Assessing the Economic Impact and Costs of Flu Pandemics Originating in Asia

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Introduction

The recent experience of SARS followed by the Asia-wide Avian flu outbreak, which threatens to mutate into a virulent human strain, have served to remind the world of the still active threat of serious global pandemics. Although fear of serious epidemics has clearly (and rightly) diminished over the last century, largely thanks to improved public health and medical capabilities, the risk has definitely not been eliminated. Indeed, the risk of *global* pandemics has actually increased given the scale and speed of modern travel. As we could see with SARS, if a contagious disease flares up in one of the world's major trade and travel hubs - such as Hong Kong – it will travel faster than it can be identified and isolated. Globalisation is not the cause of such diseases – it has clearly helped to eradicate some - but it facilitates their spread, as we know from the experience of several centuries of growth in world trade and shipping and the previous incidence of epidemics in ports.

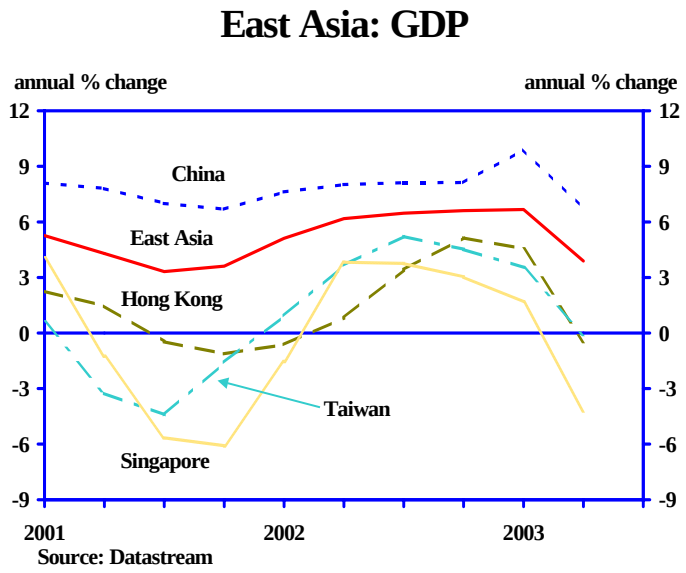
Apart from the potential for bio-terrorism, the main route by which many believe a serious pandemic could arise today is through the appearance of a new and virulent strain of flu, most probably emerging from Asia. Indeed, early in the outbreak, there were fears that SARS could pose such a pandemic threat – and the media were quick to compare this with the previous example of the deadly flu pandemic of 1918-1919. Escalating case numbers – and fatalities – were frightening for populations now unused to such epidemics except as stories in disaster movies. Fortunately, the comparison with the 1918-1919 virus was not quite accurate and SARS cases were rapidly brought under control. Nevertheless, SARS visibly demonstrated the risk and also served to highlight just how large the economic impact of such outbreaks may be.

Across the developed world and the global travel and tourism hotspots, the economic impacts of the public health risks posed by high profile contagious diseases such as SARS are likely to dwarf their costs from a purely health care perspective. SARS is not the only example of public health related shocks having a more marked influence than was previously thought likely (eg the impact of the UK's foot and mouth outbreak on the rural economy as a whole and not just agriculture – in spite of this posing no risk to humans). The reasons may be partly, if not entirely, due to the economic developments seen over the last 30-40 years, specifically the rise of discretionary spending on leisure pursuits and global travel and tourism, which is now the world's largest industry, accounting for around $3trillion in tourism receipts alone (out of total world GDP of $35-40 trillion). Discretionary spending is more sensitive and volatile than the basic shopping basket of thirty or forty years ago. International trade and investment have also grown rapidly – and global news is widely available at virtually no cost.

All together, these facts explain why a relatively "small" public health problem such as SARS, which actually caused few losses in terms of what might be called "traditional" health sector cost analysis (chiefly medical care and labour productivity), could generate such a massive overall loss in economic terms. This raises a question concerning both the appropriate measurement of the economic costs of pandemics and the acceptable scale of funding that should be considered for steps to combat and contain such health risks.

Looking at the estimates related to SARS, even assuming that this had little or no repercussions beyond the second quarter of 2003, *the evidence points to a total cost for the Asian regional economy of about US20billion in GDP terms for 2003, that is,*

overUS$2million per person infected by SARS. These estimates have been confirmed by rigorous analysis using Oxford Global Economic Model, analysis that also pointed to the gross expenditure and business losses (which may better reflect the scale of the economic problem) being as high as US$60billion. These economic costs are no longer pure conjecture (although scenario estimates produced at the time were quite accurate). As the chart below demonstrates, GDP weakened sharply in the second quarter across most of the Asian region: this was largely, although not solely, attributable to the impact of SARS.



It was also noticeable that the economic costs imposed by SARS were spread across a large part of Asia and not just in the countries in which SARS cases were actually reported (eg Thailand's economy was badly hit although there were no reported cases). Most obviously, tourism plummeted across the board although the consumer spending impact seems to have been somewhat more focused. If the outbreak had been more prolonged, losses in export orders would certainly have become a serious threat as well, with trade fairs seeing low visitor numbers or being cancelled. Fortunately, the governments involved saw the need for determined action to bring SARS under control fast – and they were largely successful in this particular case.

As many feared at the start of the outbreak, the SARS scenario could easily have proved far worse had the disease spread more rapidly, continued through summer of 2003 or recurred the following winter. Sensitivity analysis undertaken at the time, using the Oxford Model, was one way of systematically mapping out these possibilities against a highly uncertain background.

Number of SARS cases (reported by the WHO)

	PRC	Hong Kong	Singapore	Taiwan	Vietnam	Global
March 17	-	95	20	-	40	167
March 31	806	530	91	10	58	1622
April 14	1418	1190	158	23	63	3169
April 28	2914	1557	199	66	63	5050
May 12	5013	1683	205	184	63	7447
May 26	5316	1726	206	585	63	8202
June 9	5328	1753	206	680	63	8421
June 23	5326	1755	206	692	63	8459

% change from two weeks earlier

	PRC	Hong Kong	Singapore	Taiwan	Vietnam	Global
March 31	-	458	355	-	45	871
April 14	76	125	74	130	9	95
April 28	106	31	26	187	0	59
May 12	72	8	3	179	0	47
May 26	6	3	0	218	0	10
June 9	0	2	0	16	0	3
June 23	0	0	0	2	0	0

Mortality rate of SARS outbreak 9.6% of cases (Hong Kong had the highest infection rate 0.026% of population)
Mortality rate of 1918 influenza outbreak in US 2.5% of cases (infection rate 28% of population)
(Source: Molly Billings "The Influenza Pandemic of 1918" Stanford University website)

In this paper, we will draw on, and extend, our previous analysis of the economic impact of SARS in order to provide a concrete example of the issues posed by pandemics, both qualitatively and quantitatively. We will also use the SARS impact assessment to generate rough estimates of the likely economic costs of a more general scenario (or range of scenarios) for a global flu pandemic originating in Asia.

We will firstly review the general mechanisms by which events such as SARS – or flu pandemics - transmit effects into the economies concerned. We then examine why differential impacts will be seen across the affected economies and region. With data now available, we also explain how the impact of SARS must be carefully identified, screening out factors that were not SARS-related – naïve comparisons may be misleading and not all of the economic weakness in early 2003 should be attributed to SARS. Using the technical facilities of the OEF model, we can assess event impacts and then use the information obtained to test out alternative scenarios for SARS or for similar types of shocks in the future. Using this sensitivity analysis, we offer some insights into the probable impact of flu pandemics and their attendant economic costs.

Our conclusions point to global economic losses from a serious flu pandemic being of the order of trillions rather than billions of dollars – given the outcome for SARS this is not too surprising. Such estimates may have been regarded with greater scepticism pre-SARS than they are today.

Assessing the economic impact of 'event risks'

We use the term 'event risks' here to signify those risks associated with quite unpredictable events, which may be geographical phenomena (earthquakes, weather etc), political issues (unexpected changes in governments and/or policies, including wars) or other factors (such as public health risks, including SARS). Economic forecasts and sensitivity studies regularly attempt to quantify certain *economic* risk factors, such as exchange rate swings or oil price hikes, but other *non-economic* risk factors can also be examined for their impact on the economies concerned. Whatever the driving force of a shock, a rapid assessment of the likely scale and implications of the economic impact will be essential and a critical part of any policy prescriptions. This is not easy: initially very little may be known about the event let alone the scale of its effects, thus scenario testing is often used to map out potential outcomes (with economic models such the Oxford Global Model helping the analyst by bringing a degree of rigour to this task). However, the more we learn about such event-driven risks, the more we may be able to improve assessments in the future. Moreover, estimates of economic losses (or gains) associated with events are crucial in setting policy parameters afterwards as well as at the time: losses can be compared with costs of preventative policies, for example. Thus reviewing the effects of any major shock to the economic system is important both for the lessons that may be drawn for future risk analysis and for assessment of the appropriate scale of possible containment policies.

Although almost all parts of an economy – and other countries too – could be affected in principle by 'events' (be these political, geographical or of whatever source), in practice the impact may be limited by the nature of the event and/or curbed by policy actions. For example, an earthquake or policy change in the US could have implications for much of world trade and monetary policy but similar events in Taiwan or Thailand would have very limited repercussions elsewhere (although a regional impact may be felt and would be multiplied up should the 'event shock' be seen across a number of Asian countries simultaneously – as for SARS). As another example: if SARS had indeed proved to be the feared deadly flu variant, then the number of cases would have risen rapidly and dramatically in many countries simultaneously. Thus the spread of the economic impact would also have been very rapid indeed and virtually unstoppable in terms of possible policy responses and speed of reaction. In fact, SARS was (fortunately) more amenable to being brought under control. Contagion rates are clearly a critical part of any health-risk assessment: rapid and accurate information is essential in this context. Government responses to SARS were also fairly rapid and pronounced, mitigating the damage - but almost certainly these responses would have proved insufficient had SARS been rapidly and highly contagious.

Economists also face the difficult task of gauging the impact of events on confidence, which may augment the volatility in reactions compared with actual changes in underlying economic explanatory variables. The direct economic effects of a shock may be small compared with the wider and deeper threat that may arise from a serious blow to consumer and/or business confidence – and such sentiment effects are far more difficult to predict and measure. Indeed, even where survey data exists, providing some indication of the swing in sentiment, this information will not be immediately available as an event unfolds.

In the face of such difficulties in obtaining information and gauging the scale of the economic risk, an analyst must rely heavily on specialist knowledge and experience gained from previous 'events' in making first estimates ('guesstimates') of the impact of a new 'event'.

As data emerge, these estimates can be adjusted and refined. Regarding SARS, we now have the data to paint a clearer picture of the form and scale of the shock, providing both a better estimate of the cost and information that will prove useful for other scenarios – in particular for extending the analysis to the case of a flu pandemic.

Channels of transmission of a pandemic shock

In general, public health risks such as SARS create an economic shock through a number of channels of transmission. Most importantly, tourism and consumer confidence are the *main drivers* of the economic impact. These high-volatility variables fall rapidly as news breaks, cutting services exports and consumer spending, which in turn create secondary effects on the local economy (jobs and investment being lost) and on import demand. The effect thus spreads to other countries even without any direct connection to the initial driving factor (here SARS). The international contamination also spreads via the impact on confidence.

We may break out a chain of effects as follows:

- Inflows of foreign tourists to an affected country will fall sharply (and the average spend may also decline if stays are shorter and premium visitors stay away). But outbound (and local) tourism will also be affected both by concerns over travel and general retrenchment on the part of local consumers: this means cuts on both sides of the services account of the balance of payments and more losses in travel related jobs. And restrictions on travel and movement of people may be applied – possibly including quarantining, which implies still further losses in spending and tourism.
- Consumers will curb shopping trips and, especially, visits to restaurants and other leisure activities, which are seen as both high risk (as contact points) and non-essential. The perceived threat to jobs and incomes will add to local consumer caution.
- In contrast, government spending probably increases, linked to efforts to control the problem, and spending may be boosted further by fiscal packages to help those businesses most affected through such measures as tax breaks. However, implementation is likely to be slow whereas consumers cut spending fast.
- Export orders and delivery will be hampered – by the reduced numbers of visitors at trade fairs and cancellation of such fairs and conventions, by cuts in business travel and via general disruption to transport affecting goods shipments as well as people – trade impacts will create further repercussions on import demand as well, spreading the effects to trade partners, especially across highly interlinked open economies, such as Asia (or Europe or the regions of the US).
- Business confidence and investment prospects will deteriorate but very much depend on the expected duration of the problem: if this is seen as a repeated threat, the consequences will be much more serious than if it is seen as a short-lived temporary phenomenon. Low investment affects the capital stock and future growth potential.
- In fairly extreme cases, working days and production could be lost due to sickness, restrictions and fear of contact – implying another round of effects on businesses and consumers caused by both the direct implications for trade and incomes and the fact that work time losses would reflect an escalation in the serious nature of the event, further eroding confidence.

Through these channels, and depending on the duration of risk factors, then we may also expect to see effects on:

- Prices: some prices may be boosted in the short run by supply problems (fresh food products etc) whilst others (eg hotel prices) would fall on plummeting demand.
- Financial variables: a deteriorating economic outlook, especially if coupled with longer term concerns about repeated disease outbreaks and their consequences, would probably weaken financial markets and investment linked capital inflows.

As a general framework, this overview can be applied to any form of 'event risks' such as disease outbreaks – or, indeed, threats such as terrorism and crime – that most obviously impact immediately and heavily via tourism and consumer sentiment. This is also true whether or not the initial 'event' itself really proves to be a major threat to life. Sentiment is a fickle variable, especially for tourism: tourists can rapidly switch destinations (or stay home) on any 'new news' and recovering confidence can be a difficult task. The local consumer cannot switch behaviour on such a large scale and/or as rapidly as this, as some purchases are essential, such as basic foods and supplies, while others are autonomous (such as rents, insurances etc). However, discretionary spending can be reduced, cutting back on non-essentials (especially leisure type activities) and, for short periods, even spending on essentials could fall if there were to be a temporary high risk alert. If the threat were to prove serious and prolonged, then the consequences would be worse, not only reinforcing existing apprehension but impacting on other sectors as well, such as exports and investment.

Clearly if all the transmission channels were to be affected, the build up of the economic impact would be very large and sustained for a long time. The lags involved in some channels of transmission are likely to be quite prolonged anyway and this will take time to completely work out of the system even if a disease outbreak is controlled rapidly and not repeated.

At the outset of SARS, amidst great uncertainty about the type of disease and near panic reactions in the populations implicated, it seemed possible that all the transmission mechanisms listed above would be rapidly brought into play. Although the numbers actually infected, in a very populous region, were certainly not large, the growth rate in cases was initially high and maybe justified at least part of this reaction. Nevertheless, sentiment improved only slowly even after the statistics started to show that the spread of cases outside certain high-risk groups was very low.

In the event, SARS was brought rapidly under control by June of 2003. Thus the impact of the outbreak was more or less contained to just the first three economic transmission channels listed above (tourism, consumption and government spending – albeit secondary effects influenced other variables as well). This limited both the scale and the duration of the SARS effect in 2003. Although there was some debate about this at the time, we can now confirm that any other impacts were very subdued, considerably narrowing the focus of the analysis. For example, the direct SARS effect on working time and output was negligible and any SARS-related changes in other secondary variables (such as overall inflationary trends and financial conditions) were very small if they existed at all (with some exception in the case of short-term stockmarket volatility and a possible impact on Hong Kong's inflation rate, where an existing, serious deflation problem appeared to deteriorate during the second quarter).

In the case of a more prolonged and serious epidemic, these other channels of transmission

would become increasing important – as would the spread of the impact geographically. These additional impacts would need to be "grafted on" to the estimates derived from the case of SARS.

Why did SARS impact more on some countries than others?

We can also demonstrate why, even allowing for the different numbers of SARS cases, some economies were more vulnerable and susceptible to the effect of SARS than others. For example, the relative impact can be related to the following factors:

- structural issues such as the relative shares of tourism and consumption in GDP and the composition of consumer spending (including the proportion of discretionary spending).
- initial conditions (consumer sentiment susceptibility).
- government spending responses.

Looking firstly at the structure of tourism, the table below shows just how large the foreign tourism sector is for many Asian economies: any blow here looks likely to have serious repercussions elsewhere in the economy. In the table, we report simply the foreign visitor receipts, not the larger total for the tourism sector as defined by Tourism Satellite Accounts – these would include all local tourism and tourism related investment and exports as well, frequently doubling up the size of the total 'tourism economy' versus foreign tourist receipts.

Noticeably, NE Asia is far less tourism dependent than SE Asia, with Hong Kong a significant exception (which added massively to the impact of SARS on this economy).

Tourism exports (for 2002 unless otherwise stated)

	"Gross"		"Net"	
	US$ mn	**% of GDP**	**US$ mn**	**% of GDP**
NE Asia:				
China	20385	1.6	4987	0.4
Hong Kong (2000)	7930	4.8	-4572	-2.8
Taiwan	4229	1.5	-2727	-1.0
Korea	5294	1.1	-3774	-0.8
SE Asia:				
Thailand	7901	6.2	4598	3.6
Malaysia	7118	7.5	4500	4.7
Singapore	4381	5.0	-832	-0.9
Indonesia	5285	3.0	1917	1.1
Philippines	1740	2.2	869	1.1
Vietnam	1482	4.3		
Cambodia	454	12.4	416	11.4
Laos (2001)	104	5.9		

"Gross" tourism exports = business & personal travel credits
"Net" tourism exports = travel credits - travel debits
Data from IMF balance of payments yearbook & Taiwan's central bank

Clearly there is a flip side to the tourism impact: local residents will also cut their travel and tourism abroad and thus *net* tourism receipts may be less affected, or could even be positive. The historic data for net tourism is also detailed in the table above and shows a rather different vulnerability per country than the gross tourist receipts alone – indeed, if effects on outbound and inbound tourism were to be symmetric, then countries such as Taiwan, Korea, Singapore and even Hong Kong may appear to be net beneficiaries of a tourism slump.

This form of partial analysis is, of course, misleading. Losses in tourism spending, jobs and investment will still be registered because local consumers will not switch all of their cutbacks in foreign spending into local services and goods. The 'substitution' will not be one-for-one and it may also impact in different sectors, so from the business point of view many companies would still register SARS related losses and cut jobs. This measurement problem also exposes a serious weakness in using GDP to indicate 'losses' as this is based on net trade – a more appropriate measure of overall economic costs may be total final expenditure (the sum of domestic demand and exports). We will take account of this issue later in the presentation of our estimates of SARS losses.

In addition to the problem of measuring gross versus net impacts, and taking account of job losses, there is another problem in using only the tourism data to estimate export losses: this represents only part of total services trade - other components (including transport services) would be affected as well. Looking at the figures for total services trade, as reported in the table below, these may even change the ranking of which economies are estimated to be most at risk. In particular, the table highlights the much greater vulnerability of Hong Kong in both gross and net terms, and Singapore in gross terms, while indicating a possibly reduced net impact in other countries.

Exports & imports of services in Asian economies

		as a % of GDP	
	Data from	**Exports of services**	**Imports of services**
China	2001	2.9	3.4
Hong Kong	2000	24.7	14.9
Taiwan	2002	7.5	8.9
Singapore	2001	30.8	24.1
Korea	2001	6.9	7.7
Thailand	2001	11.3	12.7
Malaysia	2001	16.4	18.9
Indonesia	2001	3.8	10.9
Philippines	2001	4.4	7.1

These discussions of the way in which we can interpret and use the information from tourism and trade data also raise an interesting point concerning the early estimates of SARS losses versus the data that finally emerged. Estimates of the SARS effect on tourist inflows were undoubtedly the first port of call for most analysts when making rapid assessments of SARS-related losses in April and May, partly because the data on tourist numbers and anecdotal evidence from the sector highlighted this aspect of the impact very early in the outbreak, with less attention paid to either the imports side or the impact on other components of trade. With hindsight, this probably led to the simultaneous *overestimation* of the net trade and GDP

losses and a serious *underestimation* of the total loss in services exports.

Consumption patterns – not as badly affected by SARS as many expected

In addition to tourism effects, local consumer confidence also appeared to be directly, and rapidly, influenced by the SARS scare according to anecdotal evidence presented at the time. However, the actual data point to a rather subdued SARS impact. Indeed for some countries there is little or no sign of losses that can be definitely attributed to SARS. Whilst it seemed that bars, restaurants and other leisure industries were hard hit due to local spending cuts as well as tourism losses, and this news was presented in the press coverage, total consumption data point to only a small overall impact. This plausibly suggests that consumers do not translate confidence problems into significant, across the board, spending cuts but focus more on cutting particular types of spending. The result will be influenced by the proportion of discretionary (or non-essential) spending in the consumers' typical 'basket' of purchases. In developing countries this proportion may be quite low as consumption is dominated by essential purchases (more the case in China than in Hong Kong and Singapore). In addition, the impact on GDP will depend on the proportion of GDP accounted for by consumption.

Comparing China and Thailand to Taiwan and Korea, the total proportion of income spent on recreation, education, transport etc is higher for Taiwan and Korea (average 30%) than for China and Thailand (23%) while the proportions spent on food, alcohol, tobacco and clothing are 25% and 42% respectively (and only 14.3% for the US). In addition, consumer spending is a fairly low share GDP in China (47%). If consumption is a high proportion of GDP, then this exacerbates the impact on GDP of consumer cutbacks: Hong Kong and Taiwan (and the OECD area) are much more sensitive than China in this respect.

Initial conditions may be important

There are two issues to treat here. Firstly, for shocks that transmit most immediately into a loss in confidence on the part of tourists and consumers, the initial state of sentiment may matter in assessing susceptibility to any shock. Secondly, correct attribution of any economic weakness in 2003 Q2 to SARS implies that we must examine carefully whether problems existed in Q1, pre-SARS. To be rigorous, we must screen for other influences besides SARS.

In general, susceptibility to any shock was probably high in the first half of 2003, with sentiment threatened by regional terrorism (especially after the October Bali bombing), the Iraq war and its possible effects and overall weakness in some economies and job markets. The initial conditions were certainly very unfavourable in certain cases (Hong Kong, Taiwan and Singapore for example) because of weakening local consumption growth from late 2002 (pre-SARS). In contrast, China's economy started out 2003 robustly and, in spite of a hard hit from SARS in April and May, consumption was already recovering well by June. The consumer and overall economy was only slightly damaged in Thailand (where no SARS cases were reported but the large tourism sector still suffered from the threat of SARS in the second quarter): strong momentum and confidence helped tide Thailand over this hurdle, along with efforts on the part of the government and businesses to reassure both visitors and residents.

Thus, the impact of SARS appeared deeper in those economies that were already weak as opposed to those with strong forward momentum (China and Thailand).

Detailed analysis using the Oxford global economic model highlights just how important it is to disentangle the impact of SARS from the various other factors at work in the first half of 2003, including the threat of an Iraq war, high oil prices and other regional issues. If we do not accurately separate out these factors, we will mistakenly attribute to SARS the whole gamut of influences on the 2003 data.

Government responses

Here we will focus only on the economic measures announced, not medical and public health issues. Monetary policy was not noticeably affected by SARS, being mostly oriented to conditions in international financial markets (and, of course, SARS was not a true global pandemic). Thus the emphasis was on fiscal policy, which is usually seen as a lumbering giant at the best of times.

It is difficult to mobilize a rapid and effective response through fiscal policy although modest changes can be made to offer tax offsets and aid to particularly hard hit sectors (in this case, tourism and retailing businesses). Due to the time lags involved, the impact of such fiscal measures may appear not at the same time as the 'event risk' but with a delay of perhaps a few months, improving the chances of a rebound rather than eliminating the initial drop in activity. The scale of any fiscal reaction will also be limited by the size of the existing fiscal deficit: if this is high, then responses are likely to be very low key.

The box below illustrates the reported economic responses of five governments affected by the SARS crisis. On the whole they show a relatively cautious response with most of the increased spending being used to compensate tourism-related industries for the losses incurred by SARS. However, Malaysia's package was more ambitious in the sense that it included measures for the wider economy (albeit this came in rather late in Q2). In China, whilst the monthly data suggest that the pace of investment growth by the Chinese government was stepped up during 2003Q2, it is not likely that this was linked to SARS.

Apart from deliberate policy changes, events such as a public health scare will create an autonomous spending increase anyway, due to the costs of increased health care, clean up operations, monitoring, policing etc. On a longer term basis, the budgetary changes may be more radical if the scare itself induces changes in the scale and priority of government spending programmes – but we must assume that, if this is the case, then maintaining rigour over public finances will require some offsetting spending cuts elsewhere and/or tax increases – so the overall net stimulus will be muted.

Pursuit of fiscal prudence raises another issue: if health-related spending were to rise at the expense of cuts in other projects, this could lead to a potentially flawed distortion of government spending. Priorities need to be set carefully and considered not just on the basis of immediate events and sensational news. SARS or other pandemics must be put in the context of a class of diseases and the appropriate remedial action to curb such diseases on a systematic basis. This dilemma also highlights another difficulty in paying for the cost of reducing SARS-type risks: the problems and costs imposed by outbreaks may be global but

the heavy burden of the costs of prevention (albeit this is a global public good) may fall unequally on relatively poor developing countries, especially China, for which the average GDP/capita is only just over $1000 in spite of its high growth rates. It is clearly fair and appropriate that international institutions should assist with both thorough assessments and financial aid to assist in meeting the costs of recommended programmes.

Government economic measures in wake of SARS outbreak:

China:

April/May Price control/monitoring of SARS-related drugs and goods
Ensure health coverage of population
May Temporary reductions / waivers of taxes and administrative fees for SARS-affected industries.
Interest subsidies for air transport and tourism sectors

Hong Kong:

23 April 2003 The Government announced a HK$11.8 billion (US$1.5 billion) economic relief package, representing 1% of Hong Kong's GDP. The package included the following measures for a limited period of time:

- Temporary reductions / waivers of taxes and administrative fees
- Job creation scheme
- Loan guarantee scheme

Taiwan:

April/May The government announced that it will budget on spending NT$50bn (US$1.4bn) to help meet medical costs and business losses related to the SARS outbreak.

Singapore:

17 April 2003 The Government decided to implement a S$230 million SARS relief package, including:

- Temporary reduction / waiver of various administrative fees for tourism and transport sectors
- Relief measures for the aviation industry

Malaysia:

21 May 2003 Prime Minister Mahathir announced a RM7.3 billion (US$1.92 billion) economic package aimed to assist sectors significantly affected by SARS. Funded from the federal budget and contributions from Bank Negara Malaysia (BNM) and other financial institutions, the economic package included:

- A reduction of BNM intervention rates by 50 basis points for cheaper loans
- Foreign investment guidelines to be more investor-friendly
- Support for tourism-related industries
- Promotion of micro-credit schemes and cheaper housing loans
- Support for job training

Key data and forecast comparisons pre and post SARS

Although we first undertook analysis of the *likely* impact of SARS as the epidemic broke in late March 2003, on release of the data for 2003, we were able to make a more detailed post-event assessment of the scale of the actual impact of SARS on the economies concerned. This assessment drew on both comparisons across time and across pre SARS versus post SARS forecasts – it is, after all, difficult to disentangle the effects of other events from that of SARS itself, as we highlighted in the previous discussion, and care must be taken in attributing changes in results purely to SARS. We will review a few of the key points here.

Taking the monthly profile of the data presented in the tables below, we can see a number of developments. Firstly, that the trend in visitor arrivals to the region had already slowed prior to the SARS outbreak (mid-March) probably because of the run-up to war in Iraq. For example the growth in Korea's visitor arrivals dropped from nearly 5% in January and February to –10% in March, before travel began to be severely affected by the SARS outbreak. However, April tourist arrivals collapsed by between 20–70% for the countries hit by SARS, while the other countries in the region saw declines of between 15-35%. May showed a further deterioration across the region, with a particularly severe drop in Taiwan. With the outbreak coming under control, June's arrivals data started to show smaller declines, notably in Hong Kong and Singapore. Nevertheless, a recovery simply to the same level of visitors as the year before (ie no change over the previous year) was not seen until September/October. Even this could not be deemed a 'full recovery' (versus the position had SARS not occurred) as we would normally have expected to see some growth over 2002.

This pattern was broadly repeated in the retail sales figures. There is little to indicate that consumption in Asia was significantly affected by the outbreak of war in Iraq. SARS-affected economies experienced drops in sales growth in the order of 5-10%, with a sharp, but not complete, bounce back by June. Countries like Thailand, dependent on tourism but free from a SARS outbreak, experienced a similar profile – though to a much more modest extent (and job fears in the services economy may have been a major motivating factor).

However, data on goods exports provides little indication of any decisive change in trend with the onset of SARS. The very modest scale of any changes may simply be attributed to side effects (from generally lower regional demand and activity) rather than being a *direct* impact of the event itself. Certainly China's export performance was barely dented, while the exports of the non-SARS economies also show little sign of deteriorating relative to early 2003 trends. For the three "island" economies - Hong Kong, Taiwan and Singapore – the data are more suggestive of a small hit to exports in April / May, unwinding in June (and probably reflecting the economic disruption caused by SARS, and possibly Iraq with respect to US sales). This confirms the focus of attention as services trade.

Visitor arrivals

annual % change

	Jan/Feb	Mar	Apr	May	Jun	Jul
China	9.1	-6.5	-30.1	-31.0	-18.0	-8.5
Hong Kong	28.6	3.9	-64.8	-67.9	-38.2	-5.6
Taiwan	20.8	-0.2	-50.7	-81.9	-74.0	-27.2
Singapore	5.1	-14.6	-67.3	-70.7	-47.4	-20.4
Vietnam	17.0	0.0	-29.3	-54.0	-51.5	-32.0
Average	*16.1*	*-3.5*	*-48.4*	*-61.1*	*-45.8*	*-18.7*
Korea	4.8	-10.0	-28.6	-39.4	-26.7	-21.0
Thailand	3.1	-11.0	-44.8	-50.4	-23.8	-5.1

Exports of goods (in US$)

annual % change

	Jan/Feb	Mar	Apr	May	Jun	Jul
China	32.7	34.7	33.2	37.3	32.6	30.5
Hong Kong	18.5	15.4	9.0	13.6	14.0	7.6
Taiwan	13.0	10.2	5.5	2.0	3.4	4.5
Singapore	25.5	18.6	6.8	9.0	10.5	6.2
Average	*22.5*	*19.7*	*13.6*	*15.5*	*15.1*	*12.2*
Korea	23.5	16.2	19.6	3.9	22.3	16.0
Thailand	25.4	16.6	22.2	14.1	12.3	14.9
Malaysia	9.6	4.7	5.7	5.8	6.0	-1.1

Seasonally adjusted exports* (in US$)

monthly % change

	Jan/Feb	Mar	Apr	May	Jun	Jul
China	0.0	4.6	8.2	2.7	-3.8	7.9
Hong Kong	-1.7	9.6	-5.3	1.4	5.4	-1.8
Taiwan	2.7	-0.5	-5.7	-2.5	4.1	-0.8
Singapore	4.4	-0.7	1.8	-4.1	1.0	3.6
Average	*1.4*	*3.2*	*-0.2*	*-0.6*	*1.7*	*2.2*
Korea	-1.0	2.6	10.6	-13.7	10.1	3.5
Thailand	5.1	-2.4	6.5	0.4	-2.1	-1.8
Malaysia	-1.4	7.3	3.9	-1.9	-0.8	-3.1

* generated using Datastream's seasonal adjustment package

Retail sales (value)

annual % change

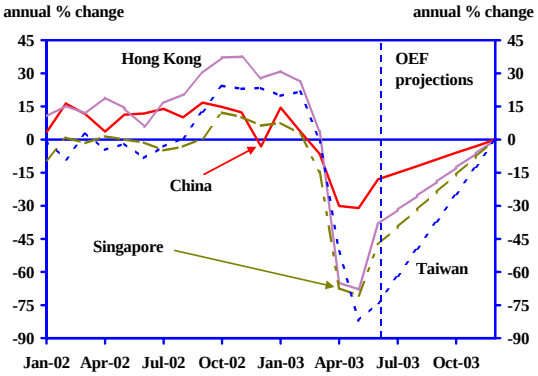
	Jan/Feb	Mar	Apr	May	Jun	Jul
China	9.3	9.3	7.7	4.3	8.3	9.8
Hong Kong	-1.3	-6.1	-15.2	-11.1	-6.5	-2.5
Singapore"	-0.6	0.0	-7.5	-7.8	0.8	-5.1
Average	*2.5*	*1.1*	*-5.0*	*-4.9*	*0.9*	*0.7*
Korea	3.3	0.1	-3.2	-1.6	-2.5	-3.3
Thailand*	7.1	6.7	4.9	5.8	6.3	3.5

" retail sales ex cars
* composite private consumption index (volume)

Mid-2003 assessment

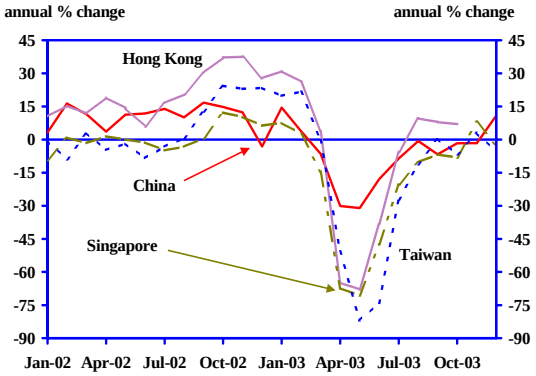
Actual 2003 data

Asia: Tourist arrivals



Source: CEIC data

Asia: Tourist arrivals

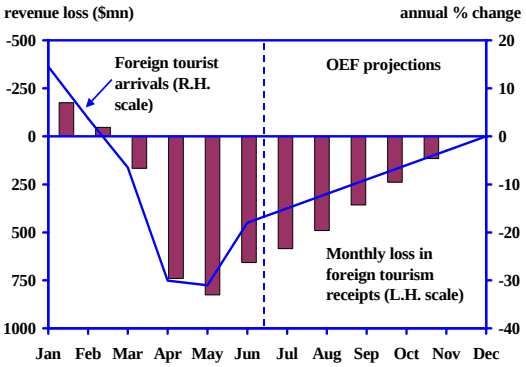


Source: CEIC data

Mid-2003 assessment

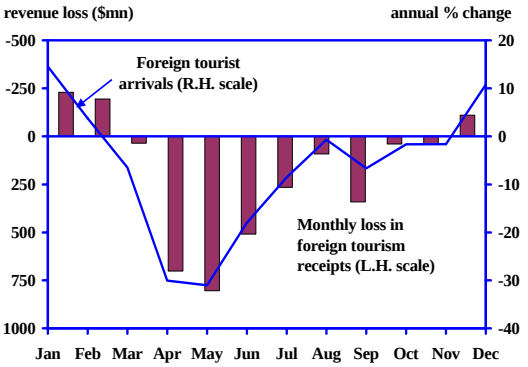
Actual 2003 data

China: Tourist arrivals & revenues



Source: OEF

China: Tourist arrivals & revenues



Source: OEF

Summary costs of SARS for East Asia foreign tourism

	Expected revenue change ($bn) from 2002 level assuming				
	Repeat of 2002 growth	Effects of Iraq war etc but no SARS	SARS outbreak ends in June 2003	SARS impact	SARS impact as % of GDP
China	2.0	1.0	-2.3	-3.3	-0.2
Hong Kong	0.8	0.4	-1.4	-1.8	-1.1
Taiwan	0.2	0.0	-0.7	-0.7	-0.2
Singapore	0.0	-0.2	-0.8	-0.6	-0.7
Vietnam	0.2	0.1	-0.1	-0.2	-0.6
Korea	0.2	-0.1	-0.6	-0.5	-0.1
Thailand	0.6	0.2	-0.7	-0.9	-0.6
Malaysia	0.3	-0.1	-1.5	-1.4	-1.4
Indonesia	-0.1	-0.4	-0.6	-0.2	-0.1
Philippines	0.1	0.0	0.0	-0.1	-0.1
East Asia	4.3	1.0	-8.8	-9.8	-0.3

Of course these estimates of the costs of SARS focus on lost foreign tourism receipts only and are therefore just a part of the overall picture. However, such numbers provide a useful starting point in predicting the scale of likely business losses, certainly in this particular sector of the economy. A more comprehensive analysis of the economic costs of SARS will not only need to assess the impact on other parts of the services account but also the direct impact on consumer spending and the *indirect* repercussions of the shock on trade and investment, which all serve to multiply up the scale of losses. We will return to this point later when we discuss the estimates based on the OEF's global economic model below.

Overall, the evidence tends to support the view expressed earlier, that the main driving forces of the SARS economic impact were through tourism (and related service industries such as air travel) and consumption and that other variables were caught up in the backwash rather than playing a lead role in initiating the disturbance to the economies affected. The distinction is important in providing an accurate assessment for SARS and establishing the focus for estimates of the impact of any future pandemics.

Isolating the SARS losses: cutting through the Gordian knot

Using model-based methods for identifying and quantifying the shortfalls on those variables *directly* affected by SARS, we have established more rigorously the changes in 2003 Q2 that cannot be explained by either the usual explanatory factors (model equations) or the problems apparent in 2003 Q1. We draw an important distinction here between the *drivers* of the scenario (those variables, such as services exports, which suffered a SARS-shock that cannot be explained by any other *economic* factor) and those variables (such as employment and investment) that appear to be adequately explained by the normal economic linkages (that is, the model equations reveal no unusual disturbance patterns – unlike the "drivers"). This does not mean there are no secondary repercussions, only that these will be derived from the changes imposed on the key drivers.

We have then used this information to run a "counterfactual" simulation using the OEF model, providing estimates of what GDP growth and consumer spending (and other variables) might have been if SARS had not occurred. The difference between this

"counterfactual" solution and the actual data provides an estimate of the total cost of SARS to the Asian economies in terms of the overall GDP losses. This estimate fully takes account of not just the direct economic effects of SARS (such as the tourism and consumption losses) but also the indirect ones too. For example, the relationships within the model allow for the repercussions of consumer spending on investment, exports and imports of goods, employment and prices.

The results we established using this methodology are tabulated below in terms of economic losses in billions of dollars and as a % of GDP. We report the estimated SARS losses for 2003 as a whole - as SARS did not recur and tourism recovered by late 2003, we can reasonably assume that losses were confined to 2003.

As we expected, the total GDP losses (in US$ billion) estimated by the 'model scenario' method are typically larger than the losses indicated by partial analysis of the impact of SARS on tourism receipts alone, although for a few countries this may not be the case as the 'tourism' analysis was only looking at the effect on the inflow of tourist receipts, not taking account of the net position after allowing for cuts in tourism outflows and other imports. Changes in imports of services (and goods) are allowed for in the model impact estimates. Indeed, lower than expected imports were an important factor behind the second quarter GDP data for 2003 being better than many feared at the time.

In addition, the OEF model can provide estimates for the overall loss in total final expenditure (TFE). As we suggested earlier, this concept may be a more appropriate way of looking at the cost of SARS and total business losses. The losses in TFE terms may correspond more closely to the initial impression that the SARS impact was severe, largely because businesses also focused on this concept of losses in the economy.

As we predicted from the comparison of country characteristics, the outcomes reflect the scale of each factor in the economy concerned: for Singapore and Hong Kong, large losses in services exports are of much greater consequence than a similar percentage loss in services exports for, say, Korea, China or Taiwan. On the whole, the consumer results were at the better end of estimates, partly, we would argue, because some items of consumption are relatively stable even if shopping trips are curtailed (eg rents, basic food purchases etc) but also because there was some opportunity for sales to rebound in June after SARS started to fade. The tourism rebound, in contrast, took some time to fully unwind as year-end data showed an upturn to 2002 levels but not a true recovery to levels that would have occurred without SARS.

Even based on a quite favourable interpretation of the data and forecasts, the losses for some countries are estimated to be very large: for Hong Kong and Singapore up to 3% of 2003 GDP looks likely to have been lost to SARS (this rises to 7-9% for losses in total expenditure, closer to actual business losses). And the losses for some other countries are only small because of the offsetting large decline in imports (Taiwan, Korea, Malaysia). For China, the still quite low level of foreign tourist receipts versus high-flying goods exports also limited the visible costs. As the source of the SARS outbreak, China seems to get off rather lightly but this assessment is accurate as China's data did indeed show a strong recovery from only short-lived problems.

Costs of SARS for East Asia in 2003 calculated using OEF model

	Technical model estimates based on Q2 data					
	Consumer spending		GDP		TFE*	
	$bn	% of GDP	$bn	% of GDP	$bn	% of GDP
China	4.2	0.3	6.1	0.5	17.9	1.3
Hong Kong	3.4	2.2	4.6	2.9	12.0	7.6
Taiwan	1.8	0.6	1.3	0.5	4.6	1.6
Singapore	0.6	0.7	2.7	3.0	8.0	9.0
Vietnam #			0.4	1.1	0.4	1.1
Korea	0.1	0.0	0.3	0.1	6.1	1.2
Thailand	1.0	0.7	1.9	1.4	4.5	3.2
Malaysia #			0.4	0.4	3.0	2.9
Indonesia #			0.3	0.1	1.9	0.9
Philippines #			0.0	0.0	0.6	0.7
East Asia			18.0	0.6	59.0	2.0

* TFE, total final expenditure = sum of domestic demand plus exports
# no figures for consumer spending because no significant changes could be attributed to SARS in Q2
The above calculations were made using 2003Q2 data in September 2003. Subsequent analysis including 2003H2 data indicate broadly similar results.

Summary costs of SARS for East Asia in 2003 (as % of GDP)

	Estimated loss of tourism revenue	OEF model GDP loss	OEF model TFE loss
China	0.2	0.5	1.3
Hong Kong	1.1	2.9	7.6
Taiwan	0.2	0.5	1.6
Singapore	0.7	3.0	9.0
Vietnam	0.6	1.1	1.1
Korea	0.1	0.1	1.2
Thailand	0.6	1.4	3.2
Malaysia	1.4	0.4	2.9
Indonesia	0.1	0.1	0.9
Philippines	0.1	0.0	0.7
East Asia	0.3	0.6	2.0

Implications for estimating the possible impact of flu pandemics

Estimating the impact of 'event risks' and alternative scenarios is a difficult and imprecise 'science'. Indeed estimates will remain subject to many errors even after all the data become available. In some cases, data are themselves poor or non-existent and many other factors will have had an influence on the outcome as well. Disentangling this Gordian knot is not easy. We have to make some fairly heroic assumptions to make headway initially and then hope to improve estimates as more information is released. Imperfections have to be accepted but we can learn from experience, create 'rules of thumb' and hopefully use this knowledge to gain

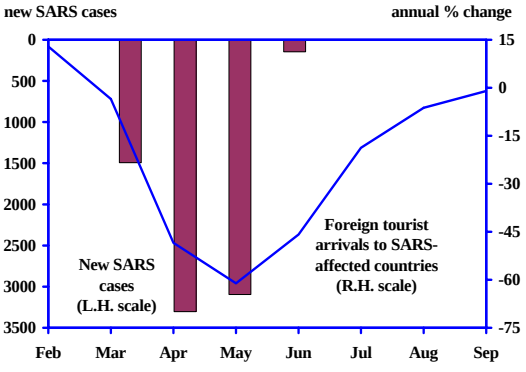
insights that can be called upon in the case of the next forecast-shattering event to turn up – and one always will.

In early 2003, SARS was the particular 'event' that turned up, and was quite definitely unexpected. That this was a high impact event cannot be denied although it did not prove as catastrophic as some feared back at the height of the panic in April 2003. We can now be more precise in defining the cost of SARS to Asia using the actual data. The OEF model suggests that the cost of SARS in terms of lost GDP was around US$20billion for Asia as a whole, equivalent to a cut of about 0.6% from 2003's growth rate for the East Asia region (as defined in the tables above). The TFE cost (more closely reflecting lost business revenues) was more likely to have been close to US$60billion, about 2% of East Asian GDP. However, given all the intervening events and uncertainty about SARS itself, the initial 'guesstimates' for the impact of SARS were really quite close to the mark. This is somewhat reassuring after all.

Had the disease lasted two quarters instead of one, with continuing impacts into late 2003 and early 2004, the losses would almost certainly have been much larger than the figure derived from simply multiplying up the losses from the second quarter of 2003. This is because of the non-linear impact caused by the introduction of new channels of transmission. In this case, the effects would have multiplied up for the tourism and consumer losses but, in addition, there would have been new losses in trade and investment to take into account later in 2003.

The economic costs were also very high compared with the actual scale of the disease – representing over US$2 million per person infected (based on the GDP estimate – over US$6million using the TFE estimate). If SARS had proved to be equivalent to the 1918/19 flu epidemic, then losses would have been many times those seen in 2003 both in terms of lives and the economic impact. But even without moving to such an extreme case, we should perhaps reflect on the fact that a SARS type virus could easily have wreaked far more havoc than it did.

Asia: New SARS cases & Tourist arrivals



Source: OEF

The information we have now derived can be used to provide a benchmarking of the likely impact of similar disease outbreaks, real or hypothetical. Taking the information on case numbers versus the economic impacts such as tourism losses and GDP estimates, we can see a strong correlation between these variables (and a fairly long recovery lag for tourist reactions). It is also reasonably clear that, in general, the impact of the number of cases (or

rather the increase in numbers infected) may be more closely linked to the regional totals for cases than individual country statistics, excepting for those countries that are at the core of the outbreak. In other words, we must explain the large losses seen in countries with no SARS cases and also the relatively uniform percentage losses in tourist numbers (excepting China) in spite of very different profiles for the numbers of cases.

Roughly speaking, the chart above indicates that on average *on a regional basis*, 1000 new cases per month may be linked to a drop of about 20% in tourist numbers. This then translates into a 0.2% decline in regional GDP. However, if we use the figures for Hong Kong alone, the data suggest that 1000 new cases (in Hong Kong) per month might lead to a drop of 60% in arrivals and a fall in GDP of about 3% for the year, whereas for China we find a tourist loss of only 15%, with GDP down 0.25% (per 1000 new cases).

Although we may need to scale the case numbers (say, against population), the statistics quoted do imply that even if China's tourist numbers had fallen by 60%, the GDP impact would only have been 1%. Clearly, the very different profiles of these economies must be taken into account when considering the likely impact, as we discussed previously. For economies that are relatively homogenous, the effects can more safely be assumed to be uniform.

More detailed work would need to be done to provide a model capable of accurately and appropriately linking the initial medical data to the probable number of cases and then to appropriate drivers of the economic model in order to seamlessly assess the likely economic losses for any case study. For longer duration epidemics, especially those of a different nature such as HIV-AIDS or malaria, further efforts would be needed to establish a means of calibrating the impacts - SARS has relatively little information to offer in these cases as the key economic transmission mechanisms vary considerably. However, SARS does provide a clear indication of the likely course of short-lived diseases and their economic impacts.

Extrapolating the SARS analysis to a more general pandemic scenario

Although a virulent flu pandemic (originating in Asia) may have some different characteristics to SARS (perhaps recurring over 2-3 years – and almost certainly engulfing more countries), it is sufficiently similar in most key features to allow us to utilize the SARS estimates as a "first base" for quantifying the impact on the Asian and global economy of such an event. In the early stages, as case numbers escalated fast and hit the headlines, we would expect a very sharp impact much the same as that seen for SARS. Indeed, if the outbreak were to be short-lived and contained, as SARS, it would be quite reasonable to assume the economic impact would be virtually identical to that witnessed for SARS.

As a rough approximation, the economic impact of a similar outbreak lasting over two quarters of the year rather than one would probably be close to double the impact of SARS. However, we would need to begin assessing further repercussions for an extended outbreak, adding to the impact. Thus a full year outbreak – or one involving more people and countries – is not simply a multiple of "SARS", but larger. This would chiefly involve losses in non-essential trade and consumption – and secondary repercussions from this. However, as the duration and/or scale escalated further, we would reach a point at which some of these impacts would stop multiplying up – for example, once virtually all tourism, non-essential

travel and discretionary spending in general is cut away, there can be no further impacts from such losses. Thus we would expect a "pause" as these effects came to a halt, leaving on-going losses more dependent on other channels of transmission such as labour shortages and disruption, causing losses in output, and also impacts on investment. At this stage, the "incremental" losses for an outbreak would become more "traditional" for public health problems - the loss in productivity and potential output, which is of little importance in the short-term and was clearly not a factor in explaining SARS losses.

We can identify each of the "steps" involved in this process and characterize them according to the form of impacts that we would expect to see:

- Stage 1: evidence starts to emerge of a flu outbreak in Asia (similar to the start of SARS) – but not really visible in the "headlines" until the second year (probably late winter) when cases would escalate rapidly;
- Stage 2: economic losses start to mount in this second year, on a scale similar to SARS per quarter of the outbreak but also rising as the impact spreads from services to goods trade;
- Stage 3: numbers infected continue to increase (but largely still contained to Asia) and the build up of economic losses for Asia begins to slowdown;
- Stage 4: the global spread escalates rapidly and creates another sharp wave of economic impacts as these ex-Asia economies go through the process of losses already seen in Asia;
- Stage 5: by the third year, new cases should be declining and the economic losses would also start to stabilise and then recede;
- Stage 6: cases peter out in years 4 and 5, the economies affected see strong recoveries.

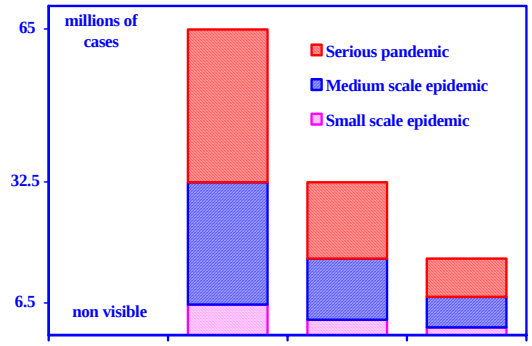
This time scale analysis must then be cross-referenced with the "scale of impact" (a pandemic Richter scale):

- Scale 1 pandemic: serious economic losses, similar to SARS on a quarterly basis - up to 6-7 million people affected almost entirely in Asia;
- Scale 2 pandemic: larger numbers involved (30-35 million) but still a mostly regional impact on the Asian economy, albeit escalating compared with SARS;
- Scale 3 pandemic: wide global impact (1% or more of world population infected) – global economic impacts cause a steep rise in losses;
- Scale 4 pandemic: global numbers very large but economic impact rises only slowly;
- Scale 5 pandemic: such large numbers and impacts that there is growing uncertainty about a collapse in the world economic order.

This framework enables us to build up a profile of pandemic scenarios, scaling the impacts over time, numbers and geography.

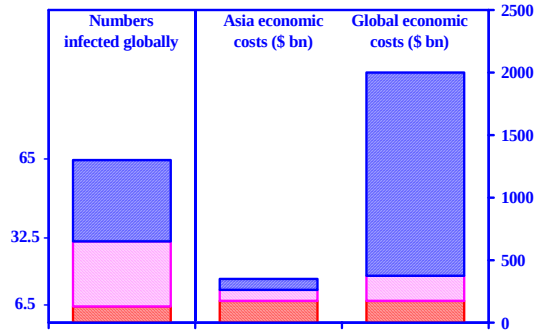
The results of this analysis are indicated in the chart and tables below, Even without taking the examples to the point of the 1918-1919 flu pandemic (with as many as 25% of the population impacted), we can establish that pandemics infecting just 0.5-1% of the world population (up to 65 million people) would probably see economic losses run to 1 to 2 trillion dollars per annum over a period of perhaps 2-3 years (based on current GDP data). This represents some 5-6% of world GDP. In fact, even a "small" Asian pandemic might lead to losses in Asia's annual GDP of $150-200 billion.

Typical outbreaks of flu pandemics



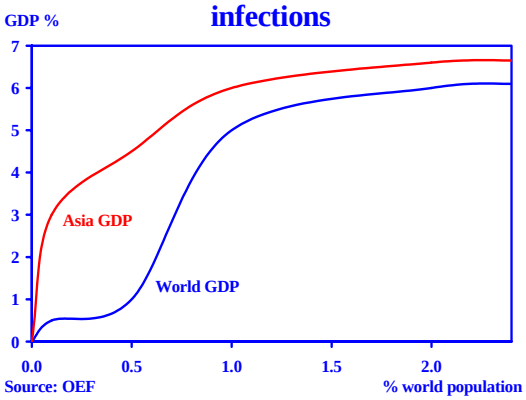
Source: OEF

Annual economic costs of Asian-origin flu-type epidemics



Source: OEF

Annual economic costs v number of infections



Source: OEF

Using the chart provided, as a reasonable "rule of thumb", we can see that beyond the first phase of rapidly rising losses up to the 1% of population mark, which we estimate would cut world GDP by some 5%, the incremental costs of an epidemic are predicted to become more linear. That is, if 2, 3 or 4% of the world population is impacted, we estimate the global loss to be of the order of 6, 7 or 8% of world GDP respectively.

This "extrapolation", if carried further, suggests that the implied loss due to an epidemic infecting some 25% of the population might be of the order of 30% of world GDP (over 10 trillion dollars at current rates), as each additional percentage point of population infected continues to add a percentage point to GDP losses once we move beyond the initial, high impact, phase of the epidemic. However, it is also likely that a further sharp collapse in activity could take place at about this point as essential services and all of global trade would be threatened. Such highly sensitive (non-linear) relationships cannot be precisely established (we have no clear precedent for this) but almost certainly extreme disruption would play a further role in creating a shutdown of the global economy - just as the UK refers to the shut down of the rural economy in relation to the recent foot and mouth outbreak.

Given the problems inherent in extreme analysis, we prefer to focus on the already massive losses that would probably be realized even in a "small" pandemic covering a low percentage of the population. Clearly impacts would also be affected by mortality rates. We might assume a mortality rate similar to the 1918-1918 pandemic but a lower average mortality rate (which could be linked to better treatment methods and vaccines) might tend to curb the losses versus the estimates provided for the "large numbers" examples (more than 2% infected, say). Nevertheless, the estimated impact of a "small numbers" scenario should be fairly robust and would probably remain quite accurate (as for SARS) on the basis that the losses in "discretionary" spending would most likely be realised early on in a pandemic even if mortality rates turned out to be fairly low compared to 1918-1919.

The "general scenario" estimates given here would benefit from further scrutiny and information - and would certainly need to be modified according to the specific type of disease profile being examined and its main channels of transmission to the economies concerned. However, the important "first phase" losses in affected economies have been clearly demonstrated by SARS and these cannot be ignored given the scale of such losses in a modern economy and the value this places on possible preventative measures. Subsequent development of an outbreak may add to the costs of a pandemic but the quite modest initial conditions required to bring about an economic impact of the order of 1-2 trillion dollars is, we believe, one of the more remarkable and, in policy terms, important features of the analysis.