# Trends in Household Income and Expenditure, 1993–2003

## Introduction

This article provides an overview of changes in households' profile and analyses household income and expenditure trends during 1993–2003. It also presents the ownership rates of home and selected consumer durables. Data were derived from the quinquennial Household Expenditure Survey (HES) conducted by the Singapore Department of Statistics.
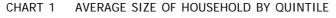
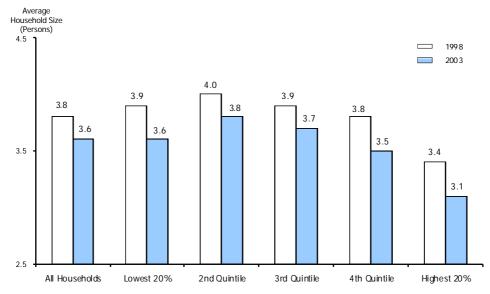## Changes in Households' Profile and Asset Ownership

Between 1998 and 2003, there were significant changes in Singapore's demographic, social and economic conditions. These socio-demographic and economic changes affected households in various quintile groups[1] differently, in terms of size of households, number of working persons and type of house.

### Declining Household Size

Household size had become smaller for all quintile groups (Chart 1). This was due mainly to the increasing proportion of one-person households. Other factors contributing to the decline in household size were lower fertility rate, delay in child bearing, and decline in the number and proportion of multi-nucleus households.

CHART 1   AVERAGE SIZE OF HOUSEHOLD BY QUINTILE



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[1]   Households are categorised into five equal income groups of quintiles based on ranking of the households by their per capita household income.

In 2003, the average household size ranged from 3.8 persons for the second quintile group to 3.1 persons for the top quintile group compared with the corresponding household sizes of 4.0 persons and 3.4 persons in 1998. During the five-year period, all quintile groups also had higher proportions of one-person households, with the top quintile group registering the most significant rise, from 11 per cent in 1998 to 16 per cent in 2003.

### Fewer Working Persons and More Retiree Households

Arising from the slowdown in the economy during the period, the average number of working persons per household fell for all quintile groups (Table 1). Another contributing factor was the rising ageing population which resulted in a higher proportion of retiree households in 2003.

For the lowest quintile group, there was a notable rise in the proportion of retiree households, from 8.5 per cent in 1998 to 14 per cent in 2003. Except for the fourth quintile group which had the same proportion of retiree households, all other quintiles also saw a rising proportion of these households during 1998–2003.

### More Households in Better Housing

Reflecting rising affluence, there were more households residing in 4-room and larger public flats in 2003 than 1998 for all households except those in the top quintile group (Table 2). In particular, households living in 4-room and larger public flats had increased markedly for the lowest two quintile groups, from 40 per cent and 51 per cent respectively in 1998 to 51 per cent and 65 per cent in 2003.

There were also higher proportions of households residing in private houses/flats during the same period for all quintile groups.

TABLE 1    AVERAGE NUMBER OF WORKING PERSONS AND PROPORTION OF
               RETIREE HOUSEHOLDS BY QUINTILE

| Per Capita Household Income Group | Average Number of Working Persons | | Per Cent of Retiree Households [1] | |
|---|---|---|---|---|
| | 1998 | 2003 | 1998 | 2003 |
| **All Households** | **1.9** | **1.7** | **2.3** | **3.9** |
| Lowest 20% | 1.1 | 0.9 | 8.5 | 13.9 |
| 2nd Quintile | 1.7 | 1.6 | 1.7 | 4.2 |
| 3rd Quintile | 2.1 | 2.0 | 0.5 | 1.0 |
| 4th Quintile | 2.3 | 2.1 | 0.3 | 0.3 |
| Highest 20% | 2.2 | 2.1 | 0.2 | 0.3 |

[1]  Retiree households referred to those comprising only non-working persons aged 60 years and over.

TABLE 2     DISTRIBUTION OF HOUSEHOLDS BY TYPE OF HOUSE

Per Cent

| Per Capita Household Income Group | Year | Private Houses/ Flats | Public Flats | | | | | Others |
|---|---|---|---|---|---|---|---|---|
| | | | Total | 1- & 2- Room | 3-Room | 4-Room & Larger | Others | |
| **All Households** | **1998** | **9.4** | **90.5** | **6.6** | **30.8** | **52.3** | **0.8** | **0.2** |
| | **2003** | **12.3** | **87.6** | **4.9** | **22.5** | **59.5** | **0.7** | **0.1** |
| Lowest 20% | 1998 | 2.3 | 97.6 | 15.7 | 41.8 | 39.9 | 0.2 | 0.2 |
| | 2003 | 2.7 | 97.2 | 12.7 | 33.4 | 50.7 | 0.4 | 0.1 |
| 2nd Quintile | 1998 | 1.9 | 97.9 | 8.8 | 37.5 | 51.2 | 0.4 | 0.2 |
| | 2003 | 3.6 | 96.3 | 6.2 | 25.2 | 64.7 | 0.2 | 0.1 |
| 3rd Quintile | 1998 | 3.9 | 96.0 | 5.8 | 30.8 | 58.8 | 0.7 | 0.1 |
| | 2003 | 4.7 | 95.0 | 3.6 | 23.1 | 67.8 | 0.4 | 0.3 |
| 4th Quintile | 1998 | 8.8 | 91.2 | 2.1 | 26.6 | 61.4 | 1.1 | – |
| | 2003 | 14.1 | 85.9 | 1.3 | 17.9 | 65.8 | 0.9 | 0.1 |
| Highest 20% | 1998 | 30.1 | 69.6 | 0.8 | 17.0 | 50.3 | 1.4 | 0.4 |
| | 2003 | 36.4 | 63.4 | 0.4 | 13.0 | 48.6 | 1.3 | 0.1 |

## Higher Ownership of Homes and Consumer Durables

During 1998–2003, home ownership was high and consumer durables continued to be prevalent among households, including those in the lowest quintile group (Chart 2 and Table 3).

The ownership rate for the lowest quintile group was remarkably high at 87 per cent, up from 84 per cent in 1998.  This compared favourably with the other quintile groups.

In comparison with the other quintile groups, significant improvements in ownership of most consumer durables were also observed for the lowest quintile group.  Some 69 per cent had an audio/video compact disc player in 2003, up from 41 per cent in 1998.  About half of the households in the lowest quintile group installed air-conditioners in their homes in 2003, compared with only 37 per cent in 1998.  Those with handphones, PCs and Internet access also rose noticeably during the period.

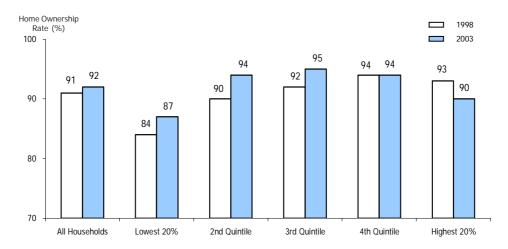CHART 2     HOME OWNERSHIP RATE BY QUINTILE

TABLE 3    OWNERSHIP OF SELECTED CONSUMER DURABLES BY QUINTILE

Per Cent

| Per Capita Household Income Group | Air-Conditioner | | Audio/Video CD Player | | Personal Computer | | Handphone | |
|---|---|---|---|---|---|---|---|---|
| | 1998 | 2003 | 1998 | 2003 | 1998 | 2003 | 1998 | 2003 |
| **All Households** | **58** | **72** | **57** | **83** | **47** | **70** | **51** | **89** |
| Lowest 20% | 37 | 50 | 41 | 69 | 25 | 48 | 29 | 72 |
| 2nd Quintile | 47 | 63 | 52 | 81 | 36 | 63 | 42 | 87 |
| 3rd Quintile | 56 | 73 | 57 | 86 | 47 | 72 | 51 | 93 |
| 4th Quintile | 67 | 82 | 64 | 89 | 58 | 81 | 62 | 96 |
| Highest 20% | 82 | 90 | 69 | 91 | 71 | 87 | 69 | 98 |

## Household Expenditure and Income Trends

In the Household Expenditure Survey, expenditure data referred to consumption expenditure. Non-consumption expenditure such as loan repayments, income tax, etc were excluded. Household income from all sources included regular income from work, as well as those received from investment, rentals and other sources.

### *Increases in Household Expenditure for All Quintiles except Lowest 20%*

Between 1998 and 2003, household expenditure increased for all quintile groups[2], except for the lowest quintile group which registered a marginal decline (Table 4). The average annual increases in household expenditure during this period were lower than those registered during 1993–1998 for every quintile group. This was because the Singapore economy was hit by several adverse

TABLE 4    AVERAGE MONTHLY HOUSEHOLD EXPENDITURE [1] BY QUINTILE, 1993–2003

| Household Income Group | Dollar | | | Per Cent Change Per Annum | |
|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1993–1998 [2] | 1998–2003 |
| **All Households** | **2,662** | **3,095** | **3,244** | **4.1** | **0.9** |
| Lowest 20% | 1,114 | 1,270 | 1,259 | 6.2 | −0.2 |
| 2nd Quintile | 1,605 | 2,047 | 2,100 | 5.9 | 0.5 |
| 3rd Quintile | 2,210 | 2,689 | 2,797 | 5.3 | 0.8 |
| 4th Quintile | 2,958 | 3,577 | 3,904 | 4.6 | 1.8 |
| Highest 20% | 5,425 | 5,891 | 6,160 | 2.1 | 0.9 |

[1]   Expenditure and income data excluded imputed rental of owner-occupied accommodation.

[2]   Data on one-person households were not collected in the HES 1992/93. Hence, one-person households were excluded from 1998 data when comparisons were made with 1993 data.

[2]   Quintiles in this section are based on ranking of households by their household income from all sources.

shocks such as the US-Iraq war and Severe Acute Respiratory Syndrome (SARS) outbreak during 1998–2003.  As a result, households tended to be more cautious and restrained in their spending during this period.

### Household Income Growth for All Quintiles except Lowest Two Quintiles

The slowdown in the economy during 1998–2003 had a significant impact on the labour market and earnings of household members.  The top two quintile groups registered positive income growth while household income for the bottom two quintile groups fell by 3.2 per cent and 0.6 per cent per annum respectively (Table 5).  This was a contrast to the

period 1993–1998 when household income increased for all quintile groups.

### Positive Impact of Government Financial Assistance

The decline in household income for the lowest two quintile groups, as shown in Table 5, reflected partly a decline in the household size during 1998–2003.  To gauge the impact of household size on the level of household income, changes based on per capita household income were further analysed.

Table 6 shows the monthly per capita household income by quintile groups.  The effect of the

TABLE 5    AVERAGE MONTHLY HOUSEHOLD INCOME [1] BY QUINTILE, 1993–2003

| Household Income Group | Dollar | | | Per Cent Change Per Annum | |
|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1993–1998 [2] | 1998–2003 |
| **All Households** | **3,458** | **4,608** | **4,867** | **6.9** | **1.1** |
| Lowest 20% | 887 | 933 | 795 | 5.0 | −3.2 |
| 2nd Quintile | 1,645 | 2,118 | 2,059 | 7.0 | −0.6 |
| 3rd Quintile | 2,487 | 3,374 | 3,379 | 7.5 | − |
| 4th Quintile | 3,799 | 5,162 | 5,309 | 7.1 | 0.6 |
| Highest 20% | 8,469 | 11,450 | 12,792 | 6.8 | 2.2 |

[1]   Expenditure and income data excluded imputed rental of owner-occupied accommodation.

[2]   Data on one-person households were not collected in the HES 1992/93.  Hence, one-person households were excluded from 1998 data when comparisons were made with 1993 data.

TABLE 6    AVERAGE MONTHLY PER CAPITA HOUSEHOLD INCOME [1] BY QUINTILE

| Per Capita Household Income Group | Income ($) | | | Rebates [2] ($) | | Income + Rebates ($) | | | Per Cent Change Per Annum | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1998 | 2003 | 1993 | 1998 | 2003 | 1993–1998 [3] | 1998–2003 |
| **All Households** | **857** | **1,298** | **1,457** | **2** | **25** | **857** | **1,300** | **1,482** | **9.9** | **2.7** |
| Lowest 20% | 240 | 304 | 281 | 2 | 27 | 240 | 306 | 308 | 9.9 | 0.1 |
| 2nd Quintile | 422 | 608 | 635 | 2 | 25 | 422 | 610 | 660 | 10.1 | 1.6 |
| 3rd Quintile | 620 | 940 | 1,004 | 2 | 25 | 620 | 942 | 1,029 | 10.6 | 1.8 |
| 4th Quintile | 929 | 1,424 | 1,572 | 1 | 25 | 929 | 1,425 | 1,597 | 10.4 | 2.3 |
| Highest 20% | 2,072 | 3,215 | 3,790 | 1 | 26 | 2,072 | 3,216 | 3,816 | 9.5 | 3.5 |

[1]   Expenditure and income data excluded imputed rental of owner-occupied accommodation.

[2]   Rebates in 1998 and 2003 included rebates on rent and utilities for HDB flats and ERS.  Such rebates and ERS were not given out in 1993.

[3]   Data on one-person households were not collected in the HES 1992/93.  Hence, one-person households were excluded from 1998 data when comparisons were made with 1993 data.

various government financial assistance schemes such as rebates on HDB rents and utilities and the Economic Restructuring Shares (ERS) which were provided by the government during the economic slowdown were also included to provide a complete picture of the overall financial situation of the households.

After taking into account the various govern-ment financial assistance, all quintile groups showed per capita income growth during 1998–2003. The lowest quintile group registered a slight increase in per capita income (0.1 per cent per annum) during 1998–2003 instead of a decline in household income as shown in Table 5. This suggests that the government financial assistance has helped to improve the

financial situation of the households, especially those in the lower income groups.

## Household Expenditure Patterns

The household expenditure pattern had undergone some changes, reflecting greater affluence and other socio-economic factors such as an ageing population. In 2003, the top three expenditure groups were housing[3], transport & communication and food (Chart 3).

Food continued to form the most important expenditure category for the lowest three quintile groups while the top two quintile
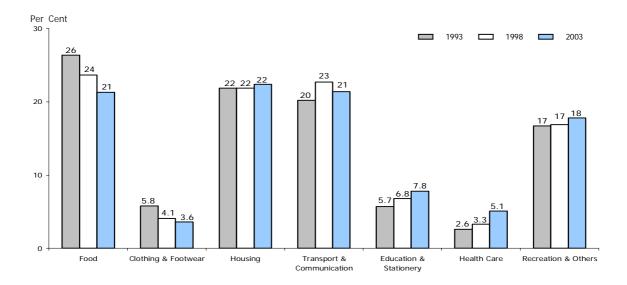
CHART 3     HOUSEHOLD EXPENDITURE PATTERN



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[3]   For owner-occupied accommodation in the housing group, imputed rental is included based on the Annual Assessed Value (AAV) of the house/flat to be consistent with the data used for the computation of the weighting pattern of the Consumer Price Index (CPI).

groups spent most on transport & communication (Table 7). The share of household expenditure on transport had fallen in 2003 as a result of declining car prices as well as lower spending on road tax and repairs & servicing of cars. Conversely, communication constituted a higher proportion due to increased spending on info-communication products and services over the decade.

The percentage share of health care expenditure was higher in 2003 for every quintile group, compared with a decade ago. This was due to greater demand for health care services associated with our ageing population. The share of expenditure on education & stationery increased during 1998–2003 for all quintile groups, except the lowest quintile group.

TABLE 7    HOUSEHOLD EXPENDITURE ON SELECTED EXPENDITURE GROUPS BY QUINTILE

Per Cent

| Household Income Group | Food | | Transport | | Communicaton | | Education & Stationery | | Health Care | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | 2003 | 1998 | 2003 | 1998 | 2003 | 1998 | 2003 | 1998 | 2003 |
| **All Households** | **23.7** | **21.3** | **19.1** | **16.7** | **3.6** | **4.7** | **6.8** | **7.8** | **3.3** | **5.1** |
| Lowest 20% | 32.2 | 28.3 | 9.0 | 8.9 | 3.7 | 5.3 | 6.2 | 5.7 | 4.2 | 7.0 |
| 2nd Quintile | 29.9 | 26.6 | 12.3 | 11.6 | 3.9 | 5.5 | 6.4 | 7.6 | 2.8 | 5.3 |
| 3rd Quintile | 27.0 | 24.2 | 16.2 | 15.1 | 4.3 | 5.5 | 6.8 | 7.3 | 4.0 | 5.2 |
| 4th Quintile | 24.5 | 21.6 | 20.0 | 18.6 | 3.9 | 5.0 | 6.6 | 8.0 | 3.0 | 4.8 |
| Highest 20% | 17.9 | 16.6 | 24.2 | 19.5 | 3.1 | 3.7 | 7.2 | 8.4 | 3.0 | 4.7 |

## Conclusion

Despite the adverse factors affecting the Singapore economy during 1998–2003, both household income and expenditure registered increases for households in most income groups, albeit smaller than those recorded during 1993–1998. Home ownership rate remained high and households were also living in better housing and enjoying greater access to most household durables.

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# Revision of the Consumer Price Index (CPI) for Households in Different Income Groups

(Base Year 2004 = 100)

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## Introduction

The general Consumer Price Index (CPI), compiled by the Singapore Department of Statistics (DOS), measures the inflation rate experienced by the average households in Singapore.  To assess the impact of price changes on households in different income groups, CPIs for the lowest 20%, middle 60% and highest 20% income groups have also been compiled and published twice a year since 1995.

Based on the latest results of the Household Expenditure Survey (HES) conducted during 2002/03, the CPI for the general households and the three-income groups were revised and released in March 2005 and August 2005 respectively.

## Coverage of CPI

For the compilation of CPI, the types and specifications of the goods and services in the CPI basket as well as their quantities are kept constant at the base period.  This ensures that any changes in the index reflect solely price changes over time.  Only consumption expenditure is included in the CPI.  Non-consumption expenditure such as transfers, income and property taxes, as well as purchase of house, shares or other financial assets are outside the scope of CPI.

## CPI Weighting Patterns

The expenditure records of some 6,070 households with two or more persons who were covered in the HES 2002/03, were used to derive the weighting patterns for the three income groups.  Households were categorized into three income groups, namely lowest 20%, middle 60%, and highest 20% based on the ranking of the households by household income from all sources.

The relative proportions of spending by households in 2002/03 were derived as the weights for all items included in the compilation of the respective CPIs, after taking into account price changes in 2004.  The weighting patterns for the three income series based on 1997/98 and 2004 are given in Table 1.

Food accounted for the biggest share of the household budget for the lowest and middle income groups.  In contrast, expenditure on transport and communication ranked top for the highest 20% income group, due to their relatively higher spending on private road transport.  However, the weight for food continued to decline for all the three income groups, reflecting the general shift in expenditure to discretionary items as well as services resulting from life-cycle changes.

TABLE 1    WEIGHTING PATTERNS FOR HOUSEHOLDS* IN DIFFERENT INCOME GROUPS,
1997/98 AND 2004

| | 1997/98-Based | | | 2004-Based | | |
|---|---|---|---|---|---|---|
| | Lowest 20% | Middle 60% | Highest 20% | Lowest 20% | Middle 60% | Highest 20% |
| **All Items** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |
| Food | 33.2 | 27.6 | 18.0 | 29.6 | 24.1 | 17.0 |
| *Non-Cooked Food* | *17.1* | *12.2* | *7.7* | *14.9* | *10.5* | *7.0* |
| *Cooked Food* | *16.1* | *15.4* | *10.3* | *14.7* | *13.6* | *10.0* |
| Clothing & Footwear | 3.6 | 4.5 | 3.8 | 2.7 | 3.8 | 3.7 |
| Housing | 26.4 | 20.6 | 22.5 | 26.0 | 20.5 | 22.2 |
| Transport & Communication | 13.7 | 21.4 | 27.8 | 14.8 | 21.5 | 23.2 |
| *Transport* | *9.9* | *17.3* | *24.7* | *9.6* | *16.1* | *19.5* |
| *Communication* | *3.8* | *4.1* | *3.1* | *5.2* | *5.3* | *3.7* |
| Education & Stationery | 6.9 | 6.8 | 7.3 | 7.0 | 8.2 | 9.0 |
| Health Care | 3.7 | 3.4 | 3.1 | 6.7 | 5.2 | 4.8 |
| Recreation & Others | 12.5 | 15.8 | 17.5 | 13.2 | 16.7 | 20.1 |

*    Households with two or more persons.

## Changes in the Consumer Price Index

Both the weights (spending patterns) and the rate of price changes in items consumed by the households would affect the inflation rates experienced by the different income groups. Table 2 shows the comparison of the CPI changes for the three income groups during the first half of 2005, based on the weighting pattern of 2004 and that of 1997/98.

In the 2004-based series, the CPI for general households rose marginally by 0.2 per cent in the first six months of 2005 over the same period in 2004.  The corresponding inflation rates for the lowest and middle income groups were 1.0 per cent and 0.3 per cent respectively.

In contrast, the 2004-based CPI for the highest income group declined by 0.5 per cent during the first half of 2005.  The trend is consistent with that compiled based on the 1997/98 basket.

The increase in the 2004-based CPI for the lowest 20% income group during the first six months of 2005 was mainly attributed to dearer food (in particular non-cooked food like fresh pork, poultry and seafood), cigarettes as well as higher conservancy & service charges and electricity tariffs.

TABLE 2    PER CENT CHANGE IN CPI FOR HOUSEHOLDS IN DIFFERENT INCOME GROUPS,
JAN-JUN 2005

(Over Corresponding Period of Previous Year)

| | 1997/98-Based | | | 2004-Based | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Lowest 20% | Middle 60% | Highest 20% | General Households* | Lowest 20% | Middle 60% | Highest 20% |
| **All Items** | **1.6** | **0.6** | **−0.6** | **0.2** | **1.0** | **0.3** | **−0.5** |
| Food | 1.9 | 1.7 | 2.0 | 1.7 | 1.8 | 1.6 | 1.8 |
| *Non-Cooked Food* | *2.8* | *2.7* | *2.7* | *2.9* | *3.0* | *2.9* | *2.9* |
| *Cooked Food* | *0.9* | *1.0* | *1.4* | *0.7* | *0.5* | *0.7* | *1.0* |
| Clothing & Footwear | 0.2 | 0.5 | 0.8 | 0.2 | −0.4 | 0.1 | 0.3 |
| Housing | 0.6 | 0.6 | 0.1 | – | 0.5 | – | −0.3 |
| Transport & Communication | 0.1 | −2.0 | −3.9 | −2.5 | −1.2 | −2.2 | −3.5 |
| *Transport* | *0.2* | *−2.5* | *−4.4* | *−3.0* | *−1.6* | *−2.6* | *−4.0* |
| *Communication* | *−0.1* | *−0.1* | *0.1* | *−0.9* | *−0.6* | *−0.9* | *−1.2* |
| Education & Stationery | 3.1 | 2.7 | 3.5 | 1.8 | 1.6 | 1.7 | 2.6 |
| Health Care | 0.7 | 0.7 | 1.1 | 0.3 | 0.3 | 0.3 | 0.5 |
| Recreation & Others | 3.7 | 0.9 | −2.2 | 0.9 | 3.3 | 1.2 | −0.7 |

\*   The index households constituted the middle 90% of all households with two or more persons by expenditure distribution.

For the middle 60% income group, additional items (over those for the lowest 20% income group) that contributed to the marginal rise in its CPI were higher overseas university tuition fees and salary for foreign maids as well as more expensive holiday travel.

Lower car prices and government levy on foreign maids were noted during January–June 2005. These price declines, coupled with their relatively higher weightage (compared to the lowest and middle income groups), caused the 2004-based CPI for the highest income group to drop by 0.5 per cent during the first half of 2005.

## Conclusion

The inflation rates for the lowest 20%, middle 60% and highest 20% income groups in the first half of 2005 reflect mainly the different consumption patterns and types of goods and services in their respective CPI baskets, notwithstanding moderate price increase for most items.

The press release on the CPI for households in the three income groups, for January–June 2005, is accessible from the SingStat website at :

**http://www.singstat.gov.sg/press/cpihhlds.html**

# Seasonal Adjustment of Time Series

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## Introduction

Seasonal adjustment is a process of using analytical techniques to estimate and remove seasonal and calendar effects, which may otherwise conceal and distort the true underlying movement of time series.

This article provides a brief overview of seasonal adjustment and outlines the seasonal adjustment methodology adopted by the Singapore Department of Statistics (DOS).

## Seasonality and Calendar Effects

Seasonality, or seasonal effect, is the intra-year periodic variation of a time series. This variation, which repeats itself in the same month or quarter every year, may be due to cultural festivals, social customs, or climatic changes. For example, visitor arrivals to Singapore tend to be higher in December which coincides with the month-long festive and vacation period.

Calendar effect refers to the variation in a time series arising from the composition of the calendar. The two main calendar effects are trading day effect and moving holiday effect.

Trading day effect arises from the difference in the number of working, or trading, days in a month. For example, industrial production tends to be higher in a particular January with 23 working days compared with another January with only 21 working days. Trading day effects are rarely evident in quarterly series, as the calendar composition over the quarters does not vary significantly.

Moving holiday effect arises from the shifting of holidays or festive periods in the calendar. Chinese New Year[1] and Hari Raya Puasa are two examples of moving holidays in Singapore.

## Decomposition of Time Series

Generally, we can decompose a time series into three main components – the trend-cycle component, the seasonal component, and the irregular component.

(a)   The trend-cycle (TC) component is the combined long-term trend and the business-cycle movement of the series.

(b)   The seasonal (S) component includes both seasonality and calendar effects.

(c)   The irregular (I) component, which is the residual after removing the trend-cycle and seasonal components, captures the random fluctuations of the short-term movement in the series.

Let $X_t$, $TC_t$, $S_t$ and $I_t$ denote respectively the original non-seasonally adjusted (NSA) data, the trend-cycle component, the seasonal component, and the irregular component at period $t$. In the seasonal adjustment process, decomposition models are mostly multiplicative or additive. The model generally adopted by DOS is the multiplicative one, although the additive model is applied to certain series.

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[1]   Chinese New Year effect can be ignored in quarterly series, as it always falls in the first quarter of each calendar year.

The multiplicative model can be expressed as $X_t = TC_t \cdot S_t \cdot I_t$. This model assumes that the absolute size of the seasonal and irregular variations depends on the level of the series – the higher the level, the greater the amplitude of oscillation. Empirical studies show that this is typical of most macroeconomic series.

The additive model can be expressed as $X_t = TC_t + S_t + I_t$. This model assumes that the size of the seasonal and irregular variations does not depend on the magnitude of the trend-cycle component.

As an illustration, the multiplicative model is more suitable for the series in Chart 1A, while the additive model is more appropriate for the series in Chart 1B.

Seasonal adjustment seeks to estimate and remove the seasonal component, leaving behind the trend-cycle and irregular components ($TC_t \cdot I_t$ for multiplicative model; $TC_t + I_t$ for additive model).

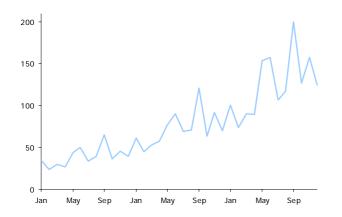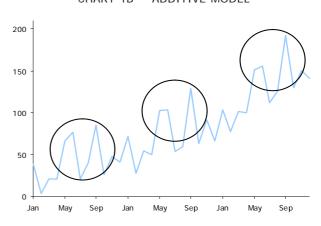CHART 1A    MULTIPLICATIVE MODEL

CHART 1B    ADDITIVE MODEL



Note that the size of the 'spikes' in Chart 1A increases as the series moves upwards, while the size of the 'spikes' in Chart 1B remains constant.

## How Seasonal Adjustment is Performed

DOS uses the X12-ARIMA method developed by the US Census Bureau to perform seasonal adjustment. X12-ARIMA is an enhancement to its predecessor, the X11-ARIMA method. X12-ARIMA has the improved capability of extending the series[2] using regARIMA modeling prior to the actual seasonal adjustment procedure. It also incorporates additional model diagnostics to better gauge the quality of the adjustment.

Conceptually, the TC and S components cannot be estimated simultaneously – estimation of the TC component cannot be done without prior knowledge of the S component, and estimation of the S component cannot be done without prior knowledge of the TC component. The X12-ARIMA method alternately estimates the TC and the S components through an iterative estimation procedure, by using series of moving averages, to derive the final seasonally adjusted (SA) figures.

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[2]    Studies show that extension of the series improves the estimates of the seasonal components and reduces future revisions as more data become available.

In principle, there are two approaches to perform seasonal adjustment – the *forward factors* method and the *concurrent adjustment* method.

For monthly data, DOS performs seasonal adjustment annually after the December figures become available. Forward factors, which are the estimates of the seasonal components for each of the next twelve months, are estimated during the annual seasonal adjustment. During the year, when the NSA figures become available, the SA figures are derived by dividing the NSA figures by the corresponding forward factors (or by subtraction if an additive model is used).

For quarterly series, DOS generally performs seasonal adjustment concurrently. In concurrent adjustment, when a new data point is available, the X12-ARIMA program is run on the entire series to obtain the SA series up to the current period. However, as concurrent adjustment results in frequent and significant revisions to the SA data, the forward factor adjustment method is used for important and closely monitored economic indicators like the quarterly GDP estimates.
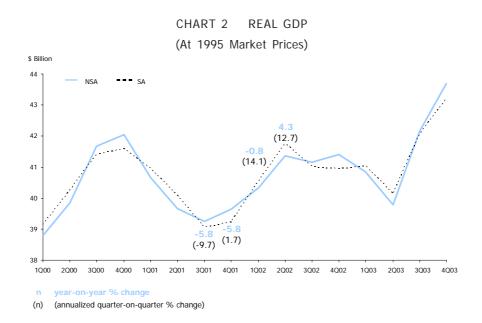
## Uses of Seasonally Adjusted Data

Traditionally, the monthly (quarterly) growth rates are computed as the percentage change from the corresponding month (quarter) in the previous year in the NSA data, giving what is termed the year-on-year growth rates. Year-on-year growth rates are simple to compute and easy to understand, but are not sensitive enough to quickly detect any changes in the growth momentum. They are also greatly affected by trading day and moving holiday effects.

Month-on-month (or quarter-on-quarter) change – which is the percentage change over the previous month (or quarter) – of the SA data provides a more meaningful comparison over a shorter time frame, and is useful for early detection of turning points.

To facilitate comparison with the more conventional annual growth rates, month-on-month and quarter-on-quarter growth rates can be annualized, ie computed to show what the annual growth rate will be if the quarterly or monthly growth rates are maintained for a one-year period.

Chart 2 shows Singapore's real GDP over the period 2000–2003, together with the year-on-year and quarter-on-quarter (annualized) growth rates. The quarter-on-quarter growth rate was able to detect a turning point in 4Q01, but the year-on-year growth rate detected the turning point only in 2Q02, a lag of two quarters.

CHART 2     REAL GDP
(At 1995 Market Prices)



**n**     **year-on-year % change**
(n)     (annualized quarter-on-quarter % change)

## Some Frequently Asked Questions

### How is it possible that, for a particular month, the NSA data shows an increase over the previous month but the SA data shows a decrease?

This happens when the increase is less than the usual seasonal increase. To illustrate, consider the retail sales index (RSI) which tends to increase sharply in December during the festive season. Suppose that an economic downturn results in a weak performance of the retail sector, the unadjusted RSI for December might still show a moderate increase over November. But because this increase is lower than that for a typical December, the seasonally adjusted RSI for December would be lower than the corresponding seasonally adjusted RSI for November.

### Why are there revisions to the SA data when no revisions are made to the NSA data?

This happens when new data points are used in the seasonal adjustment. For seasonal adjustment using the forward adjustment method, this takes place during the annual re-analysis of the data series. For concurrently adjusted data series, the entire SA series is revised with each new additional data point.

### Why doesn't seasonal adjustment smooth out some spikes in the time series?

The purpose of seasonal adjustment is not to smooth the original time series (although very often, the SA series does appear to be smoother). Rather, the aim is to remove the seasonal component from the time series. One-time events, which may cause a sudden spike in the series, are not seasonal or calendar effects, and will not be removed by the seasonal adjustment procedure.

For example, the SARS (Severe Acute Respiratory Syndrome) episode in 2003 resulted in a sharp decline in tourist arrivals to Singapore from April to June. This outlier effect is temporarily adjusted for prior to seasonal adjustment in order not to skew the estimation of the seasonal factors. However, this effect is not removed in the SA data as the effect is not seasonal in nature.

### Why are there no seasonally adjusted data for annual series?

Seasonal adjustment adjusts for the intra-year variation that repeats either periodically or in a systematic manner. This variation is not present in annual series. Hence, it is conceptually meaningless to seasonally adjust annual series.

## Launch of New Online Payment Service

To provide greater convenience and flexibility to our users, the Singapore Department of Statistics has launched the Online Payment facility which allows payment to be made electronically. With Online Payment, you could now avoid the hassle of posting cheque/bankdraft or making payment personally at the Department before the due date.

Online Payment offers 3 payment modes, namely : Visa/Mastercard, Internet Direct Debit (if you have an internet banking account with the DBS Bank of Singapore, United Overseas Bank and Citibank) and Flexipay (for local users only). With Flexipay, you could decide when to effect the payment from your bank account. Simply sign a one-time Direct Debit Authorisation (DDA) form and use your SingPass to authenticate and authorize payment.

To find out more about the payment procedure or to proceed with online payment, visit the Statistics Singapore website at

**http://www.singstat.gov.sg/pdtsvc/eservices/payment.html**

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# Educational Upgrading through Private Educational Institutions, 2004

By
Miss Lee Su Jun
Business Statistics Division
Singapore Department of Statistics

## Introduction

The Education Services Survey[1] covers private organisations that offer certificate, diploma, degree, higher degree and professional courses[2]. In 2004, there were 166 private educational institutions. Student enrolment[3] was 106,700, while the number of graduates totalled 29,000.

Of these 166 private institutions, 140 offered programmes in collaboration with overseas educational institutions. Some 80,200 students were enrolled in these external educational programmes. Graduates from the external courses stood at 17,800.

## Business Profile

On average, the private educational institutions employed 34 workers and collected operating receipts of about $4.2 million per institution in 2004 (Table 1). Small and medium sized institutions dominated the industry, accounting for 91 per cent of the total number. The proportion of profitable large institutions was higher at 71 per cent compared to small and medium ones (44 per cent and 65 per cent respectively).

TABLE 1    PERFORMANCE OF PRIVATE EDUCATIONAL INSTITUTIONS, 2004

| Firm Size | Proportion of Institutions (%) | Proportion of Profitable Institutions [1] (%) | Average Employment (No.) | Average Operating Receipts ($'000) |
|---|---|---|---|---|
| **Total** | **100.0** | **59.2** | **34.4** | **4,195.1** |
| < 10 Workers     (Small) | 31.3 | 44.0 | 3.8 | 435.1 |
| 10 – 99 Workers (Medium) | 59.6 | 65.3 | 24.9 | 3,003.4 |
| ≥ 100  Workers  (Large) | 9.1 | 71.4 | 202.0 | 24,958.3 |

[1]    Exclude non-profit organisations.

Note :  Data are based only on private educational institutions which were able to provide data on financial performance.

[1]    Data presented in the article are based on preliminary findings of the survey for reference year 2004.

[2]    Comprise only courses which award certificate ('O' level, 'A' level or equivalent), diploma, degree, higher degree and professional qualifications as a result of formal learning and examination. Exclude certificates of course attendance and honorary qualifications.

[3]    Includes students admitted in 2004, those who were admitted in previous years but still in the programme in 2004 as well as those who passed their examinations and completed the course in 2004. Graduates in 2004 constituted part of student enrolment.

## Profile of Student Enrolment and Graduates

### By Course Duration, Type of Course and Field of Study

The 166 private educational institutions conducted a total of 1,035 courses in 2004, of which 404 were diploma courses (Table 2). Part-time courses formed the majority across all the course types, as these private educational institutions catered mainly to working adults who wish to upgrade their educational qualifications.

The average course duration varied from 13 months (certificate) to 22 months (diploma) for full-time courses and 16 months (certificate) to 33 months (degree) for part-time courses.

TABLE 2    NUMBER OF COURSES AND AVERAGE COURSE DURATION, 2004

|  | Certificate | Diploma | Degree | Higher Degree | Professional |
|---|---|---|---|---|---|
| **No. of Courses** | | | | | |
| **Total** | **240** | **404** | **261** | **122** | **8** |
| Full-time | 39 | 109 | 64 | 10 | – |
| Part-time | 201 | 295 | 196 | 110 | 8 |
| Distance-Learning | – | – | 1 | 2 | – |
| **Average Course Duration (Months)** | | | | | |
| **Total** | **16** | **17** | **30** | **24** | **29** |
| Full-time | 13 | 22 | 19 | 18 | – |
| Part-time | 16 | 16 | 33 | 24 | 29 |
| Distance-Learning | – | – | 36 | 24 | – |

Note :  Similar courses offered by different private educational institutions are counted separately.

Among the various course types, student enrolment for diploma courses constituted the largest share of 35 per cent in 2004 (Chart 1). Correspondingly, the proportion of graduates from diploma courses was also the largest (44 per cent) in that year. This course type is popular among students as diploma qualifications are usually considered as the first step to acquiring a tertiary education.

The most popular field of study was Business & Administration. Students pursuing courses in this field and graduates from Business & Administration formed 50 per cent of total student enrolment and graduates in 2004 (Chart 2). Another course with significant enrolment was Information Technology (IT), accounting for 15 per cent of total student enrolment.  These two "office-oriented" courses appeal to students as most would likely be working adults seeking to upgrade their skills in the areas of IT and business administration & management.

CHART 1    PER CENT DISTRIBUTION OF
           STUDENT ENROLMENT AND GRADUATES
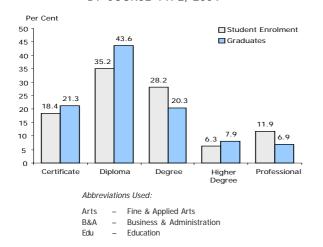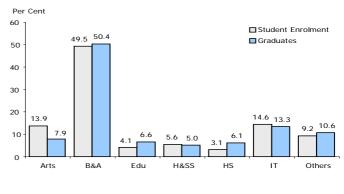           BY COURSE TYPE, 2004

Per Cent

- Student Enrolment
- Graduates

| | Certificate | Diploma | Degree | Higher Degree | Professional |
|---|---|---|---|---|---|
| Student Enrolment | 18.4 | 35.2 | 28.2 | 6.3 | 11.9 |
| Graduates | 21.3 | 43.6 | 20.3 | 7.9 | 6.9 |

*Abbreviations Used:*

Arts  –  Fine & Applied Arts
B&A  –  Business & Administration
Edu  –  Education

CHART 2    PER CENT DISTRIBUTION OF
           STUDENT ENROLMENT AND GRADUATES
           BY FIELD OF STUDY, 2004

Per Cent

- Student Enrolment
- Graduates

| | Arts | B&A | Edu | H&SS | HS | IT | Others |
|---|---|---|---|---|---|---|---|
| Student Enrolment | 13.9 | 49.5 | 4.1 | 5.6 | 3.1 | 14.6 | 9.2 |
| Graduates | 7.9 | 50.4 | 6.6 | 5.0 | 6.1 | 13.3 | 10.6 |

H&SS  –  Humanities & Social Sciences
HS  –  Health Sciences
IT  –  Information Technology

## By Gender and Age Group

There were more female than male students enrolled in courses conducted by private educational institutions in 2004. The proportion of female graduates was also higher at 57 per cent (Table 3). The female-male ratio for enrolled students and graduates were 1.1 and 1.3 respectively.

Majority of the enrolled students and graduates in private educational institutions were aged below 30 years. Individuals in this age group accounted for 63 per cent and 55 per cent of the total enrolment and graduate count respectively in 2004. In contrast, those aged 40 years and over formed less than 14 per cent of both enrolment and graduate count. This shows that the younger age group perceives educational upgrading as an important step in the pursuit of additional knowledge or acquiring of new skills.

TABLE 3    STUDENT ENROLMENT AND GRADUATES
           BY GENDER AND AGE GROUP, 2004

| | Per Cent | |
|---|---|---|
| | Student Enrolment | Graduates |
| **Gender** | | |
| Male | 46.7 | 43.1 |
| Female | 53.3 | 56.9 |
| **Age Group (Years)** | | |
| < 30 | 62.9 | 55.3 |
| 30 – 39 | 26.4 | 31.1 |
| 40 & Above | 10.7 | 13.6 |

Note :  Data are based only on private educational institutions which were able to provide breakdown on gender and age group.

# Import & Export Price Indices, Singapore Manufactured Products and Domestic Supply Price Indices

## 1st Half 2005

The **Import Price Index** increased by 3.7 per cent in 1H05 over 1H04, following a 3.1 per cent rise in 2H04 over 2H03.  Higher oil prices, which rose by 31 per cent, contributed significantly to the rise in the index.  The non-oil sub-index dropped slightly by 0.9 per cent in 1H05 over 1H04, due mainly to the decline of 3.8 per cent in machinery & transport equipment prices.

The **Export Price Index** which rose by 1.6 per cent in 2H04 over 2H03, recorded a 0.2 per cent increase in 1H05 over 1H04.  The 32 per cent increase in the oil sub-index was partly offset by the 4.7 per cent decline in the non-oil sub-index. The main contributor to the decline in the non-oil sub-index was machinery & transport equipment  whose prices fell by 9.1 per cent.

CHART 1     IMPORT PRICE INDEX

Change Over Previous Year

CHART 2     EXPORT PRICE INDEX

Change Over Previous Year

The **Singapore Manufactured Products Price Index** increased by 6.2 per cent in 1H05 over 1H04, after posting a 7.8 per cent rise in 2H04 over 2H03. The rise was mostly due to higher oil prices, which rose by 35 per cent.  The rise in prices for chemicals & chemical products (16 per cent) caused the non-oil sub-index to increase by 0.3 per cent.

The **Domestic Supply Price Index**, which measures the change in prices of imported and locally manufactured goods retained for use in the economy, rose by 8.4 per cent in 1H05 over 1H04.  The oil and non-oil sub-indices increased by 34 per cent and 0.4 per cent respectively in 1H05.

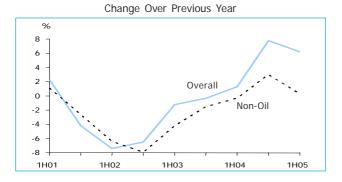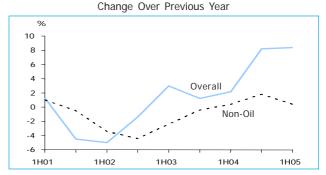CHART 3     SINGAPORE MANUFACTURED PRODUCTS
             PRICE INDEX

Change Over Previous Year

CHART 4     DOMESTIC SUPPLY PRICE INDEX

Change Over Previous Year

# National Health Survey 2004

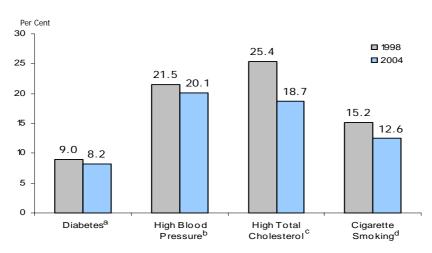*… Do you know that the health of Singaporeans has improved in recent years?*

The National Health Survey 2004 (NHS 2004) was conducted from September to December 2004. This survey is the third in the series carried out by the Ministry of Health to assess the health status of Singaporeans in relation to major health problems such as diabetes and high blood pressure.

**Declines in Prevalence of Non-Communicable Diseases and Associated Risk Factors among Singapore Residents**

Findings from the NHS 2004 showed that the proportion of adults aged 18 to 69 years with diabetes declined from 9.0 per cent in 1998 to 8.2 per cent in 2004 (Chart 1).  The prevalence of high blood pressure among adults also declined from 21.5 per cent to 20.1 per cent in 2004 over a six-year period.

Nearly one in five adults had high total cholesterol levels in 2004, compared with about one in four adults in 1998.  The proportion of adults who smoked cigarettes at least once a day decreased from 15.2 per cent in 1998 to 12.6 per cent in 2004.

CHART 1    PREVALENCE OF NON-COMMUNICABLE DISEASES/RISK FACTORS AMONG SINGAPORE RESIDENTS AGED 18 – 69 YEARS, 1998 AND 2004



| | 1998 | 2004 |
|---|---|---|
| Diabetes[a] | 9.0 | 8.2 |
| High Blood Pressure[b] | 21.5 | 20.1 |
| High Total Cholesterol[c] | 25.4 | 18.7 |
| Cigarette Smoking[d] | 15.2 | 12.6 |

a    plasma glucose 2 hours post-OGTT >= 11.1 mmol/l
b    systolic pressure >= 140 mmHg or diastolic pressure >= 90 mmHg
c    total cholesterol >= 6.2 mmol/l
d    smoked cigarettes at least once a day

**More Adults Exercise**

The proportion of adults who exercised regularly increased from 16.8 per cent in 1998 to 24.9 per cent in 2004 (Chart 2). Correspondingly, the proportion of adults who did not exercise declined from 54.7 per cent in 1998 to 48.1 per cent in 2004.

CHART 2      EXERCISE PARTICIPATION STATUS AMONG SINGAPORE RESIDENTS
AGED 18 – 69 YEARS, 1998 AND 2004



Compared with the older age groups, the proportion of adults in the age groups of 18–29 years and 30–39 years who exercised regularly showed larger increases between 1998 and 2004 (Table 1).

TABLE 1      PARTICIPATION IN REGULAR EXERCISE AMONG SINGAPORE RESIDENTS
BY AGE GROUP, 1998 AND 2004

|  |  | Per Cent |
| --- | --- | --- |
| Age Group (Years) | 1998 | 2004 |
| **Total** | **16.8** | **24.9** |
| 18 – 29 | 18.2 | 33.9 |
| 30 – 39 | 11.9 | 21.4 |
| 40 – 49 | 15.8 | 19.6 |
| 50 – 59 | 19.7 | 24.1 |
| 60 – 69 | 28.1 | 28.0 |

For more information on NHS 2004, please refer to :
**http://www.moh.gov.sg/corp/hottopics/NationalHealthSurvey/index.do**

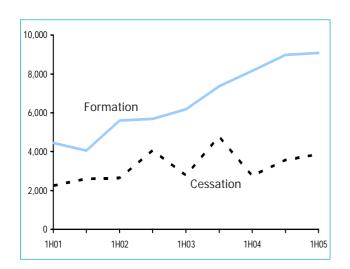# Formation and Cessation of Companies and Businesses, January–June 2005

## Companies

A total of 9,100 companies were formed in 1H05, close to the 9,000 reported in 2H04 but significantly higher than the 8,200 reported in 1H04. Company formation has been showing an increasing trend since 2H01.

In 1H05, all major industries recorded an increase in the number of new companies formed compared with 1H04. The growth in company formation ranged from 3.1 per cent (information and communication industry) to 26 per cent (administrative and support service industry).

Company cessation reached 3,900 in 1H05, an increase of 41 per cent from 1H04. The number of companies which ceased operations during 1H05 was greater than the corresponding figures in 1H04 for all major industries.

## Businesses

In 1H05, the number of new businesses formed stood at 12,100, about the same as that in 2H04. Compared with 1H04, it represented a decline of 6.5 per cent. The number of new business set-ups for most major industries was lower in 1H05 compared with 1H04, with the exception of manufacturing, and administrative & support services industries where business formation grew by 22-25 per cent.

Business cessation more than tripled in 1H05 over 1H04, reaching 24,200. This was mainly due to batch cancellation notices issued by the Accounting and Corporate Regulatory Authority (ACRA) to businesses which have failed to renew their business registration.

CHART 1    FORMATION AND CESSATION OF COMPANIES



CHART 2    FORMATION AND CESSATION OF BUSINESSES

# Overseas  Visitors

The Singapore Department of Statistics received the following visitors in the past seven months.   Topics discussed include Singapore's statistical system, use of administrative and survey data for statistical compilations, statistical infrastructure, census operations, website design, the collection, use and development of international trade in goods and services statistics, data management and analytical techniques for national accounts, balance of payments, flow of funds account, as well as total factor productivity growth in Singapore.

**ASEAN Secretariat**
**–  *ASEAN-Australia Development Cooperation Project, Regional Partnership Scheme***

- Mr John Billing
  Statistical Consultant

**Australia**
**–  *Australian Bureau of Statistics***

- Dr Tam Siu-Ming
  First Assistant Statistician
  Information Management and
  Census Division

**Bahrain**
**–  *Economic Development Board***

- Sheikh Mohammed bin Essa Al-Khalifa
  Chief Executive

- Mr Kamal Ahmed
  Projects Coordinator

**Thailand**
**–  *National Economic and Social Development Board***

- Mrs Wanida Mahakit
  Director
  National Accounts Office

- Mrs Patcharin Srinopnikom
  Director
  Flow-of-Funds Section

- Ms Prapasri Phongwatana
  Director
  Input-Output Section

- Mr Apichai Thamsermsukh
  Plan and Policy Analyst
  Production Accounts Section

**Thailand**
**–  *National Economic and Social Development Board***  (cont'd)

- Mr Chamadanai Marknual
  Plan and Policy Analyst
  Income Accounts Section

- Ms Suphannada Limpanonda
  Plan and Policy Analyst
  Flow-of-Funds Section

**United States**
**–  *Federal Reserve Bank of Minneapolis***

- Prof Edward Prescott
  2004 Nobel Prize Winner in
  Economics & Economic Advisor
  to the Federal Reserve Bank of
  Minneapolis

**Vietnam**
**–  *Vietnamese Prime Minister's Research Commission (PMRC)***

- Mr Dang Duc Dam
  Vice Chairman of PMRC

- Mr Bui Quoc Bao
  Member of PMRC

- Mr Vu An Ninh
  Deputy Director of Information
  – Media Resource Centre of the
  Government Office

- Mrs Hoang Thi Bach Yen
  Deputy Director of Information
  – Media Resource Centre of the
  Government Office

- Mrs Vu Thi Bich
  Expert of Information Resource
  Centre of PMRC

- Miss Nguyen Thi My Dung
  Expert of PMRC

# Economic Survey Series 2003

The Singapore Department of Statistics conducts an annual survey on the services industries to collect a wide range of data for studies and analyses in this sector.  The latest survey was conducted in 2004 for reference year 2003.

The Economic Surveys Series 2003 comprises eight reports.  The first seven contain detailed survey findings and statistical tables on specific economic clusters of importance to Singapore's economy, namely :

- **Education Services**  which focuses on schools and services related to the provision of education and training on various subjects

- **Wholesale Trade**  which focuses on establishments engaged in the wholesaling of household goods, fuels & chemicals, machinery & equipment, general merchandise and other goods

- **Health Services**  which focuses on hospitals, western clinics and specialized medical services, non-western clinics, dental services and other medical services

- **Information Technology Services**  which focuses on IT consultancy services, IT development, hardware maintenance and other IT-related services

- **Retail Trade**  which focuses on establishments engaged in the retail trade of general merchandise, transport equipment, personal goods, household equipment and other goods

- **Food and Beverage Services**  which focuses on restaurants, fast food outlets, food caterers and other services allied to food & beverages

- **Transport Services**  which focuses on establishments engaged in land transport, water transport, air transport, storage & warehousing services and other services allied to transport

Softcopies of these reports can be purchased from the SingStat DataShop@GovMall at :
**http://www.singstat.gov.sg/pdtsvc/eservices/datashop.html**

A final consolidated report on **The Services Sector** will provide a comprehensive performance review of the entire sector.

Key findings of **The Services Sector 2003**, as well as those from the first seven reports of the Economic Surveys Series 2003 are available on the SingStat website at :
**http://www.singstat.gov.sg/keystats/surveys/services.html**

# Population Trends 2005

Singapore Department of Statistics has released a new publication "Population Trends 2005".

"Population Trends 2005" provides a statistical analysis of Singapore's changing population profiles. This is the first edition of an annual series that puts together different aspects of demographic statistics in one volume.

The report comprises four sections, namely :

- Population Structure
- Fertility
- Family Formation and Dissolution
- Mortality

Time series of commonly used indicators are included in the Statistical Appendix.

Softcopy of this publication may be purchased online at SingStat DataShop@GovMall, which is accessible from the SingStat website at http://www.singstat.gov.sg.

A CD-ROM version of the publication is also available for sale from :

**Singapore Department of Statistics**
**100 High Street**
**#05-01 The Treasury**
**Singapore 179434**

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