc.cc.monash.edu.au



Exchange Rate  
Pass-through:  
Theory and Evidence

by

Jayant Menon

*Centre of Policy Studies  
Monash University*

Preliminary Working Paper No. IP-59 July 1993

ISSN 1031 9034

ISSN 0 642 10265 1

The Centre of Policy Studies (COPS) is a research centre at Monash University devoted to quantitative analysis of issues relevant to Australian economic policy. The Impact Project is a cooperative venture between the Australian Federal Government and Monash University, La Trobe University, and the Australian National University. During the three years January 1993 to December 1995 COPS and Impact will operate as a single unit at Monash University with the task of constructing a new economy-wide policy model to be known as *MONASH*. This initiative is supported by the Industry Commission on behalf of the Commonwealth Government, and by several other sponsors. The views expressed herein do not necessarily represent those of any sponsor or government.

## ABSTRACT

The resilience of trade balances of the major industrialised economies to changes in their exchange rates has evoked interest in the exchange rate pass-through relationship. So far, there has not been a comprehensive survey of this literature. The paper aims to fill this gap in two ways. First, it pieces together the theoretical literature on exchange rate pass-through. Second, it provides a critical survey of the empirical literature on exchange rate pass-through. Emphasis is placed on the data and methodology employed in previous work. This is done in order to guide future work in this growing area of research.

*J.E.L.* Classification numbers: F31, F32, F17

## CONTENTS

<b>1. Introduction</b>	1
<b>2. Exchange Rate Pass-through: Theory</b>	3
2.1 Exchange Rate Pass-through: The Elasticities Approach	3
2.2 Market Structure and Product Characteristics	4
2.2.1 Perfect Competition and Product Homogeneity	4
2.2.2 Imperfect Competition and Product Differentiation	5
2.3 Multinational Corporations (MNCs) and Intra-Firm Trade	11
2.4 Non-Tariff Barriers (NTBs)	13
<b>3. Exchange Rate Pass-through: Evidence</b>	15
3.1 Salient Features of Previous Studies	33
3.1.1 Country-Coverage	33
3.1.2 Data	33
3.1.3 Methodology	36
3.1.4 Findings	37
3.1.4.1 Pass-through: Degree and Dynamics	37
3.1.4.2 Pass-through Across Countries	38
3.1.4.3 Pass-through Across Studies for a Given Country	38
3.1.4.4 Pass-through Across Products	39
3.1.4.5 Stability of the Pass-through Relationship	40
<b>4. Summary</b>	40

### Tables

1. The Empirical Literature: A Summary of Data, Methodology & Findings	16
2. Number of Estimates of Pass-through by Country	34

### Figure

1. Exchange Rate Pass-through in the Presence of Quantitative Restrictions	14
--	----

**Exchange Rate Pass-through:  
Theory and Evidence<sup>1</sup>**

by

**Jayant Menon**  
Centre of Policy Studies  
Monash University

**1. Introduction**

The debate over fixed versus flexible exchange rates is one of the longest running sagas in the international economics literature. The case for flexible exchange rates, as it was initially and forcefully put by Friedman (1953) and Johnson (1969), had as one of its pillars the claim that it would provide for a more efficient system of international adjustment. In this context, the advent of floating exchange rates after the breakdown of the Bretton Woods system was greeted with enthusiasm, as it was felt that currencies had moved way out of line from their equilibrium rates during the Bretton Woods era. Under the floating exchange rate regimes, foreign exchange markets around the world have been characterised by a considerable amount of variability. However, the initial enthusiasm about the expected equilibrating role of floating exchange rates began to wane as the trade balances of major trading nations continued to show remarkable resilience to such changes.

This has led to a frantic search for explanations to account for this "adjustment puzzle". The conventional explanations couched in terms of elasticity pessimism have little to offer in resolving this issue; there is now a vast empirical literature that has convincingly established the case that Marshall-Lerner conditions are easily satisfied in most countries<sup>2</sup>. In this context, a number of authors have been motivated to step back and examine more closely the underlying relationship between exchange rates and prices of internationally traded goods, now popularly known as the exchange rate pass-through relationship<sup>3</sup>. Exchange rate pass-through refers to the degree to which

---

(1) I would like to thank Premachandra Athukorala, Peter Dixon and Donald George for comments on the paper without implicating them in any way.

(2) For useful surveys of this literature, see Magee (1975) and Goldstein and Khan (1985).

(3) In this paper, the terms "exchange rate pass-through" and "pass-through" are used interchangeably.

exchange rate changes are reflected in the destination currency prices of traded goods.

The reason for the inability of even the "elasticity optimists" to account for the sluggishness of trade flows to exchange rate changes may lie with the fact that they *assume* that exchange rate changes are fully passed-through to prices of traded goods. If exchange rate changes are not fully or substantially reflected in the selling prices of traded goods, then the anticipated quantity adjustment will be retarded even if the degree of demand elasticity is sufficiently large. In other words, a low pass-through would make it possible for trade flows to remain relatively insensitive to exchange rate changes, despite demand being highly elastic. Furthermore, if significant lags exist in the transmission of exchange rate changes to prices, coupled with the subsequent lag in the quantity-response to the relative price change, then the overall balance of payments adjustment process could be severely retarded<sup>4</sup>.

Given the importance of the pass-through issue, a sizeable literature has developed over recent years. So far, there has not been a comprehensive survey of this literature. The paper aims to fill this gap in two ways. First, it pieces together the theoretical literature on exchange rate pass-through. This is the subject of Section 2. We begin by discussing early approaches to measuring pass-through based on trade elasticities. We then proceed to consider more recent developments that emphasise market structure and product characteristics, intra-firm pricing practices of multinational corporations (MNCs), and the effects of non-tariff barriers (NTBs) on traded goods prices following exchange rate changes<sup>5</sup>. Second, it provides a critical survey of the existing empirical literature on pass-through. This is the subject of section 3. Emphasis is placed on the data and methodology employed in previous work in this area. A final section presents a summary of major points, and suggests directions that future research should take.

---

(4) A chronological taxonomy of the behaviour of prices of internationally traded goods following a depreciation is provided in Magee (1973) and Branson (1972). Magee (1973) highlights the initial phase as the "currency contract" period, in which capital gains or losses on outstanding contracts are observed. Following this, a "pass-through" period is observed, in which prices respond to the new exchange rate but quantities of trade are not yet affected. Finally, a "quantity adjustment" period completes the process, in which quantities and prices move towards a new equilibrium. The trade balance can move in almost any direction in each of these subperiods, and the duration of the lags that are involved in the second and the third phase will undoubtedly bear significantly on the overall outcome of the adjustment process.

(5) The discussion is organised so that the different factors that affect the relationship between exchange rates and prices are treated separately. This approach is necessitated by the fact that "there is no single coherent theory of devaluation (or revaluation) under imperfect competition, but rather an amalgam of reasons why prices may not respond fully to exchange rate changes" (Magee 1975, p.231).

## 2. Exchange Rate Pass-through: Theory

### 2.1 Exchange Rate Pass-through: The Elasticities Approach

Initial interest in the pass-through relationship developed as a consequence of empirical work involved in the estimation of import and export demand and supply elasticities in international trade. The relationship between the exchange rate and traded goods prices can be derived using these elasticities. Consider the following demand and supply functions for an imported good:

$$Q_D = D(P_D) \quad (1)$$

$$Q_S = S(P_F / ER) \quad (2)$$

where  $Q_D$  and  $Q_S$  represent the quantity demanded and supplied of the imported good,  $P_D$  and  $P_F$  represent the domestic and foreign currency price of the imported good, and  $ER$  represents the exchange rate (the foreign currency price of domestic currency).

Differentiating (1) and (2), we have:

$$\partial Q_D = (\partial D / \partial P_D) \partial P_D \quad (3)$$

$$\partial Q_S = \partial S / \partial P_F \{ (1/ER) \partial P_D - (P_D / ER^2) \partial ER \} \quad (4)$$

Setting (3) and (4) equal to each other in equilibrium, and denoting the elasticity of demand as  $\epsilon_D = (\partial D / \partial P_D) P_D / Q_D$  and the elasticity of supply as  $\epsilon_S = (\partial S / \partial P_F) P_D (ER / P_D)$ , we have:

$$(ER Q_D / P_D) / \epsilon_S \{ (1/ER) \partial P_D - (P_D / ER^2) \partial ER \} = Q_D / P_D \epsilon_D \partial P_D \quad (5)$$

which simplifies to:

$$(\partial P_D / P_D) / (\partial ER / ER) = (1 - \epsilon_D / \epsilon_S)^{-1} \quad (6)$$

Equation 6 shows that the percentage change in the domestic currency price of the imported good following an exchange rate change is a function of the elasticities of demand and supply. Based on this formula, it is clear that if the supply or demand for imports is perfectly elastic (inelastic), then pass-through is going to be complete (zero). Studies that employed this formula to measure pass-through focussed mainly

on the aggregate outcome for individual countries. For instance, Branson (1972) was able to show how changes in the exchange rates of large economies such as the US could alter world prices, thus ensuring the co-existence of less than full pass-through with the preservation of the law of one price. The general conclusion of these studies points to the larger less-open countries experiencing much lower pass-through than the smaller more-open economies (Kreinin, 1977; Spitaeller, 1980; for details, see Table 1).

There are a number of problems associated with the measurement of pass-through based solely on elasticities of demand and supply. First, this approach does not provide any information on the *timing* of the response of prices to exchange rate changes. Second, it ignores what lies behind the supply responses of producers in different countries (Venables, 1990). The supply response will depend on the details of the industrial organisation and of the technology of the industry under study. Recent developments in the literature on imperfect competition and trade address both these issues, and it is to these developments that we turn to next.

## 2.2 Market Structure and Product Characteristics

The theoretical explanations of incomplete pass-through have emphasised the role of market structure first, followed by product differentiation. These authors have been concerned to explain whether the empirical data on pass-through merely reflects short-run squeezing of profit margins by exporters, or if particular types of market organisation always lead to only a limited response of prices to exchange rate changes.

### 2.2.1 Perfect Competition and Product Homogeneity

In order to analyse the role of market structure and product characteristics in determining the pass-through relationship, it is useful to start with the case of a perfectly competitive market where the imported and the domestically produced good are perfect substitutes for each other. This case is important not only as a backdrop, but also to clarify the differences that exist under conditions of imperfect competition and product differentiation.

We represent the domestic demand for the domestic and imported good as  $D(P)$ , the supply of the domestic good as  $S_D(P)$ , and the supply of the imported good as  $S_M(P/ER)$ , where  $ER$  is the exchange rate (the foreign currency price of domestic currency). At market equilibrium, we have:

$$D(P) = S_D(P) + S_M(P/ER) \quad (7)$$

Totally differentiating (7), and after rearranging terms, we have the formula for pass-through:

$$\partial P / \partial ER = \epsilon^M_s \alpha / \{ \epsilon_D + \epsilon^D_s (1 - \alpha) + \epsilon^M_s \alpha \} \quad (8)$$

where  $\epsilon_D = -D'P/D$  = elasticity of domestic demand;  $\epsilon^D_s = S'_D P/S_D$  = elasticity of supply of the domestic good;  $\epsilon^M_s = S'_M P/(ER^S_M)$  = elasticity of supply of the imported good;  $\alpha$  = market share of the import.

Equation (8) highlights the importance of the elasticities of demand and supply in determining the price response to an exchange rate change in a perfectly competitive market. Under these conditions, the measurement of pass-through is similar to that using the elasticities approach discussed in Section 2.2. These elasticities also play a central role in determining the magnitude of the change in import volume following an exchange rate variation. Differentiating  $S_M(P/ER)$ , and using (8) above, we can express the proportionate change in imports as:

$$\partial S_M = \partial P \{ \epsilon_D + (1 - \alpha) \epsilon^D_s \} / \alpha \quad (9)$$

The change in imports following an exchange rate change will be greater the larger is the elasticity of foreign supply,  $\epsilon^M_s$ , since this will result in a larger proportionate change in price ( $\partial P$ ), and the larger are the elasticities of domestic demand,  $\epsilon_D$ , and domestic supply,  $\epsilon^D_s$ .

### 2.2.2 Imperfect Competition and Product Differentiation

Under conditions of imperfect competition, pricing will no longer be at marginal cost, and firms would be in a position to charge a mark-up on costs to earn above normal profits even in the long run. The important issue that needs to be addressed in the context of imperfect competition relates to how this mark-up over marginal cost might vary in response to an exchange rate change. Two factors come to mind almost immediately: (i) the degree of substitutability between the domestic and imported good, as determined by the degree of product differentiation, and (ii) the degree of market integration or separation. Both these factors can be viewed as forces that come into play to determine the price-setting power of firms, and will affect the leverage available to them in responding to exchange rate changes. The lower the degree of substitutability between these goods, and the lower the degree of market integration,