ESSAYS IN APPLIED INTERNATIONAL ECONOMICS

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ESSAYS IN APPLIED INTERNATIONAL ECONOMICS

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DISSERTATION ABSTRACT

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This dissertation is organized into two essays in international economics and finance. The first is an analysis of the US-Morocco free trade agreement and its impact on Morocco. The study uses a computable general equilibrium CGE model and relaxes assumptions of full employment and perfect competition to analyze the effects of free trade on output and income distribution across sectors of the Morocco economy. It examines the comparative statics of a general equilibrium model of production and trade, and its sensitivity to Cobb-Douglas and constant elasticity of substitution production.

The second essay models the impact of economic growth on the exchange rate under different degrees of capital mobility. It applies an IS-LM-BP model with a modified Dornbusch exchange rate model that relaxes assumptions of perfect capital mobility and full employment. The case examined is South Korea relative to Ireland

from 1974 to 1998, the post Bretton Woods era up to Ireland's adoption of the euro. The main objective is to estimate elasticities of the different determinants of the exchange rate. The application is to test the hypothesis that in a growing economy the degree of capital is mobility determines whether a currency depreciates.

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INTRODUCTION

The Link between Free Trade Agreements and Capital Mobility

This dissertation is organized into two essays in international economics and finance. The first is a General Equilibrium analysis of the US-Morocco free trade agreement and its impact on Morocco. The study uses a computable general equilibrium CGE model and relaxes assumptions of full employment and perfect competition to analyze the effects of free trade on output and income distribution across sectors in Morocco. It examines the comparative statics of a general equilibrium model of production and trade, and its sensitivity to Cobb-Douglas and constant elasticity of substitution production.

Morocco is pursuing an export-led growth policy, and has implemented a series of reforms and structural adjustments to ease its inclusion into the world economy. Nevertheless after more than two decades of far-reaching trade reforms, Morocco still restricts the movement of capital. Moroccan companies are permitted to borrow abroad without prior government approval. Moroccan individuals or corporations investing abroad must seek approval from the Foreign Exchange Board. The use of international credit cards by Moroccans is severely restricted, making it nearly impossible to use e-commerce to purchase goods internationally.

Due to higher inflation rate than its European trading partners, the IMF and World Bank pressured Morocco into making its exchange rate regime more flexible. The central bank adjusted the value of the dirham by changing the weight of the currencies in the basket and assigning an even greater weight to the euro, resulting in 5.18% effective devaluation of the dirham. In spite of this adjustment and an earlier devaluation of 9% many economist believe that the dirham is still overvalued.

The second essay models the impact of economic growth on the exchange rate under different degrees of capital mobility. It applies an IS-LM-BP model with a modified Dornbusch exchange rate model that relaxes assumptions of perfect capital mobility and full employment. The case examined is South Korea relative to Ireland from 1974 to 1998, the post Bretton Woods era up to Ireland's adoption of the euro. The main objective is to estimate elasticities of the different determinants of the exchange rate. The application is to test the hypothesis that in a growing economy the degree of capital is mobility determines whether a currency depreciates.

This model analyzes the effect of economic growth on the value of Korea's currency. The model can be extended to Morocco to analyze the efficacy of its export-led growth policy and the signing of FTA.

CHAPTER 1. THE US – MOROCCO FREE TRADE AGREEMENT: A GENERAL EQUILIBRIUM ANALYSIS OF IMPLICATIONS FOR MOROCCO

1. Introduction

Since 1995 Morocco has been working closely with the United States to develop a free trade agreement (FTA) that would allow for stronger economic relations, freer trade, and better investment conditions between the two countries. Morocco has implemented a series of adjustments and reforms to facilitate its inclusion into the world economy, including privatizing public companies, reducing government spending, and reforming laws and regulations to reduce constraints on entrepreneurial activities and to attract foreign investment. Morocco's commitment to the principles of free trade is symbolized by the passing of the Foreign Trade Law in 1992 that reversed the legal presumption of import protection. Quantitative restrictions on the import of politically sensitive goods such as flour and sugar were replaced by tariffs both ad-valorem and variable. In July 2001 a new anti-competition law was passed creating legal sanctions and outlawing anti-competitive behavior, and establishing an authority to survey market competition.

Morocco's macroeconomic management has been more successful than in most other countries in the Middle East and North Africa according to indicators such as the rate and volatility of inflation, level of the budget deficit, and the stability of the real exchange rate (Page and Underwood, 1997). In trade, the level and dispersion of tariffs have been reduced while quantitative restrictions have been eliminated (Alonso-Gamo,

Fennell, and Sakr, 1997). Nevertheless in spite of more than two decades of far-reaching trade reforms, Morocco still has significant trade barriers with a high degree of dispersion across protection rates.

The US – Morocco FTA implemented in 2005 provides immediate reciprocal tariff elimination including the immediate elimination of duties on more than 90% of the value of current bilateral trade in consumer and industrial products. The FTA also provides bilateral tariff elimination on many agricultural products with most other tariffs phased out within 15 years. US agricultural producers will benefit from new tariff rate quotas (TRQs) that provide better access to Morocco. This trade liberalization is likely to increase the competitiveness of US manufacturers and farmers in Morocco not only relative to Moroccan producers but also relative to other foreign suppliers such as the European Union with which Morocco already has an FTA.

The FTA signed with the European Union (EU) commits Morocco to a gradual removal of its barriers to industrial imports from Europe in exchange for aid, technical assistance, and a slight improvement in access to the EU market for its agricultural exports. The EU is Morocco's major trading partner, representing 75% of exports and 49% of imports (UN Trade Statistics, 2003).

The purpose of the present paper is to estimate the effects of the US – Morocco FTA on income distribution and on the adjustment of output, factor prices, and unemployment in different sectors of Morocco's economy. The present model ties the change in unemployment to change in income using Okun's law in its first direct application in an applied general equilibrium model. The analysis uses a simple competitive general equilibrium model and covers 34 economic sectors.

1.1. Economic Profile

Morocco is strategically located on the northwestern most tip of Africa, across the straight of Gibraltar only nine miles south of Europe. The World Bank ranks Morocco as a middle-income developing country with a GDP per capita for 2005, PPP adjusted, of $4,300. Morocco's total area is 172,413 square miles, slightly larger than the state of California. Morocco's economy measured by GDP is 1.1% of the US GDP, and its population is 10% of US population. The labor force in Morocco is evenly distributed between rural areas and urban areas. The service sector is concentrated in urban areas and represents the largest sector in Morocco's economy accounting for almost one-half of GDP. The service sector and employs 45% of the labor force and contributes 42.6% to GDP with the majority of Morocco's services exports generated by the travel and tourism sector. Tourism ranks as the second most important source of foreign currency after remittances from Moroccans residing abroad. Morocco has approximately three quarters of the world's phosphates reserves. It is the world's leading exporter and third largest producer of phosphates after the US and Russia.

The agricultural sector contributes 21.7% to GDP but employs 40% of the labor force (77% rural and 6.3% urban). The agricultural share of labor force attests to the relatively high labor intensity of agriculture. Agricultural products represent 30% of exports and 20% of imports. Morocco's economic growth is closely tied to the performance of the agricultural sector. The industrial sector employs 15% of the labor force and contributes 35.7% to GDP. Morocco's geographic proximity and historical ties to France and Spain mean that most of Morocco's economic and trade relations are with Europe. France, Portugal, and Spain are the largest foreign direct investors in Morocco,

combined they accounted for more than 90 % of foreign direct investment in 2001. Although Morocco's economy is relatively diversified, agriculture still plays a central role. Table 1.1, Table 1.2, and Table 1.3 show Morocco's economic indicators, main trade commodities, and main trade partners respectively.

1.2. US – Morocco Trade Relations

In 2003, The United States recorded a $66 million trade surplus with Morocco, 4.6% of Morocco's total imports valued at $462 million came from the US, while 3.4% of Morocco's total exports valued at $396 million was shipped to the US. Morocco is the 69th largest market for US exports, and the 82nd largest exporter to the US. Morocco's leading exports to the US are transistors, integrated circuits, minerals, calcium phosphates, and women's and girls' garments. Leading US exports to Morocco are aircraft, soybeans, corn, and wheat. About 60% of shipments from Morocco entered the United States duty free in 2003 on a normal trade relations (NTR) basis or under Generalized System of Preferences (GSP) program or other US provisions. Morocco is a member of the World Trade Organization (WTO) and has tariffs at rates ranging from zero to 380%.

1.3. US – Morocco Free Trade Agreement

The US – Morocco FTA addresses four important areas: market access, trade facilitation, investment, and the regulatory environment. Market access refers to the degree of openness or accessibility that one country's goods and services experience in another market and the extent to which one country's goods and services can compete with local goods and services in another market. Under the US – Morocco FTA and relying upon broader commitments both countries have made in the WTO, the two

countries agreed to progressively eliminate duties on originating goods and to implement a wide array of customs procedures that would enhance trade to ensure consistent customs treatment by both parties (USITC, 2004). The US – Morocco FTA also stipulates that no new duties would be imposed, that trade restrictions cannot be applied by either country except in special cases, that administrative fees related to trade would be limited to the cost of services rendered, and that merchandise processing fees must be eliminated.

The FTA also establishes a set of obligations in other areas that are more difficult to quantify such as rules of origin, trade in services, investment, trade facilitation including customs administration, technical barriers to trade, sanitary and phytosanitary regulations, electronic commerce, and transparency, and the regulatory environment including safeguards and trade remedies, government procurement, the protection and enforcement of intellectual property rights, labor, and the environment.

The agreement is expected to significantly impact sectors and industries undergoing the greatest degree of tariff liberalization such as machinery and equipment, grains, processed food, tobacco, petroleum, coal, chemicals, rubber, plastic products, and textiles and apparel.

With the implementation of FTA, some sectors of the Morocco's economy are expected to face increased import competition, resulting in falling prices and output, while others are expected to profit from rising prices and output as new export opportunities emerge. The economy of Morocco can be divided into two categories; a rural economy heavily dependent on agriculture, and a diversified urban economy driven

by the service and the industrial sectors. The performance of the agricultural sector gauges Morocco's economic growth.

Agriculture employs 77% of the rural labor force and only 6.3% of the urban labor force. Unemployment in rural areas is low compared to unemployment in urban areas. In 2004 rural unemployment was 3.2% while urban unemployment was 18.4%. Although unemployment is low in the country side, the rural population is heavily disadvantaged according to social and economic indicators. While rural population makes up half the population of Morocco, it accounts for 70% of the country's poor. Table 1.4 shows rural and urban areas access to electricity and safe water, literacy, and school enrollment. Low educational achievement is reflected in a rural labor force that for the most part is unskilled. Most jobs in rural areas require no formal education. The rural-urban skill gap is a major source of income inequality. On average skilled workers earn 6-7 times the wage of unskilled workers (Karshenas, 1994). One of the distinguishing features of rural employment that helps explain the low level of unemployment is the scale of employment in kind which represent 53.9% of rural employment compared with 6.5% in urban areas according to Löfgren (1999). Rural-Urban migration is another factor explaining the low level of unemployment in rural areas. Relatively unfavorable social and economic conditions and chronic drought have led to rapid rural-urban migration, which provides an important outlet for the rural labor force absorbing the bulk of its natural growth. The natural growth rate of the population in rural areas is one and half times higher than that of urban areas 2.6% and 1.7%, but the overall growth of the population in rural areas is less than 20% that of urban areas 0.7%

and 3.6%. The influx of rural population to urban areas exacerbates urban unemployment and puts downward pressure on urban unskilled wages.

The US – Morocco FTA overall impact on the economies of both countries will be different. The FTA is expected to affect certain US industries mildly, but the overall effect on US employment, production and prices is expected to be negligible because of the small size of Morocco's economy. In 2004, US imports from Morocco represented 0.04% of total imports while exports to Morocco represented 0.06% of total exports. A 100% increase in trade between the two countries would still be negligible by US standards. On the other hand, the impact on Morocco's economy will be significant, especially on the agricultural sector. The elimination of agricultural protection would generate significant aggregate welfare gains at the same time a considerable part of the disadvantaged rural population would lose strongly.

2. The Model

2.1. The General Equilibrium Model of Production and Trade

In the 1970s economists began to develop and use applied general equilibrium (AGE) models to evaluate the welfare and resource allocation effects of trade and domestic tax policies. AGE models specify explicit forms of demand and supply functions that make it possible to solve for the equilibrium values of prices and quantities once the model is fitted or scaled to a set of data.

The focus of all AGE models is the computation of changes in equilibrium values of endogenous variables brought about by changes in exogenous policy variables such as removal of subsidies or imposition of tariffs. The changes in endogenous variables can be derived using one of two methods. The first method derives the global changes in the

model's endogenous variables while the second derives the local comparative static changes.

The present emphasis is on general equilibrium comparative statics, and assumes constant returns, non-joint production, competitive pricing, and cost minimization. Factors of production are fully employed with the exception of labor. It is an application of the competitive model of production and trade summarized by Jones and Scheinkman (1977), Chang (1979), and Thompson (1989, 1995).

2.2. The Specific Factors Model

The Heckscher-Ohlin-Samuleson (H-O-S) theory describes the long run equilibrium of an economy and assumes that factors of production can costlessly move across sectors within the economy. Empirical evidence on wage differences and capital return across industries questions this assumption. Krueger and Summers (1988), Katz and Summers (1989), and Fels and Grundlach (1990) found that even after adjusting for differences in worker ability, lasting wage differences remained across industries and for long periods of time for both the US and Germany. Grossman and Levinsohn (1989) also found evidence of lasting differences in the return to capital across industries. The labor force in Morocco is composed of skilled mostly urban labor and unskilled mostly rural labor. Although empirical evidence has found that labor is relatively immobile across sectors, in the present paper skilled labor is assumed not to be sector specific but area specific. For instance, skilled labor is mobile across sectors employing skilled labor which happens to be concentrated in urban areas. Unskilled labor cannot be employed in urban sectors since it cannot be substituted for skilled labor. Rural-urban migration does

not have a significant effect on skilled wages but contributes to the increase in unemployment.

The specific factors (SF) model modifies the H-O-S model to allow for factors to be immobile between industries. The SF distinguishes the degree of factor mobility in terms of three periods:

The short run period: All factors are perfectly immobile

The medium run period: some factors are mobile while others are immobile

The long run period: all factors are mobile.

An important characteristic of the SF model is that the degree of factor mobility has an influence on how factor prices and factor incomes respond to change in exogenous variables.

2.3. The Model

The primary factors of production labor (L), capital (K), and energy (E) are used in agriculture (A), manufactures (M), and services (S). Thompson (1989) shows the mechanisms of the model through a geometric illustration. First, standard isoquants representing unit values of A, M, and S are positioned by their exogenous prices. Second, cost minimization guarantees that each unit value isoquant is supported by a common unit isoquant line with endpoints $p_j/w = 1/w$, $p_j/r = 1/r$, and $p_j/e = 1/e$ (j = A, M, S). Third, factor inputs are functions of w, r, and e determined at a_{ij} (i = L, K, E and j = A, M, S) where a_{ij} is the cost minimizing unit input i in industry j. Production functions are homothetic and exhibit constant returns, implying that each expansion path is linear at a given input price ratio.

The endowment of factors of production L, K, and E are given. With all available factors employed, outputs of A, M, and S are determined. If labor is not fully employed and employment N depends on income then output would be biased towards capital intensive manufactures. With income rising, the ratio of labor-intensive services and agriculture to manufactures increases. Production would then move along the Rybczynski line as the production possibilities frontier expands.

Okun's law is a noted empirical relationship between the change in unemployment rate and the percentage change in national income. Using Okun's law as in Thompson (1989) let u represent the unemployment rate:

$$u = (L - N)/L \qquad u > 0 \qquad (1)$$

Changes in unemployment and changes in the level of national income are assumed to be linearly related,

$$du = \alpha dY \qquad \alpha > 0 \qquad (2)$$

Differentiating (1) $du = (NdL - LdN)/L^2$ and substituting into (2)

$$dN = (1 - u)dL + \alpha dY \qquad (3)$$

Equation (3) becomes part of the general equilibrium model showing that employment N is related to the exogenous endowment of labor and the endogenous national income.

Employment is written as

$$N = a_{LA}x_A + a_{LM}x_M + a_{LS}x_S \qquad (4)$$

where x_j represents output (j = A, M, S). Differentiating (4) and using (3) gives

$$(1 - u)dL + \alpha dY = \Sigma_j a_{Lj}dx_j + s_{LL}dw + s_{LK}dr + s_{LE}de \qquad (5)$$

The aggregate economy substitution terms s_{ik} (i,k = L, K, E) summarize how firms alter their input mix when factor payments change, $s_{ik} = \Sigma_j x_j a_i^h{}_j$ where $a_i^h{}_j = da_{ij}/dw_h$. By Shepard's lemma and Taylor's formula, $s_{ik} = s_{ki}$. If s_{ik} is positive (negative), factors i and k are aggregate substitutes (complements).

Full employment in capital yield a simpler relationship,

$$dK = \Sigma_j a_{Kj} dx_j + s_{KL} dw + s_{KK} dr + s_{KE} de \qquad (6)$$

Similarly for energy,

$$dE = \Sigma_j a_{Ej} dx_j + s_{EL} dw + sEK dr + s_{EE} de \qquad (7)$$

Competitive pricing of each good implies

$$p_j = \Sigma_i w_i a_{ij} \qquad (8)$$

Differentiating (8) gives three more equations for the model

$$dp_j = a_{Lj} dw + a_{Kj} dr + a_{Ej} de \qquad j = A, M, S \qquad (9)$$

given the cost minimization envelop result, $wda_{Lj} + rda_{Kj} + eda_{Ej} = 0$.

National income is the sum of the payment to each factor of production

$$Y = wN + rK + eE \qquad (10)$$

Differentiating (10) and using (3) gives the final equation for the model

$$\gamma dY - Ndw - Kdr - Ede = (1 - u)wdL + rdK + edE \qquad (11)$$

where $\gamma = (1 - \alpha wL)$.

Organizing (2) and (5) through (11) in matrix form with the exogenous variables on the right,

s_{LL}	s_{LK}	s_{LE}	a_{LA}	a_{LM}	a_{LS}	0	$-\alpha$		dw		$(1 - u)dL$
s_{KL}	s_{KK}	s_{KE}	a_{KA}	a_{KM}	a_{KS}	0	0		dr		dK
s_{EL}	s_{EL}	s_{EE}	a_{EA}	a_{EM}	a_{ES}	0	0		de		dE
a_{LA}	a_{KA}	a_{EA}	0	0	0	0	0		dx_A	=	dp_A
a_{LM}	a_{KM}	a_{EM}	0	0	0	0	0		dx_M		dp_M
a_{LS}	a_{KS}	a_{ES}	0	0	0	0	0		dx_S		dp_S
-N	-K	-E	0	0	0	γ	γ		dY		$(1 - u)wdL + rdK + edE$
0	0	0	0	0	0	$-\alpha$	1		du		0

Partial derivatives of each of the eight endogenous variables (w, r, e, x_A, x_M, x_S, Y, u) with respect to any of the six exogenous variables (L, K, E, p_A, p_M, p_S) are obtained by inverting the system matrix using Cramer's rule. The resulting matrix can be divided into four sections. From left to right, the first row summarizes the elasticities of endogenous variables with respect to endowment of factors of production, the second row summarizes the elasticities of endogenous variables with respect to output prices, the third row the elasticities of endogenous variables with respect to unemployment, and the last row the elasticities of endogenous variables with respect to income.

dw/dv	dw/dp	dw/du	dw/dy
dx/dv	dx/dp	dx/du	dx/dy
dy/dv	dy/dp	dy/du	0
du/dv	du/dp	0	du/dy

Each row can be used to simulate the effect of changes in exogenous variables on endogenous variable. For instance, to simulate the effects of tariff removal on endogenous variables (w, r, x_A, x_M, x_S, Y, u), row two is multiplied by a vector of the expected price changes resulting from the tariff removal.

3. The Data

3.1. Morocco Factor Shares and Industry Shares

The first step in applying specific factor model is to compute the factor share matrix θ and industry share matrix λ. Table 2 is the total payment matrix used to derive factor shares and industry shares.

Factor shares are the portions each productive factor receives from industry revenue, and industry shares are the portions of productive factors employed in each industry. There are thirteen sectors and four productive factors. Capital is assumed sector specific, while labor is divided into two groups, urban employed mostly in the service and industrial sector, and rural labor employed mostly in agriculture. Energy is the only factor shared by all sectors and areas.

Summing across a row in Table 2 gives sector value added. Table 3 summarizes factor shares. Value added in agriculture is Dh209.21 billion (Dirham Dh, $1 = 9Dh) and the rural labor share is 122.96/209.21 = 58.8%, the energy share is 1.8%, and the capital share is 34.6%. The manufacturing sector is capital intensive using the share measure, with capital share varying dramatically from one sector to another. The factor share of capital in other industries is 61.6% while factor share of urban labor is 22.1%, and rural labor is 8.1%

Industry shares in Table 4 summarize the distribution of inputs across industries. Summing down a column in Table 2 gives total factor incomes. For example, total income of urban labor in all sectors is Dh308.77 billion. The industry share of agricultural rural labor is 63.6%. The industry share of capital in other industries is 28.2%, the largest industry share of capital. Capital is sector specific with each capital industry share 1 in its own industry.

3.2. Morocco Static Elasticities

Substitution elasticities as developed by Jones (1965) and Takayama (1982) summarize cost minimizing inputs adjustment when factor prices change. Following Allen (1938), the cross price elasticity between the input of factor i and the payment to factor k in sector j is

$$E_i^k{}_j = \hat{a}_{ij}/\hat{w}_k = \theta_{kj} S_i^h{}_j \qquad (12)$$

where $S_i^h{}_j$ is the Allen partial elasticity of substitution. Cobb-Douglas production implies $S_i^h{}_j = 1$. With constant elasticity of substitution (CES) production, the Allen elasticity can have any positive value. Given linear homogeneity, $\Sigma_k E_i^k{}_j = 0$ and the own price elasticity $E_i^i{}_j$ are the negative sum of cross price elasticities.

Substitution elasticities are the weighted average of cross price elasticities for each sector

$$\sigma_{ik} = \hat{a}/\hat{w}_k = \Sigma_j \lambda_{ij} E_i^k{}_j = \Sigma_j \lambda_{ij} \theta_{kj} S_i^h{}_j \qquad (13)$$

Factor shares and industry shares are used to derive the Cobb-Douglas substitution elasticities in Table 5. With Cobb-Douglas or CES the rule is substitution between inputs.

The largest own price elasticity is for energy and the smallest is for capital in other industries. Every 10% increase in the energy price causes a 17.6% decline in energy usage, and every 10% increase in the return to capital decreases its input in other industries by 3.84%. Constant elasticity of substitution would scale the elasticities in Table 5. When CES = 0.5, elasticities would be half as large as those in Table 5.

The comparative static elasticities of the system are in the inverse of the system matrix in (13) and are derived using Cramer's rule. Table 6 shows elasticities of factor prices with respect to prices of goods and services in the general equilibrium. The effects of price changes on factor payments are uneven in that with any price change some factors benefit and others lose.

The focus is on adjustments to the likely range of price changes due to the removal of trade barriers. Morocco's base tariff rates usually reach 50% ad valorem and in some cases related to TRQ products and other sensitive agricultural imports reach up to over 300%. Under the FTA agreement, Morocco would eliminate duties on many U.S. exports immediately while phasing out duties on some U.S. agricultural goods including TRQ categories and more sensitive industrial products over periods of 2 to 25 years. The US average tariff rate on imports from Morocco is around 4% ad valorem, a relatively low rate. The average tariff rate for U.S. goods entering Morocco is in excess of 20%. It is expected that the sectors that have had relatively higher trade protection will show larger effects from the implementation of the FTA. Agricultural prices are expected to fall as trade barriers are eliminated and domestic producers face increasing competition from US agricultural products, especially wheat which has been highly

protected. According to the USDA, during 1998-2003 the average Moroccan duty was 17.5% on corn, 28.4% on durum wheat, and 83.3% on bread wheat.

Table 6 shows that every 10% decrease in agricultural prices would lower agricultural rural wages and payment to capital in agriculture by 2.89% and 23.8%, and increase urban agricultural wages by 0.51%, a significant impact for capital (land) owners and rural agricultural labor. Some industrial sectors are also expected to suffer from increased competition with US products. The biggest effect on the return to capital will be in machinery sector, a relatively small sector in Morocco. Every 10% decrease in price of machinery will lower the return to capital and wages by 40.7% and 1% for urban workers. Labor in machinery is considered skilled labor and will not be affected significantly by a decrease in machinery prices since it can move to other expanding urban sectors. The expected winners from FTA are export sectors and services. One of the sectors expected to benefit from FTA is the fishing industry.

Morocco's coast line covers 2,141 miles along the Mediterranean Sea and Atlantic Ocean. The ocean off Morocco's Atlantic coast is one of the richest fishing grounds in the world. Since the 1930s, fishing has been a major industry in Morocco and its importance to the economy grew as the industry matured. The industry experienced tremendous growth and revamping during the 1980s, and since 1983 the annual catch has exceeded 430,000 tons. In 1986 and 1991 landings were the largest ever, exceeding 594,000 tons. In 1990, exports of fish and fish products were equivalent to 8% of total exports. Today, these exports account for approximately 45% of agricultural exports and employ over 100,000 people. The industry's importance is underscored in both the employment sector and by the $600 million plus of foreign exchange that the industry

brings in each year. Every 10% price increase will increase return to capital in the fishing industry by 30.3%, but will not significantly raise wages in the industry. The mining sector is also expected to gain from FTA. Morocco's mining sector is dominated by the mining of phosphates. Morocco has 76% of the world phosphates, and is the largest exporter and third largest producer after the US and Russia. Morocco's other mining industries include iron ore, manganese, lead, and zinc. A 10% price increase in the mining sector will raise return to capital by 27.7% but will have negligible effect on wages. The service sector is also expected to gain from FTA, with return to capital in the service sector benefiting the most, return to capital in construction and real estate related services is will increase by 25.7%, the return to capital in the hospitality industry will increase by 20.3%, and in other services by 23.5%. The impact on wages will be minimal with the exception of wages of urban workers in other services where a 10% price increase will lead to a 6.6% increase in their wages.

The comparative static effects of price changes on factor prices are the same for all CES production functions. Comparative static elasticities in Table 6 extend to all CES production functions regardless of substitution.

Price elasticities of output along the production possibility frontier are summarized in Table 7. A higher price raises output in a sector, attracting labor and energy from other sectors and lowering output in other sectors. Energy is a shared factor and will move without cost across sectors and areas. Labor in urban areas will move across sectors from the contracting to the expanding industries, but will not move to rural areas. Capital is sector specific and will not move.

Output in agriculture is expected to decrease as agricultural prices fall. Table 7 shows that a 10% price decrease in the price of agriculture will cause a 13.8% decrease in output.

Morocco is an important producer, consumer, and importer of barley and of durum and bread wheat. Grains are important staples in the Moroccan diet. The Moroccan government provides price support for wheat sold to licensed agents, and a retail wheat flour subsidy for low income consumers covering about 1 million metric ton (mt) of bread flour, about one-sixth of domestic wheat consumption. Morocco's corn production is insignificant. USDA states that there were about 1.5 million farmers in Morocco who grew wheat and barley in 2003. Moroccan farmers grew 1.0 million mt of durum wheat, 1.9 million mt of bread wheat, and 1.3 million mt of barley annually during the period 1998-2002.

Because Moroccan grain production is rain fed and is periodically subject to drought conditions, output is extremely variable from year to year. Moroccan crop yields fell by more than 10 percent in 6 of the 10 years during 1991-2000.
According to the USDA, during 1999/2000 to 2002/03 Morocco's average annual import of wheat was 3 million mt, approximately one-half of Morocco domestic consumption. Average annual import of coarse grains including corn was 1.4 million mt also about one-half of domestic consumption. Shapouri and Rosen (2003) projected that Moroccan imports of all grains are will grow annually by nearly 1 million mt during 2002-2012 to maintain the current level of per capita consumption.

In the industrial sector, output of machinery is expected to decrease. A price increase of 10% will lower output by 30.73%. The fishing industry will increase output

by 20.34% following a 10% price increase. Mining output will increase by 17.66%, other industries by 5.86%. Textile, garment and furs, and leather and shoes will increase by 28.71%. The textile, garment and furs, and leather and shoes are important sectors in terms of the size of the labor force employed and the contribution to GDP. Hotel and restaurant services are expected to increase by 10.26% following a 10% price increase, a relatively modest adjustment. Travel and Tourism is a well developed sector in the economy and ranks as the second largest foreign currency earner. The modest adjustment may be due to the fact that tourism sector in Morocco is relatively efficient and operates at close to full capacity. Tourism also faces competition from neighboring countries especially Spain and Tunisia.

Between 2003 and 2004 the number of unemployed declined by 2.45% or 30,000 people and total income increased by 5.77% or Dh45.89 billion. Okun's law relates the change in unemployment rate to the percentage change in national income. Using Okun's law as shown by Thompson (1989) the rate of change in unemployment assumed to be linearly related to income can be derived using (2). The rate of change in unemployment due to rising income represented by α is 0.425 where α represents the elasticity of unemployment with respect to income. An increase in income of 10% lowers unemployment by approximately 4.25%.

Various studies have estimated the economic impact of the US-Morocco FTA on the both countries. Gilbert (1999) predicts that the effects on the US economy would be negligible, 0.04 increase in imports, 0.03 % increase in exports, and no change in GDP. The effects of FTA on Morocco would be significant because of the relatively small size of Morocco. Brown, Kiyota, and Stern (2004) estimated a $920 million or 2.08% welfare

gain for Morocco. FTA benefits primarily will accrue to the export sector and the tourism industry, and will exacerbate problems in the agricultural sector. Using the Brown, Kiyota, and Stern (2004) estimate, unemployment is projected to decrease by 1.19%. Most of the new jobs created by FTA will be skilled jobs located in urban areas. Since the two labor markets are insulated from each other, unskilled mostly rural labor is not a substitute for skilled mostly urban labor, and the gain will accrue mostly to skilled labor and not trickle down to rural labor. The gain in terms of wages may be modest. Rural labor will see its wages further depressed and the FTA will be the impetus for the acceleration of rural-urban migration. The gain in terms of jobs created will be offset by the rural-urban migration that will swell the ranks of the unskilled unemployed. The overall effect of FTA on job creation may be negative at least in the immediate term before workers can relocate and retrain.

3.3. Projected Adjustment with FTA

Morocco maintains high tariff barriers relative to the US. The FTA will make the products of each country more accessible and more competitive in each other's market. Gilbert (2003) estimates the US-Morocco FTA would increase imports from Morocco to the US by 18.20 %, and US exports to Morocco by 88.25 %. Tariffs on grains range from 17.5 % for corn to 83.3 % for bread wheat. The removal of tariffs would make US agricultural products more competitive and would enable the US to regain its position as the major supplier of corn to Morocco, as well as gain a larger market share of other grains.

Based on the literature we expect agricultural prices to fall by 5% to 15%, mining prices to increase by 5%, machinery prices to fall 5%, and prices in the service sector to increase 5%. Table 8 summarizes the expected changes in prices.

To find the endogenous vector of factor price adjustments, multiply a vector of predicted price changes by the matrix of factor price elasticities in Table 6. Table 9 uses the expected price changes in Table 8. Results scale to the level of price changes, 10% price changes double the adjustments. The energy price is exogenous at the world level. Urban wages increase by 6.1% while rural wages decrease by 1.6%. The largest decrease in return to capital is in agriculture 41.2%, followed by machineries at 26.6%, steel and metal-work 3.4%, automobiles and other transportations 3.2%, and other industries 1.6%. The largest increase in return to capital is in other services increases by 15.3%, followed by textiles, garments and furs, and leather approximately 12.1%, fishing industry 11.5%, mining 10.5%, electrical equipment and electronics 8.9%, utilities, 8.9%, construction and real estate 7%, and hotel and restaurant 6.7%.

The endogenous vector of output adjustments is found by multiplying the vector of predicted price changes in Table 8 by the matrix of output price elasticities in Table 7. Sectors where return to capital is expected to decrease will also see a decrease in output. Agricultural output at 26.3%, followed by machinery output will fall by 21.6%, steel and metal-work 3.4%, automobiles and other transportations 3.2%, and other industries 1.6%. The highest increase in output will be in the other services 10.3%, followed by textiles, garments and furs, and leather approximately 7.1%, fishing industry 6.5%, mining approximately 5.5%, electrical equipment and electronics 3.9%, utilities3.9%, construction and real estate 2%, and hotel and restaurant less than 1.7%.

The output adjustments are modest relative to change in return to capital. The change in the return to capital will affect investment, generating larger long-run output adjustments. Assume a unit elasticity capital stock with respect to its return. In the present model, the percentage long-run adjustment in output is equal to the percentage change in the industry's capital stock. These long-run output adjustments are in the last column of Table 9. Output will further decline in the contracting industries and increase in expanding industries as the economy becomes more specialized. Agricultural output will decline by 41.2%, while fishing and mining outputs will increase by 11.5% and 10.5%.

The percentage change in machinery output is almost twice that of agriculture, but its impact will be relatively insignificant. FTA is expected to lower income by 0.04% and increase unemployment by 0.02%. The increase in unemployment will affect rural areas primarily.

The specific factors model provides insight into the potential output adjustments and income redistribution in Morocco under the FTA with the US as markets adjusts and the economy moves along its production frontier toward a new production pattern. Morocco's agriculture will suffer falling prices and import competition.
Sectors that are expected to benefit from FTA use unskilled labor less intensively than skilled labor, and may not be able to absorb the displaced unskilled rural labor. Chronic drought and unfavorable rural conditions accentuated by FTA will lead to rapid rural-urban migration, which provides an important outlet for the rural labor force absorbing the bulk of its natural growth but exacerbates urban unemployment and depresses urban unskilled wages.

FTA will have a greater impact on rural areas where labor is concentrated in agriculture. According to data from the early 1990s, per-capita consumption in rural areas is about half the consumption in urban areas. Rural areas also account for 70 % of Morocco's poor. The gains from FTA which are expected to go mostly to urban areas and urban skilled labor will be offset by the losses in rural areas. The present model uses Okun's law in its first application in an applied general equilibrium model to tie the change in unemployment to change in income.

Morocco's attempts at decentralizing industrial activity and promoting industrial investments in rural areas have been modestly successful. Most of the service and industrial activities are concentrated in Casablanca. Casablanca is considered the economic capital of Morocco. With the largest population and the biggest port it is the biggest city in Morocco. Casablanca's port complex has become the city's economic centre, and is one of the largest artificial ports in the world covering an area of 445 acres. The port is the second largest in North-Africa, handling around 70% of Morocco's shipping.

To end the isolation of rural areas, Morocco launched in 1995 the National Road Construction Program (PNCRR) designed to decentralize the economy by building a network of toll freeways that will link the country's interior to the coastal cities and ports. Over a nine-year period, an additional 10,000 km of rural roads were built. The ongoing program will link the Casablanca-Rabat highway to the other major cities. The Rabat-Tangiers highway is 225 km and connects the capital to the north and runs along the Atlantic coast, Rabat-Fez highway is 180 km long and runs west to east connecting the capital to the heartland, Casablanca-Taroudant highway is 555 km and runs north to south

along the atlantic coast. In addition a Mediterranean by-pass 530 km long will run west to east connecting Tangiers to the resort town of Saidia along the Algerian border.
The adoption of the toll system as tool of financing contributed to the establishment of the freeway program. This financing policy materialized when the Société Nationale des Autoroutes du Maroc (ADM) was created. ADM's principal tasks is building, managing and maintaining the highways network granted to it by the government. The toll system is designed to remunerate and amortize capital invested by the ADM for both of construction and management of the freeways. The initial duration of the conceded freeways was 35 years, later extended to 50 years so as to ensure the recovery of the capital expenditures. The principal reason for the duration extension is the low level of traffic in the freeways and the subsequent low revenue. The high tolls have deterred drivers from using the new freeways. For instance, to drive from Casablanca to Tangiers a driver must pay dh80 ($8.80) in tolls, first, dh20 ($2.20) for the 100km (60 miles) linking Casablanca to Rabat, then dh60 ($6.60) for the next 250km (148miles) between Rabat and Tangiers. ADM is also authorized to set up and operate or lease commercial facilities such as gas stations, restaurants, hotels, and transport services, within the geographic vicinity of the highway but it has not yet made use of such an option.

4. Policy Discussion

Since the accession of King Mohammed VI, important steps have been taken to reform Morocco's economy and to deepen its democratic structures. These steps include updating Morocco's intellectual property rights legislation, developing a specialized commercial court system, liberalizing the telecommunications market, and emphasizing government transparency. All of the government procurement contracts are large

projects for which the competition is predominantly European companies. Many of these projects are financed by multilateral development banks, which impose their own nondiscriminatory procurement regulations. US companies sometimes have difficulty with the requirement that bids for government procurement be in French.

The central bank sets the exchange rate for the dirham against a basket of currencies of its principal trading partners, particularly the euro that is given a strong weight and the currencies of the European trading area. This exchange rate mechanism causes dollar to dirham exchange rate to be highly volatile. This volatility increases the foreign exchange risk of importing from the United States as compared to importing from Europe.

The Moroccan dirham is convertible for all current transactions, as well as for some capital transactions, especially capital repatriation by foreign investors. The Moroccan dirham is available through commercial banks for such transactions upon presentation of documents. Moroccan companies are permitted to borrow abroad without prior government approval. Moroccan individuals or corporations investing abroad must seek approval from the Foreign Exchange Board. The use of international credit cards by Moroccans is severely restricted, making it nearly impossible to use e-commerce to purchase goods internationally.

Due to a higher inflation rate than its European trading partners, the IMF and World Bank pressured Morocco into making its exchange rate regime more flexible. The central bank adjusted the value of the dirham by changing the weight of the currencies in the basket and assigning an even greater weight to the euro, resulting in 5.18% effective

devaluation of the dirham. In spite of this adjustment and an earlier devaluation of 9% many economist believe that the dirham is still overvalued.

In November, 1989, parliament abolished a 1973 law requiring majority Moroccan ownership of firms in a wide range of industries. This law served as a barrier to US investments in Morocco. In 1993, the Moroccan government eliminated a 1974 decree restricting foreign ownership in the petroleum refining and distribution sector, and allowed Mobil Oil to buy back the government's 50% share of Mobil's Moroccan subsidiary in 1994.

Morocco sees foreign investment as a key to development and is doing everything it can to attract investors and improve its infrastructure for trade. For example, Morocco is becoming a popular base for French call centers, with the state rail company, SNCF, and France Télécom among the early operators there. US companies have a small but growing presence in Morocco. Dell Computer operates a 24-hour call center, and Motorola has some assembly operations. Several US trade associations such as ConnectUS, which includes Google and Cisco Systems among its members, and the Morocco-American Trade and Investment Council, which includes Dell and Oracle Corporation as members, are also actively promoting commerce with Morocco. Despite relatively strong macroeconomic indicators, low inflation levels (approximately 2%), and foreign currency reserves providing approximately six months of import coverage, persistent structural problems still hinder Morocco's economy. Over the last decade economic growth has been weak, partly because of dependence on agriculture – the primary motor of economic growth, and sporadic but recurring drought. A two-year drought led the economy to contract by 0.7% in 1999 and to grow by only 0.3% in 2000.

The effects were felt strongly by the rural population whose living conditions have deteriorated.

Despite the progress made by the government on economic reform, there is frequent criticism that the government is not moving quickly enough. The short term effects of FTA may be severe, especially for agriculture, the most heavily protected sector and the sector that provides the lion share of income in rural areas. Examples of short run policies that can be adopted are income transfer programs for rural agricultural labor, and the elimination of freeway tolls.

An income transfer program similar to Mexico's PROCAMPO, where farmers are compensated for the loss of protection of agricultural markets can attenuate the short run impact of FTA. Transfer payments can be made proportional to past earnings in agriculture, and specifically designed so as not to distort current production decisions (World Bank, 1997). The short term income transfer can be supplemented by long term investments in education and training of rural labor force to help it adapt to the changing economy conditions, and investments in infrastructure that would facilitate the development of non-agricultural activities in rural areas.

Eliminating tolls and replacing the financing system of freeways by granting franchises for commercial activities, such as gas stations, restaurants, and hotels along the freeway through competitive bidding, would help in promoting industrial development in the country's interior. The present financing system is less than adequate. Tolls are set too high to stimulate high traffic, and are a deterrent to drivers who prefer free secondary roads. The low traffic does not generate enough revenue to justify additional investments in commercial ventures along the freeway. Even by wealthy developed countries

standards the tolls are too high. For instance, a 148 miles trip from Rabat to Tangiers costs $6.60 while a 100 miles trip on I-95 in Maine from York to Augusta costs $3.25 in tolls. According to the World Bank, 2005 income per capita in Morocco is $1520. Relative to income, highway tolls in Morocco are exorbitant and are the reason they are deserted. Businesses operating in Morocco's interior have to consider the cost of using freeways to access Casablanca's port and markets. Although they are toll-free, secondary roads in Morocco are some of the deadliest in the world. International Road Safety News reports that the toll of dead and injured from road accidents in Morocco is over 3,800 and 15,000 and costs the State 2.5% of the GDP or about $1.2 billion a year.

The SF model does not separate the effect of FTA on rural and urban areas. Intuitively an increase in income should lead to a decrease in unemployment, as income rises and the economy grows new jobs are created but a closer look at the effect of FTA on Morocco's economy may reveal a different picture. Gilbert (2003) estimates the US-Morocco FTA would increase imports from Morocco to the US by 18.2 %, and US exports to Morocco by 88.3 %. The removal of tariffs would make US agricultural products more competitive, and would enable the US to regain its position as the major supplier of corn to Morocco, as well as gain a larger market share of other grains. The agricultural sector in Morocco is labor intensive. Table 10 shows that in 1994-1995 agriculture employed 44.8% of the population, more than half the people employed in agriculture are paid in kind.

Karshenas estimates that skilled labor earns 6 to 7 times more than unskilled workers. Most of the unskilled labor is concentrated in rural areas where unemployment is very low in spite of the huge rural-urban income inequality. Rural agricultural income

is at a subsistence level and is not affected by unfavorable economic conditions and drought. When economic conditions are unfavorable some of the rural labor migrates to the city because income is at an absolute low and cannot fall.

The model estimates that rural wages will fall by 1.6%. Since agricultural wages will not fall because they are already at a minimum, the endowment of rural labor decreases as they move to the city. To estimate the effect of FTA on unemployment, the matrix of factor prices with respect to endowment is used.

Wages will remain relatively unchanged for both urban and rural sectors. The increased share of labor in expanding sectors will not put upward pressure on wages because of high unemployment. Expanding sectors will not have to entice labor with higher wages because high unemployment causes the labor supply to be very elastic. Contracting sectors, especially in rural areas, will not see a decrease in wages because wages are already at subsistence levels. Deteriorating economic conditions force rural labor to migrate to urban areas. Löfgren explains that rapid rural-urban migration provides an important outlet for the rural labor force absorbing the bulk of its natural growth. The natural growth rate of the population in rural areas is one and half times higher than that of urban areas but the overall growth of the population in rural areas is less than 20% that of urban areas.

The elasticities of factor prices with respect to endowment in Table 11 and the estimated factor price adjustment in Table 9 are used to estimate the level of rural migration, and change in employment. For example, an increase in urban labor endowment by 10% would lower urban wages by 3%, ceteris paribus. In a tight labor market, expanding urban industries demand for labor would push wages up 6.1%, but

high unemployment would allow urban industries to increase their demand for labor without putting upward pressure on wages. To estimate the increase in employment in an expanding sector, the estimated change in factor prices from Table 9 is combined with the elasticity of factor prices with respect to endowment.

Employment in agriculture will decrease by 7.7%, while employment in fisheries and mining will increase by 1.7% and 1.9%. Some of the unemployed in agriculture will find work in fisheries and mining, but their number is minimal because agriculture dwarfs the other two sectors.

Table 12 summarizes the change in employment. Expanding sectors will increase the size of their labor, while contracting sectors will decrease the size of their labor force. These changes will not affect wages because of high unemployment.

Falling agricultural prices and import competition will accentuate the rural-urban migration, and keep wages in rural areas relatively stable. In urban areas, the effects of FTA on wages will depend on workers skill level and their industry. The service sector will be the net winner, with other services benefiting the most.

5. Conclusion

The US – Morocco FTA provides bilateral tariff elimination on many agricultural products with most other tariffs phased out within 15 years. US agricultural producers especially grains producers will benefit from new TRQ that provide better access to Morocco. The FTA will most likely increase the competitiveness of US manufacturers and farmers in Morocco not only relative to Moroccan producers but also relative to other foreign suppliers such as the European Union with which Morocco already has an FTA.

The US – Morocco FTA will benefit export industries in Morocco. Employment in expanding export sectors such as tourism, fisheries, and mining as well as some service sectors will increase. Import competing sectors will suffer from increased competition and falling prices. Income for both expanding and contracting sectors will most likely not change due to Morocco's high unemployment. The agricultural sector will be the most severely affected by FTA. The agricultural sector employs 45% of the country's labor force and more than two thirds of the rural labor force. Rural areas are characterized by low unemployment and high levels of poverty. The low level of unemployment in rural areas is due to rural-urban migration and to the scale of employment in kind, which represent 54% of rural employment. Relatively unfavorable social and economic conditions and chronic drought have led to rapid rural-urban migration, which provides an important outlet for the rural labor force. Wages in rural areas are at subsistence levels and do not fall when economic conditions worsen. The FTA will accelerate the rural-urban migration. A small fraction of the displaced rural laborer will find employment in the expanding mining and fishing sectors, while the majority will swell the ranks of the unemployed in urban areas, putting more strains on an already stressed social and economic system.

In future research, I will use a more comprehensive computable general equilibrium model and disaggregate the sectors into skilled-urban, unskilled urban, skilled-rural, and unskilled rural sectors.

Appendix 1A. List of variables and their abbreviations

Sector	Code
Agriculture	**Ag**
Fisheries	**Fs**
Mining	**Mi**
Food processing, Tobacco, Wood-working, Paper and Cardbox, Printing, Refining, Rubber and Plastics, chemicals, and Furniture	**Oi**
Textile, Garments and Furs, and Leather and Shoes	**Tx**
Steel, Non-Metal industries, Other Metals	**Sm**
Machinery	**Ma**
Electrical equipment, Electronics, and Medical and Precision equipment	**El**
Automobiles, and other Transportations	**Tr**
Utilities	**Ut**
Construction, and Real-Estate	**Re**
Hotels and Restaurants	**Hr**
Commercial services, financial services and insurance, Transport services, Telecommunication, Government services, Health care, Education and other non financial services	**Os**

Appendix 1B. Tables to Chapter 1

Table 1.1 Economic Indicators

	2005
Population (mn)	30.6
GDP($bn, PPP)	139.5
GDP per capita($, PPP)	4,300
Real GDP growth (%)	1.8
Good exports($mn)	9,472
Goods imports ($mn)	18,150
Trade balance ($mn)	-8,678
Trade openness (X+M/Y)	52.41

Table 1.2 Main Trade Commodities, US$ million, 2002

Exports		Imports	
Apparel & footwear	2,616	Computers	3,576
Fish and shellfish	918	Yarn and fabric	1,483
Electronics	883	Petroleum	1,386
Inorganic chemicals	471	Machinery	906
Phosphates	364	Cereals	749
Fertilizer	332	Motor vehicles	582
Petroleum	286	Medicines	181

Table 1.3 Main trade partners, % of total, 2002

Exports		Imports	
EU total	74.5	EU total	49.4
France	26.7	France	21
Spain	14.4	Spain	12.7
United Kingdom	8	Italy	6.4
Italy	5.6	Germany	5.3
United States	3.4	United States	4.6

Table 1.4 Morocco's Social Indicators

	Rural	Urban	Total
Population (1994)			
million	12.7	13.4	26.1
%	48.6	51.4	100
Annual population growth (1982-1994)			
Natural	2.6	1.7	2.2
Post-Migration	0.7	3.6	2
Poverty rate (1991)	18	7	13.1
Electricity access (1994)	9.7	80.7	46.2
Safe water access (1994)	4	74.2	40.1
Illiteracy rate (1994)			
Male	61	25	41
Female	89	49	67
Total	75	37	55
Primary school enrollment rates (1991)			
Male	56.5	86.7	69.9
Female	29.9	84.7	52.8
Total	43.2	85.7	61.3

Table 2 Factor Payments dh million 2004

	capital	**Energy**	**urban**	**rural**	**total**
Ag	72,477	3,716	10,061	122,966	**209,219**
Fs	15,501	11,622	17,112	4,549	**48,784**
Mi	4,165	2,735	3,805	893	**11,598**
Oi	109,565	14,446	39,289	14,445	**177,746**
Tx	22,930	14,903	49,651	15,679	**103,163**
Sm	14,183	4,319	10,715	3,864	**33,081**
Ma	1,544	1,214	2,381	1,196	**6,336**
El	10,698	3,797	13,096	4,123	**31,715**
Tr	6,340	2,158	4,762	1,688	**14,948**
Ut	4,710	3,039	8,425	634	**16,808**
Re	31,097	8,368	38,153	6,181	**83,799**
Hr	6,537	1,578	4,557	621	**13,293**
Os	88,154	118,765	106,771	17,486	**331,177**
total	**387,901**	**190,661**	**308,779**	**194,325**	

Table 3 Factor Share θ

	capital	**Energy**	**urban**	**rural**
Ag	0.35	0.02	0.05	0.59
Fs	0.32	0.24	0.35	0.09
Mi	0.36	0.24	0.33	0.08
Oi	0.62	0.08	0.22	0.08
Tx	0.22	0.14	0.48	0.15
Sm	0.43	0.13	0.32	0.12
Ma	0.24	0.19	0.38	0.19
El	0.34	0.12	0.41	0.13
Tr	0.42	0.14	0.32	0.11
Ut	0.28	0.18	0.50	0.04
Re	0.37	0.10	0.46	0.07
Hr	0.49	0.12	0.34	0.05
Os	0.27	0.36	0.32	0.05

Table 4 Industry Share λ

	capital	**Energy**	**urban**	**rural**
Ag	0.19	0.02	0.03	0.63
Fs	0.04	0.06	0.06	0.02
Mi	0.01	0.01	0.01	0.01
Oi	0.28	0.08	0.13	0.07
Tx	0.06	0.08	0.16	0.08
Sm	0.04	0.02	0.04	0.02
Ma	0.00	0.01	0.01	0.01
El	0.03	0.02	0.04	0.02
Tr	0.02	0.01	0.02	0.01
Ut	0.01	0.02	0.03	0.00
Re	0.08	0.04	0.12	0.03
Hr	0.02	0.01	0.02	0.00
Os	0.23	0.62	0.35	0.09

Table 5 Cobb-Douglas Substitution Elasticities σik

	$\hat{w}_U$	$\hat{w}_R$	$\hat{w}_E$	$\hat{w}_{Ag}$	$\hat{w}_{Fs}$	$\hat{w}_{Mi}$	$\hat{w}_{Oi}$	$\hat{w}_{Tx}$	$\hat{w}_U$	$\hat{w}_R$	$\hat{w}_E$	$\hat{w}_{Ag}$	$\hat{w}_{Fs}$	$\hat{w}_{Mi}$	$\hat{w}_{Oi}$	$\hat{w}_{Tx}$
$\hat{a}_u$	-1.53	0.54	0.34	0.03	0.04	0.09	0.10	0.08	0.02	0.01	0.03	0.01	0.01	0.07	0.01	0.23
$\hat{a}_R$	0.43	-1.38	0.35	0.26	0.02	0.00	0.07	0.07	0.02	0.01	0.02	0.01	0.00	0.03	0.00	0.09
$\hat{a}_E$	0.64	0.39	-1.76	0.02	0.05	0.01	0.07	0.07	0.02	0.01	0.02	0.01	0.01	0.04	0.01	0.40
$\hat{a}_{Ag}$	0.05	0.59	0.02	-0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Fs}$	0.35	0.09	0.24	0.00	-0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Mi}$	0.33	0.08	0.24	0.00	0.00	-0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Oi}$	0.22	0.08	0.08	0.00	0.00	0.00	-0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Tx}$	0.48	0.15	0.14	0.00	0.00	0.00	0.00	-0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Sm}$	0.32	0.12	0.13	0.00	0.00	0.00	0.00	0.00	-0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Ma}$	0.38	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	-0.76	0.00	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{El}$	0.41	0.13	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.66	0.00	0.00	0.00	0.00	0.00
$\hat{a}_{Tr}$	0.32	0.11	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.576	0.00	0.00	0.00	0.00
$\hat{a}_{Ut}$	0.50	0.04	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.72	0.00	0.00	0.00
$\hat{a}_{Re}$	0.46	0.07	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.63	0.00	0.00
$\hat{a}_{Hr}$	0.34	0.05	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.51	0.00
$\hat{a}_{Os}$	0.32	0.05	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.73

Table 6 Elasticities of factor prices with respect to price

	dp_{Ag}	dp_{Fs}	dp_{Mi}	dp_{OI}	dp_{Tx}	dp_{Sm}	dp_{Ma}	dp_{El}	dp_{Tr}	dp_{Ut}	dp_{Re}	dp_{Hr}	dp_{Os}
$\hat{a}_u$	-0.05	0.066	0.01	0.08	0.19	0.03	0.01	0.03	0.01	0.03	0.09	0.01	0.66
$\hat{a}_R$	0.29	0.04	0.01	0.04	0.27	0.02	0.01	0.04	0.01	0.02	0.08	0.00	0.10
$\hat{a}_E$	0.37	0.04	0.01	0.02	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.43
$\hat{a}_{Ag}$	2.38	-0.07	-0.01	-0.07	-0.49	-0.04	-0.02	-0.07	-0.02	-0.04	-0.15	-0.01	-0.28
$\hat{a}_{Fs}$	-0.30	3.03	-0.02	-0.12	-0.33	-0.04	-0.02	-0.06	-0.02	-0.04	-0.12	-0.01	-1.08
$\hat{a}_{Mi}$	-0.26	-0.09	2.77	-0.10	-0.27	-0.04	-0.02	-0.05	-0.02	-0.03	-0.10	-0.01	-0.91
$\hat{a}_{Oi}$	-0.07	-0.03	-0.01	1.59	-0.11	-0.01	-0.01	-0.02	-0.01	-0.01	-0.04	-0.00	-0.31
$\hat{a}_{Tx}$	-0.33	-0.19	-0.04	-0.21	3.87	-0.08	-0.04	-0.11	-0.04	-0.08	-0.24	-0.02	-1.78
$\hat{a}_{Sm}$	-0.15	-0.07	-0.01	-0.08	-0.23	2.30	-0.01	-0.04	-0.01	-0.03	-0.09	-0.01	-0.66
$\hat{a}_{Ma}$	-0.44	-0.16	-0.03	-0.17	-0.55	-0.07	4.07	-0.09	-0.03	-0.06	-0.20	-0.02	-1.43
$\hat{a}_{El}$	-0.18	-0.11	-0.02	-0.12	-0.35	-0.04	-0.02	2.90	-0.02	-0.04	-0.14	-0.01	-1.00
$\hat{a}_{Tr}$	-0.16	-0.07	-0.01	-0.08	-0.23	-0.03	-0.01	-0.04	2.34	-0.03	-0.09	-0.01	-0.67
$\hat{a}_{Ut}$	-0.19	-0.15	-0.03	-0.16	-0.41	-0.06	-0.03	-0.07	-0.03	3.51	-0.17	-0.02	-1.47
$\hat{a}_{Re}$	-0.09	-0.10	-0.02	-0.11	-0.30	-0.04	-0.02	-0.05	-0.02	-0.04	2.57	-0.01	-0.95
$\hat{a}_{Hr}$	-0.08	-0.06	-0.01	-0.06	-0.17	-0.02	-0.01	-0.03	-0.01	-0.02	-0.07	2.03	-0.57
$\hat{a}_{Os}$	-0.49	-0.14	-0.03	-0.13	-0.37	-0.05	-0.03	-0.06	-0.02	-0.04	-0.13	-0.02	2.36

Table 7 Elasticities of output with respect to output prices

	dx_{Ag}	dx_{Fs}	dx_{Mi}	dx_{Oi}	dx_{Tx}	dx_{Sm}	dx_{Ma}	dx_{El}	dx_{Tr}	dx_{Ut}	dx_{Re}	dx_{Hr}	dx_{Os}
Ag	1.38	-0.07	-0.01	-0.07	-0.49	-0.04	-0.02	-0.07	-0.02	-0.04	-0.15	-0.01	-0.28
Fs	-0.30	2.03	-0.02	-0.12	-0.33	-0.04	-0.02	-0.06	-0.02	-0.04	-0.12	-0.01	-1.08
Mi	-0.26	-0.09	1.77	-0.10	-0.27	-0.04	-0.02	-0.05	-0.02	-0.03	-0.10	-0.01	-0.91
Oi	-0.07	-0.03	-0.01	0.59	-0.11	-0.01	-0.01	-0.02	-0.01	-0.01	-0.04	-0.00	-0.31
Tx	-0.33	-0.19	-0.04	-0.21	2.87	-0.08	-0.04	-0.11	-0.04	-0.08	-0.24	-0.02	-1.78
Sm	-0.15	-0.07	-0.01	-0.08	-0.23	1.30	-0.01	-0.04	-0.01	-0.03	-0.09	-0.01	-0.66
Ma	-0.44	-0.16	-0.03	-0.17	-0.55	-0.07	3.07	-0.09	-0.03	-0.06	-0.20	-0.02	-1.43
El	-0.18	-0.11	-0.02	-0.12	-0.35	-0.04	-0.02	1.90	-0.02	-0.04	-0.14	-0.01	-1.00
Tr	-0.16	-0.07	-0.01	-0.08	-0.23	-0.03	-0.01	-0.04	1.34	-0.03	-0.09	-0.01	-0.67
Ut	-0.19	-0.15	-0.03	-0.16	-0.41	-0.06	-0.03	-0.07	-0.03	2.51	-0.17	-0.02	-1.47
Re	-0.09	-0.10	-0.02	-0.11	-0.30	-0.04	-0.02	-0.05	-0.02	-0.04	1.57	-0.01	-0.95
Hr	-0.08	-0.06	-0.01	-0.06	-0.17	-0.02	-0.01	-0.03	-0.01	-0.02	-0.07	1.03	-0.57
Os	-0.49	-0.14	-0.03	-0.13	-0.37	-0.05	-0.03	-0.06	-0.02	-0.04	-0.13	-0.02	1.36

Table 8 Expected % Price Change

Ag	**Fs**	**Mi**	**Oi**	**Tx**	**Sm**	**Ma**	**El**	**Tr**	**Ut**	**Re**	**Hr**	**Os**
-15	5	5	0	5	0	-5	5	0	5	5	5	5

Table 9 Factor price and output adjustments

	Price Change %		Factor Price Adjustments		Output Adjustments	Long run Output Adjustments
		$\hat{\mathbf{w}}_{\mathbf{u}}$	6.12			
		$\hat{\mathbf{w}}_{\mathbf{R}}$	-1.64			
Ag	-15	$\hat{\mathbf{w}}_{\mathbf{Ag}}$	-41.2	**Ag**	-26.3	-41.2
Fs	5	$\hat{\mathbf{w}}_{\mathbf{Fs}}$	11.5	**Fs**	6.49	11.5
Mi	5	$\hat{\mathbf{w}}_{\mathbf{Mi}}$	10.5	**Mi**	5.46	10.5
Oi	0	$\hat{\mathbf{w}}_{\mathbf{Oi}}$	-1.62	**Oi**	-1.62	-1.62
Tx	5	$\hat{\mathbf{w}}_{\mathbf{Tx}}$	12.1	**Tx**	7.12	12.1
Sm	0	$\hat{\mathbf{w}}_{\mathbf{Sm}}$	-3.35	**Sm**	-3.35	-3.35
Ma	-5	$\hat{\mathbf{w}}_{\mathbf{Ma}}$	-26.6	**Ma**	-21.6	-26.6
El	5	$\hat{\mathbf{w}}_{\mathbf{El}}$	8.92	**El**	3.92	8.92
Tr	0	$\hat{\mathbf{w}}_{\mathbf{Tr}}$	-3.24	**Tr**	-3.24	-3.24
Ut	5	$\hat{\mathbf{w}}_{\mathbf{Ut}}$	8.87	**Ut**	3.87	8.87
Re	5	$\hat{\mathbf{w}}_{\mathbf{Re}}$	7.02	**Re**	2.02	7.02
Hr	5	$\hat{\mathbf{w}}_{\mathbf{Hr}}$	6.71	**Hr**	1.71	6.71
Os	5	$\hat{\mathbf{a}}_{\mathbf{Os}}$	15.3	**Os**	10.3	15.3
alpha	0.43			**dy**	-0.04	
				du	-0.02	

Table 10 Structure of production and employment, 1994-1995

		Employment		
	GDP	Rural	Urban	Total
	(%)	(%)	(%)	(%)
Agriculture	18.5	77	6.3	44.8
Industry	26.5	9.3	27.2	17.5
Construction	4.3	4.1	7.1	5.4
Government Administration	12.2	0.9	11.5	5.7
Other services	38.4	8.7	47.9	26.5
Total	100	100	100	100
Total (bn Dh or '000 workers)	279.3	4640.2	3870.4	8510.5

Table 11 Elasticities of factor prices with respect to endowment

	dv_U	dv_R	dv_E	dv_{Agr}	dv_{Fish}	dv_{Min}	dv_{OInd}	dv_{Tex}	dv_{Ste}	dv_{Mach}	dv_{Elec}	dv_{Tran}	dv_{Uti}	dv_{Cons}	$dv_{H\&R}$	dv_{Ste}
dw_u	-0.30	-0.07	0.14	-0.08	0.02	0.00	0.02	0.02	0.01	0.00	0.01	0.00	0.01	0.02	0.00	0.01
dw_R	0.15	-0.46	0.04	-0.01	0.02	0.00	0.04	0.06	0.01	0.00	0.02	0.00	0.01	0.05	0.01	0.01
dw_E	0.02	0.19	-0.42	0.26	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00
dw_{Agr}	-0.22	0.78	-0.06	0.02	-0.03	-0.01	-0.08	-0.10	-0.02	0.00	-0.03	-0.01	-0.02	-0.08	-0.01	-0.02
dw_{Fish}	0.26	0.07	0.15	-0.10	-0.02	-0.01	-0.04	-0.04	-0.01	0.00	-0.01	-0.01	-0.01	-0.02	0.00	-0.01
dw_{Min}	0.22	0.04	0.14	-0.09	-0.02	0.00	-0.03	-0.03	-0.01	0.00	-0.01	0.00	-0.01	-0.02	0.00	-0.01
dw_{OInd}	0.08	0.06	0.00	0.00	-0.01	0.00	-0.01	-0.02	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00
dw_{Tex}	0.52	0.34	-0.06	0.01	-0.05	-0.01	-0.08	-0.09	-0.02	-0.01	-0.02	-0.01	-0.02	-0.06	-0.01	-0.02
dw_{Ste}	0.18	0.12	0.01	-0.02	-0.02	0.00	-0.03	-0.03	-0.01	0.00	-0.01	0.00	-0.01	-0.02	0.00	-0.01
dw_{Mach}	0.32	0.31	0.09	-0.07	-0.04	-0.01	-0.07	-0.08	-0.02	0.00	-0.02	-0.01	-0.01	-0.06	-0.01	-0.02
dw_{Elec}	0.30	0.19	-0.04	0.01	-0.03	-0.01	-0.04	-0.05	-0.01	0.00	-0.01	-0.01	-0.01	-0.04	-0.01	-0.01
dw_{Tran}	0.17	0.11	0.03	-0.02	-0.02	0.00	-0.03	-0.03	-0.01	0.00	-0.01	0.00	-0.01	-0.02	0.00	-0.01
dw_{Uti}	0.49	0.06	0.02	-0.02	-0.03	-0.01	-0.05	-0.05	-0.01	0.00	-0.01	-0.01	-0.01	-0.03	-0.01	-0.01
dw_{Cons}	0.33	0.12	-0.07	0.03	-0.03	-0.01	-0.04	-0.04	-0.01	0.00	-0.01	-0.01	-0.01	-0.03	0.00	-0.01
$dw_{H\&R}$	0.19	0.05	0.00	-0.01	-0.01	0.00	-0.02	-0.02	-0.01	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01
dw_{OSer}	0.30	-0.08	0.39	-0.25	-0.02	-0.01	-0.04	-0.04	-0.01	0.00	-0.01	-0.01	0.00	-0.02	0.00	-0.01

Table 12 Change in employment

Sector	% change in employment by sector	% change in total employment	Net Change
Agr	-7.71	-2.05	
Fish	1.65	0.05	
Min	1.91	0.01	-1.99
OInd	-0.94	-0.03	
Tex	-6.90	-0.25	
Ste	-1.64	-0.01	
Mach	-2.40	0.00	
Elec	-4.04	-0.04	
Tran	-1.17	0.00	-0.34
Uti	-2.50	-0.03	
Cons	-4.23	-0.30	
H&R	-1.28	-0.01	
OSer	8.52	1.67	1.33
		Total Net Change	-1.00

CHAPTER 2. AN EMPIRICAL STUDY OF RESTRICTED CAPITAL MOBILITY AND EXCHANGE RATES

1. Introduction

The literature on floating exchange rates has looked at relative money supplies when analyzing exchange rates and relative price levels. The literature includes Branson (1986), Bilson (1978), Driskil (1976), Henderson (1980), Balassa (1964), and Frankel (1979). While this literature has provided a rich array of predictions and long-run relationships between money, exchange rates, and price levels, it has provided very little insight into exchange rate behavior in response to economic growth and different levels of capital mobility.

The purpose of the present paper is to evaluate the impact of different levels of capital mobility on the exchange rate applying an open economy macroeconomic framework and using two structural models, the monetary model and a stock-flow model developed by generalizing the Dornbusch model to allow imperfect capital mobility. The case examined is South Korea relative to Ireland from 1974 to 1998 covering the post Bretton Woods system up to Ireland's adoption of the euro.

The demand for money function and the assumption of uncovered interest parity in the monetary model and the Dornbusch model are very similar but the two models yield different results. The model proposed by Dornbusch (1976) has a money demand

function similar to that presented in the basic monetary model of Keynes where the demand for money is a function of income, price, and interest rate:

$$M = kPY^{\alpha} e^{-\beta i} \quad (1)$$

where M represents the domestic money stock, k is a parameter that takes account of factors (such as real income) that affect the demand of real money, P is the price level, Y is income, and i is the domestic interest rate.

The Dornbusch model also assumes perfect capital mobility, implied by uncovered interest parity:

$$i - i^* = E(\hat{S}) \quad (2)$$

where the interest rate differential $i - i^*$ is equal to the expected change in the exchange rate.

Korea and Ireland are two small open economies that have experienced continuous economic growth over the last three decades. Ireland has had relatively less restrictions on capital mobility than Korea and has seen its currency continuously appreciate relative to South Korea's won between 1974 and 1998. Figure 1 shows the appreciation of Irish punt relative to the South Korean won from 1974 to 1998. Korea and Ireland are not major trading partners, and both countries are small open economies and price takers in the foreign exchange market. The won and the punt are traded publicly in the international exchange rate market. The US is a trading partner for both. The "triangular" exchange rate between won, the US dollar, and punt equalizes rates. Any disparity in the indirect exchange rate between the won to the punt via the dollar or any other currency would be eliminated by arbitrage. Two small open

economies do not need to be trading partners in order to evaluate the relative change in the value of their respective currencies.

The monetary model assumes price flexibility and competition in trade to make exchange rate analysis relatively uncomplicated. Hacche and Townend (1981) argue that it is unique in the way in which its special assumptions about price flexibility and competition in trade simplify analysis by allowing the exchange rate to be regarded as the price that clears the money market in a small open economy. Four models of exchange rate determination are discussed below.

2. Survey of Exchange Rate Models

2.1. Mundell-Fleming Model

The Mundell-Fleming model is a small open economy IS-LM framework that can be used to analyze the influence of monetary policy on the exchange rate following Fleming (1962) and Mundell (1963). Dornbush (1980) calls the Mundell-Fleming model "the backbone of macroeconomic models of the exchange rate." The model assumes domestic price levels are constant and the output level is determined at given levels of foreign trade and capital flows. The model also assumes foreign price levels and foreign real incomes are exogenous with net exports a decreasing function of domestic real income and the exchange rate. Imports are assumed price elastic. The foreign interest rate is exogenous.

Net inflow of capital is assumed to be an increasing function of the domestic interest rate and the expected rate of depreciation. With uncovered interest rate parity, an increase in the domestic interest rate or depreciation of the home currency will cause a ceteris paribus inflow of foreign capital. When the domestic interest rate increases,

foreign investors increase their holdings of domestic bonds and an inflow of capital results. Similarly, depreciation causes an inflow of foreign capital as domestic exports become relatively cheaper and foreign importers increase their demand for domestic exports.

The Mundell-Fleming model in Figure 2 assumes perfect capital mobility and a floating exchange rate, and analyzes the influence of an increase in the money supply on the exchange rate starting from a position of equilibrium where the goods and the money markets are in equilibrium and the external payments balanced. The model considers an exogenous increase in the money supply which puts downward pressure on the interest rate in the short run. The decreasing interest rates would in turn stimulate interest sensitive expenditures and income increases. The excess supply of money will be eliminated through a decrease in the interest rate and an increase in income but a balance of payment deficit would develop. To eliminate the deficit, the domestic currency depreciates. In sum, the Mundell-Fleming model predicts that domestic monetary expansion leads to depreciation. The external balance is maintained primarily through the current account and equilibrium in money and goods markets is re-established by a combination of lower interest rates and higher output.

The Mundell-Fleming model allows different levels of capital mobility and economic growth. When applying the IS-LM-BP framework, an increase in domestic income could cause either an appreciation or a depreciation of the domestic currency depending on capital mobility.

Given international trade in goods and services as well as assets, its balance of payment B is represented by:

$$B = T(q, Y) + K(i-i^*) \quad (3)$$

The trade balance depends on the relative price of foreign goods in terms of domestic goods q and on domestic income Y. The capital account K depends on the interest rate differential. The capital account is positive when there is net inflow of capital and negative when there is a net outflow of capital. The BP equilibrium is achieved when there are no surpluses and no deficits,

$$B = T(q, Y) + K(i-i^*) = 0 \quad (3')$$

Capital mobility and the BP slope are determined by the interest elasticity of the capital account. In Figure 3, an economy that is facing no capital mobility without international trade in financial assets has a zero capital account so that the balance of payments is made up solely of the current account which is not a function of the interest rate. The balance of payments locus is then represented by the vertical line T = 0 and is perfectly interest inelastic.

For an economy with imperfect capital mobility, with the balance of payments (BOP) and balance of trade (BOT) initially balanced. At any given interest rate, an increase in income causes imports to increase and the trade balance to deteriorate, and moves the economy into payments and trade account deficits. Assuming fixed exchange rates to correct for the trade deficit, the domestic interest rate increases to make domestic bonds more attractive relative to foreign bonds and entice capital inflow. The inflow of capital generates a capital account surplus and improves the balance of payments by offsetting the trade balance deficit.

For any given level of capital mobility there can be an increase of interest rate large enough to induce capital inflow necessary to eliminate the balance of payments

deficit. As domestic income increases, balanced of payments can be maintained through the capital account by an appropriate increase in the domestic interest rate, and the BOP equilibrium locus for an economy with imperfect capital mobility is represented by the upward sloping schedule labeled B = 0.

The final alternative is an economy with perfect capital mobility in which balance of payments equilibrium can occur only if the economy is on the perfectly horizontal BB locus. An increase in domestic income will result in an increase in imports and a worsening of the trade balance. To restore a payments balance in the case of an economy with imperfect capital mobility, the interest rate would have to increase to induce inflows of capital. In the case of an economy with perfect capital mobility, the interest rate does not have to increase to induce inflows of capital because any amount necessary to balance the payments is available in the world capital market at the world rate i*. The BP locus for an economy with perfect capital mobility is perfectly horizontal or perfectly interest elastic.

Starting with a model similar to the Mundell-Fleming model in Figure 1 but severely restricting the mobility of capital, an increase in income would cause the currency to depreciate in Figure 4. The IS curve is a schedule of interest rate and corresponding domestic income that keep the domestic goods market in equilibrium. Two key assumptions are made when the IS curve is derived with government spending and the relative price of foreign goods in terms of domestic goods constant. When the economy is below full employment, an increase in income can come about either as a result of government policy intervention through an increase in government spending or a

decrease in taxes, or as long-run adjustment to expansionary monetary policy. Such an exogenous increase in spending is represented by a rightward shift in the IS curve. One of the main ideas of Keynesian economics is that in the short run the equilibrium level of output can be trapped below full employment resulting in chronic unemployment and recession. Government policy intervention is then believed to be vital in moving the economy out of recession, with increased government spending having a leading role in that recovery. But government policy intervention or any real disturbance is believed to be ineffective when exchange rates are flexible. A real disturbance is any exogenous disturbance that does not change the money demand or money supply or originate in the money market as a nominal disturbance.

One of the implications of the Mundell-Fleming model is that fiscal policy under a flexible exchange rate is ineffective. It is also argued (Barro, 1990) that real disturbances would not have any effect on output but would only affect the exchange rate. McKibbin and Sachs (1991) use a sophisticated dynamic Mundell-Fleming model to show that commercial policy in the form of protection against imports (a real disturbance) would not have any lasting effect on output and would only result in exchange rate appreciation. The assumptions of full employment and perfect capital mobility in the Mundell-Fleming model affect the effectiveness of real disturbances on output. Relaxing those assumptions would alter the effect of real disturbances on output and the exchange rate.

In Figures 4 and 5 the assumptions of perfect capital mobility and full employment have been relaxed. Figure 4 represents an economy where capital mobility is less restricted relative to the economy in Figure 5. The relatively more mobile capital

in Figure 4 is shown by the flatter BP and steeper LM curves. In Figure 5 capital is less mobile and is shown by a steeper BP curve and a flatter LM curve. An increase in income would cause the currency of the economy with more mobile capital to appreciate and the currency of the economy with less mobile capital to depreciate.

The Mundell-Fleming model has shortcomings in light of more recent theoretical developments. There are no explicit dynamics and lags in the response of output and trade, there is no price response to either monetary shocks or currency depreciation, and the interest rate effect on the capital flows seems permanent and non-eroding. Portfolio balance models also assume BOP equilibrium but offer a more comprehensive analysis by taking into account asset preferences and the requirements for portfolio balance.

2.2. Portfolio Balance Models

Portfolio balance models focus on requirements for stock equilibrium in the markets for domestic money, domestic assets, and foreign assets. While the Mundell-Fleming model focuses on requirements for flow equilibrium in the goods market and the balance of payments, Branson and Halttunen (1979) use a portfolio balance model where domestic residents are the exclusive holders of domestic money and bonds. Domestic residents also hold foreign bonds which represent the only tradable asset, and domestic assets and foreign assets are assumed to be gross substitutes. A fall in domestic holding of foreign bonds represents an increase in liabilities to foreign countries. The ratio of wealth domestic residents wants to hold in each asset is dependent on relative expected common currency yields.

The exchange rate has three separate effects. First, exchange rates change the value of foreign assets in terms of domestic currency. Total wealth in nominal domestic

currency will rise with depreciation and fall with appreciation. Second, exchange rate expectations are an integral part of the relative yields of domestic and foreign assets. Third, exchange rates affect the current account and the net acquisition of foreign assets.

Portfolio balance models view the exchange rate in the short run as determined by the balance of asset markets, the accumulation of foreign assets, and lagged response on the current account. In the long run the current account is balanced.

Consider the effect of an increase in the money supply through the purchase of domestic bonds by the domestic central bank assuming that the original equilibrium is a full equilibrium with asset supplies fixed and a balance of payment equal to zero. The increased money supply will cause an excess demand for domestic bonds and excess supply of money at the original interest rate and exchange rate. Return to equilibrium in the domestic assets market will require domestic interest rate to drop. The excess demand for domestic bonds bids the prices of domestic bonds up or domestic interest rate down. The drop in domestic interest rate makes domestic bonds a less attractive asset. The lower interest rate in turn will cause an increase in the demand for foreign bonds that can be eliminated by depreciation. The new asset equilibrium represents short run equilibrium and is achieved by a lower interest rate and depreciation.

The current account at the initial equilibrium is balanced, with positive investment income offset by a trade deficit since the domestic country is a net creditor in the foreign bond market. The adjustment to the new equilibrium will not have any effect on the current account at first since the lower interest rate and depreciated currency have restored portfolio balance with net foreign bonds unchanged. The increase in foreign bond holding produced by lower domestic interest rate is offset by the sale of foreign

bonds produced by the effect of depreciation on the composition of wealth. With goods prices unaffected, the new equilibrium will cause deterioration in the terms of trade that will affect net exports and net foreign assets.

If the usual conditions on price elasticities of trade hold, depreciation will cause a current account surplus and an increase in net foreign assets, upsetting the portfolio balance. The new equilibrium is transitory. These new disturbances cause an excess supply of foreign bonds and a parallel excess demand for domestic assets. To restore portfolio balance the domestic currency appreciates reducing net exports and consequently slowing growth. The increase in net foreign assets will increase net investment income push the current account into further surplus. For stability, trade elasticities are assumed to be large enough so the reduction in net exports outweighs the increase in net investment income. The current account surplus produced by the initial depreciation is eliminated and equilibrium reestablished.

The exchange rate in its adjustment to the long run equilibrium is at first higher than in the temporary asset equilibrium but decreases as the current account re-balances. This overshooting of the exchange rate is explained by the assumption that exchange rates and interest rates respond quickly to monetary shocks to maintain portfolio balance, while trade takes a longer time to adjust. In the long run the current account is balanced but with lower net exports and higher net investment income since net foreign assets have increased.

The change in the exchange rate will depend on whether the change of the money supply had any effect on real income. If there has been no growth in real income, the exchange rate will be higher than at the outset because the increase in the money supply

would cause a proportional increase in the price level and less than proportional depreciation. If monetary expansion results in an increase in real income, the direction of change in the exchange rate will be ambiguous.

2.3. Monetary Model

The monetary model of exchange rates is based on money market equilibrium and can be considered a version of the portfolio balance model. The exchange rate is determined by the purchasing power parity condition (PPP).

The basic monetary model assumes perfect capital mobility, PPP, and price levels implied by PPP such that the demand and the supply of money match for given levels of real outputs, interest rates, and exchange rate. Figure 2 illustrates the basic monetary model using the IS-LM-BP framework. At a given level of real output (full employment) the IS curve is vertical and a horizontal balance of payment (BP) shows perfect capital mobility. The equilibrium exchange rate is such that the LM curve intersects the IS curve at the interest rate given by the perfect capital mobility.

The basic monetary model can be set out as three structural equations, a demand for money equation, where the demand for money is a function of the price level P, real income Y, and interest rate i,

$$m = \ln k + p + \alpha y - \beta i \qquad (1')$$

where m represents the logarithm of domestic money stock, k is a parameter that takes account of factors (such as real income) that affect the demand of real money, and p and y are the logarithms of the price level and income respectively. The foreign demand for money is based on similar assumptions and is identical to the domestic demand for money with * superscript to denote foreign variables and parameters.

The exchange rate S represents the foreign currency price of domestic currency and is given by the PPP as the ratio between foreign and domestic price levels.

$$S = \kappa P/P^* \quad (4)$$

where κ is a constant, not necessarily 1. Substituting and logarithmic transformation of (4) gives the following equation

$$s = K - m + m^* + \alpha y - \alpha^* y^* - \beta i + \beta^* i^* \quad (5)$$

where $K = \ln k - \ln k^* + \ln \kappa$. Equation (5) may be estimated as the reduced form of the system, with the right hand variables assumed exogenous.

According to the monetary approach, changes in the variables will affect money market equilibrium which in turn affects the exchange rate. The model predicts that an increase in the domestic money supply will cause a proportional depreciation of the domestic currency. The assumptions of PPP and unit price elasticity in the demand for money force elasticity of the exchange rate with respect to domestic money supply to equal -1 and with respect to foreign money supply to equal 1.

In the adjustment to monetary expansion, an increase in the money supply will cause an increase in demand for goods and assets. Domestic residents have two possible mechanisms to dispose of the excess supply of money. The first mechanism operates through a trade deficit and reduces the money balances as the domestic residents increase their purchase of foreign goods. The trade balance deficit causes a reduction of total domestic assets and represents a portfolio-size adjustment. The second mechanism operates through a capital account deficit as the excess supply of money is used to purchase foreign assets. The exchange of money to acquire foreign assets affects the composition of the portfolio but not the size of the total portfolio and represents a

portfolio-composition adjustment. Since all variables are assumed exogenously determined, they do not respond to a monetary shock. Real output is at its full employment level, domestic prices are tied by international competition and cannot respond directly, and the domestic interest rate is tied to the foreign interest rate and exchange rate expectations by uncovered interest rate parity in (2).

The resulting disequilibrium causes excess demand for foreign goods and assets leading to depreciation. Domestic prices rise to restore equilibrium, consistent with PPP. The real money supply is unchanged since the price elasticity of money demand is unitary. The rise in the price level and depreciation are proportional to the increase in the money supply. The basic monetary model regards the exchange rate as the effective "price" that clears the domestic money market through the domestic price level. The domestic price level is flexible to maintain PPP.

Most studies following the monetary approach assume that higher domestic income relative to foreign income leads to an increase in domestic transactions. This higher rate of domestic transactions results in a higher money demand relative to foreign money demand causing appreciation.

The monetary model predicts that a rise in the domestic interest rate will lower the exchange rate by causing an excess supply of money. The money market equilibrium is determined by the price level and exchange rate. The domestic interest rate is exogenous and must satisfy the uncovered interest rate parity in (2). For a given foreign interest rate i* the domestic interest rate is determined by exchange rate expectations. A rise in the interest rate i is the result of change in exchange rate expectations. The change in interest rate differential represents the expected depreciation of the domestic currency, consistent

with uncovered interest parity and not corresponding to an increase in the expected relative yield of domestic assets.

The expected change in the exchange rate E(ŝ) must be assumed exogenous to the current exchange rate and its determinants when estimating (5) as the reduced form for the exchange rate. This assumption is inconsistent with the rational expectations hypothesis (RE). The exogeneity assumption can be maintained if exchange rate changes are assumed to depend on market perceptions of inflation and conditions in the money market, perhaps unresponsive in the short run to changes in the determinants of the current exchange rate. This last condition is inconsistent with the basic monetary model. When expectations are assumed to be rational, the domestic interest rate and the interest rate differential become endogenous as in Mussa (1976). To endogenize the domestic interest rate and the interest rate differential (2) can be rewritten as

$$i_t - i_t^* = s_t - E_t s_{t+1} \qquad (6)$$

where s_t represents the logarithm of the exchange rate at time t and $E_t s_{t+1}$ represents the expectation of percentage change in the exchange rate at time t+1 given information available at time t. Substituting (6) into (5) gives

$$s_t = (1/1-\beta)Z_t + (\beta / 1+ \beta)\, E_t\, s_{t+1} \qquad (7)$$

where $Z = K - m + m^* + \alpha y - \alpha^* y^* - (\beta^* + \beta)i^*$.

The rational expectation of the exchange rate in any future time period t+j can be expressed as a function of the expected value of the composite exogenous variable Z plus the expected exchange rate in the following period t+j+1.

Deriving the reduced form of the exchange rate,

$$s_t = (1/(1-\beta))\, \Sigma_j^{\infty}{}_{=0}\ (\beta/(1+\beta))^j\, E_t Z_{t+j} \qquad (8)$$

The domestic interest rate is no longer an exchange rate determinant and with the RE hypothesis the current exchange rate is a function of the actual current values as well as the expected future values of exogenous variables. The incorporation of RE hypothesis into the model gives rise to some propositions.

Proposition 1. The foreign exchange market is efficient because all relevant information pertaining to future market conditions is discounted into the current exchange rate. The discount factor $\beta /(1+ \beta)$ is directly related to the interest rate elasticity of domestic demand for money. The only case where the exchange rate is solely determined by exogenous variables other than the interest rate is when the domestic demand for money is perfectly inelastic. In that case, the current exchange rate is independent of interest rates and exchange rate expectations, essential only in determining the interest rate.

Proposition 2. The change in the exchange rate between any two periods consists of an expected component anticipated in the interest differential at time t -1 and an unexpected component indicating new information. The change in the exchange rate can be decomposed to show the expected and unexpected components using interest rate parity (6) as shown by Dornbusch (1978)

$$(i_{t-1} - i_{t-1}^*) + E_{t-1}(i_t - i_t^*) = s_{t-1} - E_{t-1}s_{t+1} \qquad (9)$$

Subtracting (9) from (6) and rearranging,

$$s_t - s_{t-1} = [i_{t-1} - i_{t-1}^*] + [(i_t - i_t^*) - E_{t-1}(i_t - i_t^*)] + [E_t s_{t+1} - E_{t-1} s_{t+1}] \qquad (10)$$

The first term in square brackets represents the expected rate of appreciation between time t -1 and t anticipated at time t -1. The second and third terms in square brackets

represents new information. The second term represents adjustment of expectations for time t, and the third term represents an adjustment of expectations at time t+1.

Proposition 3. Efficiency and rationality imply that unexpected changes are serially uncorrelated and unpredictable with zero mean, but they do not imply that the rate of change of the exchange rate will follow a random walk since the exogenous determinants in (8) and the interest rate differential in (10) could be serially correlated.

Proposition 4. The effect of a change in an exogenous variable depends on how it affects expectations of future adjustments of exogenous variables. For example, the effect of monetary expansion in the basic monetary model will have a proportionate effect on the exchange rate while the short run effect with RE may be greater if the expectations of monetary growth are temporarily raised.

Proposition 5. The RE hypothesis implies that an explanation of how expectations of the exogenous variables are formed must be included in econometric modeling of the exchange rate to account for expected changes of these variables and the effects of these changes on expectations.

2.4. The Dornbusch Model

The model of Dornbusch (1976) has a money demand function similar to the basic monetary model (1) with the added assumption of perfect capital mobility (2) yielding results comparable to the portfolio balance model but very different from the monetary model. The Dornbusch model assumes that exchange rate expectations and interest rates are endogenous, PPP does not hold due to imperfect trade competition, and the rates of adjustment in assets and goods markets differ with exchange and interest rates adjusting faster than output and goods prices.

The model reduces to two functions that relate the domestic price level to the exchange rate. One function describes the conditions for equilibrium in the domestic goods and money markets, and the other describes condition for equilibrium in financial markets. Exchange rate expectations are assumed to be regressive so the expected rate of appreciation depends on the disparity between the actual current rate and the long run exchange rate Ś determined within the model and consistent with perfect foresight and rationality. The expected rate of appreciation is

$$E(\hat{s}) = \varepsilon(\acute{s} - s) \qquad (11)$$

where ś is the logarithm of Ś, and s is the logarithm of S, ε is the regressive factor that determines the expected rate of appreciation between the expected long-run exchange rate and the actual current rate.

Money market equilibrium with perfect capital mobility is obtained by substituting (2) and (11) into (1),

$$m = K + p + \alpha y - \beta i^* + \beta\varepsilon(\acute{s} - s) \qquad (12)$$

In the steady state, S = Ś and (12) gives an expression for the long run price level P'(bar) which clears the money market for given M, Y, and i*,

$$p' = -K + m - \alpha y + \beta i^* \qquad (13)$$

Rearranging (12) also gives the direct relationship between the domestic price level p and the exchange rate s implied in the condition for financial markets equilibrium,

$$s = \acute{s} + (1/\beta\varepsilon)(p - p') = \acute{s} + (1/\beta\varepsilon)(p + K - m + \alpha y - \beta i^*) \qquad (14)$$

Money market equilibrium implies that for given M and Y, a higher P implies a higher i. The higher i implies a lower E(ŝ) because of perfect capital mobility and a lower E(ŝ) implies higher S because of the regressive expectations assumption.

Figure 6A shows that $\bar{p}$ is determined by the requirement that $m = m^d$ and by the value of i determined by the interest parity. Figure 6B shows vertical intercept determined in the Figure 6A and the negatively sloped $p = \bar{p}$ curve which represents the combination of p and $(s + p^*)$ that are consistent with the equilibrium value of the general price level. The positively sloped $q = \bar{q}$ curve (where q is the logarithm of the relative price of domestic goods in terms of imported goods) represents the combination of p and $(s + p^*)$ consistent with the equilibrium value of the relative price of domestic goods. The intersection of the two curves in Figure 6B determines the equilibrium price of domestic goods $\bar{p}$ and the equilibrium domestic price of imported goods $(\acute{s} + p^*)$. An increase in m or a decrease in y or K shifts the $m = m^d$ curve in Figure 6A upward causing $\bar{p}$ to increase. An increase in i^* or in $E(\hat{s})$ moves the equilibrium point C in Figure 6A upward along the $m = m^d$ curve and results also in an increase in $\bar{p}$. Anything that increases $\bar{p}$ will cause the $p = \bar{p}$ curve to shift upward resulting in an equal increase in p and $(\acute{s} + p^*)$. Similarly anything that increases $\bar{q}$ will shift the $q = \bar{q}$ curve upward resulting in increase in p and a decrease in $(\acute{s} + p^*)$.

An equation for the steady state $\acute{S}$ can be derived from the goods market. The demand D for domestic output is positively related to real income and competitiveness, and negatively related to interest rate,

$$\ln D = u + \delta (p - s - p^*) + \varphi y - \sigma i \qquad (15)$$

The price level is the goods market clearing mechanism as opposed to the money market in the monetary model. The inflation rate is assumed proportional to excess demand,

$$\Delta p = \pi [(\ln D) - y] = \pi[u + \delta(p - s - p^*) + (\varphi - 1)y - \sigma i] \qquad (16)$$

When the goods market is in equilibrium, excess demand is equal to zero. The price level and the exchange rate are at their steady state and the domestic interest rate is equal to the foreign interest rate.

Rearranging (16) gives:

$$\acute{s} = p' - p^* + (1/\delta)[u + (\varphi - 1)y - \sigma i^*] \quad (17)$$

For given P*, Y*, and i* when the exchange rate is in the steady state, domestic output is equal to domestic income. Substituting (13) into (17) gives

$$\acute{s} = (-K + u/\delta) - p^* + m + [-\alpha + (\varphi - 1)/\delta]y + [\beta - (\sigma/\delta)]i^* \quad (18)$$

Substituting (18) into (14) gives an equation in S and P, with all other variables exogenous,

$$s = [(u/\delta) - K(1 - 1/\beta\varepsilon)] + (1/\beta\varepsilon)p - p^* + [-\alpha(1 - 1/\beta\varepsilon) + (\varphi - 1)/\delta]y + (1 - 1/\beta\varepsilon)m$$
$$+ [\beta - (\sigma/\delta) - (1/\varepsilon)]i^* \quad (19)$$

The upward sloping curve AA in Figure 7 shows the relationship between s and p derived in (19).

A second equation in s and p that describes equilibrium conditions in domestic goods and money markets can be derived from (16) by setting Δp equal to zero and substituting for i from the money demand function to show the relationship between s and p in Figure 7, represented by the downward sloping curve $\hat{p} = 0$,

$$s = [(u\beta - \sigma K)/\beta\delta] - [(\sigma/\beta\delta) - 1]p - p^* + [(\beta(\varphi - 1) - \alpha\sigma)/\beta\delta]y + (\sigma/\beta\delta)m \quad (20)$$

The negative coefficient of p shows the negative relationship between p and s. For the goods market to be in equilibrium, the higher is the p the lower s must be. Point B in Figure 7 represents the steady state value of s or full equilibrium solving (18), (19), and (20). If p is to the left of $\hat{p}=0$ curve, there is excess demand in the goods

market and p will rise. If p is to the right of ^p = 0 curve, there is excess supply in the goods market and p will fall, reestablishing the stable equilibrium at point B.

Equation (18) shows that an increase in the domestic money supply will result in a fall in the exchange rate proportional to the increase in the money supply. The Dornbusch model goes beyond the comparative static result of the basic monetary model by adopting the dynamic assumptions that the rates of adjustments of exogenous variables are different. Dornbusch assumes that interest rates and exchange rates respond instantly to shocks, while prices and output response is delayed. An increase in the domestic money supply will shift the AA curve downward to A'A' in (19) and the ^p = 0 to the right to ^p' in (19). The new intersection will be a new full equilibrium at point C since in the long run the change in p and s will be in the same proportion. The assumption of price rigidity in the short run implies that the exchange rate must fall below its long run equilibrium s_2 to s_1 to maintain equilibrium in asset market. The higher real money supply implies that a lower interest rate is required which has to be offset by higher expected appreciation of the exchange rate.

Each of the four models examined attributes changes in exchange rates to monetary policy, predicting currency depreciation (appreciation) when money supply is increased (decreased). While the Mundell-Felming model stresses the influence of the exchange rate on the current account as the adjusting mechanism that corrects for payment imbalances caused by monetary shocks, the other three models stress the role of the exchange rates in restoring equilibrium to asset markets. The "asset-market" approach sets the Mundell-Felming model apart from the other three models. The monetary model is also distinguished from the other models because of its price

flexibility assumption. Monetarists assume that the price level is flexible enough to clear the money market, and that interest rates are not influenced by monetary shocks but are determined by expectations of inflation in

$$i - i^* = -E(\hat{s}) = E(\hat{p} - \hat{p}^*) \quad (21)$$

Price stickiness implies that monetary expansion means real monetary expansion in the short run. In the Dornbusch model, monetary expansion causes interest rates to fall to restore money market equilibrium, which in turn lead to depreciation for relative expected yields given the regressive nature of expectations in

$$i - i^* = -E(\hat{s}) = \varepsilon(\acute{s} - s) \quad (22)$$

3. The Model

3.1. The Reduced Form Equations

Despite the differences, the four theoretical models examined arrive at the same conclusion: monetary expansion will cause depreciation. But the portfolio balance model identifies conditions where the effects of monetary expansion on the exchange rate are ambiguous. If income is below full employment level, the change in the value of the exchange rate will depend on whether the change of the money supply had any effect on real income. If domestic real income increases, domestic currency could appreciate or depreciate depending on whether real income effect dominates monetary effect and vise-versa.

Most studies assume that if domestic income grows faster than foreign income, domestic transactions will increase. This increase of domestic transactions will result in an increase of domestic money demand relative to foreign money demand, which causes the domestic currency to appreciate. The model set out in (5) relays the essence of the

monetary approach and also represents the building block for the portfolio balance model and the Dornbusch model. In the short-run (4) would be considered as unrealistic since most empirical studies of the demand for money have shown lagged adjustment. PPP is almost always considered a long-run assumption. If partial adjustment to the desired stock for money is permitted, the money demand in (1') becomes

$$\Delta m = \gamma'[\ln k + p + \alpha y - \beta i - m_{-1}] \qquad (23)$$

$$\Delta m^* = \gamma''[\ln k^* + p^* + \alpha^* y^* - \beta^* i^* - m^*_{-1}] \qquad (23')$$

where Δ represents the first difference operator, and $(1 - \gamma')$ and $(1 - \gamma'')$ are the adjustment coefficients in the domestic and foreign functions.

Similarly (4) becomes

$$\Delta s = \gamma[p - \ln\kappa - s_{-1} - p^*] \qquad (24)$$

Recasting the Dornbusch model in discrete time (14) becomes

$$s_t = \check{s} + (1/\beta\varepsilon)(p_t - p') = \check{s} + (1/\beta\varepsilon)(p_t + K - m_t + \alpha y_t - \beta i_t^*) \qquad (14')$$

(14') shows the direct relationship between the domestic price level P and the exchange rate S that is implied in the condition for financial markets equilibrium. For given M and Y, money market equilibrium implies that, the higher is P, the higher i must be, and the higher is i, the lower must E ($\hat{S}$) be because of perfect capital mobility, and for lower E ($\hat{S}$), S must be higher because of the regressive expectations assumption.

The demand D for domestic output is directly related to real income and competitiveness, and negatively related to interest rate. From the goods market, a steady state $\check{s}$ equation can be derived,

$$\ln D_t = u + \delta(p_t - s_t - p_t^*) + \varphi y_t - \sigma i_t \qquad (15')$$

The price level represents the clearing mechanism in the goods market. The inflation rate is assumed to be proportional to excess demand

$$p_{t+1} - p_t = \pi(\ln D_t - y_t) = \pi[u + \delta(p_t - s_t - p_t^*) + (\varphi - 1)y_t - \sigma i_t] \qquad (16')$$

(16') also gives

$$p_t = (\pi u - K) + m_{t-1} + \pi\delta(p - p^*)_{t-1} + (\beta\varepsilon - \pi\delta)s_{t-1} - \beta\varepsilon\check{s} + [\pi(\varphi - 1) - \alpha]y_{t-1} - \pi\sigma i_{t-1} + \beta i_{t-1}^* \qquad (16'')$$

When the goods market is in equilibrium, the price level and the exchange rate are at their long-run equilibrium, and the domestic interest rate is equal to the foreign interest rate. In that case, (17) becomes

$$\acute{s} = p' - p_t^* + (1/\delta)[u + (\varphi - 1)y_t - \sigma i_t^*] \qquad (17')$$

For given P*, Y*, and i*, when the exchange rate is at its long-run equilibrium, domestic output is equal to domestic income and (18) becomes

$$\acute{s} = (-K + u/\delta) - p_t^* + m_t + [-\alpha + (\varphi - 1)/\delta]y_t + [\beta - (\sigma/\delta)]i_t^* \qquad (18')$$

Substituting equation (18') into equation (14') gives (19'),

$$s_t = [(u/\delta) - K(1 - 1/\beta\varepsilon)] + (1/\beta\varepsilon)p_t - p_t^* + [-\alpha(1 - 1/\beta\varepsilon) + (\varphi - 1)/\delta]y_t + (1 - 1/\beta\varepsilon)m_t + [\beta - (\sigma/\delta) - (1/\varepsilon)]i_t^* \qquad (19')$$

The Dornbusch model assumes that in the short run the goods and the asset markets have different rates of adjustments, and lead to overshooting when there are monetary disturbances. Replacing equation 1 by equation 23 modifies the Dornbusch model to allow for different rates of adjustment in the goods and asset markets

$$\Delta m_t = \gamma'(K + p_t + \alpha y_t - \beta i_t - m_{t-1}) \qquad (20')$$

The Dornbusch equation representing asset market equilibrium (19') becomes

$$s_t = [(u/\delta) + K(1 + 1/\beta\varepsilon)] + (1/\beta\varepsilon)p_t + p_t^* + [\alpha(1 + 1/\beta\varepsilon) + (\varphi - 1)/\delta]\, y_t - (1 + 1/\gamma'\beta\varepsilon)m_t + (1 - \gamma'/\gamma'\beta\varepsilon)m_{t-1} - [\beta + (\sigma/\delta) + (1/\varepsilon)]i_t^* \qquad (19'')$$

The assumption made in the four theoretical models examined that the determinants of the exchange rate are exogenous is unrealistic. The magnitude of change in the exchange rate will depend on whether the change of the money supply had any effect on real income.

To "endogenize" the determinants of the exchange rate, an income equation is specified as a linear function of the domestic interest rate, and the balance of payment

$$Y_t = \bar{A}_t - \theta I_t + B_t \qquad (25)$$

where Y_t is income at time t, $\bar{A}_t$ is exogenous absorption, I_t is domestic interest rate, and B_t is the balance of payment at time t.

Rewriting (25) in log form we obtain,

$$y_t = \bar{a}_t - \beta i_t + \alpha b_t \qquad (25')$$

where y is dY/Y, ā is $\bar{A}/Y$, βi is (θI/Y)(dI/I), and αb is (B/Y)(dB/B).

A balance of payment equation is also specified as a linear function of domestic incomes and the relative prices, and interest rates differential

$$B_t = \check{T}_t - \lambda Y_t + \omega Q_t + \eta(I_t - I_t^*) \qquad \eta > 0 \quad \lambda, \omega \geq 0 \qquad (26)$$

where $\check{T}$ represents exogenous trade, Q (Q=sp*/p) is the relative price level, and $(i_t - i_t^*)$ is the interest rates differential.

Rewriting (26) in log form we obtain,

$$b_t = t'_t - \psi y_t + \tau q_t + \mu(i_t - i_t^*) \qquad \eta > 0 \quad \lambda, \omega \geq 0 \qquad (26')$$

where b is dB/B, t' is Ť/B , ψy is (λY/B)(dY/Y), τq is (ωQ/B)(dQ/Q), and μ($i_t - i_t^*$) is [μ($i_t - i_t^*$)/B] [d($i_t - i_t^*$)]/($i_t - i_t^*$). The model estimated is a system of three simultaneous equations

$$s_t = a_0 + a_1 p_t + a_2 p_t^* + a_3 y_t + a_4 m_t - a_5 m_{t-1} - a_6 i_t^* + e_t \quad (27)$$

$$y_t = \bar{a}_t - \beta i_t + \alpha b_t + \varepsilon_t \quad (28)$$

$$b_t = t'_t - \psi y_t + \tau q_t + \mu(i_t - i_t^*) + \upsilon_t \quad (29)$$

3.2. Data and Methodology

The variables used in this paper are money supply, GDP, interest rate, price level, relative price of imports to exports, the balance of payment and exchange rate for South Korea, and interest rate, and price level of Ireland. All the variables with the exception of foreign interest rates are expressed in log form. The Data is quarterly data from 1974 until 1998, and was obtained from the International Monetary Fund *International Financial Statistics 2003.*

A number of studies most notably Putnam and Woodbury (1980) have reported OLS parameters estimates that are consistently right-signed and significant, after estimating the basic monetary model estimation. Using OLS to estimate the coefficients of the determinants of exchange rates generates biased parameters that appear to be statistically significant but are devoid of any economic significance. When nonstationary variables are present, there might be a spurious regression as shown by Granger and Newbold (1974). Enders (1995) explains that a spurious regression has a high R square, t-statistics that seem significant and results that are without any economic significance. The OLS estimation reveals evidence of serial correlation. When autoregressive

techniques are used, the estimated parameters are reduced in magnitude and significance as shown in tables 1 and 2.

The following AR(1) model is used to test for stationarity

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \varepsilon_t \quad (30)$$

A Dickey-Fuller test is then performed to test for trend stationarity,

$$\Delta y_t = \alpha_0 + \gamma_1 y_{t-1} + \alpha_1 t + \varepsilon_t \quad (31)$$

The variables are detrended and three error correction (ECM) long run spurious models are estimated:

Exchange rate model

$$s_t = \beta_0 + \beta_1 s_{t-1} + \beta_2 p_t + \beta_3 pf_t - \beta_4 if_t + \beta_5 m_t + \beta_6 y_t - \beta_7 m_{t-1} + \varepsilon_t \quad (27)$$

Income model

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 i_t + \beta_3 b_t + \varepsilon_t \quad (28)$$

Balance of payments model

$$b_t = \beta_0 + \beta_1 b_{t-1} + \beta_2 y_t + \beta_3 q_t + \beta_4 difi_t + \varepsilon_t \quad (29)$$

and the residual for each model is checked using the Engler-Granger regression for random walk.

$$\Delta\varepsilon_t = \alpha_1 \varepsilon_{t-1} + \mu_t \quad (32)$$

The final ECM model estimated is:

Exchange rate model

$$\Delta s_t = \alpha_0 + \alpha_1 \Delta s_{t-1} - \alpha_2 \Delta if_t + \alpha_3 \Delta p_t + \alpha_4 \Delta pf_t + \alpha_5 \Delta m_t - \alpha_6 \Delta m_{t-1} + \alpha_7 \Delta y_t - \alpha_8 \Delta if_{t-1} + \alpha_9 \Delta p_{t-1} + \alpha_{10} \Delta pf_{t-1} - \alpha_{11} \Delta m_{t-2} + \alpha_{12} \Delta y_{t-1} + \alpha_{13} \varepsilon_t + \upsilon_t \quad (33)$$

where the exchange rate lag differential is determined by the lag differentials of lagged exchange rate, foreign interest rate and lagged foreign interest rate, domestic price level

and lagged domestic price level, foreign price level and lagged foreign price level, domestic income and lagged domestic income, domestic money supply and lagged domestic money supply, and a spurious error term given by,

$$\varepsilon_t = s_t - \beta_0 - \beta_1 s_{t-1} - \beta_2 p_t - \beta_3 pf_t - \beta_4 if - \beta_5 m_t - \beta_6 y_t - \beta_7 m_{t-1} \quad (27A)$$

Income model

$$\Delta y_t = \alpha_0 + \alpha_1 \Delta i_t + \alpha_2 \Delta b_t + \alpha_3 \Delta y_{t-1} + \alpha_4 \Delta i_{t-1} + \alpha_5 \Delta b_{t-1} + \alpha_6 \varepsilon_t + \upsilon_t \quad (34)$$

where the income lag differential is determined by the lag differentials of lagged income, domestic interest rate and lagged interest rate, balance of payments and lagged balance of payments, foreign price level and lagged foreign price level, domestic income and lagged domestic income, domestic money supply and lagged domestic money supply, and a spurious error term given by,

$$\varepsilon_t = y_t - \beta_0 - \beta_1 i_t - \beta_2 b_t - \beta_3 y_{t-1} \quad (28A)$$

Balance of Payments

$$\Delta b_t = \alpha_0 + \alpha_1 \Delta y_t + \alpha_2 \Delta difi_t + \alpha_3 \Delta q_t + \alpha_4 \Delta b_{t-1} + \alpha_5 \Delta y_{t-1} + \alpha_6 \Delta difi_{t-1} + \alpha_6 \Delta q_{t-1} + \alpha_8 \varepsilon_t + \upsilon_t \quad (35)$$

where the balance of payments lag differential is determined by the lag differentials of lagged balance of payments, income and lagged income, interest rate differential and lagged interest rate differential, relative price level and lagged relative price level , and a spurious error term given by,

$$\varepsilon_t = b_t - \beta_0 - \beta_1 y_t - \beta_2 q_t - \beta_3 difi_t - \beta_4 b_{t-1} \quad (29A)$$

Substituting (27A) into (33), (28A) into (34), and (29A) into (35) we obtain

Exchange rate

$$s_t - s_{t-1} = \alpha_0 + \alpha_1 s_{t-1} - \alpha_1 s_{t-2} - \alpha_2 if_t + \alpha_2 if_{t-1} + \alpha_3 p_t - \alpha_3 p_{t-1} + \alpha_4 pf_t - \alpha_4 pf_{t-1} + \alpha_5 m_t - \alpha_5 m_{t-1} - \alpha_6 m_{t-1} + \alpha_6 m_{t-2} + \alpha_7 y_t - \alpha_7 y_{t-1} + \alpha_8 if_{t-1} - \alpha_8 if_{t-2} + \alpha_9 p_t - \alpha_9 p_{t-1} + \alpha_{10} pf_t - \alpha_{10} pf_{t-1} + \alpha_{11} m_t - \alpha_{11} m_{t-1} + \alpha_{12} y_t - \alpha_{12} y_{t-1} + \alpha_{13}[s_t - \alpha_0 - \alpha_1 s_{t-1} - \alpha_2 p_t - \alpha_3 pf_t + \alpha_4 if - \alpha_5 m_t - \alpha_6 y_t + \alpha_7 m_{t-1}] \quad (36)$$

The models estimated are:

Exchange rate

$$s_t - s_{t-1} = (\alpha_0 - \alpha_{13}\beta_0) + (\alpha_1 - \alpha_{13}\beta_1)s_{t-1} - (\alpha_2 - \alpha_{13}\beta_2)if_t + (\alpha_3 - \alpha_{13}\beta_3)p_t + (\alpha_4 - \alpha_{13}\beta_4)pf_t + (\alpha_5 - \alpha_{13}\beta_5)m_t - (\alpha_6 - \alpha_{13}\beta_6)m_{t-1} + (\alpha_7 - \alpha_{13}\beta_7)y_t + \alpha_8 \Delta if_{t-1} + \alpha_9 \Delta p_{t-1} + \alpha_{10}\Delta pf_{t-1} + \alpha_{11}\Delta m_{t-2} + \alpha_{12}\Delta y_{t-1} \quad (37)$$

Income

$$y_t - y_{t-1} = (\alpha_0 - \alpha_6\beta_0) + (\alpha_1 - \alpha_6\beta_1)i_t + (\alpha_2 - \alpha_6\beta_2)b_t + (\alpha_3 - \alpha_6\beta_3)y_{t-1} + \alpha_4(i_{t-1} - i_{t-2}) + \alpha_5(b_{t-1} - b_{t-2}) \quad (38)$$

Balance of Payments

$$b_t - b_{t-1} = (\alpha_0 - \alpha_8\beta_0) + (\alpha_1 - \alpha_8\beta_1)y_t + (\alpha_2 - \alpha_8\beta_2)difi_t + (\alpha_3 - \alpha_8\beta_3)q_t + (\alpha_4 - \alpha_8\beta_4)b_{t-1} + \alpha_5(y_{t-1} - y_{t-2}) + \alpha_6(difi_{t-1} - difi_{t-2}) + \alpha_7(q_{t-1} - q_{t-2}) \quad (39)$$

4. Estimation Results

Table 3A, 3BA, 3C, 4A and 4B summarize the stationarity, ARCH, and Dickey-Fuller tests results. The price levels, money supply, interest rate differential, and the balance of payment are stationary, while the exchange rate, income level, interest rates, and the relative price level are non-stationary.

The variables are detrended and error correction (ECM) long run spurious models for the exchange rate, income, and balance of payments are estimated and the results summarized in Tables 5A, 5B and 5C.

To account for endogeneity, a three stage least square (3SLS) regression is used to estimate the coefficients of the determinants of exchange rate, income, and balance of payments. The estimated exchange rate coefficients are shown in Table 6A.

4.1. The Exchange Rate Estimation Results

The lagged exchange rate coefficient is -0.99 almost unit value and is significant at 99% level, implying that any change in the exchange rate at time t-1 period, ceteris paribus, is reversed at time t. An appreciation of the currency in period one is followed by an equal depreciation the following period, elimination any change in the value of the currency.

Foreign interest rates are not significant. The Korean government restricted the movement of capital, especially the outflow of Korean capital. High foreign interest rates were not sufficient to attract Korean capital. High foreign interest rates did not affect the exchange rate since Koreans were not able to invest abroad.

The negative sign of domestic price level coefficient is inconsistent with PPP and is statistically significant at 95% level. The negative sign of the price level could be due to price stickiness, consistent with the Dornbusch model. For a given level of output, the Dornbusch model states that following a monetary expansion, the exchange rate will overshoot its long-run equilibrium due to the rigidity of the price level. The subsequent adjustment process will lead to appreciation and rising prices.

The exchange rate elasticity with respect to the price level is -0.27, implying a 10% increase in prices will cause a 2.7% appreciation in the currency. According to PPP, an increase in the price level causes the currency to depreciate. Rivera-Batiz and Rivera-Batiz explain that from time to time PPP fail to explain exchange rate changes. Between

1981 and 1985, if PPP were to hold, the dollar should have depreciated when it persistently appreciated in value.

The two periods lagged change in money supply is statistically significant at the 90% level and has negative sign implying appreciation. The opposite signs of the money supply and the two periods lagged change in the money supply support the overshooting assumption of the Dornbusch model. A 10% increase in the money supply will cause the currency to depreciate at first, overshooting its long-run equilibrium, and then to revert to its long-run equilibrium. Two periods after a 10% increase in the money supply, the currency appreciates by 4.2%.

The signs of the coefficients of income and lagged change in income are negative and consistent with the theory. A 10% increase in income will cause 2.8% appreciation. Rising incomes lead to an increase in domestic transactions. This higher rate of domestic transactions results in a higher money demand relative to foreign money demand which causes appreciation.

4.2. The Income Estimation Results

The coefficients of income are reported in Table 6B. With the exception of the intercept and interest rate, all the parameters are insignificant. The intercept represents autonomous absorption such as government spending, and is statistically significant at the 99% level. The coefficient value is zero implying the government spending does not contribute to income.

The interest rate coefficient is positive and significant at 99% level. The sign of interest rate is contrary to expectation, and implies that a 1% increase in interest rate will

lead to a 0.28% increase in income. The increase in income could be caused by an inflow foreign capital.

4.3. The Balance of Payments Estimation Results

The balance of payments estimates are reported in Table 6C. The lagged balance of payments coefficient is significant at the 99% level and negative, implying that a 10% balance of payment "surplus" will lead to 3.83% balance of payment deficit the following period. A BOP surplus represents an inflow of funds and an increase in the money supply. The expanding money supply will cause the relative price level to change, making export expensive and imports less expensive. The change in the relative price level leads to a BOP deficit.

The income coefficient is also significant at the 99% level and negative. The income coefficient represents the marginal propensity to import; a 10% increase in income will increase in the balance of payments deficit by 20%.

The coefficient of the lagged change in income is also negative and significant at the 99% level. All the other variables are not significant.

5. Conclusion

The model estimated shows that the BOP curve for Korea lies below the LM curve, implying that capital is responsive to interest rate changes. Although Korea restricts the movement of domestic capital, it has been able to attract foreign capital. As Korean income increases, ceteris paribus, the Korean won appreciates. The model also shows that as income increases, the balance of payment deteriorates. As Koreans become wealthier their consumption of imports increases. The model can be extended to other countries in estimating the change in the value of a country's currency relative to that of a

trading partner. The treatment of capital by countries adopting export-led growth policies is detrimental to the efficacy of that strategy. Countries relying on exports to fuel their economic growth want to keep the value of their currency inelastic relative to income. The model endogenizes the determinants of the exchange rate, income, and the balance of payments, and predicts the effect of economic growth on the exchange rate, and the changes in the exchange rate on the balance of payments and income.

In future research, I will include the relative money supply, income, interest rate, price level, and balance of payments of two trading partners in estimating the exchange rate. Including variables from both countries may yield more robust results.

Appendix 2A. Tables to Chapter 2

Table 1. OLS Regression

Variable	Parameter Estimate	SE	t-Value	Pr> t		
Intercept	6.14	0.54	11.4	<.0001		
llnp	0.34	0.29	1.14	0.26	R-Square	0.65
lnpf	-0.64	0.14	-4.69	<0.0001	Durbin-Watson	0.74
lny	-0.24	0.11	-2.21	0.03	SSE	1.39
lnm	1.21	0.48	2.53	0.01		
lnm_1	-0.78	0.43	-1.83	0.07		
if	-0.00	0.01	-0.15	0.88		

Table 2. Autoregressive estimation

Variable	Parameter Estimate	SE	t-Value	Pr> t		
Intercept	-0.02	0.02	-1.15	0.25		
Δlnp	-0.80	0.55	-1.45	0.15	R-Square	0.10
Δlnpf	0.19	0.59	0.32	0.75	Durbin-Watson	2.20
Δlny	0.03	0.05	0.47	0.64	SSE	0.72
Δlnm	0.68	0.31	2.22	0.03		
Δlnm_1	0.16	0.28	0.58	0.57		
Δif	-0.01	0.01	-0.68	0.50		

Table 3A Test for stationarity (AR1): $y_t=\alpha_0+\alpha_1 y_{t-1}+\varepsilon_t$

Variable	α_1	S.E.	R2	Mean$\{\varepsilon_t\}$	Cov$\{\varepsilon_t\}$	Corr$\{\varepsilon_t\ \varepsilon_{t-1}\}$
lns	0.92	0.05	0.80	0.00	0.00	-0.06
lnp	0.98	0.00	1.00	0.00	0.00	0.45
lnpf	0.97	0.00	1.00	0.00	-0.03	-0.66
lnm	0.99	0.00	1.00	0.00	0.00	-0.10
lnm_1	0.99	0.00	1.00	0.00	0.00	-0.10
if	0.98	0.03	0.93	0.00	0.03	0.03
lnif	0.09	0.00	0.91	0.00	0.00	0.34
lnq	0.94	0.04	0.88	0.00	0.00	0.35
lndifi	0.85	0.05	0.72	0.00	0.00	-0.03
lni	0.97	0.03	0.91	0.00	0.00	0.18
lnb	0.00	0.10	0.00	0.00	0.00	0.00

Table 3B. Test for stationarity: $|\alpha_1|+2\sigma$

Variable	α_1	SE	$\|\alpha_1\|+2\sigma$		
lns	0.92	0.05	1.01	non-stationary	
lnp	0.98	0.00	0.99	stationary	
lnpf	0.97	0.00	0.98	stationary	Residual series $\{\varepsilon_t\}$
lny	0.97	0.08	1.00	non-stationary	in AR(1) process
lnm	0.99	0.00	0.99	stationary	is white noise:
lnm_1	0.99	0.00	0.99	stationary	Mean = 0
if	0.98	0.03	1.04	non-stationary	Covariance near zero
lnif	0.09	0.00	0.10	stationary	Correlation < 0.5
lnq	0.94	0.04	1.01	non-stationary	
lndifi	0.85	0.05	0.95	stationary	
lni	0.97	0.03	1.03	non-stationary	
lnb	0.00	0.10	0.20	stationary	

Table 3C. ARCH model on $\varepsilon t^2=\beta_0+\beta_1\varepsilon^2_{t-1}+\mu_t$

Variable	β_1	t-stat	Mean{ μ_t)	Cov{ μt)	Corr{ μt $\mu t-1$}	
lns	0.07	0.05	0.00	0.00	0.00	
lnp	0.21	0.00	0.00	0.00	-0.01	
lnpf	0.10	0.00	0.00	0.00	-0.03	Residual series {εt}
lny	0.20	0.02	0.00	0.00	0.05	in AR(1) process
lnm	0.06	0.00	0.00	0.00	0.01	is white noise:
lnm_1	0.06	0.00	0.00	0.00	0.01	Mean = 0
if	0.40	0.03	0.00	0.14	0.06	Covariance near zero
lnif	0.45	0.00	0.00	0.00	0.04	Correlation < 0.5
lnq	0.40	0.04	0.00	0.00	-0.01	
lndifi	0.34	0.05	0.00	0.00	-0.02	
lni	0.44	0.03	0.00	0.00	0.00	
lnb	-0.01	0.10	0.00	-0.01	0.00	

Table 4A. Dickey-Fuller Unit Root test with TREND: $\Delta y_t=\alpha_0+\gamma_1 y_{t-1}+\alpha_1 T+\varepsilon_t$

Variable	$\alpha 0$	$\gamma 1$	$\alpha 1$	t-stat	Mean{ εt)	Cov{ εt)	Corr{ εt $\varepsilon t-1$ }
lns	1.31	-0.19	0.00*	-3.10	0.00	0.00	-0.01
lnp	0.14	-0.03	0.00	-3.35	0.00	0.00	0.45
lnpf	0.10	-0.02	0.00	-2.50	0.00	0.00	0.24
lny	4.09	-0.51	0.02**	-6.13	0.00	-0.01	-0.31
lnm	0.49	-0.05	0.00*	-2.75	0.00	0.00	-0.12
lnm_1	0.50	-0.05	0.00*	-2.77	0.00	0.00	-0.12
if	3.30	-0.19	-0.02**	-3.24	0.00	0.08	0.09
lnif	1.77	-0.93	-0.00**	-164.00	0.00	0.00	0.40
lnq	0.00	-0.07	0.00	-1.67	0.00	0.00	0.34
lndifi	0.28	-15.00	0.00	-2.82	0.00	0.00	-0.03
lni	0.34	-0.11	-0.00*	-2.29	0.00	0.00	0.02
lnb	10.10	-1.01	0.00	-9.88	0.00	0.00	0.00

**significant at 99% level; * significant at 95% level

Table 4B. Dickey-Fuller Test

Variable	SE	$(\gamma_1-1)/SE$	$(\gamma_1-1)/SE$	Critical values		
		$(\gamma_1<1)$	$(\gamma_1>-1)$	0.01	0.05	0.10
lns	0.06	-19.10	28.80	-4.04	-3.45	-3.15
lnp	0.01	-99.50	188.00	-4.04	-3.45	-3.15
lnpf	0.01	-152.00	296.00	-4.04	-3.45	-3.15
lny	0.08	-18.00	17.70	-4.04	-3.45	-3.15
lnm	0.02	-57.40	106.00	-4.04	-3.45	-3.15
lnm_1	0.02	-56.50	104.00	-4.04	-3.45	-3.15
if	0.06	-20.70	31.60	-4.04	-3.45	-3.15
lnif	0.01	-339.00	187.00	-4.04	-3.45	-3.15
lnq	0.04	-29.40	53.70	-4.04	-3.45	-3.15
lndifi	0.05	-21.30	34.10	-4.04	-3.45	-3.15
lni	0.05	-23.70	40.40	-4.04	-3.45	-3.15
lnb	0.10	-19.90	9.73	-4.04	-3.45	-3.15

Table 5A. ECM –Spurious Exchange rate

Variable	Parameter Estimate	SE	t-Value	Pr> t
Intercept	-0.01	0.01	-1.06	0.29
lns_1	0.64	0.08	8.14	<.0001
lnp	-0.09	0.21	-0.40	0.69
lnpf	-0.16	0.12	-1.35	0.18
If	0.00	0.01	0.56	0.58
lnm	0.68	0.27	2.51	0.01
lny	-0.03	0.08	-0.34	0.73
lnm_1	-0.51	0.23	-2.18	0.03

Table 5B. ECM –Spurious Income

Variable	Parameter Estimate	SE	t-Value	Pr> t
Intercept	-0.16	0.24	-0.64	0.52
lny_1	0.91	0.03	30.00	<.0001
lni	-0.28	0.13	-2.19	0.03
lnb	0.02	0.02	0.76	0.45

Table 5C. ECM –Spurious Balance of Payments

Variable	Parameter Estimate	SE	t-Value	Pr> t
Intercept	10.50	1.13	9.33	<.0001
lnb_1	-0.02	0.10	-0.17	0.86
lny	-0.08	0.09	-0.86	0.39
lnq	-2.05	1.39	-1.47	0.14
lndifi	-0.22	0.19	-1.18	0.24

Table 6A. Exchange rate

Variable	Elasticities	Parameter Estimate	SE	t-Value	Pr> t
Intercept	0.04	0.02	0.01	1.75	0.08
Δif	-0.77	-0.01	0.01	-0.90	0.37
Δlnp	-0.27	-0.86	0.36	-2.39	0.02
Δlnpf	-0.01	-0.43	0.14	5.14	<.0001
Δlnm_1	0.72	0.21	0.15	1.42	0.16
Δlny	-0.28	-0.31	0.12	-2.68	0.01
Δlns_1	-0.99	-0.34	0.10	-3.30	0.00
Δlnp_1	-0.10	-0.10	0.35	-0.28	0.78
$\Delta lnpf_1$	0.27	0.27	0.37	0.75	0.46
Δif_1	0.00	0.00	0.01	0.17	0.87
Δlny	-0.17	-0.17	0.07	-2.58	0.01
Δlnm_2	-0.42	-0.42	0.23	-1.83	0.07
Resid		1.02	0.07	13.70	<.0001

Table 6B. Income

Variable	Elasticities	Parameter Estimate	SE	t-Value	Pr> t
Intercept	0.00	0.02	0.01	3.22	0.00
Δlni	0.28	-0.27	0.08	-3.39	0.00
Δlnb	-0.05	-0.01	0.02	-0.31	0.76
Δlny_1	-0.95	-0.02	0.04	-0.62	0.54
Δlni_1	-3.48	-0.15	0.10	-1.47	0.15
Δlnb_1	0.00	0.00	0.01	-0.12	0.90
Resid		0.99	0.03	29.10	<.0001

Table 6C. Balance of Payments

Variable	Elasticities	Parameter Estimate	SE	t-Value	Pr> t
Intercept	0.00	0.16	0.08	1.92	0.06
Δlny	-2.04	-3.89	0.71	-5.45	<.0001
Δlndifi	5.80	-0.03	0.21	-0.13	0.89
Δlnq	-26647.00	-3.51	2.56	-1.37	0.17
Δlnb_1	-0.38	-0.40	0.06	-6.88	<.0001
Δlny_1	-1.22	-2.22	0.39	-5.75	<.0001
$\Delta lndifi_1$	-4.46	-0.16	0.22	-0.75	0.45
Δlnq_1	-36556.00	1.80	2.68	0.67	0.50
Resid		1.07	0.07	15.80	<.0001

Appendix 2B. Figures to Chapter 2

Figure 1. Won/Punt Exchange Rate

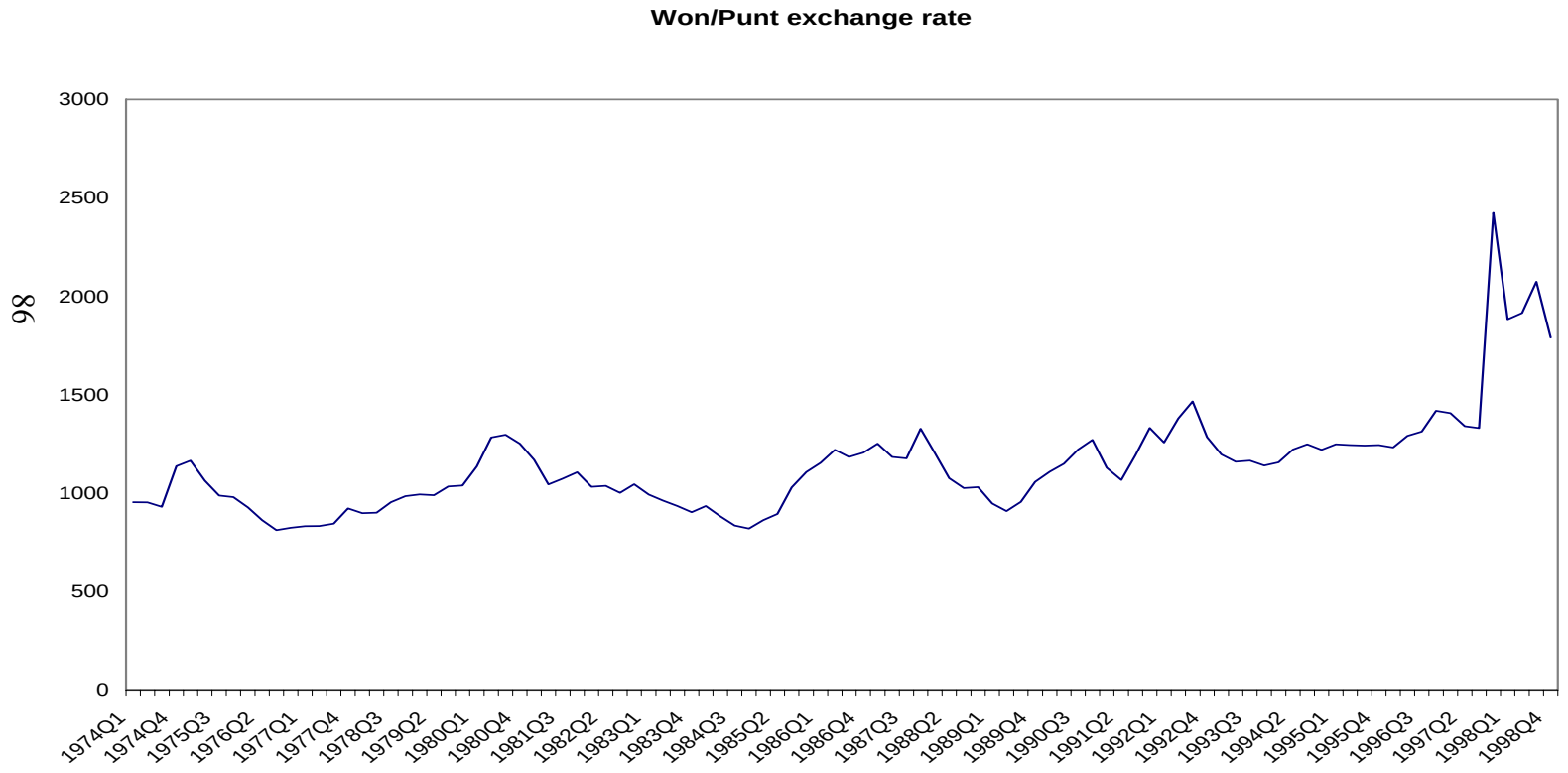


Figure 2. The basic monetary model

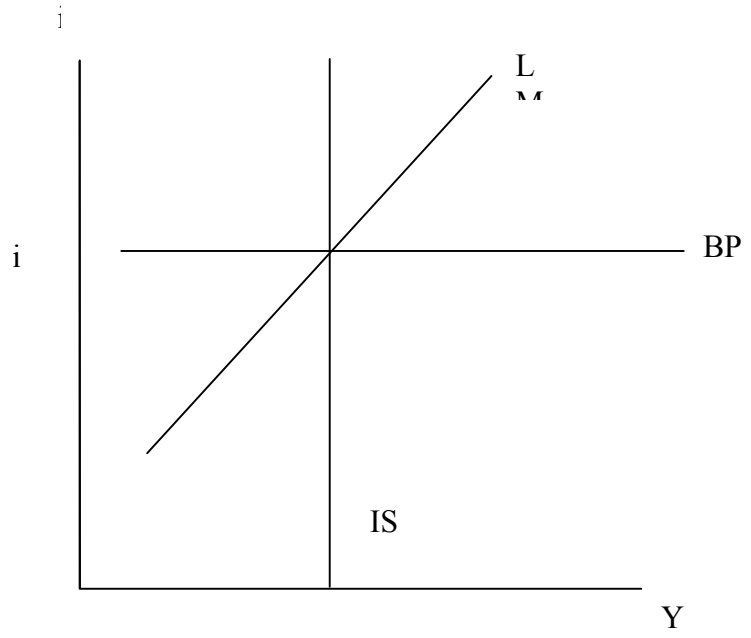


Figure 3. The BP equilibrium and capital Flows

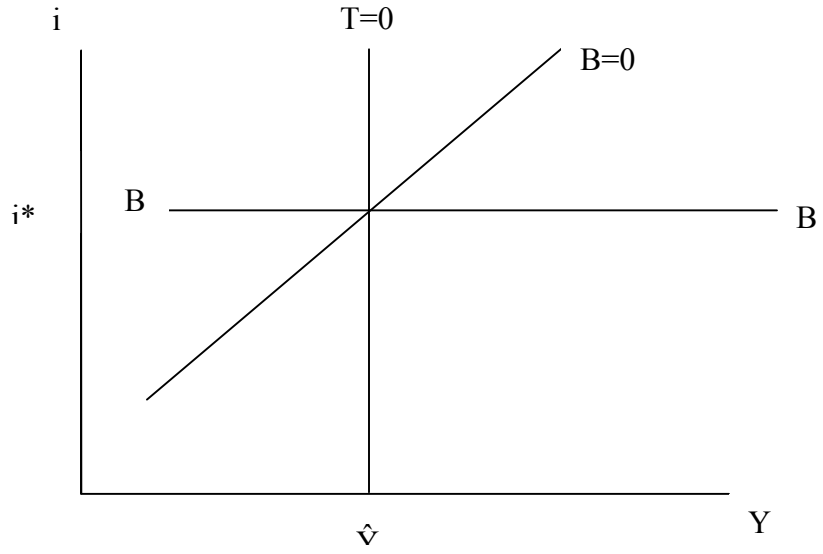


Figure 4. Effects of income growth in flatter BP and steeper LM

An increase in income creates a BP surplus. The currency appreciates and causes the BP to shift upward thus restoring equilibrium.

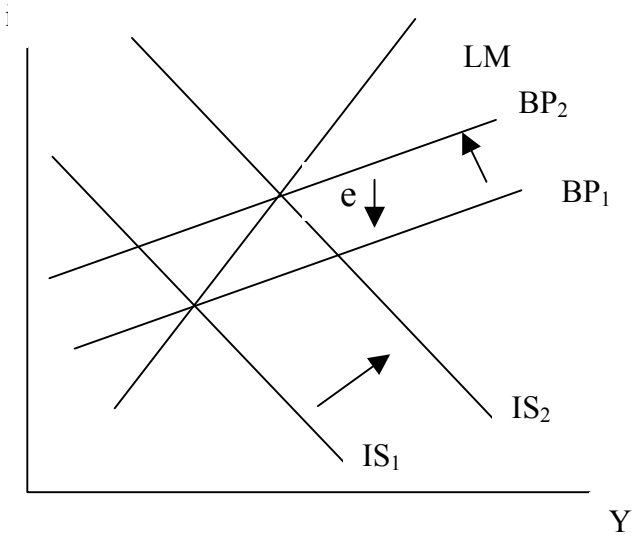


Figure 5. Effects of income growth in steeper BP and flatter LM

An increase in income creates a BP deficit. The currency depreciates and causes the BP to shift downward thus restoring equilibrium

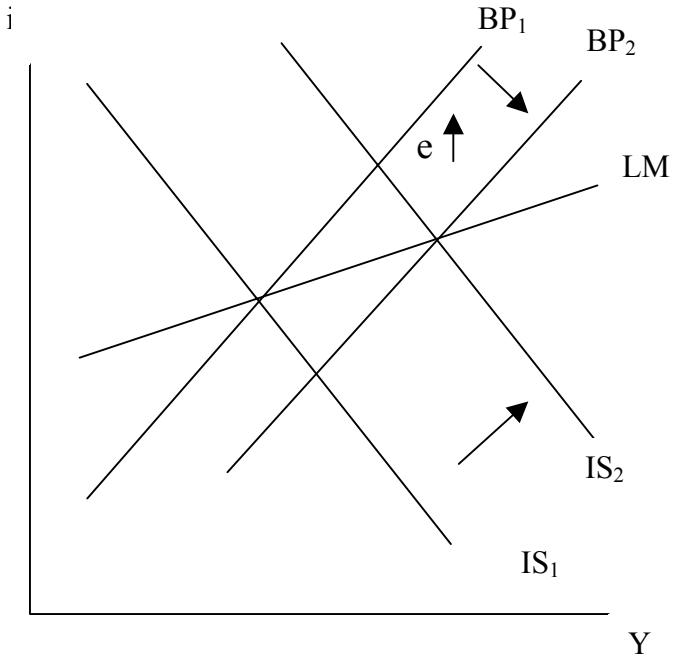


Figure 6. Goods and assets market equilibrium

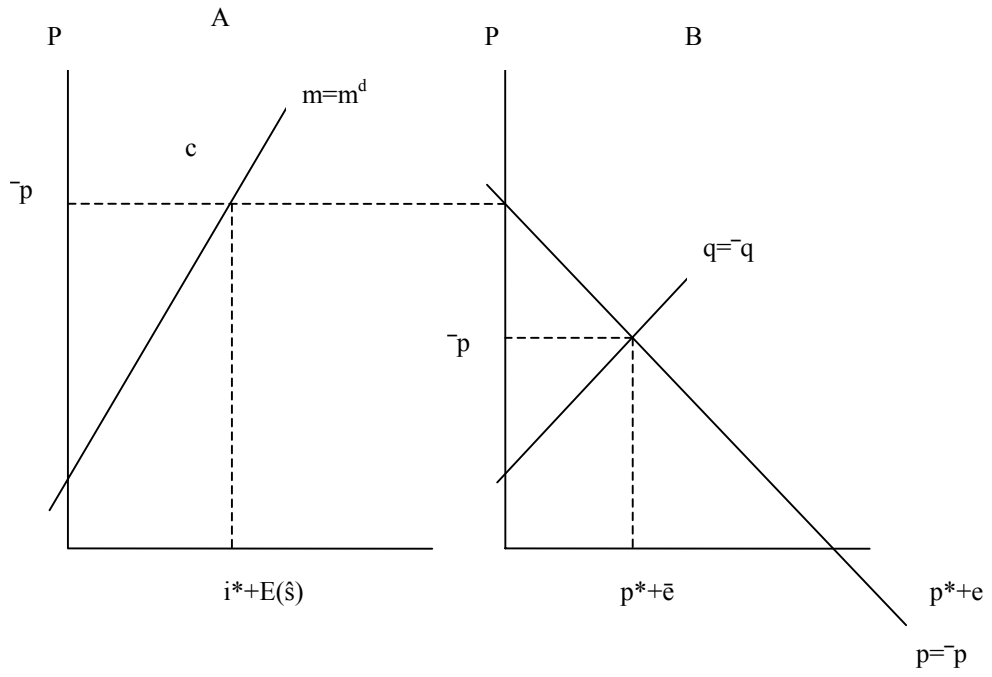
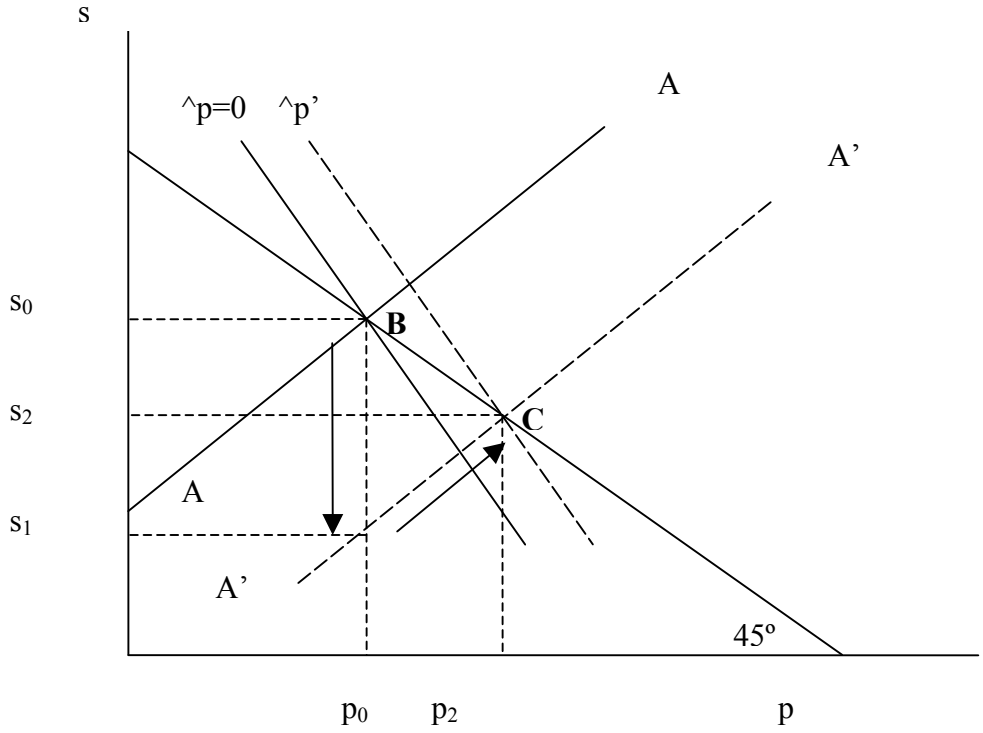


Figure 7. Price and exchange rate adjustment



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