The Tools of the Analysis

- **Main Model:**
  - ESU01 (62 equations)
  - By Tilak Abeysinghe and Choy Keen Meng
  - (Book is out, “The Singapore Economy: An Econometric Perspective”, Routledge 2007)

- **Objectives of the model:**
  - Understanding Singapore’s macroeconomic structure
  - Policy Analysis
  - Forecasting
The Tools of the Analysis

- ESU Multi-country model (12 equations)
  By Tilak Abeysinghe
  NBER Working paper and other publications

- Objectives of the model:
  - Transmission of shocks to GDP across borders
  - Forecasting to generate FORGDP
  - First-cut forecasts on Singapore’s GDP growth
The Tools of the Analysis

- **Housing market model** (Satellite model for ESU01)
  By Tilak Abeysinghe and Gu Jiaying

- **6 equations:**
  - Long run equilibrium price
  - Short run price adjustments
  - Housing stock adjustment (identity)
  - New housing supply (residential investment)
  - Vacancy rate
  - User cost of housing (identity)

Plus some bridging equations
Projections on the Singapore economy

- Medium term projections (last chapter of the book)

Under very plausible assumptions about external demand and assuming investment and labor inflows continue,

Singapore is likely to grow by 6-7% over the next decade.
Projections on the Singapore economy

- Short term forecasts (barring unexpected events)

2007Q4 is likely to register another healthy growth rate close to 9%.

2008 growth may exceed 8%. Lower bound 6.5%
Projections on the Singapore economy

- Why the optimism?

The model picks up the increased intra-regional trade effect, especially China (see next slide)
## Percent Change in export shares between 2000 and 2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Spore</th>
<th>Mal</th>
<th>Indo</th>
<th>Thai</th>
<th>Phil</th>
<th>S-Korea</th>
<th>Taiwan</th>
<th>HK</th>
<th>China</th>
<th>Jap</th>
<th>USA</th>
<th>Rest OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spore</td>
<td>0.0</td>
<td>-2.5</td>
<td>5.0</td>
<td>0.2</td>
<td>-0.4</td>
<td>0.9</td>
<td>-0.8</td>
<td>2.2</td>
<td>5.9</td>
<td>-1.2</td>
<td>-7.7</td>
<td>-1.6</td>
</tr>
<tr>
<td>Mal</td>
<td>-1.6</td>
<td>0.0</td>
<td>0.9</td>
<td>2.2</td>
<td>-0.1</td>
<td>0.5</td>
<td>-0.9</td>
<td>1.5</td>
<td>5.0</td>
<td>-2.0</td>
<td>-2.2</td>
<td>-3.3</td>
</tr>
<tr>
<td>Indo</td>
<td>-1.4</td>
<td>1.5</td>
<td>0.0</td>
<td>1.3</td>
<td>0.4</td>
<td>2.9</td>
<td>-0.9</td>
<td>-2.6</td>
<td>5.2</td>
<td>6.5</td>
<td>-8.5</td>
<td>-4.3</td>
</tr>
<tr>
<td>Thai</td>
<td>-1.5</td>
<td>2.1</td>
<td>1.6</td>
<td>0.0</td>
<td>0.5</td>
<td>0.6</td>
<td>-1.1</td>
<td>0.7</td>
<td>5.5</td>
<td>-0.2</td>
<td>-6.1</td>
<td>-2.2</td>
</tr>
<tr>
<td>Phil</td>
<td>0.1</td>
<td>1.3</td>
<td>0.7</td>
<td>0.6</td>
<td>0.0</td>
<td>0.4</td>
<td>-0.3</td>
<td>3.0</td>
<td>10.3</td>
<td>3.0</td>
<td>-15.4</td>
<td>-3.7</td>
</tr>
<tr>
<td>S-Korea</td>
<td>-0.6</td>
<td>-0.8</td>
<td>-0.1</td>
<td>0.2</td>
<td>-1.1</td>
<td>0.0</td>
<td>-0.3</td>
<td>-0.3</td>
<td>15.0</td>
<td>-2.6</td>
<td>-5.5</td>
<td>-3.8</td>
</tr>
<tr>
<td>Taiwan</td>
<td>0.5</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.2</td>
<td>0.1</td>
<td>0.9</td>
<td>0.0</td>
<td>-5.2</td>
<td>20.0</td>
<td>-2.4</td>
<td>-9.9</td>
<td>-4.2</td>
</tr>
<tr>
<td>HK</td>
<td>-0.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>-0.1</td>
<td>0.7</td>
<td>-0.5</td>
<td>0.0</td>
<td>11.3</td>
<td>-0.3</td>
<td>-7.7</td>
<td>-3.4</td>
</tr>
<tr>
<td>China</td>
<td>0.8</td>
<td>1.0</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>2.9</td>
<td>-0.3</td>
<td>-6.7</td>
<td>0.0</td>
<td>-0.6</td>
<td>-2.9</td>
<td>4.3</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.9</td>
<td>-0.6</td>
<td>0.2</td>
<td>1.1</td>
<td>-0.5</td>
<td>2.7</td>
<td>0.2</td>
<td>1.7</td>
<td>8.6</td>
<td>0.0</td>
<td>-8.4</td>
<td>-4.0</td>
</tr>
<tr>
<td>USA</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.3</td>
<td>0.3</td>
<td>-0.9</td>
<td>0.0</td>
<td>3.9</td>
<td>-2.7</td>
<td>0.0</td>
<td>-0.2</td>
</tr>
<tr>
<td>ROECD</td>
<td>0.1</td>
<td>0.1</td>
<td>0.5</td>
<td>-0.1</td>
<td>-0.2</td>
<td>6.6</td>
<td>0.6</td>
<td>-1.9</td>
<td>-1.6</td>
<td>-0.5</td>
<td>-3.5</td>
<td>0.0</td>
</tr>
</tbody>
</table>
## Housing Stock

<table>
<thead>
<tr>
<th></th>
<th>HDB and Other Govt</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,2,3-room</td>
<td>4-room</td>
<td>5-room</td>
<td>Exec</td>
<td>Total HDB+</td>
<td>Private</td>
<td>Total</td>
</tr>
<tr>
<td>2005</td>
<td>276605</td>
<td>327701</td>
<td>207299</td>
<td>65160</td>
<td>879566</td>
<td>229356</td>
<td>1108922</td>
</tr>
<tr>
<td>2006</td>
<td>272736</td>
<td>330416</td>
<td>207879</td>
<td>65153</td>
<td>879092</td>
<td>233364</td>
<td>1112456</td>
</tr>
<tr>
<td>Growth</td>
<td>-1.4</td>
<td>0.8</td>
<td>0.3</td>
<td>-0.01</td>
<td>-0.1</td>
<td>1.7</td>
<td>0.3</td>
</tr>
</tbody>
</table>
## Housing Wealth Inequality

<table>
<thead>
<tr>
<th>Stock (units)</th>
<th>Public Share</th>
<th>Private Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>Value (estimate)</td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Model

Adaptation of the Stock-Flow model

\[ H_t = (1 - \delta)H_{t-1} + S_t \]
Determination of Long-run Equilibrium Price

\[ F_t D(P^*, Y^d, FW_t, UC^h_t) = H_t (1 - v^*_t) \]

\[ H_t = (1 - \delta) H_{t-1} + S_t \]

- **F** = total number of households (F to indicate family units)
- **D** = proportionate demand (fraction of F who want to own a house)
- **P** = long-run equilibrium price
- **Y^d** = per capita disposable income
- **FW** = per capita financial wealth, best proxy CPF balances
- **UC^h** = user cost of housing
- **H** = housing stock (cumulative housing investment)
- **v^*_t** = natural vacancy rate (assumed to be constant)
- **S** = new supply of property (residential investment in our case)
- **\delta** = House depreciation rate (set at 3% per annum; en block sale effect?)
User cost of housing (demand side)

- Mortgage payments or imputed rents
- Management fees
- Other maintenance costs
- Property tax
- Expected house price inflation
- Other short-term policy measures
  
  e.g. 1996 capital gain tax, loan ceiling 80% etc.

Expected profits (supply side)

- Expected price \( E_t(P_{t+1}) \)
- Labor cost
- Land price
- Building material prices
- Development and other government charges
Assuming a log-linear relationship:

\[ \log F_t + \log D_t = \log H_t + constant \]

\[ \log D_t = \beta_1 \log P_t^* + \beta_2 \log Y_t^d + \beta_3 \log FW_t + \beta_4 \log UC_t^h \]

Solve for:

\[ \log P_t^* = \frac{1}{\beta_1}[\log H_t - \log F_t - \beta_2 \log Y_t^d - \beta_3 \log FW_t - \beta_4 \log UC_t^h] \]

Regular data series on \( F_t \), the number of households, are not available. Therefore, assume

\[ F_t = kPOP_t \]

\[ POP = POPR + POPF = \text{resident POP} + \text{foreign POP} \]

Proportionality doesn’t hold with respect to resident population; \( k \) seems to have increased over time due to the switch to nuclear families. But with respect to total population, \( k \) may be constant.

Total population instead of resident population will capture the demand for rental units too.
Previous formulation yields

\[
\log P_t^* = \frac{1}{\beta_1} \left[ \log(\text{H} / \text{POP})_t - \beta_2 \log Y^d_t - \beta_3 \log \text{FW}_t - \beta_4 \log \text{UC}^h_t + \text{const} \right]
\]

Estimating equation:

\[
\log P_t^* = \alpha_0 + \alpha_1 \log(\text{H} / \text{POP})_t + \alpha_2 \log Y^d_t + \alpha_3 \log \text{CPF}_t + \alpha_4 t + u_t
\]

Theoretically, \( \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 \cdot 100 = 0 \)
The estimated long-run equilibrium price equation:

\[ \log P_t^* = constant - 2.8 \log (H / POP)_t + 2.3 \log Y_t^d + 1.6 \log CPF_t - 0.008t \]

(this is a cointegrating regression)

Calibrated equation:

\[ \log P_t^* = constant - 2.8 \log (H / POP)_t + 2.2 \log Y_t^d + 1.6 \log CPF_t - 0.0025t \]
In terms of annual percentage growth rates

\[ P^\text{growth} = -2.8(H\text{growth} - POP\text{growth}) + 2.2Y^d\text{growth} + 1.6CPF\text{growth} - 1.0 \]

\[ = -2.8H\text{growth} + 2.2POP\text{Rgrowth} + 0.6POP\text{Fgrowth} + 2.2Y^d\text{growth} + 1.6CPF\text{growth} - 1.0 \]

Demand growth = \[-0.4P^\text{growth} + 0.8Y^d\text{growth} + 0.6CPF\text{growth} + 0.8POP\text{Rgrowth} + 0.2POP\text{Fgrowth} - 0.4\]
A breakdown of Property Price Inflation Rate

<table>
<thead>
<tr>
<th>Contribution to Long Run Property Price Inflation Rate (%) (2)x(3)</th>
<th>Elasticity Estimates (3)</th>
<th>Average annual growth (%) 2005Q1-2007Q2 (2)</th>
<th>Disposable income per capita</th>
<th>CPF per capita</th>
<th>Constant (User Cost of H)</th>
<th>Total</th>
<th>Trend Property Price Inflation Rate since 1977</th>
</tr>
</thead>
<tbody>
<tr>
<td>H stock</td>
<td>1.8</td>
<td>-2.8</td>
<td>3.7</td>
<td>3.0</td>
<td>-</td>
<td>-5.0</td>
<td>17.7</td>
</tr>
<tr>
<td>POP Resident</td>
<td>1.8</td>
<td>2.24</td>
<td>12.0</td>
<td>12.0</td>
<td>0.56</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>POP Foreign 15+</td>
<td>12.0</td>
<td>0.56</td>
<td>3.7</td>
<td>3.0</td>
<td>1.6</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>Disposable income per capita</td>
<td>3.7</td>
<td>2.2</td>
<td>3.7</td>
<td>3.0</td>
<td>1.6</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>CPF per capita</td>
<td>3.0</td>
<td>1.6</td>
<td>3.0</td>
<td>3.0</td>
<td>-1.0</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Constant (User Cost of H)</td>
<td>-</td>
<td>-1.0</td>
<td>-</td>
<td>-1.0</td>
<td></td>
<td>-1.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>17.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trend Property Price Inflation Rate since 1977**

7.0
Long-run equilibrium property price

Actual PPI (log scale)
Equilibrium PPI and its trend
Projected property price inflation based on:
Population growth = 2.6%
Disposable income per capita growth = 4%
CPF balances per capita growth = 4%
Property supply (units) below (gross, not net of en block scraps)

(short run dynamics ignored)

<table>
<thead>
<tr>
<th>Year</th>
<th>Planned Supply (from ST)</th>
<th>Private Stock (Units)</th>
<th>Growth rate of H stock</th>
<th>House price inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>233364</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2899</td>
<td>236263</td>
<td>1.2</td>
<td>18.0</td>
</tr>
<tr>
<td>2008</td>
<td>6579</td>
<td>242842</td>
<td>2.8</td>
<td>13.7</td>
</tr>
<tr>
<td>2009</td>
<td>15846</td>
<td>258688</td>
<td>6.5</td>
<td>3.2</td>
</tr>
<tr>
<td>2010</td>
<td>16727</td>
<td>275415</td>
<td>6.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>
Short-run price adjustments

Dependent variable  \( \Delta \ln PPI_t = \) Property Price Inflation
Sample period 1995Q1 – 2007Q2, \( R^2 = 0.78 \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>t-value</th>
<th>t-prob</th>
<th>Partial R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.06</td>
<td>2.35</td>
<td>0.024</td>
<td>0.12</td>
</tr>
<tr>
<td>( \Delta \ln PPI_{t-1} )</td>
<td>0.59</td>
<td>7.13</td>
<td>0.000</td>
<td>0.55</td>
</tr>
<tr>
<td>Disposable income growth (( \Delta \ln Y^d_t ))</td>
<td>0.35</td>
<td>3.80</td>
<td>0.000</td>
<td>0.26</td>
</tr>
<tr>
<td>CPF growth (( \Delta \ln CPF_{t-1} ))</td>
<td>0.48</td>
<td>1.66</td>
<td>0.104</td>
<td>0.06</td>
</tr>
<tr>
<td>User cost growth (( \Delta \ln CPI^h_t ))</td>
<td>-1.65</td>
<td>-2.86</td>
<td>0.007</td>
<td>0.17</td>
</tr>
<tr>
<td>Vacancy Rate (( v_t ))</td>
<td>-0.79</td>
<td>-2.57</td>
<td>0.014</td>
<td>0.14</td>
</tr>
<tr>
<td>Subsale Rate (( \Delta SUBSR_t ))</td>
<td>0.18</td>
<td>1.96</td>
<td>0.057</td>
<td>0.09</td>
</tr>
<tr>
<td>Error Correction Term (( P_{t-1} - P^*_t ))</td>
<td>-0.06</td>
<td>-3.62</td>
<td>0.001</td>
<td>0.24</td>
</tr>
</tbody>
</table>
Impact of a 1% increase in PPI on the macroeconomy (from ESU01 model)

(% change from the baseline)

Note the drop in consumption expenditure
Cumulative impact of a 1% increase in PPI

GDP increases only by 0.13% over the baseline after 5 years

Obviously construction investment increase is the largest, 1.6%
Price bubbles caused by

- Demand-supply imbalances
- Panic buying and speculation

Why price bubbles should be avoided

- Effect on consumption expenditure. Loss of a built-in-stabilizer
- Bubbles create persistent market disequilibrium due to the Cobb-Web phenomenon in the property market
- Income redistribution; who gets richer?
Falling consumption share of disposable income and property price

Lead Effect of Property price inflation on APC
Optimal Property Price Inflation?

This needs to be worked out.

- Historical trend of 7% price appreciation per year seems more than sufficient. For this -

  Assuming population growth = 2.6%, disposable income per capita growth = 4%, CPF balances per capita growth = 4%:

  Housing stock has to grow by 5% per year.

- Not easy given the land scarcity

- Need to manage the demand!

  Investment demand (local, foreign)

  Owner occupancy demand
You can download the slides from the SCAPE website:

NUS ➔ Dept. of Economics ➔ SCAPE ➔ ESU ➔ Conferences

http://nt2.fas.nus.edu.sg/ecs/cent/ESU/conference.htm

Thank you 😊