DEBTS AND A SOLVENCY MODEL FOR MALAYSIA

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ABSTRACT

The Asian currency crisis, which was triggered by the floatation of the Thai baht in early July 1997, has once again brought up the debate on the causes of a currency crisis. Many have argued that the core of the crisis was the result of deteriorating market fundamentals. Others have argued that the cause is a self-fulfilling crisis or investor’s herd behaviour. In this paper, the solvency index for Malaysia is calculated based on the price elasticity of demand and GDP supply. The cointegration analysis is employed in which the dynamic OLS is used to estimate the price elasticity. The solvency index for Malaysia was 0.74% and the amount that was actually paid was greater than a fraction needed to be considered “solvent” (9.0%). From the empirical findings, it is suggested that the crisis was a matter of short-term liquidity difficulties and panic rather than insolvency.

ABSTRAK

Krisis mata wang Asia telah sekali lagi membawa kepada perdebatan mengenai penyebab berlakunya krisis mata wang. Ramai yang berpendapat punca utama krisis adalah disebabkan oleh asas pasaran yang merosot. Pendapat lain mengatakan ianya adalah krisis yang berbentuk “self-fulfilling” atau tindakan secara berkelompok oleh pelabur. Indek mampu bayar bagi Malaysia dikira berdasarkan kepada keanjalan permintaan harga dan penawaran Keluaran Dalam Negara Kasar (KDNK). Analisis kointegrasi digunakan di mana OLS dinamik digunakan untuk menganggarkan keanjalan harga. Indek mampu bayar bagi Malaysia ialah 0.74% dan jumlah sebenar yang dibayar adalah lebih besar dari pada pecahan yang perlu dibayar untuk dikategorikan sebagai “mampu bayar” (9.0%). Daripada keputusan empirikal ini, ia mencadangkan yang krisis tersebut cuma merupakan masalah kecairan jangka masa pendek dan panik dan bukan masalah tidak mampu bayar.
external debt level must be compared with the present value of future revenue.

The solvency index actually calculates the minimum level of external debt repayment when $r_i > n_i$. The index weights the external debt/exports ratio by an average measure of the difference between expected real growth and real interest rates in the future. Here the hierarchy of these two rates in time is taken into consideration. Thus the index is superior to the traditional static measures of solvency, i.e., external debt/GDP ratio or external debt/exports ratio, etc. In this case, although a country has a small foreign debt, it may be less solvent if the growth rate is slower compared to a country with a larger foreign debt but grows faster. Empirically, Cohen (1985), showed that the debtor countries (in 1983), with a few exceptions, needed to repay 15% of their exports to be deemed solvent. The solvency indices for a few countries were calculated, namely, Turkey (7.7%), Argentina (16.4%), Mexico (12.11%) and Brazil (15%). By comparing these percentages to the actual transfers, all these countries successfully passed the solvency test.

The invariant measure of wealth (IMW), which is the linear combination (weighted average) of the country’s GDP and export, is used; if the creditors prefer basing their lending on the GDP measure, this will encourage the debtor country to change its relative price structure in such a way as to artificially increase the value of its GDP (i.e., by overvaluing its currency). Conversely, if creditors base their estimations on export measures, the country will devalue its currency ineffectively.

As the concern is on the solvency of an indebted nation, the domestic budgetary problem is eliminated, and the government’s wealth is the same as the nation’s wealth. This is expressed as Equation (1) below:

$$W_i = \frac{\sum_{s=0}^{\infty} T_s}{\sum_{s=0}^{\infty}(1 + r_i)}$$

Based on Equation (1), we have two possibilities which are:

(i) The rate of interest ($r$) is above the rate of growth ($n$) of the economy ($r_i > n_i$). Under this circumstance, the country’s wealth is said to be finite and a fixed fraction of its resources should be transferred to creditors to be considered as solvent.

(ii) The rate of interest ($r$) is below or equal the rate of growth ($n$) of the economy ($r_i < n_i$). In this case the country’s wealth is infinite, and therefore, there is no solvency problem.
\[ D_t = (1 + r_t) D_{t-1} - TB_t = (1 + r_t) D_{t-1} + (IM_t - EX_t) \]  

where
- \( Y \) = gross domestic product
- \( D \) = net external debt (gross debt-gross assets)
- \( n \) = growth rate
- \( r \) = the world real interest rate
- \( TB \) = trade balance
- \( EX \) = exports
- \( IM \) = imports

Basically at any time \( t \), the nation produces \( Y \) and its aggregate spending is given as:

\[ A_t = C_t + I_t + G_t \]

Therefore,

\[ Y_t = A_t + (EX_t - IM_t) \]  

(4)

The left-hand side of Equation (4) represents the nation's aggregate income at the end of period \( t \), and the right-hand side of the equation denotes total expenditure.

The trade balance of the nation can be expressed as:

\[ TB_t = (EX_t - IM_t) = Y_t - A_t \]  

(5)

where \( TB_t - rD_{t-1} \) is the current account of the nation.

Based on this framework, solving forward in time the intertemporal budget constraint that a nation must obey can be expressed as:

\[ D_0 = \sum_{t=0}^{\infty} \frac{TB_t}{\Pi(1 + r_s)} \]

or

\[ D_0 = \sum_{t=0}^{\infty} \frac{Y_A}{\Pi(1 + r_s)} \]  

(6)
exports alone will create distortions, therefore, the linear combination of GDP and exports is used, whereby:

\[ IMW = \alpha \text{EX} + (1-\alpha) \text{GDP} \]

Where  
\[ \text{EX} = \text{exports} \]
\[ \text{GDP} = \text{real output} \]
\[ \alpha = \text{the weight of exports} \]
\[ (1-\alpha) = \text{the weight of the home output} \]

By using IMW, a small change in the real exchange rate would not affect the IMW.

\[ \frac{dIMW}{de} = \frac{\alpha dEX}{de} + (1-\alpha) \frac{dGDP}{de} = 0 \]

where \( e = \) real exchange rate which is defined as \( e = \frac{PW}{PX} \) where PW is the world price facing the country, and PX is the domestic prices (express in US dollar), \( d \) is the total derivative operator. The above expression then can be written as:

\[ \alpha = \frac{ \frac{dGDP}{de} }{ \frac{dGDP}{de} - \frac{dEX}{de} } \]

\[ \alpha = \frac{ (e/GDP)(dGDP/de) }{ (e/GDP)(dGDP/de) - (e/GDP)(dEX/de) } \]

\[ \alpha = \frac{ \eta \text{GDP} }{ \eta \text{GDP} - [(EX/GDP)(\eta \text{EX})] } \]  

(8)

Where \( \eta \text{EX} = \) the elasticities of Export  
\( \eta \text{GDP} = \) the elasticities of GDP with respect to real exchange rates  
\( \frac{EX}{GDP} = \) the export share in home output

As the estimation of export demand and output supply equations use real exchange rate as \( e = \frac{PX}{PW} \), the expected signs of the long run elasticities in equation (8) have opposite signs. Thus the appropriate weights for export and output can be written as:
Where,

\( Q_x = \) Exports of goods  \\
\( P_x = \) Price of exports  \\
\( P_w = \) Price of world exports  \\
\( Y_w = \) a scale variable  \\
\( Gci = \) Export composition index  \\
\( u, v = \) error terms  \\
\( GDP = \) the real GDP of the country  \\
\( K = \) capital stock – Following Muscatelli, it is constructed by using the gross fixed capital formation, where the capital output ratio is multiplied by GDP. The capital-output ratio is derived on the basis of a three-year moving average of incremental GDP and gross fixed capital formation for 1966. (Data is gathered from the International Financial Statistics, various issues).

Equation (10) is the export demand, which depends upon the relative price of exports to the world price \((P_x/P_w)\), the world income and the exports composition index.

Coefficients \(a_0, a_1, a_2\) are expected to be negative, positive and positive respectively. Equation (11) is the GDP supply, which depends upon the relative price of exports to the world price \((P_x/P_w)\), and the stock of capital \((K)\). Coefficients \(b_1\) and \(b_2\) are expected to be positive.

In estimating the price elasticities of export demand and GDP supply, the dynamic OLS method is used as the static long run OLS is subject to bias in a small sample, and since the lagged terms are ignored. The inclusion of lagged and leading values of the first differences of the I(1) variables can solve the potential of simultaneity bias and small sample bias among regressors. Based on this model, the long run export demand and import demand equations are as follows:

**Long-run exports demand**

\[
Z = (a_0, a_1, a_2, a_3), X = [1, (px/pw), (Yw), (Gci)] \\
Q_x^d = z'x + \sum_{j=1}^{j} \alpha \Delta(px/pw) + \sum_{j=1}^{j} \beta \Delta Y_w + \sum_{j=1}^{j} \lambda j \Delta Gci + \mu x
\]

**Long-run GDP supply**

\[
Z = (b_0, b_1, b_2), X = [1, (px/pw), K)]
\]
The relationship between export demand and all the variables are as expected. All variables have correct signs, and these have proved to be of a sensible magnitude, and all are significantly different from zero at the 5 percent level. Similarly this is also true for the GDP supply.

The IMW can be estimated based on the estimated elasticities of export demand and GDP supply. From Equation (9),

$$\alpha = \frac{-\eta \text{ GDP}}{-\eta \text{ GDP} + [(\text{EX/GDP})(\eta \text{ EX})]}$$

By replacing the relevant long run elasticities into the above equation, the weight of export and GDP is obtained as follows:

$$\text{IMW} = 0.66(\text{Ex}) + 0.34(\text{GDP})$$

(12)

**SOLVENCY INDEX FOR MALAYSIA**

The solvency index can be calculated using the formula below.

$$D_t = \sum_{s=1}^{\infty} \frac{\pi \text{IMW}_{t+s}}{(1+r)^s}$$

As mentioned earlier, $p$ is the fraction that is needed to service the debt. Assuming that the growth rate (of the IMW) and the interest rate are constant (i.e. $r_t = r$ and $n_t = n$), the following is obtained:

$$D_t = \sum_{s=1}^{\infty} \frac{\pi [(1+n)^s \text{IMW}_t]}{(1+r)^s}$$

$$D_t = \pi \text{IMW}_t \frac{[(1+n)/(1+r)]}{1 - [(1+n)/(1+r)]}$$

$$D_t = \frac{\pi \text{IMW}_{t+1}}{(r-n)}$$
Based on total debt and IMW under two different scenarios, results obtained are as shown in Table 4.

**Table 4**  
Solvency Index and Actual % Paid

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>TDS/IMW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt/IMW*5.5%</td>
<td>Debt/IMW*1.0%</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>0.76%</td>
<td>0.14%</td>
</tr>
<tr>
<td>1991</td>
<td>0.71%</td>
<td>0.13%</td>
</tr>
<tr>
<td>1992</td>
<td>0.28%</td>
<td>0.05%</td>
</tr>
<tr>
<td>1993</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1994</td>
<td>0.33%</td>
<td>0.06%</td>
</tr>
<tr>
<td>1995</td>
<td>0.64%</td>
<td>0.12%</td>
</tr>
<tr>
<td>1996</td>
<td>0.74%</td>
<td>0.14%</td>
</tr>
</tbody>
</table>

Notes: TDS is total debt service. IMW is the invariant measure of wealth obtained from Equation 12.

As can be seen in Table 4, percentage in first and second columns are the fixed fraction of Malaysia's IMW that have to be allocated to the foreign debt service to be declared solvent under pessimistic and optimistic scenarios. As the actual total debt service Malaysia had paid in the 1996-1997 period was greater than the index, Malaysia was considered as solvent (see the third column in Table 4). Further details on the calculation of the solvency index and percentages that were actually paid by Malaysia can be seen in appendix A.

**CONCLUSION**

In evaluating the credit worthiness of a country, the invariant measure of wealth (IMW) is used instead of using exports or GDP alone. By using the IMW, which it is the weighted average of the country's exports and GDP, the 'moral hazard' problem is avoided. From empirical results obtained, the solvency condition for Malaysia is satisfied. Malaysia is said to be satisfying its intertemporal external solvency condition as long as it allocates a fixed fraction (p) of its IMW to service the external debt, where p is the fraction required to satisfy the national budget constraint. It is clear that Malaysia passed the solvency test in the late 1997.
REFERENCES


