Structure of the paper

• Introduction
• Background on Influenza Pandemics
• Macroeconomic Costs of Disease
• A Global Economic Model
• Modeling the Pandemic shocks
• Results
  – Core scenarios
  – Sensitivity Analysis
• Summary and Conclusions
Overview

• H5N1 Avian influenza might be the source of the next human influenza pandemic

• What are the economic consequences globally?
  – ADB study (Asia focus)
  – CBO study (US focus)

• Enormous Uncertainty but can use historical experience adjusted for current conditions
Overview

• Explore 4 possible scenarios based on pandemics of the 20\textsuperscript{th} century
  – Mild (1968 Hong Kong Flu)
  – Moderate (1957 Asian Flu)
  – Severe (lower estimates of 1918/19 Spanish Flu)
  – Ultra (higher estimates of 1918/19 Spanish Flu)
Approach

- Following the new literature from Lee and McKibbin (2003) on SARS
- Translate pandemic scenarios into a series of shocks and implement them in a global economic model
  - The Asia Pacific G-Cubed multi-country multi-sector model
Countries

- United States
- United Kingdom
- Canada
- New Zealand
- China
- Korea
- Singapore
- Malaysia
- Indonesia
- Oil Exporting Developing Countries
- Eastern Europe and the former Soviet Union
- Other Developing Countries
- Japan
- Europe
- Australia
- India
- Taiwan
- Hong Kong
- Thailand
- Philippines
Sectors

- Energy
- Mining
- Agriculture
- Durable Manufacturing
- Non-Durable Manufacturing
- Services
G-Cubed (Asia Pacific) Model

- Estimated dynamic intertemporal model with Keynesian short-run rigidities
  - Adjustment costs in capital accumulation
  - Financial capital mobile given risk premia
  - Wages adjust slowly given labour market rigidities
  - Financial markets for equity, bonds, money
  - Mix of intertemporal optimizing and rule of thumb decision rules
  - Imposition of intertemporal budget constraints
Modeling a Pandemic
Creating the Shocks

• Major shocks:
  – Reduction in labour force (due to mortality and illness, includes carers)
  – Increase in business costs (differentiated by sector);
  – Shift in consumer demand (away from affected sectors);
  – Re-evaluation of country risks
Critical assumptions

• Start with US assumptions on epidemiological outcomes (study by Meltzer, Cox and Fukuda(1999))
  – Attack rate
  – Case mortality rate
• Scale for other countries based on a series of relative indicators
Critical assumptions

• Country specific
  – Geography indicator
    • Ease of entry, capacity to spread internally
      – Factors (air transport data, location in northern or southern hem, pop density, share of urban pop)
  – Health policy indicator
    • Resources available
      – Per capita health spending, antiviral doses available
  – Governance Quality indicator – govt effectiveness, regulatory quality, corruption control
  – Index of financial risk
  – Sectoral exposure in services
Epidemiological Assumptions: Attack Rate

- 1918/19 (USA) - 10% to 40%
- 1957/58 (USA) - 15% to 40%
- 1968/69 (Hong Kong) 10% to 30%
- Metzler US estimate 15% to 35%
- G-Cubed assumption 30%
Epidemiological Assumptions: Case Fatalities

- 1918/19 (USA) – 0.2% to 4%
- 1957/58 (USA) – 0.04% to 0.27%
- 1968/69 (Hong Kong) 0.01% to 0.07%

- Metzler US estimate 15% to 35%
- G-Cubed assumption
  - Mild 0.0233%
  - Moderate 0.2333%
  - Severe 1.1667%
  - Ultra 2.3333%
Figure 1: Geography Indicator

The figure shows the index values for various countries, with labels on the x-axis representing different countries such as Australia (AUS), LDC, Canada (CAN), China (CHI), Europe (EUR), and more. The y-axis represents the index values, ranging from 0 to 1.8, with specific countries like the USA (USA) and others, each having a corresponding index value.

The chart illustrates the geographical distribution and comparison of index values across these countries.
Figure 2: Health Policy Indicator

Index

AUS  LDC  EEB  CAN  CHI  EUR  GBR  HON  IND  INO  JPN  KOR  OPC  MAL  NZL  PHI  SNG  TAI  THA  USA
Figure 3: Mortality Rate Under each scenario

index_mild
index_mod
index_severe
index_ultra
Figure 4: Additional labor force shock due to Absenteeism
Figure 5: Service Sector Exposure in Production

The chart shows the sensitive output relative to total service output for various countries. The y-axis represents the percentage of sensitive output, while the x-axis lists the countries. The countries are ordered from left to right: AUS, LDC, EEB, CAN, CHI, EUR, GBR, HON, IND, INO, JPN, KOR, OPC, MAL, NZL, PHI, SNG, TAI, THA, USA. The bars indicate the percentage of sensitive output for each country.
Figure 13: Demand shocks - Moderate Scenario

-3.500
-3.000
-2.500
-2.000
-1.500
-1.000
-0.500
0.000
AUS LDC EEB CAN CHI EUR GBR HON IND INO JPN KOR OPC MAL NZL PHI SNG TAI THA USA

% change

-0.500
-1.000
-1.500
-2.000
-2.500
-3.000
-3.500

energy
mining
agriculture
durable man
non-durable manufacturing
services
Results
Global Deaths in millions: Mild (1.4); Moderate (14); Severe (71); Ultra (142)
Table 7: 2006 percentage GDP loss by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Ultra</th>
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<tr>
<td>USA</td>
<td>-0.6</td>
<td>-1.4</td>
<td>-3.0</td>
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<td>Japan</td>
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<td>-3.3</td>
<td>-8.3</td>
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<tr>
<td>Europe</td>
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<tr>
<td>Canada</td>
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<tr>
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<td>-2.4</td>
<td>-5.6</td>
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<tr>
<td>China</td>
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<tr>
<td>India</td>
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<tr>
<td>Taiwan</td>
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<td>-2.8</td>
<td>-7.0</td>
<td>-13.6</td>
</tr>
</tbody>
</table>

Source: APG-Cubed model version 63A
GDP Change in the Moderate Scenario

% deviation from base

2005 2006 2007 2008 2009 2010 2011 2012 2013
USA Japan Europe Malaysia Philippines Hong Kong
Summary

• Even a mild pandemic has significant costs (0.8% of global GDP or $330 billion)
• A repeat of the 1918/19 Spanish flu could cost up to $4.4 trillion
• The impacts are larger on developing countries because of larger shocks and the relocation of international capital flows to the relative safe havens of the US and Europe
• Equity markets fall and bond markets rally
• Inflation may rise or fall depending on the relative scale of cost increases versus demand switches
Summary

• Monetary responses matter
  – Countries which peg the exchange rate tend to suffer even more because of a tightening of policy to maintain the peg
Conclusion

• Predicting the impacts of pandemic influenza is difficult but the range of estimates found in this paper suggest that costs of any outbreak is potentially large and much larger than the resources currently being spent globally to tackle the likely sources of an outbreak
Background Papers

www.BROOKINGS.edu

www.SENSIBLEPOLICY.com