

FEA Working Paper No. 2002-6

POST- SHOCK IMPACT ANALYSIS:  
THE MALAYSIAN PERSPECTIVE WITH A FOCUS ON  
KLANG VALLEY INDUSTRIES

Su-Fei Yap

Address: Faculty of Economics and Administration, University of  
Malaya, Lembah Pantai, 50603 Kuala Lumpur, Malaysia.

Email : [g1sufei@yahoo.com](mailto:g1sufei@yahoo.com)

Or [g2yss@um.edu.my](mailto:g2yss@um.edu.my)

**POST- SHOCK IMPACT ANALYSIS:  
THE MALAYSIAN PERSPECTIVE WITH A FOCUS ON  
KLANG VALLEY INDUSTRIES**

**Abstract**

This paper reports on the results of an empirical study whereby the effects of exogenous changes are simulated using a macromodel linked to a demand-driven interregional, interindustrial framework focusing on Klang Valley, the most important commercial, industrial and business region in Malaysia. The analysis identifies differences in the severity of reactions, at the regional-sectoral level, towards world shocks and other external stimuli.

As countries accelerate into a phase of global enmeshment, consumer and production activities have to be increasingly viewed on a relatively open platform rather than restricted to domestic links. Apart from external shock is the question of policy-induced internal change. This study attempts to assess the impact of two external changes and two policy-linked adjustments upon sectoral production considering both macroeconomic sensitivity and industrial interdependence. A bi-modular framework combines the structural accountability of a macromodel with trade and technical links approximated by an interregional input-output model.

Acknowledgements: I would like to express my deepest appreciation to Shymala Nagaraj, Lee Kiong Hock and Abdul Aziz Abdul Rahman for their constructive comments and feed back.

## **1. Introduction**

The world economy with which the Malaysian economy is intricately linked, is fundamentally volatile. Fluctuating currencies, the emergence of trade blocks, international labour migration and other externalities lend a note of uncertainty with regard to future growth paths. Malaysia's degree of susceptibility to these global fluctuations deserves attention.

Positive connotations of such global links have no doubt been observed in Malaysia's own breakneck speed of development particularly in the early nineties, its rapid structural transition over the last two decades and its blueprint for industrial status by 2020 which was, and will be, export-led. High growth rates were fuelled by substantial private investment in the areas of manufacturing, construction, petroleum and Free Trade Zone export-oriented industries. A pivotal factor was the sharp increase in foreign direct investment particularly after 1986, related to financial liberation. Foreign direct investment also provides a key link between the domestic and external economies.

Drawbacks, on the other hand, are associated with the possibility that a world recession can severely affect the local economy as our

growth is intimately tied to the external sector. Consequences of capital outflow linked to foreign direct investment withdrawal are generally construed to be negative. Decreased product competitiveness owing to high production costs and low efficiency levels will also hurt, particularly as economies liberalise and deregulate. Susceptibility to world price shocks and the effectiveness of domestic policies given the comparative openness, are other problems we have to contend with.

Furthermore, there are likely to be differences in the degree of impact across regions within the country. Specifically the economic problem holds a regional dimension too, given their diversity in economic activities. Different natural resources, skilled labour pools, historical developments and the present industrial mix implies diverse economic strengths and weaknesses. Policy issues are mostly implemented at the national level and may remain non-optimal for individual regions. Policies should be adapted to separate regions of growth in a manner which also accounts for trade amongst the regions themselves. The preferred approach takes the macro level outlook in tandem with the international regional perspective to acquire a comprehensive analysis of the effects of exogenous change.

On the issue of regional focus, Klang Valley, as the commercial and manufacturing hub of the country with the highest population density, comprises a unique sub-economy clearly distinguishable from the Rest

of Malaysia. It holds a particularly strategic central position with a GDP equivalent to 31 % of the nations total GDP and the highest per capita income<sup>1</sup>. Recent years have witnessed the launching of large scale transportation<sup>2</sup> and construction projects<sup>3</sup> in the region. Designs for a megacity<sup>4</sup> in the heart of Klang Valley would further enhance the already existing importance of the region as the centre of trade, industry and administration. The birth of super corridors accessing the megacity has its implications. The lack of research on Klang Valley in particular, stems from most researchers' emphasis on national planning over regional strategies. The problem is exacerbated by a deficiency of regional data.

As such this paper combines the evaluation of exogenous changes, both external and internal, outlines their macro-wide effects and details sectoral-regional shifts as a response to changes. Specifically, the Klang Valley (termed Region 1) has been identified as the region of interest and its technical/trade links are built in relation to the Rest of Malaysia (termed Region 2). Expected production rise and fall in the output of individual industries suggest expansion and contraction respectively. The simulations are conducted for an eight-year post-shock period. We explore the consequences of world demand shock, fiscal injection, price shock and monetary tightening.

---

<sup>1</sup> Selangor and Federal Territory, Outline Perspective Plan Malaysia, 1991-2000 p. 124

<sup>2</sup> Malay Main English Daily, 08/02/95, p.6; New Straits Times Section 2, 06/03/95, p.5)

<sup>3</sup> New Straits Times, Section 2, 14/12/95 p. 11.

<sup>4</sup> The Star 30/8/95 p.

## 2. Objectives

The study aims to assess the Malaysian economy's vulnerability to exogenous shocks of sufficient magnitude through a series of experimental simulations. This is made possible using an integrated framework comprising a macromodule and an interregional interindustrial module.

The paper attempts to provide some answers to certain fundamental questions which have emerged, particularly in the context of displacements in industrial output owing to policy changes or external fluctuations. Specifically, the questions we address are:

- (i) How would the domestic economy respond to a global demand shift?
- (ii) How effective are monetary and fiscal instruments under the present circumstances?
- (iii) Is any impact necessarily homogenous or would it be spatially defined?
- (iv) Would that not be linked to regional disparities in industrial strengths, trade associations and comparative?
- (v) Can such issues be investigated in the context of the Klang Valley vis-à-vis the Rest of Malaysia, and if so, what are the lessons for the regions concerned?

The analysis provided will complement efforts of regional planners in identifying and understanding possible outcomes of various exogenous changes and thus facilitate the formulation of appropriate policies.

### **3. Analytical Framework**

The bimodular framework combines a macromodule (termed Module 1) with an interregional input-output module (termed Module 2). In the earlier stages of research both modules were permitted to evolve, each acquiring its own ground and direction. This is done on the premise that a meaningful linkage ought to be drawn on structurally sensible models whose intramodular consistencies are also ensured. The modules are not detailed in this paper which focuses on the outcome of experiments using the linked system.

Briefly, the macromodule comprises 94 endogenous variables and 58 exogenous factors which include policy instruments and external variables. The equations explain movements in aggregate demand, trade, production, value-added, prices, monetary, fiscal and labour. The econometrically estimated parameters provided input for a CGE-type analysis (Tower 1984, Tower and Loo 1989, Dixon et al 1992) in Yap (1998). The studies conducted suggest the modules' viability in capturing important macro-fundamentals (Yap 1999).

The interregional input-output system was methodically constructed from an updated version (Yap 1998) of the national tables. Regional fabrication coefficients and trade flows between Klang Valley and the Rest

of Malaysia were determined using Round's (1978) Technique. An evaluation based on feedback effects and multipliers demonstrated the importance of spatial analysis. The interregional interindustrial inverse thus generated serves as a component module of the integrated system discussed here.

The rationale for incorporating a macromodule stems from the need to assess macroeconomic susceptibility to external shocks based on the current structural make-up. Among other factors, the module endogenises the vector of prices, real demand, value-added, wages and important components which would otherwise be exogenous with respect to the interindustrial system of accounts.

An interregional input-output model, rather than the national input-output system, further imparts a spatial dimension where an industry in one region is quite distinct from the same industry in another region at the same point in time. In commodity and service flows, decisions are seen to be made, not only on the question of how much is required but also from where it must come from.

The analysis will also determine if regional disparities exist, what their comparative strengths and weaknesses are and the linkage factor. This paves the way for output, income or employment impact studies on a regional basis. Furthermore, the transmission of external shocks and its simultaneous outcome on all industries and economic units will be given a regional focus.

By linking the interregional input-output system with a macromodel, a mechanism is set up where income and expenditure in the input-output framework is ultimately tied to all other economic factors either via direct or indirect pathways. Any exogenous shock can be traced from its source through displacements in macro variables from their equilibrium positions, thus affecting production decisions at the industry level.

In turn, industrial gross supplies and income (value-added) totals should measure up to macro level projections as a bottom-up check on consistency. This goes some way in addressing the issue of inconsistencies between results from input-output studies and macromodel estimates where the analyses are separately conducted.

Due to limited time series data on a sectoral-cum-regional basis, regional econometric models cannot be constructed without compromising on the number of variables which can be comfortably endogenised and thus explained. As such, input-output tables are the primary means by which sectoral linkages can be accommodated.

Moreover, comparatively lower volume of regional input-output analyses based on Malaysia had been implemented at the time our research commenced, and none which centred on metropolitan Klang Valley.

It is hoped that such simulation exercises will prove informative to those with an interest in supply side adjustments for Klang Valley in particular in the wake of internal or external exogenous changes.

#### 4. **Experimental**

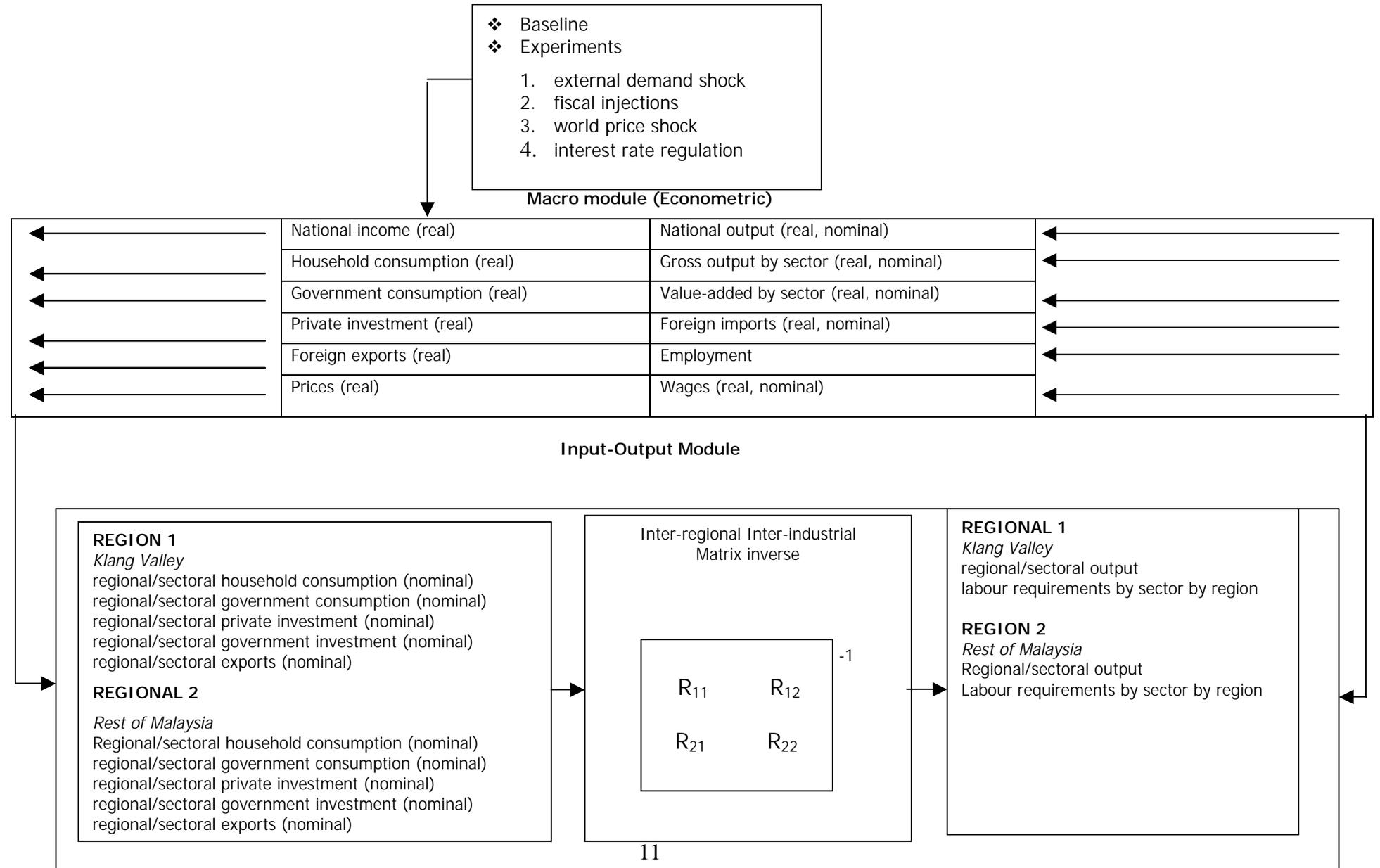
Figure 1 diagrammatically illustrates the type of bimodular linkage used which fall along the lines of Isard and Anselin (1982). The latter's approach however, used existing modules while this study is drawn on own modules built. Another difference lies in that our experiments are tailored towards a range of exogenous stimuli. Thirdly, intra-modular linkages, specifically macro-variable interdependence and cross-regional, inter-industrial connectivity are unique and reflective of Malaysia's economic structure.

The baseline ex-post simulation requires forecasts for all 58 exogenous macro variables for an eight-year interval beginning from the onset of shock. These estimates are produced using each variable's mean growth rate determined over a 20-year span.<sup>5</sup> This step corresponds to the

---

<sup>5</sup> Minor adjustments were made to these rates to take into consideration the opinion of experts, published information in the media or public announcements.

Figure 1: Experiments with Exogenous Changes



upper, boxed segment in Figure 1 relating to exogenous stimuli with specific reference to 'baseline' estimates.

Given the exogenous scenario, the macromodule simulates responses in all 94 endogenous variables for both the in-sample and post-sample period and these are stored on disk. The subset of estimates (see the central, left-hand-side boxed segment of Figure 1) comprising real bank charges, real expenditure components and prices are used in the determination of nominal values for bank charges, private and public consumption, private and public investment and exports.

The relevant macro variables are assigned regional weights according to the structure laid down in the input-output module. This corresponds to the lower, left-hand-side boxed segment of Figure 1. Regional demand totals are sectorally distributed using final demand coefficients for the corresponding end-use category.

Pre-multiplication of this final demand matrix by the inter-regional, inter-industrial inverse<sup>6</sup> (lower, middle boxed segment of Figure 1) yields a matrix of gross output requirements identified with each final demand category according to region (lower, right-hand-side boxed segment of Figure 1). Row wise summation of values in this matrix produces sectoral output targets which regions have to meet if final demand levels anticipated are to be fulfilled. Shortfalls in production are likely to create

---

<sup>6</sup> Generated in Yap (1998) for base year 1990 which is the inter-regionalised and updated version of the national 1987 input-out tables currently available.

supply bottlenecks hence constraining growth. Employment to output ratios are used to provide labour absorption estimates based on gross output forecasts.

Rather than directly adjusting the demand vector to reflect different policy variables, we chose to simulate expenditure reactions to external shocks. This is where the macromodule provides critical input. This input in turn, is picked up by the inter-regional input-output system and given a regional-sectoral interpretation. Incorporation of external changes marks the initial step which corresponds to the upper boxed segment in Figure 1 with specific reference to the 'experiments' listed. The general procedure otherwise conforms to the stepwise framework given in the same figure.

Five experiments were conducted involving disturbances to the baseline trend in exogenous variables. The changes attempted are summarised as follows :

- (1) World demand change is simulated through a one percent per annum sustained increase in world activity (proxied by World Gross Domestic Product in constant terms). This represents a decline over the 20 year average growth rate of three percent per annum employed in baseline forecasts.

The level of world activity impacts the system via trade operations. This experiment probes our susceptibility towards external demand uncertainties.

- (2) Real fiscal injections were growing at an average of about 10 percent per annum over the sample period. More aggressive spending is simulated through a higher growth rate of 13 percent per annum. The study assesses the effectiveness of fiscal policy under the present economic structure.
- (4) We test for the extent of our dependence on favourable world prices by simulating contracting world prices. Slower growth is approximated by a 4 percent per annum increase in the latter as opposed to the expected level of 6 percent per annum. We opted for sustained lower rates of changes as opposed to a one-time price shock.
- (5) Effectiveness of the interest rate as a monetary instrument is evaluated in the fifth experiment. We simulate monetary tightening following higher interest rates which retard investment growth and regional production. The experiment is attempted with a sustained interbank lending rate of 9 percent, representing an approximate 2 points increase over the long-run average current rate.

The exogenous adjustments above are applied in separate simulations in order that responses may be identified according to the nature of shock applied.

## **5. Experiments with External Demand Shock**

The macro-module provides a succinct interpretation of the consequences of any major slowdown in global activity levels proxied by lower growth rates in world real gross domestic product.

It was shown (Yap 1999) that in cases involving external shocks of this nature, international trade serves as the springboard from whence all national systems derive their stimulus, positive or otherwise. Also important was the quantification of percentage changes which provided a measure of reaction depth and which pointed to an overall sensitivity to such perturbations. The substantial magnitude of change following the simulated linkup is a reflection of this phenomenon. (The experiment was conducted without counteractive measures such as that discussed in earlier. Each shock was simulated independently).

Results from the first of our linkage experiments based on world demand disturbances have been summarised in Table 1. Percentage deflections from baseline levels provide an indication of the overall impact on regional industries.

Under the given scenario, both merchandise and service exports as well as imports fall, with exports producing larger changes. The downturn in trade and total balances and the resultant net drop in GNP causes a recessionary phase. Factors associated with income changes, such as private consumption or money demand, simultaneously contract. Variables incorporating lags exhibit delayed responses.

The issues we contend with in the flow model covers the question of direction of change, relative magnitudes, effects of lag and the extent of direct and indirect dependence each industrial sector has on final markets.

From the macromodel, it was shown that, a drop of one percent in world GDP caused the largest cutback in the export sector. Pricing also plays a role in the money-based accounting system. Estimates were obtained as products of both real expenditure and specific deflators. Price deflators for private and public consumption as well as investment also declined, tied to the declining domestic GDP deflators. This culminates in much lower estimates for nominal variables vis-à-vis the baseline forecast. In the aggregate, production falls and demand for labour contracts, movements consistent with the expenditure-driven input-output representation.

Effects related to changes in world GDP are largely experienced within the same period of impact. Smaller, delayed responses work only through indirect linkages via intermediary factors such as prices. The results indicate that not only were early stage reactions of high magnitude but that the cumulated effects of sustained foreign recession could markedly dampen industrial activity.

Table 1 also reveals that the cross-sectional disturbances generated are segmented. Industries are not equally affected by any one impulse.

The importance of direct and indirect connectivity with the export sector is jointly dictated by final market content and the technology inverse.

We looked into the extent of displacement induced by given exogenous disturbances by comparing percent deviations from baseline output forecasts. The mining sector suffers the largest production setback owing to the shock. Gross output falls by 10.8 percent in Region 1 (Klang Valley) and by 10.7 percent in Region 2 (the Rest of Malaysia), a year following the shock. This can be traced to its high export-market dependence which acquires much of its significance from its large direct coefficient. Changes in indirect demands do not account for much since this sector has low forward and backward inter-industrial linkages. Its lowered production levels appears to be consistent with the macro-simulated mining export values which draws strongly on external pull.

Manufacturing reaction is also very significant. Its fall of 9.8 percent applies nationwide. This arises from several interacting factors. For one, the sector's extensive intermediation results from large inter-industrial purchase and sales levels. As other industries reduce output, input demands for manufactures will fall by a comparatively large amount. For another, this secondary sector maintains important trade linkages. Therefore any downturn in industrial activity within Region 2 will influence manufacturing interests in Region 1 and vice versa. Thirdly, manufacturing has expanded its export base and reduced its domestic

market. This intensifies the linkage between the open sector and manufacturing growth.

Agriculture serves as a key industrial supplier to various sectors but itself demands little in the way of input requirements. Its chief link with the industrial matrix works through agro-based manufacturing industries. It is likely that the sharp fall implicated in agricultural net output is tied to manufacturing's cutback in gross production. Our agricultural sectors are traditionally export oriented. This, coupled with its reliance on domestic buoyancy results in the sector's apparent vulnerability, not only to external vagaries but to internal fluctuations as well.

The export sector has little direct bearing on the construction industry since domestic final users absorb the larger part of its output. However, the sector sustains the fourth largest swing from baseline values. Structurally, the building industry is characterised by substantial intermediation. It can be inferred that the observed reaction is one owing to the presence of tight inter-industrial linkages where negative feedbacks are seen to compound any initial down-thrust in production.

Direct and inverse coefficient analysis indicate that trade and transport and communications are important service inputs into manufacturing and construction activities. The former two industries have higher export market content within the sub-group of service sectors. It comes as no surprise therefore that the trade group and transport/communications are found to incur moderately large adverse

reactions to the drop in external demand. On the other hand, the simulation provides evidence of the relative stability in government service output.

The remaining service industries have neither extensive connectivity with other industries nor significant direct export dependence. Consequently, foreign events are unlikely to severely retard growth in these service sectors. Comparatively smaller movements observed are mostly tied to their indirect links with the economy. The drop in national gross production parallels the fall in value-added. Consumers address the change in household receipts by reducing expenditure. A fairly large proportion of services actually goes into private consumption. Household consumption is linked to exports via national income and price movements. Hence, the pathway from world shocks to the tertiary sectors follows a more roundabout route. Service industries in both regions adopt the same pattern of change.

The effects are compounded over time. This is seen in widening chasms between baseline forecast and estimates based on weakening external demand. An inflexion occurs after about five years following the onset of world recession. At this juncture, negative changes associated with the manufacturing industry even exceeds that of mining and agriculture. Unlike the mining industry which is almost wholly export-based, a fair share of manufacture's final users also comprise households and investors. The observed shift results from a joint lowering of

consumption and investment by a greater margin (compared to the other years). Since manufacturing is also closely tied to these variables, the industry's contraction becomes aggravated.

The result can be further broken down into two sets of responses namely aggregate behaviour at the national level and inter-industrial response at the regional level. This merely facilitates an analytical discussion since in reality, national and regional economies are closely inter-twined. Suppose national output contracts with falling exports, demand for labour gets scaled down. A proportional reduction in wages, non-wage income and taxes result. Private investors, in observing current incomes as proxy for future demand adjust investment accordingly. Household spend less. Fewer taxes for the government also implies lower public expenditure. Therefore, a softening in external demand causes all aggregate indices to alter.

In the second phase, intermediate demands readjust as technological constraints dictate the proportion of input to be consumed. A shrinking final market effectively decreases direct and indirect demand for input. The mechanism is multiplicative thus exacerbating net effects over the years.

We concur that long drawn world recession is an unlikely phenomenon. It is therefore pointed out that the simulation is primarily to test the boundaries of sectoral resilience and to illustrate possible relative displacements amongst the industries following a similar shock.

## 6. Experiments with Fiscal Injections

An injection of public development funds over and above the average rate charted in the previous years amounts to an expansionary stimulus. Government expenditure creates an increase in demand in the aggregate. Prices go up and this raises supply. Higher real income encourages investment and consumption growth. The change in money demand translates into a larger circulation of currency thus instituting price inflation. The result also indicates the possibility of smaller trade surpluses owing to expanded imports.

In reading the changes into the input-output format, it becomes apparent that here, investment plays a key role in driving supply. Public development spending is correlated with total investment. Industries affected are chiefly those strongly linked to gross fixed capital formation. It was previously noted that over 90 percent of construction output reaching final markets goes into capital formation.

The analysis suggest that movements in industries following public expansionary programs will be determined through its connective web beginning with the stimulus, then direct components of investment and following through to indirect demands generated in the system.

Table 2 provides a summary of our findings taken from experiments with higher public expenditure. The expansionary stimulus

triggers positive, industry-wide output adjustments. However, percentage deflections from baseline levels vary considerably across industries.

Following fiscal intervention, the government sector will be likely to yield the largest output change for obvious reasons. Changes are recorded as 6.3 percent (Year 2), 10.8 percent (Year 4), 15.3 percent (Year 6) and 19.7 percent (Year 8). The upturn in construction accounts for the second highest induced effect-an observation consistent with our arguments. The pickup in its activity rate is steady but not very high. Percentage deviations from forecasts at baseline were 4.5 percent in Year 4 and about 7.8 percent for Year 8 in Region 1. Displacements were similar in Region 2 where the building industry recorded movements of 4.6 percent (Year 4) and 8.1 percent (Year 8) in response to the proposed stimuli.

Rankings amongst the rest of the industries altered considerably over the years and initial relative patterns of change were not sustained although all changes were clearly expansionary. Sectoral responses ranged in magnitude from small to moderate, in comparison to the outcome on government or construction activity.

A few reasons can be posited. For one, the equilibrium study took account of the fact that government expenditure changes bring on inflation. This lowers real purchasing power which partially offsets the increase in household consumption through a contraction in disposable income. It also undermines our pricing edge in competitive international markets. Exporting sectors which are sensitive to comparative prices,

among them manufacturing and agriculture, will likely experience some adverse effects.

All categories of demands are derived from the macro-model, alongside price forecasts. The input-output model is jointly driven by private and public demand components which explains how effects may affect one another. What emerges comprises the sum reaction which proved to be both moderate and positive. Moreover, lagged responses were built into the macro system and induced changes take place over a period of time.

## **7. Perturbation in World Prices**

Macroeconomic pathways revisited indicate that a drop in world prices results in economic contraction. This starts out from less favourable relative prices leading to falling exports after a lag. Trade balances worsen, compounded by import growth which rises from perceived higher domestic prices. Expenditure and money fall and national income is lower assuming interest rates unchanging. Equilibrium in aggregate demand and supply will correspond to decreased prices and output. Demand for labour contracts pushing wages down.

Freely adjusting prices should form an internal buffer against falling demand by improving international competitiveness and raising domestic disposable income. Findings however showed that prices are less than elastic although they have the appropriate signs. The interpretation

adopted was that prices serve to modulate contractions but are structurally not sensitive enough to fully restore the initial equilibrium.

The assumption that producers read information embodied in prices will mean lower industrial activity following decreases in world prices. Our results are presented in Table 3. For the majority of industries, behaviour is predictable with downward adjustments in employment and output levels. Note that the largest deflections from baseline forecasts are given by consumption and investment-linked industries. This is not entirely surprising. References made to our table on elasticities will confirm that although reactions begin with the export sector, its ultimate effects on aggregate demand variables are even greater.

Construction responds with substantial reductions in output (see Table 3). Its gross production declines by 8.77 percent in Year 2 and 14.1 percent in Year 4 relative to baseline estimates. Deviations are largest in Year 8 (-18.0 percent), its magnitude decreasing by the end of the decade. The adjustments made in this sector mirror upheavals in the area of investment demand.

Other services and trade, hotels and restaurants incur the second and third largest contractions owing to falling demand. For example, service output drops by 5.7 percent in Year 2 and by as much as 14.2 percent in Year 6. The change is smaller in Year 8 when its gross output was estimated to be about 11.9 percent lower than baseline levels. Service final demand is concentrated on households and the responses

charted suggest that private consumption may be another important facet to consider in testing for industrial reaction to price shocks.

The findings inform us that changes in the international frontier could very well result in domestic variable changes far exceeding the early stimulus derived from the trade sector. This is in spite of the fact that trade provides the primary means by which such impulses can reach us.

## **8. Interest Rate Perturbations**

It is emphasised at this juncture that this experiment involved increasing interest rates with contractionary effects. The same results will be equal in magnitude and opposite in direction for the lowering of interest rates with expansionary effects.

Raised interest rates provide a subtle tool for monetary regulation where net results on real variables are very largely negative. Since key movements come after a delay, this policy variable may be unsuitable when rapid and more dramatic effects are desired. Nevertheless, it was shown that it can apply downward pressure on expenditure and prices, a manoeuvre sometimes necessary under conditions of economic overheating. While this also causes a slowdown in investment growth and regional production, the curb on inflation may prove advantageous in the longer term.

The series of interest-induced changes may be segregated into two areas namely, that attributed to monetary effects (of lower magnitude and

with immediate result) and that given to real changes (of relatively larger magnitude and experienced after a lag). In the macro-model, money supply is demand-determined at its given price (the real interest rate). Money works through prices in providing critical market signals to both buyers and sellers who respond according to established modes of behaviour. Private investment is instrumental in accounting for the major shift in real variables one period later. As producers perceive a drop in absorption levels and stocks accumulate, employment levels will be tailored down when gross output contracts. This results in higher unemployment and real wages decline.

Circumstances which prevail at the national level must be reflected in ensuing inter-industrial relationships. Industries are depicted to read macroeconomic sequences for regional production decisions. When expenditure estimates are grafted onto the input-output system we derive the direct and indirect consequences of demand changes, given a technical a perspective.

Taken against baseline estimates, the adjustments (Table 4) for half the regional industries appear to fluctuate. Note the deviation sequences that were obtained for agriculture, mining, manufactures, the trade group and transport/communications. Negative changes recorded for Year 2 are followed by positive swings in production two years later. This reverts to negative adjustments in Year 6. By the turn of the decade, recovery is seen in the manufacturing and service sectors.

Some amount of backtracking may be called for in order to see why this is so. Clearly, this apparently diverse group of industries share one or more common feature or features which have drawn out their similar dependencies on given exogenous stimuli. While household shares of manufactures and the two services mentioned are fairly large, the same cannot be said for mining. On the other hand, exports provide a common ground – all five industries mentioned have substantial links to external demand. It goes to reason that exports have been fluctuating about their baseline projections. The two internal factors which may provide an explanation are domestic prices and the rate of exchange. The simulated shock slows down inflation and the rate of price growth which favours exports. The latter effects comes about one period later (the relevant regressor is lagged). The short-run analysis tells us that when 'everything affects everything else' the initial total export change is negligible and that the following adjustment will be a negative one. Exports are a component of GNP which relates to many other economic factors. Changes in real variables can themselves be linked to price movements.

In short for the agriculture, mining, manufacturing, trade and transport/communications industries, an output fall away from baseline levels is followed by a rise to above baseline levels. The sequence is then repeated. This was traced to changes in the exchange rate and prices and their impact on exports and real income. Therefore, given existing dynamics, the potential for oscillatory movements exist. Inherent cyclical

tendencies in certain variables become observable when interactions run for a longer period of time.

In the remaining five industrial classes of both regions, resultant displacements are persistently negative. Secondly, the proportion of change is small in the beginning for most industries, a gradual pick-up in magnitude follows. Displacements are largest in Year 6. Percentage deviations from baseline forecasts decline by Year 8. A third point concerns the observation that for the most part the construction industry (in this group of sectors) suffers the largest setback. Construction's results for Year 4 are an exception – its rationale is provided below as the issues are dealt with point by point. The results have to be interpreted in the context of both macroeconomic fluctuations and inter-industrial relationships.

Industries producing utilities, construction, business service, other services and government services experience negative changes throughout the duration of simulation. It follows that the major link between this representation of sectors in the input-output system and macroeconomic shifts comprises a demand component whose response (in the wake of rising rates of interest) remained consistent and fairly stable. Construction, utilities and services are typically domestic-oriented industries. They hold weaker ties with the external sector but are highly dependent on internal expenditure changes. Construction is particularly dependent on investment while utilities have important associations with

both investment and consumption. Over two-thirds of final output from the three given service categories are consumed by households. Therefore, output adjustments in these industries are a better reflection of internal economic transformations that are taking place.

On the macro front, a higher interest rate creates the largest changes in fixed capital formation. Private consumption is indirectly affected via falling income levels. Steadily contracting final markets faced by the five industries can be attributed to the dominant effects of these private expenditure changes. In short, the standard negative response we get from these industries are related to comparatively large and persistent domestic expenditure reactions as well as the industries' linkages with particular final markets.

Percentage deviations in output change are also observed to get progressively larger, then peak in Year 6 before tapering down. This mostly corresponds to changes in private spending determined by the macro model. Note that higher interest rates also cause a general price decrease. Improvements in real purchasing power are restorative but only partially so. Apparently, the net price effect does not fully compensate real demand decreases initiated by private investors.

Inter-industrial linkages act to deepen the final outcome. Production slow-down in any one industry will be exacerbated by simultaneous contractions in other sectors as well. As industries make negative adjustment, the given sector will face lower demands for its own

output. It reacts to this by reducing output volume and this leads to a further drop in its intermediate input requirements which are purchased from other industries. Cross-regional trade will be proportionally scaled down. Industrial repercussions could lead to results more severe than provided by its first impact.

Small negative displacements in these same industries in Year 4 can also be attributed to inter-industrial connectivity. Export-oriented sectors underwent an intermediate period of recovery at the time. As these expanded output, they drew on intermediates acquired from other local production units. Although industries which were dependent on local markets experienced a setback three to five years post-shock, a measure of relief was obtained from improved inter-industrial sales to other, then expanding, sectors. This reduced the adverse effects of declining investment and domestic consumption. Consequently, smaller negative changes were recorded for construction, utilities and service sectors in Year 4.

In other words, inter-industrial linkages can either reinforce the effects of a stimulus (as seen in results for Year 6) or soften an impact (as seen in results for Year 4) depending on the number and type of industries undergoing change and the nature of such change (contractionary or expansionary).

It has been shown that the construction industry holds extensive indirect links with the rest of the economy. This sector would therefore show greater sensitivity to changes in most other industries including movements not directly related to its own. While construction's output-path continuously diverged from baseline estimates, decreases sustained were not as large as one might expect from an investment-driven industry. It would appear that the industry derived positive spillover from other expanding industries.

By Year 6, another economic trough was created. Findings show that an industry-wide recession is likely to be tied to a slump in the construction industry. The latter's fall relative to baseline projections reached 7.2 percent in Year 6 equivalent to a difference close to 1,130 million Ringgit (or RM1.1 billion) in gross turnover. The experiment suggests that a 2-point increase in real interest rates and maintained for over five years can be quite significant at the sectoral level particularly when inter-industrial relationships have been accounted for.

## **9. Conclusion**

The outcome from a decline in world income was evaluated in Section 5. We gave an account of the cause-and-effect pathways followed and reported the extent of downward displacements in output for all the industries. The sharp reduction in manufacturing output is attributed to its extensive intermediation and major trade links. Significant reaction were also recorded for the mining and agricultural

sectors owing to their higher export market dependence. Another contributory factor lies in agriculture's reliance on domestic buoyancy through its ties with the manufacturing base.

A higher fiscal injection (as discussed in Section 6) translates into an expansionary stimulus accompanied by inflation and import growth. Investment is critical in demand-pull. The industries chiefly affected are the construction and government sectors. Multiplier effects due to construction activities are likely to induce positive, secondary reaction of smaller magnitude from other industries.

Section 7 analysed the consequences of a drop in world prices. Expenditure and money balances decline. Lowered output and employment levels ensue with decreases in all price indicators. It was surmised that while prices might have restored the pre-shock equilibrium, their responses were found to be insufficiently elastic. Unlike world demand changes which primarily displace the mining, manufacturing and agricultural sectors, the largest deflections from baseline levels owing to world price shocks were shown by the construction, other services and trade, hotel and restaurant industries. It was explained that although the impulse originated in the export sector, its final impact on other aggregate demand components is considerably higher. The results suggest that external shocks are quite capable of generating domestic changes far in excess of the initial stimulus resulting from trade.

Interest rate changes induce, first monetary, then real changes. In Section 8 it was shown that higher rates of interest result in industrial output fluctuations about given baseline levels for five industries. Their oscillatory-type supply movements reflect underlying displacements in the export sector mediated by price changes. On the other hand, for the rest of the industries, deviations were consistently negative highlighting the contractionary nature of an interest rate hike. This illustrates that an identical exogenous shock on aggregate variables can lead to different responses by regional industries when inter-industrial inter-regional linkages are jointly considered.

In summary, it was shown in this paper that aggregate behaviour sets the overall pace which the industries must accommodate, given existing input and output constraints that confront them. Initiating pulses simulated are national, not regional in origin; this explains the low intra-sectoral variation amongst regions. Inter-sectoral differences however were more pronounced, responses from a handful of sectors even went against the general tide of change. Reasons postulated are based on what we know from inter-industrial relationships, final market dependencies and the extent and depth of linkages. The top-down approach used facilitated disaggregation down to the regional-industry level. Experiments revealed how individual industries react differently to the same stimulus, the outcome being dependent on the inherent structural characteristics of each sector.

## References

1. Dixon, P. B., Parmenter, B. R., Powell, A. A., Wilcoxon, P. J. (1992), Notes and Problems in General Equilibrium Economics in Bliss, C. J. and Intriligator, M. D. (eds.), Advanced Textbooks in Economics, Vol. 32.
2. Isard, W. and Anselin, L. (1982), Integration of Multiregional Models for Policy Analysis, Environment and Planning A., Vol. 14, pp. 359-396.
3. Round, J. I. (1978), On Estimating Trade Flows in Interregional Input-Output Models. Regional Science and Urban Economics, Vol. 8 pp. 289-302.
4. Tower, E. (1984), Effective Protection, Domestic Resource Cost and Shadow Prices: A General Equilibrium Perspective. World Bank Staff Working Paper, No. 664, September.
5. Tower, E. and Loo, T. (1989), On Using Computable General Equilibrium Models to Facilitate Tax, Tariff and Other Policy Reforms in Less Developed Countries in Chapter 11, Gills, M.S. (ed), Tax Reform in Less Developed Countries, Duke University Press, pp. 391-416.
6. Yap, S.F. (1998), Towards a Linked Bi-modular Equilibrium Analysis of the Malaysian Economy, Ph.D. Thesis submitted to University of Malaya.
7. Yap, S.F.(1999), Exogenous Perturbations and the Malaysian Economy: Measuring Net Effects, Malaysian Journal of Economic Studies, Vol. 36, No. 2, December.

**TABLE 1: LINKAGE EXPERIMENTS**

**DEMAND SHOCK: SUSTAINED WORLD RECESSION (ONSET OF SHOCK IN YEAR 1)**

	POST-SHOCK YEAR 2	POST-SHOCK YEAR 4
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
<b>REGION 1</b>		
1 AGR	-9.52776	-15.5757
2 MIN	-10.7816	-16.9437
3 MNF	-9.86178	-15.9056
4 UTL	-7.56314	-13.0166
5 CONS	-9.38424	-14.7911
6 TRD, HTL, REST	-8.37379	-14.1213
7 TR & COMM	-8.83583	-14.5102
8 BUSINESS	-5.23258	-8.49386
9 OTHSERV	-6.93970	-12.4882
10 GOVT	-2.08416	-3.80530
<b>REGION 2</b>		
1 AGR	-9.55029	-15.5893
2 MIN	-10.7106	-16.8622
3 MNF	-9.83970	-15.8777
4 UTL	-7.67620	-13.1422
5 CONS	-9.38104	-14.8118
6 TRD, HTL, REST	-9.43165	-14.1901
7 TR & COMM	-8.89945	-14.6427
8 BUSINESS	-5.32823	-8.65850
9 OTHSERV	-6.92444	-12.4609
10 GOVT	-2.09177	-3.81812

**TABLE 1: LINKAGE EXPERIMENTS**

DEMAND SHOCK: SUSTAINED WORLD RECESSION (CONTINUED)

	POST-SHOCK YEAR 6	POST-SHOCK YEAR 8
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
<b>REGION 1</b>		
1 AGR	-20.2558	-26.9042
2 MIN	-19.9182	--31.4879
3 MNF	-21.3410	-25.2147
4 UTL	-17.8858	-21.7829
5 CONS	-19.3807	-22.1205
6 TRD, HTL, REST	-19.2767	-23.2561
7 TR & COMM	-19.3159	-23.5755
8 BUSINESS	-10.8719	-12.1677
9 OTHSERV	-17.8560	-21.3054
10 GOVT	-5.54225	-6.97160
<b>REGION 2</b>		
1 AGR	-20.3829	-26.6230
2 MIN	-19.9952	-31.1174
3 MNF	-21.3153	-25.2110
4 UTL	-18.0825	-22.0840
5 CONS	-19.4593	-22.2959
6 TRD, HTL, REST	-19.3776	-23.4049
7 TR & COMM	-19.5818	-24.0353
8 BUSINESS	-11.0923	-12.3960
9 OTHSERV	-17.8387	-21.3492
10 GOVT	-5.56089	-6.99336

TABLE 2: LINKAGE EXPERIMENTS

EXPANSIONARY IMPULSE: HIGHER GOVT. TOTAL EXPENDITURES  
(ONSET OF SHOCK IN YEAR 1)

	POST-SHOCK YEAR 2	POST-SHOCK YEAR 4
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
REGION 1		
1 AGR	0.484977	0.954594
2 MIN	0.159697	0.343632
3 MNF	0.467186	0.913479
4 UTL	0.996958	1.780081
5 CONS	2.244355	4.512489
6 TRD, HTL, REST	0.935475	1.842530
7 TR & COMM	0.763121	1.390622
8 BUSINESS	0.635063	1.050902
9 OTHSERV	0.798190	1.500149
10 GOVT	6.330957	10.79053
REGION 2		
1 AGR	0.511130	0.995723
2 MIN	0.202923	0.422037
3 MNF	0.508196	0.984464
4 UTL	1.162285	2.039756
5 CONS	2.305891	4.618337
6 TRD, HTL, REST	0.985136	1.917649
7 TR & COMM	0.836859	1.513600
8 BUSINESS	0.676950	1.114501
9 OTHSERV	0.874971	1.627493
10 GOVT	6.332568	10.79658

TABLE 2: LINKAGE EXPERIMENTS

EXPANSIONARY IMPULSE: HIGHER GOVT. TOTAL EXPENDITURES  
(CONTINUED)

	POST-SHOCK YEAR 6	POST-SHOCK YEAR 8
	% CHANGE FROM BASELINE	% CHANGE FROM BASELINE
	FORECAST	FORECAST
REGION 1		
1 AGR	2.167038	3.893109
2 MIN	3.542129	9.104686
3 MNF	0.990484	0.332663
4 UTL	2.404934	2.485567
5 CONS	6.7281198	7.860261
6 TRD, HTL, REST	2.603272	2.694619
7 TR & COMM	1.999391	2.255548
8 BUSINESS	1.255563	1.032775
9 OTHSERV	1.786593	1.104116
10 GOVT	15.30901	19.70552
REGION 2		
1 AGR	2.053580	3.443253
2 MIN	3.437636	8.671829
3 MNF	1.093212	0.462925
4 UTL	2.728527	2.846107
5 CONS	6.893162	8.107914
6 TRD. HTL, REST	2.692233	2.790162
7 TR & COMM	2.159737	2.438736
8 BUSINESS	1.326625	1.093601
9 OTHSERV	1.967410	1.34284
10 GOVT	15.32596	19.74941

TABLE 3: LINKAGE EXPERIMENTS

PRICE SHOCK: WORLD PRICES FALL  
(ONSET OF SHOCK IN YEAR 1)

	POST-SHOCK YEAR 2	POST-SHOCK YEAR 4
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
REGION 1		
1 AGR	-0.41955	-0.72180
2 MIN	3.335298	5.287986
3 MNF	0.469133	0.733909
4 UTL	-3.64212	-6.30619
5 CONS	-8.76663	-14.1059
6 TRD, HTL, REST	-4.16552	-7.06919
7 TR & COMM	-1.23343	-2.11865
8 BUSINESS	-3.42171	-5.89562
9 OTHSERV	-5.76536	-10.2400
10 GOVT	-2.18741	-4.02558
REGION 2		
1 AGR	-0.33892	-0.58674
2 MIN	3.065419	4.867478
3 MNF	0.373659	0.582685
4 UTL	-3.17742	-5.48297
5 CONS	-8.77542	-14.1447
6 TRD, HTL, REST	-3.96151	-6.71196
7 TR & COMM	-1.19312	-2.03150
8 BUSINESS	-3.41538	-5.88782
9 OTHSERV	-5.70332	-10.1331
10 GOVT	-2.18698	-4.02370

TABLE 3: LINKAGE EXPERIMENTS

PRICE SHOCK: WORLD PRICES FALL (CONTINUED)

	POST-SHOCK YEAR 6	POST-SHOCK YEAR 8
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
REGION 1		
1 AGR	-0.41955	-0.72180
2 MIN	3.335298	5.287986
3 MNF	0.469133	0.733909
4 UTL	-3.64212	-6.30619
5 CONS	-8.76663	-14.1059
6 TRD, HTL, REST	-4.16552	-7.06919
7 TR & COMM	-1.23343	-2.11865
8 BUSINESS	-3.42171	-5.89562
9 OTHSERV	-5.76536	-10.2400
10 GOVT	-2.18741	-4.02558
REGION 2		
1 AGR	-0.33892	-0.58674
2 MIN	3.065419	4.867478
3 MNF	0.373659	0.582685
4 UTL	-3.17742	-5.48297
5 CONS	-8.77542	-14.1447
6 TRD, HTL, REST	-3.96151	-6.71196
7 TR & COMM	-1.19312	-2.03150
8 BUSINESS	-3.41538	-5.88782
9 OTHSERV	-5.70332	-10.1331
10 GOVT	-2.18698	-4.02370

TABLE 4: LINKAGE EXPERIMENTS

MONETARY TIGHTENING: HIGHER INTEREST RATES  
(ONSET OF SHOCK IN YEAR 1)

	POST-SHOCK YEAR 2	POST-SHOCK YEAR 4
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
REGION 1		
1 AGR	-0.000749	0.255475
2 MIN	-0.000906	0.505886
3 MNF	-0.000442	0.323084
4 UTL	-0.000973	-0.06818
5 CONS	-0.001514	-0.02892
6 TRD, HTL, REST	-0.000941	0.000345
7 TR & COMM	-0.000741	0.155559
8 BUSINESS	-0.000809	-0.34780
9 OTHSERV	-0.001013	-0.23516
10 GOVT	-0.002688	-.44705
REGION 2		
1 AGR	-0.000716	0.261995
2 MIN	-0.000887	0.490907
3 MNF	-0.000461	0.318951
4 UTL	-0.000989	-0.0.2876
5 CONS	-0.001534	-0.002634
6 TRD, HTL, REST	-0.000941	0.017396
7 TR & COMM	-0.000759	0.169537
8 BUSINESS	-0.000823	-0.33627
9 OTHSERV	-0.001034	-0.23094
10 GOVT	-0.002689	-0.44599

**TABLE 4: LINKAGE EXPERIMENTS**  
**MONETARY TIGHTENING: HIGHER INTEREST RATES**  
**(CONTINUED)**

	POST-SHOCK YEAR 6	POST-SHOCK YEAR 8
	% CHANGE FROM BASELINE FORECAST	% CHANGE FROM BASELINE FORECAST
REGION 1		
1 AGR	-0.31818	-1.77305
2 MIN	1.546329	-5.52025
3 MNF	-0.59707	0.885538
4 UTL	-1.13982	-0.39720
5 CONS	-7.18256	-4.56037
6 TRD, HTL, REST	-2.13469	-0.90734
7 TR & COMM	-0.85520	-0.40312
8 BUSINESS	-1.11364	-0.40312
9 OTHSERV	-1.37740	-0.66331
10 GOVT	-0.86911	0.175488
REGION 2		
1 AGR	-0.39038	-1.40392
2 MIN	1.35845	-5.19217
3 MNF	-0.66198	0.829269
4 UTL	-1.14620	-0.32044
5 CONS	-7.25189	-4.63094
6 TRD, HTL, REST	-2.12043	-0.86419
7 TR & COMM	-0.89699	-0.38566
8 BUSINESS	-1.11754	-0.64940
9 OTHSERV	-1.39864	0.157317
10 GOVT	-0.87414	-0.55371