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The Determinants of Trade Balance and Adjustment to the Crisis in Indonesia

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Indonesia Program

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CIES DISCUSSION PAPER 0508

The Determinants of Trade Balance and Adjustment to the Crisis in Indonesia

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Abstract:

This paper investigates the effects of real exchange rate depreciation and supply side shocks on exports and imports. Indonesia provides an interesting case study of the subject because this country experienced a large depreciation, banking sector collapse, and socio-political turbulence during the Asian crisis episode. The results suggest that trade balance will improve following devaluation through an increase in exports and a collapse in imports. Because the elasticity of imports with respect to the real exchange rate is greater than that of exports, improvement in trade balance would be mainly come from import compression. It is also found that export performance could have been far better if Indonesia did not suffer from banking problems and socio-political turbulence.

JEL Classifications: F10 and F31.

Key Words: Real Exchange Rate, Export, Import, Indonesia.

I. INTRODUCTION

The effectiveness of exchange rate depreciation in improving the trade balance has long been an issue of considerable interest to economists and policy makers. The traditional Keynesian expenditure switching hypothesis suggests that a real depreciation makes home produced traded goods more competitive, thereby reducing imports and stimulating exports. Based on this switching effect, Corden [1997; 267] suggests devaluation as a form of 'indirect protection' accompanying a trade liberalisation in order to provide a temporary relief for less competitive or previously protected sectors. Moreover, as widely known, devaluation is often prescribed by the IMF for countries facing a balance of payment crisis.

However, despite the popular belief that depreciation can improve trade balance, empirical works tend to suggest mixed results. Amongst 30 countries studied, Rose [1990; 271-3] finds that the impact of devaluation on trade balance is insignificant for 28 countries, and one country shows negative impact. He concludes that devaluation does not necessarily lead to an increase in trade balance. More recent work by Upadhyaya and Dhakal [1997; 343-5] also suggests that improvement in trade balance is only found in one country out of eight countries studied. On the other hand, others like Bahmani-Oskooe [1998; 89-96] and Himarios [1989; 143-68] find trade balance improvement following currency devaluation.

The issue of whether or not the trade balance will improve after devaluation become more important as the twin crises (currency and banking crises) become frequently recurring in the 1990's. In the context of the twin crises, there are two issues worth highlighting. First, as seen in the Asian crisis episode, all countries experienced

massive capital inflow reversals. The negative swing in the capital account needed to be counter balanced by improvement in the current account. If the trade balance is not so responsive to a depreciation, then the exchange rate need to overshoot to have a large enough compression on aggregate expenditure. Second, in the midst of the crisis the banking sector was paralysed. While the export oriented firms became more competitive, they were incapable of expanding their operation because of credit constraint, because several banks and finance houses went bankrupt and some other banks faced increased non-performing loans. In Indonesia for example, by June 1999, 71 banks had been closed and the non-performing loans soared to 57 per cent. As loanable funds succumbed in bad loans, the expansion in export might have been held back by the contraction of bank loans.

The objectives of the paper are two folds. First, the effect of a real depreciation on export and import will be assessed. This is important because the responsiveness of import and export will determine whether or not a depreciation can improve trade balance. The second objective is to assess the impacts of supply side shocks on the export performance. These shocks include banking sector collapse and socio-political turmoil.

Indonesia provides an interesting case study of the subject for the following reasons. By any measure this country is the hardest hit during the Asian crisis. The rupiah depreciated far larger than other currencies, and yet Indonesia's export performed poorer than other country in the region. Thailand, the second worst affected country, had surpassed its pre-crisis export level in 1999. On the other hand, Indonesia's export achieved the pre-crisis level in 2000.[1] Moreover, banking collapse and socio-political

turmoil in Indonesia are by far the most severe, and are important to be considered as sources of disturbance on export. The public cost of bank restructuring in Indonesia is estimated to be about 51 per cent of pre-crisis GDP, compared with 5, 13, and 25 per cent in Malaysia, South Korea, and Thailand, respectively [Lindgren *et al.*, 2000; 40].

Considering these facts, it is postulated that the relatively poorer export performance was due to the collapse of the banking sector and other supply side shocks. The findings of this study suggest that import and export are responsive to a change in the real exchange rate and thus a depreciation tend to improve the trade balance. It is also found that a higher export growth could have been attained if Indonesia did not suffer from banking problems and socio-political turbulence.

The rest of the paper is organized as follows. Section 2 describes the model used in this study and summarises the theory behind it. Section 3 discusses data and econometric procedure. Section 4 discusses the findings obtained from estimation and simulation of the model. Section 5 highlights the conclusion.

2. THEORETICAL MODEL

The empirical analysis of this study is based on the conventional elasticity approach to balance of payment adjustment. It is assumed that the economy consists of two goods; home and foreign goods. Part of home goods is exported and part of foreign goods is also demanded by domestic consumers. Thus, two long-run relationships characterizing export and import functions need to be specified.

Real export (X) is determined by real exchange rate (q), real world income (Y^*) and export production capacity (C). Y^* is treated as a demand shifter while C is a supply shifter. Here the real exchange rate is defined as $q = eP^*/P$, where e is the nominal exchange rate, while P^* and P is international and domestic prices. More succinctly, the export function is specified as:

(1) $X = x(q, Y^*, C)$

This formulation of export function allows us to test explicitly whether export is demand or supply determined. In the traditional Marshallian approach, export demand function is specified or $X = x(q, Y^*)$ [e.g. Rose 1990; 271-3]. However, the small country assumption implies that the world market would absorb as much export as Indonesia can offer, and thus export should be supply driven, $X = x(q, C)$.[2] In other words, the coefficient attached to Y^* should be insignificant.

Real import (M) is defined to be a function of real exchange rate and real domestic income (Y). By the small country assumption, world supply of imports should be perfectly elastic. In other words, import is demand determined. More succinctly, import demand functions can be expressed as:

(2) $M = m(q, Y)$

The real trade balance is usually stated in terms of domestic price and hence it takes the form as:

(3) $T = X - qM$

$T = t(q, Y^*, Y, C)$

Rose [1990], amongst others, estimates directly the above reduced form equation of trade balance. This estimation procedure has two advantages. First, it is a relatively straightforward procedure and the results are equivalent to those obtained from estimating equations (1) and (2). Second, based on the estimated coefficients, it is easy to assess the impact of trade depreciation on the trade balance directly. If the coefficient attached to the exchange rate is positive and significant, depreciation improves the real trade balance.

A major limitation of the approach is that it fails to shed light on the possible differential impact of real depreciation on export and import. If export response is insignificant, the adjustment will be mainly through import compression. Higher prices of imported intermediate input and capital goods may depress investment and output [Bruno, 1979; 270-89 and van Wijnbergen, 1986; 17-38]. Thus, the impact will be recessionary, if export does not offset the negative impacts of devaluation. In other case, where export expands while import remains unaffected, the impact will unambiguously expansionary. The bottom line is that, it is not only improvement in trade balance that is important to be tested, but more importantly is the way the improvement is achieved.

Moreover, by estimating equations (1) and (2) using the error correction modelling (ECM) procedure under which the long-run cointegrating relationships are specifically identified, we will be able to analyse the dynamics of adjustment process of export and imports. Thus both final and transitory impacts on each components of the trade balance can be traced within one framework. Because of that, we prefer to estimate (1) and (2) rather than the reduced form equation.

3. DATA AND ECONOMETRIC PROCEDURES

The model suggests 6 variables to be included in the system: *X*, *M*, *Y*, *Y**, *C*, and *q*. The data series used in the empirical analysis are gathered from Indonesian Financial Statistics of Bank Indonesia (IFS-BI) and Central Agency of Statistic (Badan Pusat Statistik, BPS). The data are quarterly and the observations involved are from 1984:Q1 to 1997:Q2. All variables are transformed in to log form.

Total export is defined as total volume non-oil export only, that is total value of non-oil export divided by its price index (it terms of domestic price). Oil exports are excluded since they are determined exogenously through quota by OPEC.[3] Total import is defined as total value of import divided by domestic import price index. As usual, *Y* is the real GDP stated in terms of 1993 price. The world income, *Y**, is measured in terms of a trade weighted GDP of the OECD countries. The real exchange rate is a trade-weighted index of Indonesia against its ten major trading partners. The countries included in the calculation are Japan, USA, Singapore, South Korea, Germany, Taiwan, China, Australia, Netherlands, and United Kingdom. Following Edwards [1989], the wholesale price index (WPI) of those countries is used as a proxy for *P**, and Indonesia's consumer price index (CPI) is used as the domestic price.

The analysis begins with specification of data generating process of each variable. For this purpose, two unit root tests are used: Phillips-Perron (PP) and augmented Dickey-Fuller (ADF) tests. The tests are done both in the level and first difference of the data and the results are presented in the Appendix Table 1. In all cases, the results provided by PP test are consistent to that of ADF test. The tests suggest that all variables

are non-stationary in the level and stationary in the first difference, implying that all variables are 1(1) series.

Because of that, we can employ a "two-step" ECM procedure, which permits separate estimation of long-run (steady state) relationships and short-run dynamics. In the first regression, the two long-run relationships as suggested in the equation 1 and 2 are estimated using the so-called (FMOLS) developed by Phillips and Hansen [1990; 99-125]. The errors from this regression are then incorporated in to the ECM. Moreover, impulse response functions are derived from the ECM for assessing the short-run dynamics of the impacts of exchange rates on the system.

The fully modified ordinary least squares regression technique is particularly powerful for small sample estimations [Phillips and Loretan, 1991; 407-36].[4] This procedure relies on semi-parametric bias corrections, which remove nuisance parameters hampering statistical inference of estimates obtained using simple OLS. The parameters estimated using this procedure, therefore, both asymtotically unbiased and valid, and asymptotic t-statistic for the parameters can be derived from the corrected covariance matrix.

Either the simple OLS based estimation procedure suggested by Engle and Granger [1987; 231-53] or the maximum-likelihood methods advocated by Johansen [1988; 231-54] could have been used. The main problem with the Engle-Granger procedure is that the OLS estimator has an asymptotic distribution, which is non-normal and affected by nuisance parameters. This means the standard t-statistics will not be valid asymptotically. On the other hand, the FMOLS corrects the estimates for both

endogeneity and nuisance parameters, so that the t-statistics follow the standard normal distribution.

Unlike other procedures, Johansen's method integrates both the long run and short run dynamic in a unified fashion. Moreover, this method can determine the number of cointegrating vectors. However, the small-sample properties of this method are still unknown and often result in hardly interpretable coefficients. Recent applications of this procedure have resulted in at least two practical problems [Hall, 1990; 317-23]. First, both the trace and determinant test statistics used to determine the number of cointegrating relationships, and the estimates of the long run coefficients, are very sensitive to the choice of the lag length imposed in the initial vector autoregression (VAR). The second problem is that severe multi-collinearity may appear between some of the variables, especially when dealing with VAR of a reasonable size. This, in turn, makes the point estimates of the long run coefficients even more sensitive to the choice of lag length. These two problems were encountered in our experiments, and therefore we choose FMOLS as the preferred technique.

A cointegrating relationship amongst I(1) series exist if the error terms in the FMOLS is stationary. In order to minimise the risk of over rejecting/accepting the presence of cointegration, we adopt two different null hypotheses: no cointegration (Phillips-Perron test) and cointegration (Durbin-Watson and J1-Park tests).[5] Mathematical exposition of these test can be found in Banerjee *et al.* [1993; 136-53], and Park [1991; 119-43].

In the second regression a vector error correction model (VECM) is estimated by imposing the estimated residual from FMOLS on a system of 5 equations. Note that

variable Y^* is treated as an exogenous variable and therefore we only have 5 dependent variables. A seemingly unrelated regression (SUR) procedure is employed in order to increase efficiency of the estimation by utilising the information contained in the correlation matrix of disturbances that impinge on each of the relationships that comprise the system. The number of lags of first difference variable included as the explanatory variables is determined by using Swartz Bayesian Criteria (SBC) and Akaike Information Criteria (AIC). In order to maintain a reasonable degree of freedom, the maximum lag order is set to four. As can be seen in Appendix Table 2, both SBC and AIC suggest that the optimal order is two.

The estimated coefficient in the VECM can be used to construct an impulse response function (IRF). IRF traces the effect on the system of an exogenous shock to one of the variables in the system. The effect can be traced through deviations of the shocked time paths from the expected time path given by the model. This technique is quite useful in certain types of policy and sensitivity analysis. In this study, the shock will be given to q and C.

4. RESULTS AND DISCUSSION

Long-run effects

The results of cointegrating regression for the export function (unrestricted) are reported in Table 1. Note that the coefficient attached to the world income variable is statistically insignificant. It suggests that it does not add to the explanatory power of the regression over and above the other two variables. This result is consistent with the

hypothesis that exports from developing countries are supply, rather than demand, determined [Athukorala and Riedel, 1996; 81-98]. World income was therefore omitted in the final estimation. [6]

The final results are reported in Table 2. It is worth mentioning that the restricted regression improves statistical properties of the estimated coefficients as shown by stronger t-ratios. Thus, now the function characterises export supply response.

The elasticity of non-oil exports with respect to the real exchange rate is 1.32, suggesting that non-oil export is responsive to devaluation. Since oil exports are exogenously determined by OPEC, the improvement in total export will be solely determined by non-oil exports following a real devaluation.

The coefficient attached to the capacity index suggests that a one per cent increase in export capacity leads to 1.12 per cent in export volume. This also means that domestic obstacles hampering production is a significant constraint on export performance. Therefore, competition policies and supply side reforms are critical for export development. These reforms include trade liberalisation, financial sector reforms especially that affect trade financing and investment, and tax and other facilities for export oriented firms. Starting from 1983, Indonesia embarked progressive trade liberalisation, which resulted in across the board decline in trade protection. Effective rate of protection for manufacturing products in 1995 was 16 per cent compared to 59 per cent in 1987 [Fane and Condon, 1996; 33-54]. Moreover, progressive domestic financial liberalisation embarked in 1983 and 1988 may have positive impacts on export development through the supply of trade financing. The ratio of M2 to GDP in 1996 was about 52 per cent compared to only 19 per cent in 1983.

The fact that the supply shifter is more important than the demand shifter in explaining in explaining Indonesia's export in the pre-crisis period has a broader consequence on modelling of export and on policy decisions. In previous studies for Indonesia and most studies for other countries, supply side factors are usually omitted which may cause mis-specification errors.[7] Therefore, it is not surprising that their findings tend to give inconclusive results regarding the effect of devaluation. On policy front, my finding suggest that where international demand is not a constraint a small country can gain from export driven economic growth by way of reforming the supply side of the economy. Moreover, in the context of the twin crisis, negative supply side shocks that hamper export can make the adjustment in the balance of payment more difficult.

The other factor influencing trade balance is the demand for imports, which is a function of real domestic GDP and real exchange rate. The regression results for demand for imports are presented in Table 3. All cointegration tests consistently support the stability of the function characterising demand for imports. Moreover, all coefficients are significant.

The elasticity of total imports with respect to domestic GDP is larger than one, suggesting that total imports are responsive to changes in GDP. A one per cent increase in real GDP will increase imports by 1.2 per cent. The relatively high income elasticity of imports is not surprising since they are mainly composed by capital goods and non-necessity consumer goods.

The coefficient attached to the real exchange rate suggests that one per cent depreciation results in 1.9 per cent contraction in real import. There are three channels

that may explain the decline in imports. First, depreciation increases the domestic price of imported goods, leading to substitution of imported goods by domestic goods. Second, it reduces real income, leading to overall compression in domestic absorption. Third, the burden of foreign debt increases, causing a decline in investment.

In order to assess the long-run impact of depreciation on trade balance, the Marshall-Lerners condition is usually used. Unfortunately, the condition cannot be derived from the estimates simply because oil export is excluded from total export. As an alternative, a qualitative evaluation will be used. If we assume that oil export is not affected by the change in real exchange rate, the change in total export will be determined by non-oil export. If the assumption holds, trade balance will improve following devaluation through reduction in import and expansion in export. However, since the elasticity of import is bigger than that of export, the improvement would come mainly from import compression.

Short-run Dynamics

Within the international trade literature it is not uncommon to find arguments suggesting that trade balance respond only with lag to changes in exchange rate [e.g. Junz and Rhomberg, 1973; 412-5]. Magee [1973; 303-23] and Krueger [1983; 67-80] argues that because trade contracts have been made at the time of devaluation, therefore the completion of that contracts dominates the change in trade balance in the short run. In other words, the effects of devaluation will be realised in the new contracts.

The short-run dynamics of adjustment in export and import are analysed by using impulse response functions. A one standard deviation shock is given on the real exchange rate. Note that a positive shock means a real depreciation. Figure 1 displays the effects the shock on export and import.

The effects on export tend to be expansionary both in the short run and in the long run. Export response does not seem to be sluggish, and in fact the highest impact occurs instantaneously. There are some fluctuations up to the tenth quarter, but the effects are still positive which suggest export expansion through time. The finding is consistent with that of Rosner [2000; 61-95] which is in contrast with the official data. The data suggest that Indonesia's export fell during 1997-1999 both in terms of value and quantity. However, the export price index was not properly adjusted for the fall of world commodity prices during that period. When a more appropriate price index is used, Rosner [2000] finds that export volume actually increased by 24 per cent during that period.

With regards to imports, the effects tend to be negative starting from the second quarter. Thus, both short-run and long-run analyses suggest a deterioration in imports following a devaluation. Rosner [2000] also finds that despite the decline in import prices (in dollar terms), import quantity fell sharply during 1997-1999. Nominal, exchange rate depreciation was about 66 per cent while the dollar price of imported goods fell by about 20 per cent and therefore the domestic price of import increased by about 40 per cent. Hence, it is not surprising that the quantity of import declined sharply.

In the context of the twin crisis, it is also worth to analyse the effect of the collapse of the banking sector on export performance. In the model, this effect can be

captured by a negative shock on the export capacity index. The breakdown in the domestic loan market might affect the availability of trade financing for exporters from domestic banks. It might also have been difficult to find new creditors (e.g., foreign banks), because of the high uncertainty during the crisis. In effect, because of credit constraints, the capacity to export declined. In other words, the effect of a loan implosion will be the same as that for a supply disruption.

Figure 2 displays the effect of a negative one standard deviation shock of capacity index on exports. It shows a decline in exports, and therefore there is evidence that the collapse of the banking sector and supply disruptions had reduced exports. This supports the view of Hill [2000] that the poor export performance was the result in part of a paralysed domestic credit market. Since the revival of exports will partially offset output contraction during the crisis, bank restructuring is a key to the recovery.

5. CONCLUSION

The findings suggest that real exchange rate depreciation can improve the real trade balance in Indonesia through expansion in real export and collapse in real import. It is also shown that import is more sensitive to exchange rate, and therefore improvement in trade balance will be mainly come from import compression.

The short-run dynamic analysis suggests that export responses are instantaneous with some minor lingering effect up to ten quarters. However, the growth of export remains positive throughout the adjustment process. The over all short-run responses of

import are negative with lag of about one quarter. In sum, it can be inferred that trade balance tend to improve without some lag.

In addition, negative supply side shocks tend to retard export significantly and therefore undermine the positive impacts of depreciation. Thus, export could have been performing far better following the onset of the crisis in Indonesia if a currency crisis was not coincided with banking crisis and other supply side disruptions.

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TABLE 1.

RESULTS FOR EXPORT FUNCTION (UNRESTRICTED REGRESSION)

Explanatory Variables	*Coefficient*	*T-ratio*
Log of real exchange rate	0.9943	2.4406
Log of world GDP	1.2586	0.8188
Log of capacity index	0.9221	3.5905
Constant	-0.0174	-0.0670
Statistical Properties		
$R^2 = 0.961$	F = 441.006	CRDW = 1.976
PP (t) = -7.394	PP (Z) = -55.102	Park's J1(0,3) = 7.194

TABLE 2.

FINAL RESULTS FOR EXPORT FUNCTION (RESTRICTED REGRESSION)

Explanatory Variables	*Coefficient*	*T-ratio*
Log of real exchange rate	1.3281	5.0304
Log of capacity index	1.1196	15.8520
Constant	-0.1025	-2.4419
Statistical Properties		
$R^2 = 0.967$	F = 813.117	CRDW = 1.899
PP (t) = 6.408	PP (Z) = 49.439	Park's J1(0,3) = 6.003

TABLE 3.

REGRESSION RESULTS FOR DEMAND FOR IMPORTS

Explanatory Variables	*Coefficient*	*T-ratio*
Log of real GDP	1.2181	16.1043
Log of real exchange rate	-1.8857	-11.4592
Constant	0.0849	2.5490
Statistical Properties		
$R^2 = 0.983$	F = 1584.052	CRDW = 1.763
PP (t) = -6.373	PP (Z) = -52.155	Park's J1(0,3) = 4.747

FIGURE 1.

RESPONSE OF EXPORT AND IMPORTS TO A ONE STANDARD DEVIATION SHOCK ON REAL DEPRECIATION

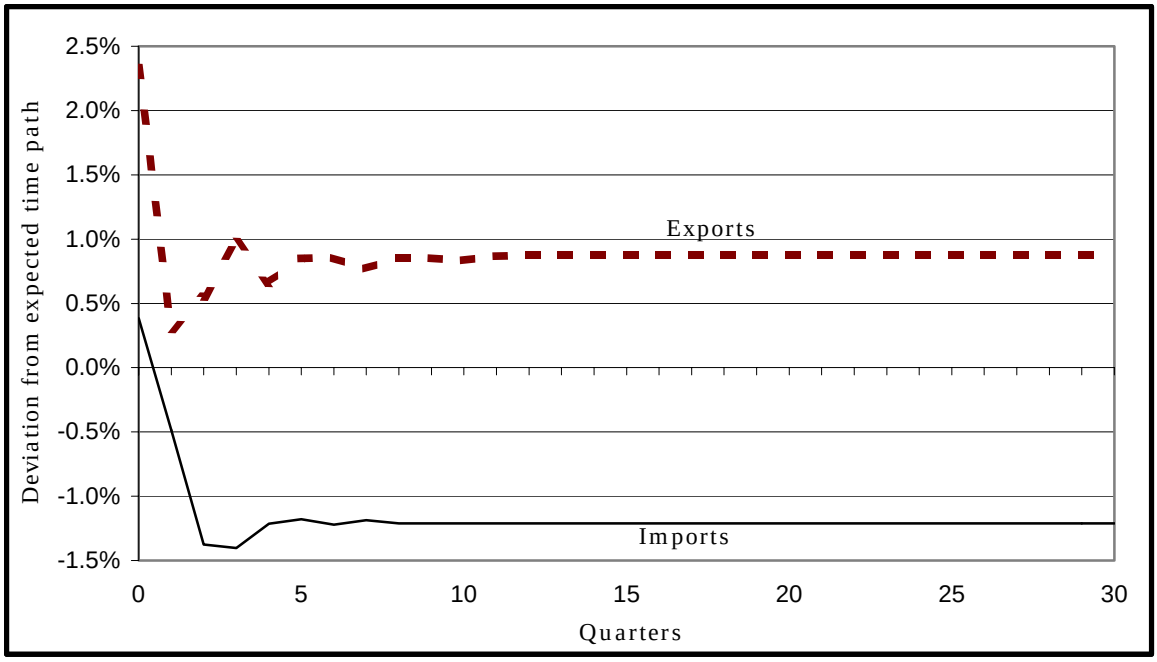
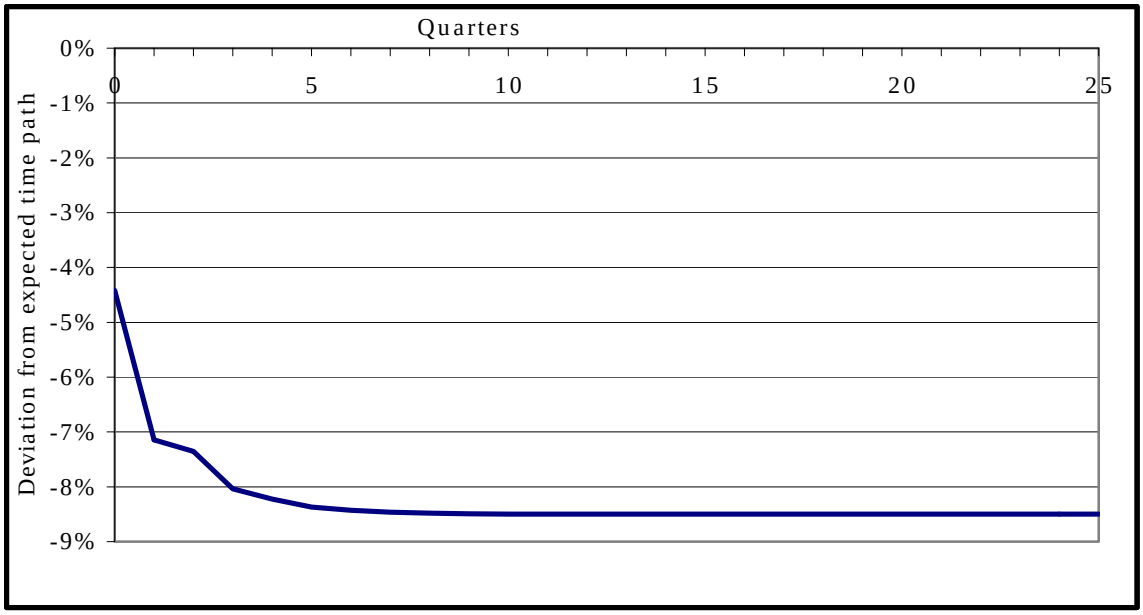


FIGURE 2.

RESPONSE OF EXPORTS TO A NEGATIVE ONE STANDARD DEVIATION SHOCK ON CAPACITY INDEX.



APPENDIX TABLE 1.

UNIT ROOT TESTS

	Level		First Difference	
	ADF	PP	ADF	PP
GDP	-2.79	-0.63	-4.15	-12.50
Export	-2.14	-2.12	-4.43	-12.57
Imports	-3.07	-3.16	-4.15	-9.73
Real Exchange Rate	-3.18	-3.46	-9.39	-9.09
Export Capacity Index	-3.29	-1.12	-3.95	-10.54
World GDP	-2.69	-2.71	-5.75	-7.14

Notes: The 5 per cent critical value for both ADF and PP is –3.41 (with trend).

APPENDIX TABLE 2.

TESTING THE OPTIMAL LAG ORDER OF THE VECM

Lag Order	Schwarz Bayesian Criterion (SBC)	Likelihood Ratio Statistic (LR-test)
The maximum lag order = 8		
8	308.0438	185.6743
7	292.9944	185.9211
6	299.1492	207.3721
5	298.9446	222.4637
4	304.5137	243.3290
3	282.0610	236.1724
2	271.4307	240.8383
1	263.7677	248.4716
0	-133.7622	-133.7622
The maximum lag order = 7		
7	299.4305	191.2483
6	306.2732	213.5456
5	304.6865	227.4135
4	311.2463	249.4279
3	283.4439	237.0801
2	271.8381	240.9289
1	263.7340	248.2794
0	-144.9349	-144.9349

Note: For maximum lag order equal to 7 and 8, both SBC and LR test consistently suggest 4 as the optimum lag.

NOTES

1. Note that the fall in value of exports in both countries during 1997-1998 was caused by the fall in export price. Their export volumes actually increased, but Indonesia's performance was poorer [Rosner, 2000].

2. See Athukorala and Riedel [1996] and the literature cited therein for debates on small country assumption.

3. When oil exports are included, the estimation result is very unsatisfactory. It appears that total real exports are negatively related to the real exchange rate and world GDP.

4. Inders [1993] provides a useful simulation-based comparison of this and other cointegration techniques. Phillips and Hansen [1990] and Phillips and Loretan [1991] show that FMOLS work effectively for sample sizes as small as 50.

5. See Banerjee [1993] *et al.*

6. This variable deletion is accepted by the standard variable deletion LR-test = 2.056 (insignificant).

7. One amongst the few exception is that of Athukorala and Riedel [1996]

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