# Decomposing Growth: A Historical/Decomposition Simulation of Thailand's Sectoral Growth between 2000 and 2005*

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## 1. INTRODUCTION AND METHODOLOGY

The aim of this paper is to provide an analysis of sources of Thailand's economic growth between 2000 and 2005. The timeframe is intentional as, during those years, the Thai economy was recovering from a severe contraction that occurred during the 1997 financial crisis. It is of interest to observe what factors contributed the most to the recovery before the economy began to feel the impacts of the global economic meltdown that started in 2007. In particular, we intend to identify the key structural factors contributing to real GDP and sectoral output growth.[1] The analysis will shed light on the "relative contributions" of each structural factor to growth. The main challenge for this task is to "decompose" growth into the portions contributed by different types of structural changes. To achieve this goal, we adopt the "historical/decomposition simulation" methodology to sort out the effects of each of the five categories of structural changes. The five types of structural changes considered include changes in technology, preference (taste), trade, investment, and general macro aggregates. We consider these five factors key structural parameters influencing growth.

Although there are a substantial number of studies on Thailand's total factor productivity (TFP) (see Bosworth 2005 and references therein), only a limited number of studies have attempted to sort out in a systematic way the relative importance of different types of growth drivers. From this perspective, the historical/decomposition methodology is well suited for the purpose as it has been widely used in the computable general equilibrium (CGE) literature as a way to estimate the effects of various structural changes during a certain time period (see, for example, Kwanjai 1997 and Somsajee 2002). As an example, some studies have applied this methodology to sort out the effects of trade policies from other structural changes that might be happening during the period under study, see, for example, Kwanjai et al. 1995.

We employ a genre of CGE models called CAMGEM-H for this analysis. The model was adapted from the ORANI-G model of the Australian economy for applications in the Thai context.[2] The databases for our analysis are input-output tables in 2000 and 2005 provided by the National Economic and Social Development Board (NESDB). A schematic illustration of the historical/decomposition simulation is depicted in Figure 1. In historical simulation, we feed in "observed changes" in the economy as shocks to the model. In particular, we feed in observed changes in various macro aggregates between 2000 and 2005, such as growth in real private consumption, real export, capital stock, consumer price index, real import, real investment, real government spending, growth rate of population, employment growth, changes in terms of trade, and the cif (cost, insurance, and freight) price of imports. We also feed in (shock) changes in various flow accounts from the input-output tables for the years 2000 and 2005. The model would then compute changes in some pre-selected structural parameters necessary to satisfy these observed changes. The computed changes in structural parameters of interest are classified into five groups as follows:

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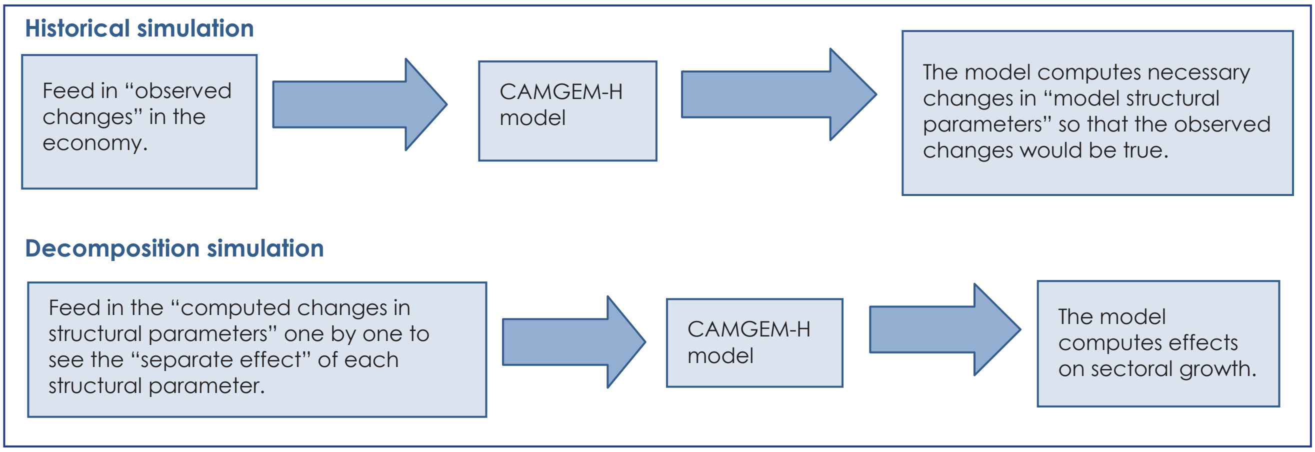
**Figure 1 Schematic Illustration of Historical/Decomposition Simulation**




1. Technology parameters:
   - Changes in technology parameters relating to the efficiency in using intermediate inputs in the production of goods and services.
   - Changes in technology parameters relating to the efficiency in using intermediate inputs in the production of capital (investment).
   - Changes in technology parameters relating to the efficiency in using labor in the production of goods and services.
   - Changes in technology relating to the efficiency in using primary factors (labor, land, and capital) as a whole.
2. Trade parameters:
   - Export quantity shift parameter: This parameter measures how much the export demand curve would have to shift right to accommodate the kind of export changes seen during 2000 and 2005.
   - Import twist parameter: This parameter measures the extent of import preference (preference over domestic goods) that would induce the kind of import changes observed during 2000 and 2005.
3. Preference (taste) parameters:
   - Change in taste parameters for private consumption.
   - Change in taste parameters for government consumption.
   - Change in taste parameters for special exports: This parameter is closely related to tourists' spending and the two terms are used interchangeably.
4. Investment parameters:
   - Rate of capital accumulation: This parameter approximates how much capital accumulates or de-cumulates in the economy during the time period under study.
   - Required rate of return: This parameter measures the required rate of return on investment during the time period under study.
5. General macro aggregates:
   - Changes in the ratio of trade balance to GDP.
   - Changes in the ratio of government consumption to private consumption.
   - Changes in the ratio of tourists' spending (special export) to private consumption.

After the computed changes have been made in the structural parameters of interest, we conduct a decomposition simulation (see Figure 1). The purpose of this simulation is to "isolate" the effects of each structural change by feeding in the computed changes of the structural parameters one by one. By feeding in parameter changes category by category, we are, in effect, holding other structural changes constant (i.e., feeding in "zero" changes for other structural parameters). This method would enable us to sort out, for example, how much of the sectoral output growth is due to changes in technology and how much of it stems from changes in taste.

## 2. RESULTS FROM HISTORICAL SIMULATION

Between 2000 and 2005, there was a general economy-wide improvement in the efficiency of using primary factors (labor, land, and capital) in production. Thailand used less primary factors to produce one unit of output by approximately 3.78 percent per year. This result is perhaps not surprising for the Thai economy between 2000 and 2005 was reasonably stable and growing at a moderate pace.

Table 1 shows the computed changes in the first two technology parameters: efficiency in using intermediate inputs for production and investment (see section 1 above). During the period 2000-2005, the Thai economy appeared able to use intermediate inputs more efficiently in the production of goods/services and in capital creation (investment). Most inputs (commodities) were used less (indicated by negative signs) to produce one unit of goods/services and investment. Notable exceptions were iron and machinery used in the production of goods/services (see second column), where proportionately more were used. It is possible that an increase in the usage of iron and machinery implies a degree of technical deterioration in the production of heavy manufacturing goods. This is, however, not the case for the efficiency in using intermediate inputs for investment (see last column), where we observe an improvement in the efficiency of using iron and machinery. Some other potentially important inputs for investment were, however, used less efficiently, e.g., electrical appliances, electronics, and vehicles.

**Table 1 Changes in Intermediate Input Saving Technology for Production and Investment**

| Commodity | Percentage change in commodity inputs needed to produce one unit of goods/services | Percentage change in commodity inputs needed to produce one unit of capital (investment) |
|---|---|---|
| Agriculture | –0.1 | –10.2 |
| Food | –2.6 | 11.2 |
| Textiles | –3.5 | 1.3 |
| Garments | –4.5 | 0.4 |
| Leather | –0.6 | –73.2 |
| Jewelry | –6.0 | –4.2 |
| Wood | 0.3 | –6.1 |
| Chemicals | –1.0 | –41.0 |
| Electrical appliances | 1.6 | 3.3 |
| Electronics | –3.6 | 1.4 |
| Vehicles | –6.6 | 16.3 |
| Iron | 10.5 | –13.7 |
| Machinery | 2.6 | –0.1 |
| Margin goods* | –6.3 | –10.5 |
| Services | 2.0 | –3.1 |
| Others | 1.2 | –4.2 |

* Margin goods here include wholesale trade, retail trade, railway and road freight transport, coastal and inland water transport, and air transport.

In the case of labor saving technology, Table 2 shows how much labor was used less (negative sign) or more (positive sign) in the production process of each industry. Note that the list in the first column is now industries and not commodities (as in Table 1). It is clear that labor was used less efficiently in industries that employed unskilled labor more intensively, e.g., agriculture, food, textiles, garments, and leather. There was an improvement in labor saving technology in industries that use skilled labor more intensively, such as electrical appliances, electronics, jewelry, and vehicles. This result perhaps reflects the change in the structure of the Thai economy toward more capital-intensive industries, and thus the need for a smaller number of qualified (skilled) labor.

**Table 2 Changes in Labor Saving Technology**

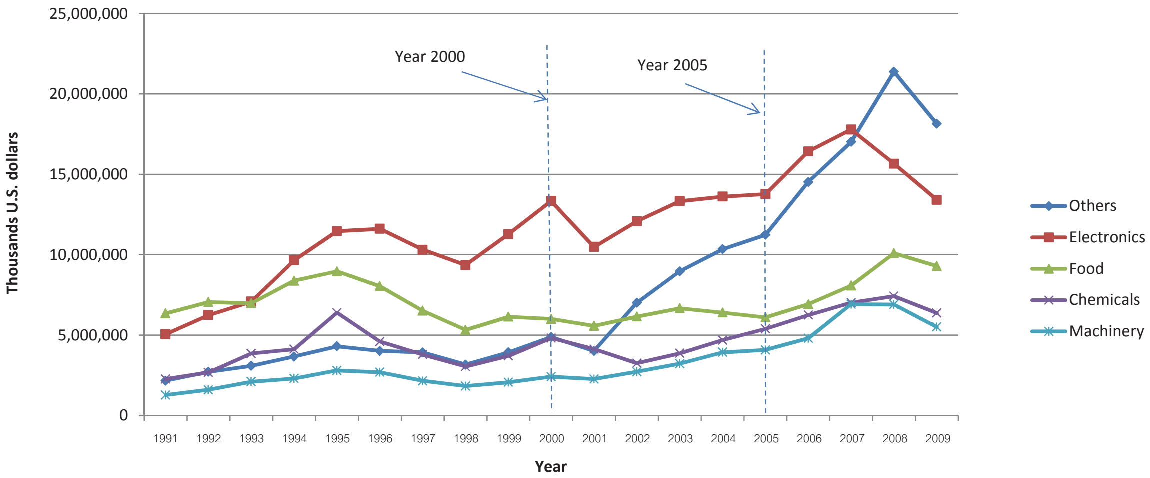
| Industry | Percentage change in labor requirement per unit of output |
|---|---|
| Agriculture | 6.8 |
| Food | 5.6 |
| Textiles | 3.0 |
| Garments | 4.3 |
| Leather | 7.4 |
| Jewelry | –0.8 |
| Wood | 12.8 |
| Chemicals | 10.6 |
| Electrical appliances | –5.6 |
| Electronics | –6.3 |
| Vehicles | –9.5 |
| Iron | 7.0 |
| Machinery | 8.6 |
| Margin goods | 8.2 |
| Services | 2.4 |
| Others | 7.4 |

Table 3 shows estimates of the changes in trade parameters. Export quantity shift reasonably reflects changes in the pattern of Thailand's sectoral exports over the years under study. Thailand's exports of textiles, leather, and garments have shown stable or declining trends (see Figure 2) and thus a relatively low estimate of export quantity shift. On the other hand, the larger estimates of export quantity shift for iron, machinery, vehicles, chemicals, and electrical appliances reflect an increase in the export of these commodities (see also Figure 2). The import twist parameter shows a general favor for most imported products, with the exception of agriculture and vehicles. This observation is consistent with a decline in the import of agricultural products and vehicles over the years concerned (see Figure 3).

**Table 3 Changes in Trade Parameters**

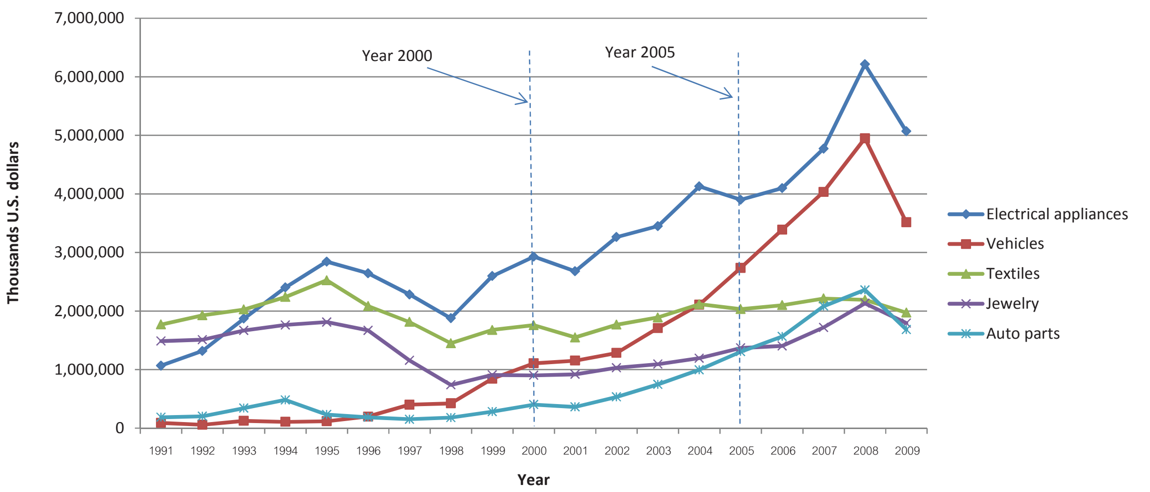
| Commodity | Export quantity shift | Import twist |
|---|---|---|
| Agriculture | 4.1 | –1.5 |
| Food | 2.9 | 5.6 |
| Textiles | 2.3 | 3.3 |
| Garments | 1.1 | 11.2 |
| Leather | 2.2 | 3.8 |
| Jewelry | 2.6 | 21.4 |
| Wood | 5.4 | 4.7 |
| Chemicals | 6.3 | 4.6 |
| Electrical appliances | 5.9 | 1.7 |
| Electronics | 2.8 | 8.3 |
| Vehicles | 7.6 | –12.4 |
| Iron | 11.7 | 3.2 |
| Machinery | 8.0 | 12.5 |
| Margin goods | –0.5 | 0.8 |
| Services | 0.3 | 10.7 |
| Others | 6.4 | 9.4 |

## Figure 2 Thailand's Real Exports[1/] by Industry



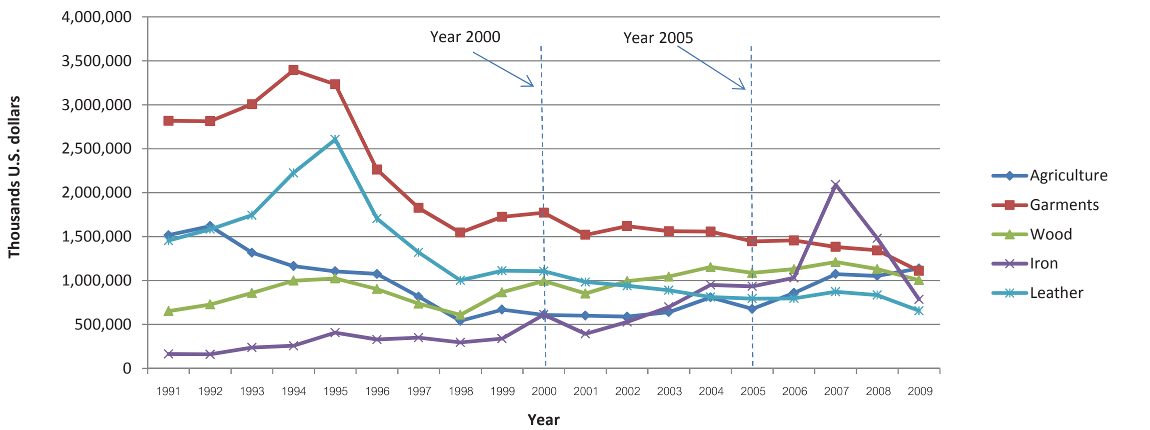

Note: 1/ Export values are deflated into 1994 U.S. dollars.
*Source:* PC Trade Analysis System (PC TAS) and Ministry of Commerce, Thailand, by author's calculation.

## Figure 2 Thailand's Real Exports[1/] by Industry (cont.)



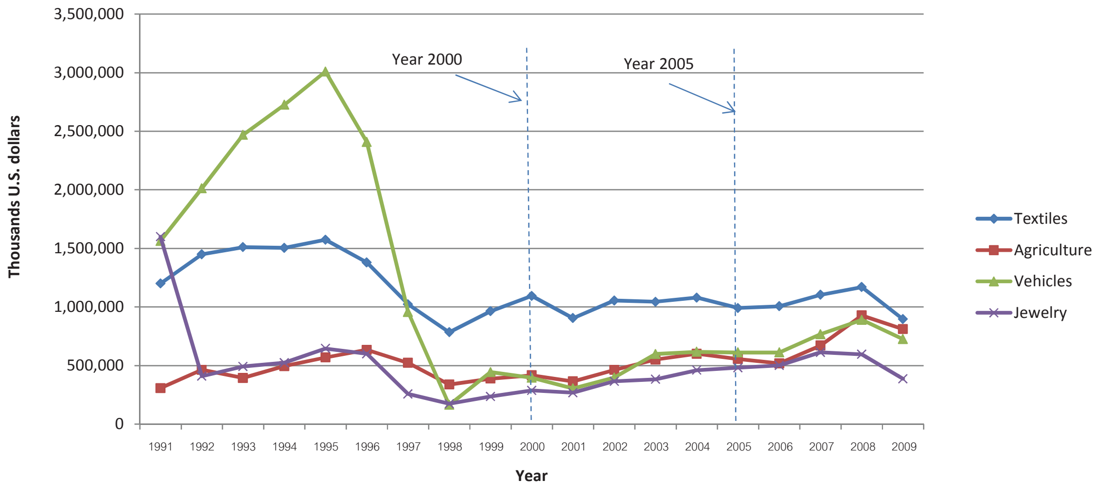

Note: 1/ Export values are deflated into 1994 U.S. dollars.
*Source:* PC Trade Analysis System (PC TAS)and Ministry of Commerce, Thailand, by author's calculation.

## Figure 2 Thailand's Real Exports[1/] by Industry (cont.)




Note: 1/ Export values are deflated into 1994 U.S. dollars.
*Source:* PC Trade Analysis System (PC TAS) and Ministry of Commerce, Thailand, by author's calculation.

**Figure 3 Thailand's Real Imports[1/] for Selected Industries**




Note: 1/ Export values are deflated into 1994 U.S. dollars.
*Source:* PC Trade Analysis System (PC TAS) and Ministry of Commerce, Thailand, by author's calculation.

For changes in preference (taste) parameters, Thai household preference during the years 2000 and 2005 was found to favor some luxury and electrical commodities, such as jewelry, vehicles, electronics, and electrical appliances (see Table 4). An increase in preference for margin commodities (wholesale, retail, and transportation) is probably not surprising in view of the increase in both the number and size of multinational retailers during the period under study. Interestingly, a decline in preference for service commodities is somewhat contrary to the trend at the time, when many new service businesses sprang up, such as spas and resorts. However, since the service sector defined here includes many categories of service businesses, as well as government public services, a decline in preference for services needs to be carefully interpreted.

In terms of gonvernment spending preference, the most noticeable positive changes were in food, wood, and electronics, perhaps reflecting more spending on public construction, food welfare programs, and some education-related products such as computers. Tourists' taste shows a strong preference for agriculture, garments, leather, and jewelry.

As for investment parameters, our historical simulation indicates a decline by 0.245 percent per year in the required rate of return on investment, while capital de-cumulates at the rate of 6.197 percent per year.

Finally, for parameters on general macro aggregates, trade balance to GDP was found to have decreased slightly, by 0.017 per year. Government spending and special export (tourists' spending) were found to have increased by 0.899 percent less and 0.266 percent more than private consumption, respectively.

**Table 4 Changes in Preference Parameters**

| Commodity | Change in household consumption preference | Change in government consumption preference | Change in special export (tourists' consumption) preference |
|---|---|---|---|
| Agriculture | 10.8 | 0.1 | 13.4 |
| Food | –0.2 | 20.5 | –28.2 |
| Textiles | –7.7 | 3.7 | –2.6 |
| Garments | –6.8 | –11.2 | 6.4 |
| Leather | –0.9 | 2.8 | 8.9 |
| Jewelry | 9.0 | –5.1 | 14.4 |
| Wood | 2.2 | 71.1 | –30.8 |
| Chemicals | 3.4 | –36.4 | –21.1 |
| Electrical appliances | 8.5 | –14.8 | –9.2 |
| Electronics | 15.2 | 28.7 | –55.7 |
| Vehicles | 6.0 | 1.3 | –67.3 |
| Iron | –13.9 | –91.7 | –10.5 |
| Machinery | 3.8 | –26.5 | –31.1 |
| Margin goods | 3.9 | 5.6 | 3.6 |
| Services | –3.2 | 1.1 | 1.0 |
| Others | 0.7 | 2.1 | –3.1 |

## 3. RESULTS FROM DECOMPOSITION SIMULATION

In the following paragraphs, we present the results on the effects of "each structural factor" on sectoral output growth. Other aspects of sectoral adjustments, such as effects on wages, employment, capital and land usage/rentals, will be postponed for the future version of this paper.

The general increase in efficiency in using primary factors (capital, labor, and land) contributed the most to sectoral output growth. Most sectors grew on the order of 3-6 percent per year as a result of this technology improvement (see Table 5).

For intermediate input saving technology in production, assuming that industries use as major input materials in the same category (e.g., the food industry mainly uses food commodities as inputs and the electronics industry mainly uses electronic commodities as inputs), there seems to be a correspondence between sectors that exhibit a "large enough" efficiency gain in using intermediate inputs and their corresponding positive and significant output growth. These sectors include textiles, garments, jewelry, electronics and vehicles (compare Table 1 and Table 5). On the other hand, sectors with a decline in the efficiency of using intermediate inputs, such as iron and machinery, exhibit a large negative growth. Note that the contributions to output growth from intermediate input saving technology for some sectors are so large that they offset the effects that come from other technology parameters. Examples include iron, with a negative growth rate of 8.6 percent per year, and electronics, with a positive growth rate of 10.9 percent per year.

For intermediate input saving technology in investment, our estimates indicate a small decline in output growth across investment sectors. That technology improvement/deterioration in using intermediate inputs for investment does not contribute much to sectoral output growth should not be surprising since investment decisions largely depend on other potentially more important factors, such as interest rates and profit potentials.

For labor saving technology, the sectors that show improvement in labor efficiency also show positive and significant output growth (compare Table 2 and Table 5). These sectors include jewelry, electrical appliances, electronics, and vehicles. Sectors that show a decline in labor saving technology experience a decline in output growth more or less proportionately with their decline in labor efficiency (compare Table 2 and Table 5).

The overall effect of technology change on sectoral output growth is shown in the last column of Table 5. The positive effect from an economy-wide increase in primary factor utilization has offset negative effects from other technology parameters, and thus we saw a general growth in output across sectors. This is especially true for electronics, vehicles and jewelry, where positive effects from primary factor usage are combined with the effects coming from better use of intermediate inputs. On the other hand, in iron and machinery industries, the declines in efficiency in the use of intermediate inputs are combined with inefficiencies in the use of labor and produce negative output growth.

As for trade parameters, both the benign effects of export quantity shift and the adverse effects of import twist exert a fairly strong effect on output growth (see Table 6). As expected, sectors that exhibit high estimates for export quantity shift grew at higher rates (compare Table 3 and Table 6). These sectors include "others," chemicals, electrical appliances, vehicles, iron, and machinery. These sectors are export-oriented and thus very sensitive to changes in export quantity shift. Interestingly, import twist exerts more or less uniform adverse effects on output growth across sectors, on the order of –2 percent to –4 percent. The total effect of the

**Table 5 Impact of Technological Changes On Industries' Output Growth (unit in percentage per year)**

| Industry | Impact of technology changes in: Primary factors (saving) | Intermediate input usage for production | Intermediate input usage for capital creation | Labor saving | Total impact of technology |
|---|---|---|---|---|---|
| Agriculture | 4.8 | –0.6 | –0.6 | –1.9 | 1.7 |
| Food | 5.0 | –0.3 | –0.5 | –2.0 | 2.2 |
| Textiles | 5.4 | 0.5 | –0.5 | –2.1 | 3.2 |
| Garments | 5.5 | 2.6 | –0.6 | –2.2 | 5.3 |
| Leather | 4.5 | –0.4 | –0.5 | –1.9 | 1.7 |
| Jewelry | 3.7 | 4.2 | –0.4 | 1.4 | 8.9 |
| Wood | 5.0 | –1.1 | –0.9 | –2.2 | 0.8 |
| Chemicals | 4.8 | –0.6 | –0.6 | –2.0 | 1.6 |
| Electrical appliances | 4.8 | –3.3 | –0.5 | 1.9 | 2.9 |
| Electronics | 3.3 | 10.9 | –0.3 | 1.3 | 15.2 |
| Vehicles | 4.2 | 1.7 | 2.6 | 1.5 | 10.0 |
| Iron | 4.8 | –8.6 | –0.4 | –2.0 | –6.2 |
| Machinery | 5.0 | –3.8 | –0.5 | –2.1 | –1.4 |
| Margin goods | 4.5 | –0.8 | –0.4 | –1.8 | 1.6 |
| Services | 4.9 | 0.1 | –1.0 | –2.0 | 2.0 |
| Others | 4.6 | –1.3 | –0.6 | –1.9 | 0.9 |

**Table 6 Impact of Trade Parameters on Industries' Output Growth (unit in percentage per year)**

| Industry | Export quantity shift | Import twist | Total trade impact |
|---|---|---|---|
| Agriculture | 4.4 | –3.1 | 1.3 |
| Food | 4.4 | –3.2 | 1.2 |
| Textiles | 4.4 | –3.3 | 1.1 |
| Garments | 4.8 | –3.8 | 1.0 |
| Leather | 3.8 | –2.6 | 1.1 |
| Jewelry | 3.2 | –3.8 | –0.5 |
| Wood | 4.7 | –3.1 | 1.7 |
| Chemicals | 4.6 | –3.4 | 1.2 |
| Electrical appliances | 5.0 | –2.7 | 2.3 |
| Electronics | 3.7 | –2.2 | 1.4 |
| Vehicles | 5.4 | –1.4 | 4.0 |
| Iron | 5.5 | –3.2 | 2.2 |
| Machinery | 5.3 | –4.2 | 1.1 |
| Margin goods | 4.6 | –3.1 | 1.4 |
| Services | 4.9 | –4.1 | 0.8 |
| Others | 4.6 | –4.0 | 0.6 |

trade factor on output growth is, in general, positive (see last column of Table 6) with a particularly high growth for export-oriented sectors, such as vehicles, iron, and electrical appliances. Note that the effects of export quantity shift and import twist on sectoral output growth are individually large but with opposing effects, resulting in a moderate effect of the trade factor on growth.

For taste parameters, the negative effects of consumer preference on some sectors, such as garments, textiles, food, and leather, are negative output growth in these sectors (see Table 4 and Table 7). However, increased preference for jewelry, electrical appliances, electronics and vehicles does not seem to boost output growth in the corresponding sectors. The negative growth rates in these sectors, however, are more moderate, and turn positive in vehicles and jewelry industry. One of the reasons for a relatively mild effect of consumer preference on these sectors is that these sectors are export-oriented and not producing for local demand. Increase in consumer preference toward these goods thus has a limited impact on the sectors' growth.

Government preference in general does not exert much effect on sectoral output growth, although the large shift of government preference away from chemicals and machinery does have a slightly negative effect on the output growth of these sectors. Preference shift for special export in general has a positive effect on sectoral output growth, although by not very much. The total effect of the taste factor on output growth is a slightly negative growth across most sectors, except for vehicles, jewelry, agriculture, and margin goods.

As for investment parameters, a reduction in the required rate of return appears to boost all sectors' growth by a significant degree (see Table 8). Some manufacturing sectors, such as chemicals, electrical appliances, iron and machinery, exhibit large positive impacts. Interestingly, relatively labor-intensive sectors also benefit significantly from a reduction in the rate of investment return. These sectors include agriculture, food, textiles, and garments. Capital de-cumulation contributes to a negative growth rate across all sectors. In the past, it used to be the case that overinvestment caused the output of some sectors to decline (see, for example, Kwanjai 1997). Between 2000 and 2005, the investment climate must have stabilized somewhat after the financial crisis of 1997. The overall effect of investment factors is to slightly increase output growth for all sectors (see last column of Table 8).

**Table 7 Impact of Taste Changes on Industries' Output Growth (unit in percentage per year)**

| Industry | Household consumption | Government consumption | Special Export | Total impact of taste changes |
|---|---|---|---|---|
| Agriculture | 0.8 | 0.2 | 0.1 | 1.1 |
| Food | –0.8 | 0.2 | 0.0 | –0.7 |
| Textiles | –1.0 | 0.2 | 0.2 | –0.6 |
| Garments | –2.7 | 0.2 | 0.4 | –2.0 |
| Leather | –0.5 | 0.1 | 0.3 | –0.1 |
| Jewelry | 0.6 | 0.1 | 0.4 | 1.1 |
| Wood | –0.4 | 0.2 | 0.0 | –0.3 |
| Chemicals | –0.6 | –0.3 | 0.1 | –0.9 |
| Electrical appliances | –0.6 | 0.1 | 0.1 | –0.4 |
| Electronics | –0.2 | 0.1 | 0.1 | 0.0 |
| Vehicles | 0.2 | 0.2 | 0.2 | 0.5 |
| Iron | –0.3 | 0.1 | 0.1 | –0.1 |
| Machinery | –0.5 | 0.0 | 0.1 | –0.4 |
| Margin goods | 0.7 | 0.1 | 0.4 | 1.2 |
| Services | –1.4 | 0.4 | 0.4 | –0.7 |
| Others | –0.5 | 0.2 | 0.1 | –0.2 |

**Table 8 Impact of Investment Parameters on Industries' Output Growth (unit in percentage per year)**

| Industry | Impact of required rate of return | Impact of capital accumulation | Total investment impact |
|---|---|---|---|
| Agriculture | 2.1 | –1.4 | 0.6 |
| Food | 2.2 | –1.4 | 0.8 |
| Textiles | 2.3 | –1.4 | 0.9 |
| Garments | 2.3 | –2.2 | 0.1 |
| Leather | 1.9 | –1.2 | 0.8 |
| Jewelry | 1.6 | –1.0 | 0.6 |
| Wood | 2.2 | –0.9 | 1.3 |
| Chemicals | 2.1 | –1.2 | 0.9 |
| Electrical appliances | 2.1 | –1.0 | 1.1 |
| Electronics | 1.4 | –0.6 | 0.8 |
| Vehicles | 1.9 | –0.1 | 1.7 |
| Iron | 2.1 | –1.1 | 1.0 |
| Machinery | 2.2 | –0.7 | 1.5 |
| Margin goods | 2.0 | –1.2 | 0.8 |
| Services | 2.1 | –1.7 | 0.4 |
| Others | 2.0 | –1.2 | 0.8 |

For parameters on general macro aggregates, the effect of changes in balance of trade to GDP, ratio of government spending and tourists' spending to private consumption turn out to have a slightly positive effect on output growth for all sectors (see Table 9).

**Table 9 Impact of General Macro Factors on Industries' Output Growth (unit in percentage per year)**

| Industry | Total impact |
|---|---|
| Agriculture | 0.5 |
| Food | 0.5 |
| Textiles | 0.5 |
| Garments | 0.6 |
| Leather | 0.4 |
| Jewelry | 0.3 |
| Wood | 0.4 |
| Chemicals | 0.4 |
| Electrical appliances | 0.4 |
| Electronics | 0.3 |
| Vehicles | 0.4 |
| Iron | 0.4 |
| Machinery | 0.4 |
| Margin goods | 0.6 |
| Services | 0.7 |
| Others | 0.5 |

Table 10 compares the effects of each structural factor on sectoral growth. It is clear that the major sources of growth for most sectors are technology improvement and trade, where investment, taste, and general macro factors play more limited roles. It is interesting to note that, in some sectors, although their exports were increasing sharply, the key driving source of growth is actually technology improvement. These sectors include vehicles, electrical appliances, and electronics. Note in particular that the iron sector, although it benefits from a large export increase, also suffers from large import increases. This "canceled-out" effect of trade factors combined with a large decline in technology produce negative and significant growth for the sector.

Table 11 shows the contributions of each structural parameter on real GDP growth. Technology and trade turned out to be the major source of growth of the Thai economy between 2000 and 2005. In some episodes in the past, investment and trade used to be the main driving sources of Thailand's economic growth (see, for example, Kwanjai 1997 for the period 1985 to 1990, and Somsajee 2002 for the period 1990 to 1995). The importance of trade (especially exports) in stimulating growth is generally accepted. Improvement in technology then is a welcomed growth driver.

**Table 10 Comparison of Impacts from Various Structural Factors on Industries' Output Growth (unit in percentage per year)**

| Industry | Technology | Trade | Taste | Investment | General macro | Total impact |
|---|---|---|---|---|---|---|
| Agriculture | 1.7 | 1.3 | 1.1 | 0.6 | 0.5 | 5.3 |
| Food | 2.2 | 1.2 | –0.7 | 0.8 | 0.5 | 4.0 |
| Textiles | 3.2 | 1.1 | –0.6 | 0.9 | 0.5 | 5.1 |
| Garments | 5.3 | 1.0 | –2.0 | 0.1 | 0.6 | 5.0 |
| Leather | 1.7 | 1.1 | –0.1 | 0.8 | 0.4 | 3.9 |
| Jewelry | 8.9 | –0.5 | 1.1 | 0.6 | 0.3 | 10.4 |
| Wood | 0.8 | 1.7 | –0.3 | 1.3 | 0.4 | 3.9 |
| Chemicals | 1.6 | 1.2 | –0.9 | 0.9 | 0.4 | 3.2 |
| Electrical appliances | 2.9 | 2.3 | –0.4 | 1.1 | 0.4 | 6.2 |
| Electronics | 15.2 | 1.4 | 0.0 | 0.8 | 0.3 | 17.6 |
| Vehicles | 10.0 | 4.0 | 0.5 | 1.7 | 0.4 | 16.7 |
| Iron | –6.2 | 2.2 | –0.1 | 1.0 | 0.4 | –2.7 |
| Machinery | –1.4 | 1.1 | –0.4 | 1.5 | 0.4 | 1.3 |
| Margin goods | 1.6 | 1.4 | 1.2 | 0.8 | 0.6 | 5.6 |
| Services | 2.0 | 0.8 | –0.7 | 0.4 | 0.7 | 3.3 |
| Others | 0.9 | 0.6 | –0.2 | 0.8 | 0.5 | 2.5 |

**Table 11 Impacts of Structural Changes on Real GDP Growth (unit in percentage per year)**

| | Real GDP |
|---|---|
| **1. Total technology factors** | **1.9** |
| Intermediate input saving in production | –0.3 |
| Intermediate input saving in capital creation | –0.6 |
| Labor saving | –1.9 |
| Primary factor saving | 4.7 |
| **2. Total trade factors** | **1.2** |
| Export quantity shift | 4.7 |
| Import twist | –3.5 |
| **3. Total taste factors** | **–0.03** |
| Household consumption | –0.5 |
| Government consumption | 0.2 |
| Special export | 0.3 |
| **4. Total investment factors** | **0.7** |
| Rate of capital accumulation | –1.4 |
| Required rate of return | 2.1 |
| **5. General macro factors** | **0.6** |
| **Sum total** | **4.4** |

Note: Some numbers are rounded from actual model results; therefore, the sum of effects in each category of structural parameters might not equal the totals reported.

It is interesting to note that preference actually contributes a slightly negative effect to growth. This finding suggests an opportunity to expand the local market as an alternative engine of growth. Doing so would free us from relying too much on exports and exposing the country to volatile global financial conditions.

## 4. CONCLUSION

This paper has analyzed the effects of structural changes on industries' output growth. We found technology improvement and trade to be major driving forces for real GDP and output growth in most sectors during the years 2000 and 2005. Major exporting sectors, such as electronics, electrical appliances, and vehicles, were actually enjoying large positive growth as a result of technology improvements (with trade factors coming in second). Sectors such as iron experienced negative output growth (despite an increase in iron exports during the years under study) because of technology deterioration.

## ENDNOTES

1 Sectoral classification follows our practice in other parts of this research project. It is based on the mapping of products' Harmonized System (HS) Code (at the six-digit level) into industries. We then map sector definitions as used in Thailand input-output tables to our definition of industries as closely as possible.

2 See Centre of Policy Studies (CoPS), Monash University, at http://www.monash.edu.au/policy/oranig.htm, for a development of this family of CGE models. CAMGEM-H was developed from ORANI-G model in a joint effort of Chulalongkorn University and Monash University.

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