MONETARY APPROACH TO THE JORDANIAN
BALANCE OF PAYMENTS
(1968 - 1986)

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Abstract

The aim of this paper is to analyse the Jordanian balance of payments within the monetary approach. It links the disequilibrium in the balance of payments (deficits or surpluses) to the disequilibrium in the domestic money market. A balance of payment deficit is, according to the monetary approach, a reflection of excess supply of money. The study concludes that in order to correct for such disequilibrium, the Central bank should control domestic credit expansion. To reach such conclusion, a reduced form equation model is specified, modified and estimated using Jordanian annually and quarterly data for the period 1968-1986. The results do confirm that the behavior of the reserve flow during the last two decades was in line with the propositions of the monetary approach. Some policy implications were suggested as a conclusion to the study.

I. Introduction

This paper provides an empirical study of the Jordanian balance of Payments, major emphasize is placed on the money market in an attempt to test the theoretical proposition that the balance of payments is a monetary phenomena.

The proposition derives from what Harry Johnson and Robert Mundell, among others (Johnson, 1973; Tsiang, 1977; Shone, 1980; Johnson and Frankel, 1976), have called a new approach to the theory of balance of payments, more specifically it is known as the Monetary Approach to the Balance of Payments(I).

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The empirical analysis will investigate the relationship between the balance of payments and the rate of domestic credit expansion. The balance of payments in a small open economy like Jordan plays an important role in determining the changes in the stock of domestic money. International reserves flows, for example, will increase the domestic money supply either if they are added to money balances of the country or if they were exchanged for domestic currency.

The question that may be asked is this; what are the major determinates of the Jordanian reserve flows?, and what role, if any, do policy actions play in affecting such flow?

The monetary approach implies that the central bank can exercise some degree of manipulating the money market through affecting credit creation policies and thus affecting the state of the balance of payments.

The plan of the paper is as follows: next a theoretical framework of the theory behind the monetary approach with its basic mathematical formulation will be presented. Then a brief descriptive analysis of the Jordanian balance of payments followed by model estimation and analysis. Finally policy implications will conclude the paper.

II. Theoretical background

The development of the monetary approach to the balance of payments during the early 1970's has set a series of studies and discussions of open economy macroeconomics for several years. The origin of the approach can be traced back to David Hume's writings on money, but its modern format was developed during the late 1960's. Robert Mundell, Harry Johnson, and Jacob Frankel can be considered among the pioneers in this area of research.

In an attempt to search for a general theory of the balance of payments, at least three well known approaches emerged, the elasticity approach, the absorption approach, and the monetary approach. All tried to give an answer to how to correct for balance of payments problems.

* The Elasticity Approach employs a partial equilibrium framework to analyse the effect of devaluation on exports and imports, it excludes the movement in capital and it is assumed to be exogenously given. The approach dominated during the
late 1930's and early 1940's. It gave an answer to how a devaluation can improve the trade balance such an answer was based on the assumption that the Marshall-Lerner condition holds, that is in a two-country, two-goods world, a devaluation in the deficit country would be beneficial if the sum of the two countries elasticities of demand for imports exceeds unity (i.e., if the Marshall-Lerner condition holds). It should be mentioned that only under strict conditions; such as less than full employment and/or perfectly elastic supply of output - given the Marshall-Lerner condition - would a devaluation give the expected improvements in the trade balance (Johnson, 1961, PP374-388; and Melvin, 1985, PP99-105).

* The Absorption Approach: This approach on the other hand, which was developed by Sidney Alexander (Alexander, 1968, P367), is based on the famous income-expenditure identity:

\[ Y = C + I + G + X - M = A + B \]

where A is the domestic absorption and B is the trade balance. Then this approach views the trade balance as the difference between domestic output and domestic absorption, which implies that trade balance can be improved by any policy which causes a reduction in expenditure relative to output. More specifically, a devaluation can improve the trade balance if it succeeded in increasing domestic production relative to domestic demand. It should be pointed out here that under the condition of full employment, the effect of devaluation depends upon the inflation it causes which in turn will reduce the value of real money balances and reduce expenditure (Melvin, 1985, PP105-107; and Alexander, 1968, P367).

Both of these approaches have their shortcomings and limitations specially if applied to Jordanian data. They emphasis a partial approach by ignoring the capital account and focusing mainly at the trade balance, moreover the strict conditions needed for their applicability and the adverse effects the devaluation of the dinar will have on the economy, make the need for the monetary approach more acute.

The essence of the monetary approach is this; it stresses that the balance of payments involves essential monetary phenomena; that is, any dis-equilibrium in the balance of payments, (deficit or surplus), is based on monetary dis-equilibrium (excess supply or excess demand), i.e., the differences existing between the amount of money supplied by the Central bank and the amount people desire to hold. If domestic money supply exceeds money demand (excess supply), then spending rise
above receipts, and part of the increased spending is directed at foreign goods, services and assets, the excess supply of money is eliminated by outflow of money to other countries. Thus the monetary approach to the balance of payments do in fact emphasize the determinants of demand for and the supply of money since these will also determine the position of the balance of payments, i.e.; surplus or deficit. So in order to control the state of the balance of payments, Central Bank should control domestic money market, or, more specifically, should control domestic credit expansion. Therefore the main insight of the monetary approach is the inclusion of the equilibrium in the monetary sector, and also it fills the gap left by the previous approaches which were based on the implicit assumption that there were no monetary consequences associated with balance of payment disequilibrium (Johnson, 1961, P388).

III. The Model Specification

An attempt is made to construct a basic simple, one equation, model capable of effectively enabling us to analyse the state of the Jordanian balance of payments, the usual assumptions are first; small economy, second; open and actively involved in international economic transactions.

Both assumptions were satisfied by Jordan. The rational behind the first assumption is this, we assume small countries can not effect the international terms of trade of goods and services, or the rate of interest they face, in other words, the country is considered a price taker in the international market. The rational behind the second assumption, is this, the country is assumed to be quite open, the degree of openness is usually measured by how active the country in international trade, and how much reliance the country places on foreign markets to satisfy domestic needs.

A) money demand: We consider the money demand \( m^d \) to be a function of the price level \( p \), real income \( y \) and the rate of interest \( i \) more specifically.

\[
m^d = f(p, y, i) \tag{1}
\]

Generally the demand for money is assumed to be homogenous of degree one in price level. Then equation 1 can be re-written as:

\[
M^d = P \cdot f(y, i) \tag{1}'
\]
with the following expected relations:

\[ r^2 > 0, \quad r^3 < 0 \]

Which means that money demand is positively related to the level of real income and negatively related to the opportunity cost of holding money\(^{(5)}\).

B) Money supply: the factors affecting money supply \(M^s\) in an open economy were linked to changes in monetary base or changes in high powered money \(H\). The base or the high powered money is simply the sum of international reserves \(R\) at the Central Bank, and the Central bank credit \(D\); more specifically:

\[ M^s = a \cdot H \quad \text{......... (2)} \]

Where \(M_s\): The stock of domestic money; narrow definition of money supply. \(H\): is the monetary base which can be defined as; (Zecher, 1972, PP288-289):

\[ H = R + (OA \cdot OL) = R + D \]

and \(R\) is the Central Bank holding of international reserves, \(OA\) all other assets of the Central Bank, \(OL\) all other liabilities of the Central Bank, and \(D\) is the level of domestic credit. Equation 2 can be further simplified:

\[ M^s = a \cdot (R + D) \quad \text{......... (2)'} \]

If we assume that money multiplier is constant, then:

\[ \Delta M^s = a \cdot \Delta(R + D) = a \cdot (\Delta R + \Delta D) \]

But: \(R\) is simply the state of the balance of payments \(B\):

\[ B = \Delta R \quad \text{......... (3)} \]

Therefore:

\[ \Delta M^s = a [B + \Delta D] \quad \text{......... (4)} \]

or:

\[ B = 1/a [\Delta M^s] \cdot \Delta D \quad \text{......... (5)} \]

at equilibrium: \(M^s = M^d\) and \(\Delta M^s = \Delta M^d\).
then:

\[ B = M^d - \Delta D \quad \ldots \ldots \ (6) \]

Equation (6) states that the balance of payments corresponds to those additions to (or subtractions from) money balances that people desire to hold, but is not being provided by the Central bank in the form of changes in domestic credit. A balance of payment surplus \((B > O)\) represent a situation of excess demand for money over what Central bank is supplying, and a balance of payments deficit \((B < O)\) represents the reverse case\(^6\). Substituting for \(M_d\) in equation (1)'and for \(m^s\) in equation (2)\(^9\):

\[ \text{p.f.}(y, i) = a \cdot (R + D) \quad \ldots \ldots \ (7) \]

by taking the total differentials of both sides of equation (7) we obtain\(^7\).

\[ \frac{R}{H} = \frac{\hat{P}}{H} + E_{fy} \hat{Y} + E_{fI} \hat{I} - \frac{D}{H} \quad \ldots \ldots \ (8) \]

for small open economy, the domestic price \(P\) is given by the following formula:

\[ \hat{P} = \theta R \cdot \hat{P}^* \quad \ldots \ldots \ (9) \]

Where: \(ER\) is the on-going exchange rate, i.e., the domestic price of foreign-currency, and \(P^*\) is the foreign price level and thus:

\[ \hat{P} = \theta R + \hat{P}^* \]

So equation (8) can be written as:

\[ \frac{R}{H} = \theta R + \hat{P}^* + E_{fy} \hat{Y} + E_{fI} \hat{I} - \frac{D}{H} \quad \ldots \ldots \ (10) \]
Equations (8) and (10) are the basic two equations that can be tested. Equation 8 if considered will imply the fixed exchange rate system and ER = 0. Equation 10 if considered implies flexible or floating exchange rate system and R = 0. For a small open economy like Jordan; the exchange rate of the JD is virtually constant against major international currencies, so equation (8) only will be considered.

Equation (8) can be formulated in a testable form as; (Zecher, 1972, PP288-289, and, Bean, 1976, PP327-328):

\[
\frac{R}{H} = \frac{a_0 + a_1 \hat{P} + a_2 \hat{Y} + a_3 \hat{D} + a_4}{\hat{D} + \hat{U}} \quad \text{... (8)}
\]

Therefore: our theoretical expectations according to the monetary approach are as follows:

- Changes in the price level \( \hat{P} \) or domestic inflation reflect changes in the world prices and are assumed to have a positive effect on balance of payments. The increase in the price level reduce the real value of money and cause people to hoard in order to restore their actual real money \( \hat{D}_1 > 0 \) and has a value around unity.

- The coefficient \( a_2 \) is the usual income elasticity of demand for money and its expected value should be positive \( (\hat{a}_2 > 0) \) this caused by the income effect\(^8\), which states that economic development i.e., increase real income and in turn increases the real demand for money and cause reserve inflow if Central Bank did not sterilize reserve flows. Sterilization usually refers to the ability of the Central Bank to offset international reserve flows and follow an independent monetary policy (Melvin, 1985, PP97-99).

- Interest rate has a negative effect upon the balance of payments, because an increase in the rate of interest increases the cost of holding money, and will make people adjust their portfolio and decrease their money balances until equilibrium is achieved (Campbell and Campbell, 1984, PP318-319).

- The coefficient of \( \hat{D} \) have a value of (-1), especially if Central bank try not to sterilize the flows of reserves\(^9\).
IV. The State of Jordanian Balance of Payments

Jordan is a small open economy with limited resources, quite active on the international market. The volume of exports has increased considerably from JD8.73 million in 1964 to about JD256.03 million in 1986, with an annual growth rate of 11.2%, on the other hand, the volume of imports has increased from JD49.38 million in 1964 to about JD847.83 million in 1986 with an annual growth rate of 16.2%. As we look at the international trade statistics for several years, the dominance of foreign trade sector in the national economy can clearly be seen. The volume of trade (export plus import) relative to the level of gross national product has increased from 41% in 1969 to maximum of 87% in 1981 and fluctuated since then to reach 75% in 1985 and about 58% in 1986, table (1) shows the percentage of both exports and imports to the level of gross national products (GNP), for the years 1968-1986. Such figures and ratios can be considered to reveal the degree of openness of a country. One other measure is the percentage of imports to total effective demand\(^{10}\), still another third measure of the dependency of a country on trade is the percentage of total imports to gross domestic product (GDP); which reveal the production capacity of the economy. Table (1) contains some of those measures, all were high for Jordan by all normal standards.

The Jordanian balance of payments is characterized by a dichotomy of unique feature. It suffers from a chronic trade balance deficits which is a measure of outflow of foreign exchange and a fluctuated an overall balance over the years of the study. Table (2) summarizes the major items of the balance of payments for the period 1970-1986. The trade deficit (imports exceeds exports) for all years, is being countered by surplus in services and unilateral transfers balance, the net result is a fluctuated net overall balance. A closer look at this chronic trade deficit, one can see that it was increasing until 1985 despite the many and continuous efforts to decrease, or even to control, it. It rose during the period 1973-1985 by an annual rate of growth close to 18% (Talahia, 1987, PP4-5), until it reached a peak of JD871.73 million in 1983 and declined to JD761 million in 1985. In 1986, the balance of payments in general took a different path, it was characterized by major structure changes in most of its items and showed an overall balance of a JD35 million, one major reason is the clear reduction in trade deficit which reached its lowest level since 1983 of JD591.8 million with a percentage change of about -22.3% the highest since 1968 (Central Bank of Jordan, 1986, PP71-72). Table 3 and figure 1 show the state of the trade balance.
## Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>GNP</th>
<th>Imports</th>
<th>Exports</th>
<th>Imports GNP</th>
<th>Exports GNP</th>
<th>% Trade GNP</th>
<th>GDP</th>
<th>% Imports</th>
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<td>1968</td>
<td>166.4</td>
<td>57.492</td>
<td>14.172</td>
<td>34.5</td>
<td>8.5</td>
<td>43.9</td>
<td>156.1</td>
<td>36.8</td>
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<td>1969</td>
<td>197.4</td>
<td>67.752</td>
<td>14.750</td>
<td>34.3</td>
<td>7.5</td>
<td>41.0</td>
<td>183.4</td>
<td>36.9</td>
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<tr>
<td>1970</td>
<td>187.0</td>
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<td>12.169</td>
<td>35.2</td>
<td>6.5</td>
<td>41.7</td>
<td>174.4</td>
<td>37.4</td>
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<td>11.440</td>
<td>38.4</td>
<td>5.7</td>
<td>44.1</td>
<td>186.2</td>
<td>41.2</td>
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<td>1972</td>
<td>221.0</td>
<td>95.310</td>
<td>17.005</td>
<td>34.8</td>
<td>7.9</td>
<td>52.7</td>
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<td>241.5</td>
<td>108.247</td>
<td>18.984</td>
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<td>7.8</td>
<td>73.9</td>
<td>218.3</td>
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<td>50.8</td>
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<td>63.3</td>
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<td>48.938</td>
<td>62.2</td>
<td>13.0</td>
<td>75.2</td>
<td>312.1</td>
<td>74.9</td>
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<td>1976</td>
<td>562.4</td>
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<td>69.445</td>
<td>60.4</td>
<td>12.3</td>
<td>72.7</td>
<td>421.6</td>
<td>80.5</td>
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<td>1977</td>
<td>660.7</td>
<td>454.517</td>
<td>82.099</td>
<td>68.9</td>
<td>12.4</td>
<td>81.3</td>
<td>514.2</td>
<td>88.4</td>
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<tr>
<td>1978</td>
<td>787.0</td>
<td>458.942</td>
<td>90.900</td>
<td>58.8</td>
<td>11.6</td>
<td>70.4</td>
<td>632.2</td>
<td>72.6</td>
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<td>1979</td>
<td>921.3</td>
<td>585.666</td>
<td>120.907</td>
<td>63.6</td>
<td>13.6</td>
<td>76.7</td>
<td>953.0</td>
<td>77.8</td>
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<tr>
<td>1980</td>
<td>1189.3</td>
<td>715.977</td>
<td>171.575</td>
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<td>74.6</td>
<td>979.5</td>
<td>73.1</td>
</tr>
<tr>
<td>1981</td>
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<td>1047.505</td>
<td>242.632</td>
<td>70.6</td>
<td>16.4</td>
<td>87.0</td>
<td>1182.5</td>
<td>88.6</td>
</tr>
<tr>
<td>1982</td>
<td>1673.4</td>
<td>1142.493</td>
<td>264.527</td>
<td>68.3</td>
<td>15.8</td>
<td>84.1</td>
<td>1343.2</td>
<td>85.0</td>
</tr>
<tr>
<td>1983</td>
<td>1769.3</td>
<td>1103.310</td>
<td>210.574</td>
<td>62.4</td>
<td>11.4</td>
<td>74.3</td>
<td>1461.3</td>
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</tr>
<tr>
<td>1984</td>
<td>1854.5</td>
<td>1017.340</td>
<td>290.350</td>
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<td>73.5</td>
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<td>71.5</td>
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<td>1985</td>
<td>1846.2</td>
<td>1074.445</td>
<td>310.888</td>
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<td>16.8</td>
<td>74.9</td>
<td>1573.3</td>
<td>68.3</td>
</tr>
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<td>1986</td>
<td>1917.4</td>
<td>847.830</td>
<td>256.030</td>
<td>44.2</td>
<td>13.4</td>
<td>57.6</td>
<td>1613.6</td>
<td>52.6</td>
</tr>
</tbody>
</table>

Figure 1

Net Goods & Services Balance, Capital

1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86

$\text{Net G\&S Balance}$  $\text{Capital Movements}$  $\text{Reserve Flows}$
Table 3  
Balance in Jordan 1970-1986

(millions) JD

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports</th>
<th>Exports</th>
<th>Trade Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>76.627</td>
<td>11.440</td>
<td>-65.190</td>
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<tr>
<td>1972</td>
<td>95.310</td>
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<td>1975</td>
<td>234.012</td>
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<td>1977</td>
<td>454.517</td>
<td>82.099</td>
<td>-372.417</td>
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<td>1978</td>
<td>458.942</td>
<td>90.911</td>
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<td>1979</td>
<td>585.666</td>
<td>120.907</td>
<td>-464.758</td>
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<td>1980</td>
<td>715.977</td>
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<td>-544.510</td>
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<td>1981</td>
<td>1047.505</td>
<td>242.632</td>
<td>-804.872</td>
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<tr>
<td>1976</td>
<td>847.83</td>
<td>526.03</td>
<td>-591.800</td>
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</table>

Source: Central Bank;  
Monthly Statistical Bulletin; special issue 1964-1983  
and different issues for 1984 - 1986.

Generally, those measures and other fiscal policy actions that were undertaken to reduce the deficit dealt with limiting imports and encouraging exports without trying to see what cause those excess demand for imports and excess supply of exports, the monetary approach do link the demand for goods and services to the money market, and to achieve balance of payments equilibrium, money market should be in equilibrium. That is; this approach is looking at the deficit in the balance of payments as being a reflection of the imbalances in the money market. That is for deficit to be eliminated or controlled, the imbalances between supply and demand for money has to be eliminated or controlled.
The period 1968-1986 covers a very vital time; different economic development plans were initiated and/or implemented. All of those plans had goals of economic development in most sectors of the economy, and due to the implementation of these plans to achieve those goals, imports grow at an annual rate of 19.3% to reach a high level of JD1074.5 million in 1985, in the same time exports grow at a rate of 24% to reach a high level of JD310.9 million in 1985.

The above mentioned deficit and the fluctuated state of the overall balance have a negative effect on the development strategies and on the country's external position. The continuous depletion of the country's foreign reserves and the increased debtiness make the responsibility of the monetary authorities, embodied with the Central bank, and of the decision makers, so great. A series of attempts has been taken to correct for this deficit, they took many form. A look at the different development plans, we can find that among the goals of the five year plan (1976-1980), is to decrease the balance of trade deficit to JD131 million by 1980, that is by limiting imports to reach JD300 million by 1980, and by increasing exports to reach JD169 million by 1980 (Central Bank of Jordan, 1980, PP87-88), the actual figures for 1980 revealed totally opposite situation; imports increased to reach JD714.8 million (414.8 million in excess of the plan's target) ie; imports grow at a growth rate close to 138%. Exports increased to reach JD171.5 million with growth rate equal to 1.4% which led to an increased deficit to JD543.3 million. The reason for this failure can be explained by the elasticity approach; import demand being relatively inelastic, and with increased income levels during the late 1970's and increased levels of expenditure, the demand for foreign goods increased substantially, and on the other hand, foreign demand for Jordanian product is relatively elastic due to increased competition from foreign products. Also domestic exports did not increase enough to meet some the increase in import demand.

The third five year plan 1986-1990 is aiming at increasing exports by an annual rate of 7% during plan period to reach JD333 million by 1986, and continue to increase to reach JD437.0 million by 1990 (Central Bank of Jordan, 1986, PP80-81) and it aims also at decreasing imports to grow at a low rate of 2.7% during plan years.

It should be mentioned here that the central bank took some monetary policy actions to reduce the deficit such as credit restrictions by increasing the legal reserve ratio and by reducing the credit deposit ratio, among other policy actions to increase its control over the credit expansion, as a result of all such measures, trade deficit did decline starting 1984 and on.
Figure 2: Trade Deficit 1970-1986
V. Model Estimation and Analysis

The general framework outlined above will be estimated, but before the estimation stage, we should look at the demand for money, and more specifically the opportunity cost of holding money.

The opportunity cost of holding money may be defined as the discounted real yield on the best alternative investment that have been made (Dornbusch and Fischer, 1978, PP210-211). In practice, however, a distinction should be made between economies with well-developed financial markets where alternative opportunities are available and economies with immature financial market where opportunities are limited. The capital market, the market for bonds, and common stocks market in Jordan, all are in their early stages of development and thus, there is no well specific set of alternatives available to the investor. Generally, market interest rate is being used as a measure of the opportunity cost of holding money. In Jordan, the market rate of interest is officially pagged below its market clearing rate. Table (4) shows the structure of lending and borrowing rates as set by the central bank of Jordan 1980-1986. The law govern credit control and the banking system in Jordan (13) empowered the central bank to determine the minimum and the maximum interest rate and the transaction costs charged by banks, and to prescribe the manner in which funds from saving and other deposits should be utilized and to put the ceiling on total loans and credit. Thus, the Central bank do, through the use of its known instruments (14), alter the way financial resources will be allocated.

The result of the above discussion led us to conclude that interest rate in Jordan does not, in fact, represent the conditions existing in the money market. R. Dornbusch and S. Fisher did express the fact that the expected rate of inflation is a good proxy for the opportunity cost of holding money; "In markets where interest rates are controlled and do not rise to reflect expected inflation, individuals begin to think of alternative of buying goods rather than holding money when the expected rates of inflation rises" (Dornbusch and Fischer, 1978, P235). Thus; we are going to estimate the money demand function equation (1) above, with either the average market interest rate or the expected rate of inflation as a measure of the opportunity cost of holding money.

That is:

\[ Md = P.f (Y, i) \]  
\[ Md = P.f (Y, INF) \]

\[ \text{(1)} \]

\[ \text{(11)} \]
<table>
<thead>
<tr>
<th>Year</th>
<th>Bank Contribution</th>
<th>Bonds</th>
<th>Stocks</th>
<th>Real Estate</th>
<th>Deposit</th>
<th>Bank Loans</th>
<th>Bank Grants</th>
<th>Current Balance Sheet</th>
<th>Leading Index Measures %</th>
<th>Leading Index Revenue %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.6%</td>
<td>0.2%</td>
<td>0.4%</td>
<td>0.5%</td>
<td>0.3%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.9%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Structure of some leading and lagging ratios 1980 - 1986

Table (4)
Where: INF is the expected rate of inflation, and as an approximation we are going to assume that expected inflation equal the difference between domestic price changes and world inflation\(^{(15)}\).

(1) Estimation

Both equation (1) and (11) were estimated for Jordan, luckily enough both functions performed quite well, when estimated using annual data for 1968-1986 and quarterly data\(^{(16)}\), for the period 1968: I to 1986: IV, all variables used in the estimation are defined in the appendix at the end of the paper. Here are the results:

** Annual Data:

\[
\hat{M} = 0.025 + 0.789 \hat{Y} - 0.814 \hat{i} \\
(0.708) (3.741) (3.377)
\]

\[R^2 = 0.70\]  
\[DW = 2.09\]  
\[F(2,15) = 17.19\]

\[
\hat{M} = -0.018 + 1.030 \hat{Y} - 0.042 INF \\
(0.365) (3.536) (0.087)
\]

\[R^2 = 0.52\]  
\[DW = 2.64\]  
\[F(2,14) = 7.51\]

** Quarterly data:

\[
\hat{M} = -0.004 + 0.653 \hat{Y} - 0.118 \hat{i} \\
(0.068) (4.793) (0.667)
\]

\[R^2 = 0.25\]  
\[DW = 1.99\]  
\[F(2,70) = 11.6\]

\[
\hat{M} = -0.029 + 0.682 \hat{Y} - 0.285 INF \\
(0.491) (4.967) (1.281)
\]

\[R^2 = 0.26\]  
\[DW = 1.99\]  
\[F(2,70) = 12.41\]

Where the numbers in parantheses are t-statistics. The estimates of both income and interest rate or inflation elasticities of demand for money conform to expectations. The money demand income elasticity ranges from 0.789 to 1.030 using annual data and about 0.65 using quarterly data, while interest rate (or inflation) elasticities vary clearly between annual and quarterly data. The t-statistics reveal that income and interest rate estimates are significant at 5% level of significance while inflation is not significant using both annual and quarterly data. The low \(R^2\) (the coefficient of determination)\(^{(17)}\) using quarterly data, eventhough ac-
ceptable, reveals the fact that changes or much of the variation in money demand in Jordan is not systematically related to changes in real income or to interest rate or to inflation, other left-out variables do account for it. The interest rate format is relatively more acceptable on empirical and on theoretical grounds, and for comparison purposes both $M^d$ versions are going to be considered and both quarterly and annually data are going to be used.

We turn now to the estimation of the reserve flow equation number (8) above: (a) sample: annually 1968-1986

- money demand function (1):
  \[
  R = 0.01 + 0.31\hat{P} + 0.76\hat{Y} - 0.66\hat{i} - 0.57
  \]
  \[
  H = 1.367 \quad 5.314 \quad 2.862 \quad 2.809
  \]
  \[
  R^2 = 0.83 \quad F(4,13) = 13.68 \quad DW = 2.07
  \]

- money demand function (11):
  \[
  R = -0.05 + 0.14\hat{P} + 0.69\hat{Y} - 0.39\hat{I}N - 0.49
  \]
  \[
  H = 0.396 \quad 2.507 \quad 0.870 \quad 1.418
  \]
  \[
  R^2 = 0.53 \quad F(3,14) = 3.65 \quad DW = 2.06
  \]


- money demand function (1)
  \[
  R = 0.01 + 0.47\hat{P} + 0.40\hat{Y} - 0.14\hat{i} - 0.94
  \]
  \[
  H = 2.149 \quad 2.432 \quad 0.775 \quad 7.482
  \]
  \[
  R^2 = 0.53 \quad F(4,68) = 19.53 \quad DW = 1.98
  \]

- money demand function (11)
  \[
  R = 0.01 + 0.49\hat{P} + 0.43\hat{Y} - 0.24\hat{I}N - 0.96
  \]
  \[
  H = 2.247 \quad 2.573 \quad 1.120 \quad 7.982
  \]
  \[
  R^2 = 0.54 \quad F(4,68) = 19.88 \quad DW = 1.97
  \]
These results show that all variable do sustain their expected signs with either money demand formation and with either data set. Estimates obtained by using annually data with interest rate as a measure of the opportunity cost of holding money show reliability, statistically more significant, and reveal more explanatory power as it is clear from \( R^2 \). The numbers in parantheses are the \( t \)-statistics for the corresponding estimate, most estimates are significant at 5\% level of significance. Also the significance of the whole estimated equations can be judged by looking at the values of F-test, again all equations are statistically significant. Testing the hypothesis of no serial correlation among the residuals the reported values of the Durbin-Watson (DW) reveal the rejection of such hypothesis at 5-10\% level for all equations.

2. Analysis of the estimates:

From the above pairs of regressions reported for annually and quarterly data and for the two formulation of \( M^d \) equation, the most interesting results to notice are:

a) The income and interest rate elasticities in equations a(1) and a(2); the income elasticity is of reasonable magnitude 0.76 and 0.69 and the interest rate elasticity is about 0.66 somewhat higher than expected magnitude but significant and of the right sign.

b) The price level coefficients did maintain its expected sign and magnitude and is significant in equations a(1), a(2).

c) Estimates of the coefficients of \( D \), growth rate of domestic credit is not in line with its expected magnitude but of the correct sign. We did expect on theoretical grounds that this coefficient be of (-1) if Central bank try not to sterilize the reserve flow, our equation reveal an estimate of -0.57 in a(1) and only -0.49 in a (2) far below (-1), while using quarterly data, the \( D \) coefficient approaches the value of (-1), about (-0.95), which conforms with our priori expectations. But on the annual level we may suspect that Central bank do infact practice sterilization. To test for such action, we did estimate the following equation (Melvin, 1985, P98).

\[
\hat{D} = a \cdot B \hat{R}
\]  \hspace{1cm} \text{(12)}

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Where; B is the sterilization coefficient, ranging in value from 0 when there is no sterilization to 1 when there is complete sterilization. An estimate of equation (12), using annual data for the same period:

\[
\hat{D} = 0.227 - 0.65 \hat{R} \quad \text{..... (12)}
\]

\[
(2.35) \quad (1.12)
\]

This result means that there is partial sterilization, that is, the Central bank is being able to sterilize a significant fraction of reserve flows\(^{(18)}\). Under the monetary approach, if a country had an excess supply of money this country will tend to lose international reserves and run a deficit until money supply equals money demand, but if the Central bank desires, for some reason, this high level of money supply and react to the deficit by further increasing money supply, the deficit will persist as long as the Central bank tries to maintain a disequilibrium in money market, (excess \(M^\delta\)), to keep a target level \(M^\delta\).

These results taken together suggest that the Jordanian reserve flow experienced over the period 1968-1986 has been broadly in conformity with the monetary approach to the balance of payments, and if Central bank is able to sterilize reserve flow, it will be only in the short-run. This will mean that the Central bank is choosing a growth rate of money supply in short-run, and in the long-run growth must be in line with the monetary approach. But in short run, sterilization is possible were reserve flow are offset by changes in domestic credit creation.

It should be mentioned here that the theory and the estimation were based on the assumption of exogenously given price level, the country is open and small, and the rate of inflation is exogenously determined, since Jordan is small to have any noticeable impact on world prices.

To check whether this implication is supported by data, we follow the assumption of purchasing power parity (Carbough, 1985, P289).

\[
P_{\text{domestic}} \quad \frac{\text{..... (13)}}{P_{\text{foreign}} = \text{ER}}
\]
Then we can postulate that inflation in Jordan \( \hat{P}_{\text{Jordan}} \) may be written as a constant fraction times the world\(^{(19)} \) rate of inflation plus a stochastic disturbance term:

\[
\hat{P}_{\text{Jordan}} = \hat{c} \hat{P}_{\text{World}} + U_t \quad \text{--------- (14)}
\]

for a price taking hypothesis to be true, we should get: \( \hat{c} = 1 \), equation 14 was estimated using both annual and quarterly data, the results are reported in Table 5: Rows (1) and (2) give an estimate significantly different from unity at 5% level of significance, this is likely due to the bias in estimate due to measurement error or left-out variables. In this case a bound for \( \hat{c} \) can be found (Genebergy, 1978, PP298-326), by reversing the role of dependent and independent variables (Rows (3), and (4) in table 5). This method yielded a point estimate for \( \hat{c} \) of either (0.33 and 0.75) or (0.64 and 0.92), although still low (less than one), a 99% confidence interval will include unity. Thus this result do support the view that Jordan is a price taker in an integrated world.

**Table (5): Relationship between the rates of inflation in Jordan and the in rest of the world**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Coefficient (T-Value)</th>
<th>( \hat{c} )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual 1968-1986</td>
<td>(1) ( P_{\text{Jordan}} )</td>
<td>( P_{\text{World}} )</td>
<td>0.33 (3.539)</td>
<td>0.33</td>
<td>0.56</td>
</tr>
<tr>
<td>Quarterly 1968I-86IV</td>
<td>(2) ( P_{\text{Jordan}} )</td>
<td>( P_{\text{World}} )</td>
<td>0.64 (13.324)</td>
<td>0.64</td>
<td>0.59</td>
</tr>
<tr>
<td>Annual</td>
<td>(3) ( P_{\text{World}} )</td>
<td>( P_{\text{Jordan}} )</td>
<td>1.33 (3.539)</td>
<td>0.75</td>
<td>0.57</td>
</tr>
<tr>
<td>Quarterly</td>
<td>(4) ( P_{\text{World}} )</td>
<td>( P_{\text{Jordan}} )</td>
<td>1.09 (13.324)</td>
<td>0.92</td>
<td>0.59</td>
</tr>
</tbody>
</table>

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VI. Policy Implications

Finally some policy implications can be stated:

1. The results obtained using annual data are more consistent and in strong support to the notion that the monetary approach to balance of payments do explain the reserve flow for the last two decades, and the theory implies that through monetary policy of credit creation, the Central bank can minimize the impact of reserve flows on the economy. An expansion (contraction) of domestic credit by 1%, will lead to reserve outflow (inflow) equals to 0.57 of a percent.

2. Economic growth ($\hat{Y} > O$) and rises prices will lead to surpluses ($\hat{R} > O = \text{Inflow}$), a notable conclusion supported by the results. A 1% increase in real output will lead to reserve inflow or surplus in balance of payments equal to 0.77 of a percent. Whereas a 1% raise in domestic price level will lead to reserve inflow of 0.32% such a result emphasize that a raise in price level will lead to reduction in real value of money balance, and cause people to hoard in order to restor their money holding to its desired level and thus excess demand for money and $B > O$.

3. Growth in either the expected inflation rate or domestic interest rate will be associated with reserve outflow. As expected inflation rate raises, the opportunity cost of holding money increases and people look for substitute, their purchase of goods and services increases and the resulting reserve outflow, similar reasoning for the rates of interest.

4. To cure a deficit, contraction of domestic credit will be more feasible to work if compared with devaluation of the dinar which is suggested by other approaches, mainly the absorption approaches (Alexander, 1986, P369). That is any balance of payment disequilibrium, i.e., deficit (outflow) or surplus (inflow) can be, according to monetary approach, handled with domestic monetary policy rather than with exchange rate adjustment. Devaluation of the Dinar is considered substitute to reducing the growth of domestic credit. But; devaluation lowers the value of the dinar to the rest of the world, while domestic credit control keeps stable exchange rate. Also, devaluation will have a negative affects beside those, it will discourage trans-
fer remittances, by loosing confidence in the real value of the dinar, and increase the price of imports. Jordan is an import based economy, so devaluation will have adverse effects.

5. If no sterilization (here we mean complete sterilization), domestic balance of payments will be improved by an increase in rate of growth in income through increase in money demand.

Finally to summarize: the monetary approach as discussed do attribute a significant rate of the international process to monetary variables. The model estimated for Jordan does predict that reserve accumulation is positively related to growth rate of domestic real income, and negatively correlated with the rate of domestic credit expansion. The approach implies that the Central bank of Jordan can exercise some control over international reserve flows through manipulating the component of the monetary base, through its credit expansion policies.
Footnotes


2. International Reserves (R) flows are considered in this paper to reflect the state of the balance of payments, R. Shone: The monetary approach; 1980, P201-208.

3. Can be measured simply by looking at the volume of imports relative to the level of GNP; if this ratio is equal to 20% or above for small country, it is considered open; for example, the degree of openness of Jordan 1985 is about 58.1 = 1074.45/1846.2.


5. The choice of the opportunity cost of holding money will be made later at the estimation stage in section V below.


7. Equation (8) can be obtained as:
   1. \( P \cdot f(y,i) = a \cdot (R+D) \)
   taking differentials of both sides:
   \( P \cdot d f(y,i) + dp f(y,i) = da (R+D) + a \cdot d (R+D) \)
   a is constant \( da = 0 \); and:

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2. \[ P \left[ \frac{\partial f}{\partial y} \frac{\partial f}{\partial i} + dp. f(y,i) = a(dR + dD) \right] \]
dividing both sides of 1 by 2

\[
\begin{align*}
\frac{\partial f}{\partial y} & \quad \frac{\partial f}{\partial i} & \quad df \quad dy \quad di \quad dp \quad dR \quad dD \\
\delta y & \quad \delta i & \quad \delta t & \quad P & \quad H & \quad H \\
\end{align*}
\]

\[ \frac{dx}{X} \]

define: \( X = \frac{X}{dx} \) as the growth rate of \( X \), and

\[ \frac{dy}{X} = \frac{E_{yx}}{Y} \]

as the elasticity of \( Y \) with respect to \( X \).

Then with simple manipulation

\[
\begin{align*}
\frac{dp}{P} + \frac{\partial f}{\partial y} & \quad \frac{df}{dy} \quad \frac{di}{y} \quad \frac{df}{di} \quad \frac{dR}{R} \quad \frac{dR}{H} \quad \frac{dD}{D} \quad \frac{dD}{H} \\
\end{align*}
\]

or:

\[
\begin{align*}
\frac{R}{H} & \quad \frac{R}{P} + \frac{E_{fy}}{Y} \quad \frac{E_{fi}}{i} \quad \frac{D}{H} \\
\end{align*}
\]

\[ \hat{R} = \frac{R}{H} \quad \hat{Y} + \hat{D} \quad \hat{D} \quad \cdots \quad (8) \]

8. Usually \( E_{my} \) stems from both transaction and precautionary motives of Keynes. Also it can be said that an increase in real income lead to an increase in goods available for export and hence inflow of reserves and also increased real income will cause an increase in demand for money.

9. A test of sterilization will be performed to check on Central bank action: \( D = Bo \cdot B_1 R \), if \( B_1 > 1 \) complete sterilization see equation (11).

10. Such a measure is considered in other studies: See H.Talafha; Jordanian Trade Balance; 1987, P 4-5.

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1976 - 1980 The first five-year plan.  
1981 - 1985 The second five-year plan.  

12. All attempts were focused on reducing aggregate demand from abroad, which is the traditional elasticity approach in order to make the demand for foreign goods more elastic.


14. They could include; discount rate, open market operation and reserve requirement policy, among other instruments.

15. \( \text{INF} = P - P^{\text{US}} \), where \( P^{\text{US}} \) is the U.S. inflation rate, INF is the inflation due to domestic imbalances net of foreign inflation.

16. Quartely data for all variables of our model are available expect for GNP. We have used the method developed by Adolfo Diaz in his article: Money and Prices in Argentina 1935-1962, "Journal of Money and Credit & Banking, Vol. 3 May 1971 P245-262, to generate quarterly data for GNP for the period 1968-1986, see the appendix at the end of the paper for the formulas and data used.

17. The coefficient of Determination measures the percentage of the variation in the dependent variable that can be explained by the set of independent variables, see A. Koutisjannis; Theory of Econometrics, MacMillan Education LTD. 1987, P151.

18. Similar results using a simultaneous model were obtained by Ummaya Tukan in his unpublished Ph.d thesis: The offset to monetary policy in an environment of capital and exchange controls; University of Columbia; 1987, P100.

19. The U.S.inflation rate was used as a proxy for world inflation due to the intensity of the $ usage as a medium of exchange in the world trade.
APPENDIX

Data used in the estimation

Definitions:

\[ R = \] Central Bank holding of International reserves.
\[ D = \] Domestic credit; calculated from the central bank balance sheet as the difference between other assets and other liabilities.
\[ M = \] The narrow definition of the money supply.
\[ i = \] The average yield on deposits (average deposit rates).
\[ H = \] High powered money, (the monetary base).
\[ P = \] Price index for the cost of living, with 1980 = 100.
\[ Y = \] Gross national product in current prices.
\[ ER = \] The mid-period exchange rate, fils/dollar.

Quarterly data are available for all variables except for \( Y \) (GNP), therefore we utilized a technique based on simple weighted extrapolation formulas used by Adolf Diz in his study: Money and prices in Argentina; Journal of money credit and banking vol. 3 may 1971, PP245-262. Those formulas are:

Let \( Y_t \) denote GNP in year \( t \) and \( Q_i \) denote the value for the quarter \( i \) of year \( t \), then the quarterly figures were obtained as follows:

\[
\begin{align*}
X_1 &= \frac{(4Y_t)}{Q_i} \cdot [Y_{t-1} + 0.625 (Y_t - Y_{t-1})] \\
X_2 &= \frac{(4Y_t)}{Q_i} \cdot [Y_{t-1} + 0.875 (Y_t - Y_{t-1})] \\
X_3 &= \frac{(4Y_t)}{Q_i} \cdot [Y_t + 0.125 (Y_{t+1} - Y_t)] \\
X_4 &= \frac{(4Y_t)}{Q_i} \cdot [(Y_t + 0.375 (Y_{t+1} - Y_t)]
\end{align*}
\]
### FIRST: Annual data 1968-1986

<table>
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<th>Year</th>
<th>ER TJD</th>
<th>D TJD</th>
<th>H TJD</th>
<th>M TJD</th>
<th>I %</th>
<th>P TJD</th>
<th>Y MJD</th>
<th>fils</th>
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<td>87.98</td>
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<td>113.11</td>
<td>530.54</td>
<td>594.77</td>
<td>4.80</td>
<td>100.00</td>
<td>1185.3</td>
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<td>433.57</td>
<td>143.27</td>
<td>576.84</td>
<td>701.66</td>
<td>4.69</td>
<td>113.29</td>
<td>1501.0</td>
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<td>624.03</td>
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<td>120.70</td>
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<td>1983</td>
<td>380.26</td>
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<td>705.77</td>
<td>869.42</td>
<td>5.31</td>
<td>122.65</td>
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<td>563.13</td>
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<td>129.60</td>
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<td>6.07</td>
<td>132.00</td>
<td>1917.4</td>
<td>344.8</td>
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</table>


* TJD Thousand of JD. * MJD millions of JD
### SECOND: Quarterly data 1968: I to 1986: IV

<table>
<thead>
<tr>
<th>Year</th>
<th>R</th>
<th>D</th>
<th>H</th>
<th>M</th>
<th>I</th>
<th>P</th>
<th>Y</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>TJD</td>
<td>TJD</td>
<td>TJD</td>
<td>%</td>
<td>MJD</td>
<td>MJD</td>
<td>Fils</td>
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<td>1968-1</td>
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Source: Central Bank of Jordan monthly statistical Bulletin and Annual reports different issues and IMF; international financial statistics; different issues.
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