China: new engine of world growth

Ross Garnaut and
Ligang Song (editors)

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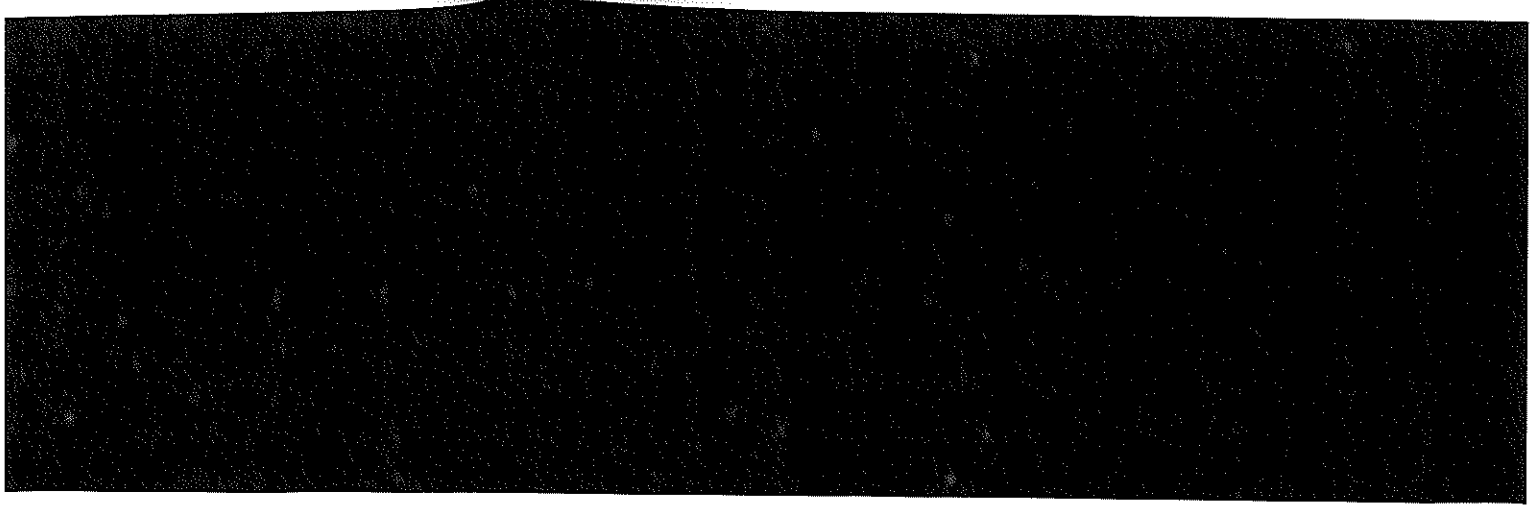

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The impact of SARS

Jong-Wha Lee and Warwick J. McKibbin

The outbreak of SARS (severe acute respiratory syndrome) has had an important impact on the People's Republic of China (hereafter referred to as China). When the virus was at its most virulent, from November 2002 to July 2003, it had a direct impact on economic activity. But it has also had a more fundamental and long lasting impact on possible political and economic reforms in China.

The first outbreak of SARS was in Guangdong Province, the source of annual cycles of disease for over a century. China has been criticised for its initial response, in which lack of transparency and attempts to minimise the impact of the disease, in apparent violation of World Health Organization (WHO) guidelines, were a primary cause of the propagation of SARS to the world. The experience of SARS has illuminated weaknesses in China's public health system and raised questions about the ability of the government to respond to serious crises and coordinate responses between the central government and regional authorities. These issues have potential impacts on the political system as well as on the economy because of the possibility of future diseases and resulting impact on FDI flows into China.

This chapter gives an overview of the SARS outbreak, presents some estimates of the economic costs to date and possible costs over the medium term and draws some lessons for policy in China. Our empirical estimates of the economic effects of the SARS epidemic are drawn from our earlier paper, which was based on a global model called the G-cubed (Asia Pacific) Model. A few recent studies including Chou, Kuo and Peng (2003), Siu and Wong (2003), Hanna and Huang (2003) and Wen (2003) provide some estimates of the economic effects of SARS on individual

Asian countries such as China, Hong Kong and Taiwan. But these studies focus mostly on assessing the effects of SARS on industries such as tourism and the retail service sector. However, merely calculating the effects on the number of cancelled tourist trips or declines in retail trade does not provide a full picture of the impact of SARS because such a calculation ignores links across sectors, and across economies through international trade and capital flows. The multi-sector multi-country model captures important links across sectors, as well as across countries, through goods and services trade and capital flows.

The G-cubed model also incorporates individuals' expectations and their forward-looking intertemporal behaviour. We are interested in distinguishing the effects of a temporary shock from those of a persistent shock, for instance, when foreign investors expect that SARS or other epidemics of unknown etiology may break out in some Asian countries not just this year but at some time in the future, they demand a greater risk-premium from investing in affected economies. Long-term impacts of this type would have far more devastating consequences for China than the short-term cost of SARS.

CHINA'S RESPONSES TO SARS

The SARS virus is contagious and often fatal. In the eight months after its first outbreak in China in Guangdong province on 1 November 2002, the SARS disease spread to 30 economies, infecting 8,437 people and causing 813 deaths worldwide (Table 2.1).

By July 2003, SARS seemed to have disappeared, and WHO declared that SARS outbreaks had been contained worldwide (Table 2.3). Yet scientists still do not know details about the coronavirus that causes SARS. The precise mechanism by which this atypical pneumonia is spread is still unclear. Many countries have successfully contained the SARS outbreaks and local transmission, but the disease may recur later in 2003.[1] There is speculation that even if it diminishes in the Northern Hemisphere summer, it could re-emerge in an even more fatal form in the next influenza season. Experts assess that the likelihood of discovering a vaccine or treatment for SARS in the foreseeable future is very low. Crowds of anxious patients may overwhelm the hospitals during the next flu season (Enserink 2003).

SARS has posed a big challenge to China. Hong Kong and Taiwan were worst hit. As of 14 July 2003, 5,327 people had been infected with SARS in China and 813 of those had died. This represented 63.1 per cent of SARS cases and 42.8 per cent of

Table 2.1 Cumul
2003[1]

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Canada	
China	
China, Hong Kong	
China, Macao	
China, Taiwan	
Malaysia	
Mongolia	
Philippines	
Republic of Korea	
Singapore	
Thailand	
United States	
Viet Nam	
Other countries	
Total	

Notes: [1] Cumulative nun
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Table 2.1 Cumulative number of reported probable cases of SARS, 11 July 2003[1]

	Cumulative number of case(s)[2]	Number of deaths	Number recovered[3]	Date last probable case reported	Date for which cumulative number of cases is current
Canada	250	38	194	9 Jul 2003	10 Jul 2003
China	5327	348	4941	25 Jun 2003	11 Jul 2003
China, Hong Kong	1755	298	1433	11 Jun 2003	11 Jul 2003
China, Macao	1	-	1	21 May 2003	10 Jul 2003
China, Taiwan	671	84	507	19 Jun 2003	11 Jul 2003
Malaysia	5	2	3	20 May 2003	4 Jul 2003
Mongolia	9	-	9	6 May 2003	2 Jun 2003
Philippines	14	2	12	15 May 2003	11 Jul 2003
Republic of Korea	3	0	3	14 May 2003	2 Jul 2003
Singapore	206	32	172	18 May 2003	7 Jul 2003
Thailand	9	2	7	7 Jun 2003	1 Jul 2003
United States	75	-	67	23 Jun 2003	9 Jul 2003
Viet Nam	63	5	58	14 Apr 2003	7 Jun 2003
Other countries	49	2	45		
Total	8437	813	7452		

Notes: [1] Cumulative number of cases includes number of deaths. As SARS is a diagnosis of exclusion, the status of a reported case may change over time. This means that previously reported cases may be discarded after further investigation and follow-up. As of 14 July, WHO no longer publishes a daily table of the cumulative number of reported probable cases of SARS. [2] Decrease in the number of cumulative cases and discrepancies in the difference between cumulative number of cases of the last and the current WHO update are attributed to the discarding of cases. [3] Includes cases who are 'discharged' or 'recovered' as reported by the national public health authorities.
Source: World Heath Organization, n.d. CSR Severe Acute Respiratory Syndrome (SARS) homepage, World Health Organization, Geneva. Available online at http://www.who.int/csr/sars/en/.

deaths worldwide. Hong Kong reported 1,755 cases and 298 deaths. Taiwan had 671 cases and 84 deaths.

The SARS outbreaks have highlighted several sociopolitical problems in Chinese society, including lack of transparency, inaccurate information, and lack of coordination between central and local authorities. The response by the Chinese government to the epidemic has been fragmented and opaque. Only on 11 February did the Chinese Ministry of Health inform the WHO of an outbreak of acute respiratory syndrome for the first time (Table 2.3). There is even later evidence that the Chinese

government was attempting to hide the epidemic, making only minimal information available. As a result, public fears began to rise as rumours spread by telephone and email. Responding to mounting criticism of its lack of transparency, the government quickly adapted to encourage more open reporting. On 20 April, Chinese leaders removed the mayor of Beijing and the Minister of Health from their posts.

The quick spread of SARS has raised doubts about the capability of China's medical system to deal with major epidemics. Overall healthcare spending is not low as a proportion of GDP in China, amounting to about 5 per cent of GDP, but health expenditure per capita is only US$45 in China (Table 2.2). About one-third of the population has no access to improved sanitation. The government announced a comprehensive scheme to set up a nationwide health network to fight SARS and prevent other diseases. The response to SARS could represent a breakthrough for the improvement of the health care system in China.

The slow government response to this previously unknown disease raises grave concerns about China's institutional quality and its potential for growth. Although it

Table 2.2 Health expenditure and sanitation indicators for selected countries

	Health expenditure, total (per cent of GDP)	Health expenditure per capita (Current US$)	Improved sanitation facilities (per cent of population)
China	5.3	45	29
Hong Kong	4.4	950	100
India	4.9	23	16
Indonesia	2.7	19	47
North Korea	2.1	18	99
South Korea	6.0	584	63
Malaysia	2.5	101	n.a.
Philippines	3.4	33	74
Singapore	3.5	814	100
Thailand	3.7	71	79
Vietnam	5.2	21	29
United States	13.0	4499	100
Japan	n.a.	n.a.	n.a.
High income OECD	10.2	2771	n.a.
World	9.3	482	55

Source: CEIC, 'World development indicators', presented in Hanna, D. and Huang, Y., 2003. SARS Impact on Asian Economies, Paper presented at Asian Economic Panel, Keio University, Tokyo, 11–12 May.

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	47
	99
	63
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	74
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and Huang, Y., 2003. SARS anel, Keio University, Tokyo,

is difficult to quantify the impact of the disease on the decisionmaking of foreign investors, they must surely have lost some degree of confidence in China. The impact of SARS on FDI has been relatively minor but its recurrence, or that of another epidemic, in China could have disastrous impacts on future foreign investment flows.

MODELLING ECONOMIC IMPACTS OF THE SARS EPIDEMIC

Most earlier studies on the economic effects of epidemics focus on direct medical costs or incomes forgone as a result of disease-related morbidity and mortality. Costs include private as well as public expenditures on diagnosing and treating the disease. Costs are increased by the need to maintain sterile environments, implement prevention measures, and do basic research (Commission on Macroeconomics and Health 2002).

Previous researchers have also focused on the long-term demographic consequences of epidemics. The first impact of epidemics is a negative shock to the population and labour force. Epidemics can have further effects on demographic structures by influencing fertility decisions of households. Another important mechanism by which a disease has an adverse impact on the economy's long-term growth is the destruction of human capital (Lee and McKibbin 2003).

However, the direct consequences of the SARS epidemic in terms of medical expenditures or demographic effects seem to be rather small, in particular compared to such major diseases as HIV/AIDS or malaria (see Bloom and Mahal 1997; Commission on Macroeconomics and Health 2002; Haacker 2002).

The number of probable SARS cases is still small compared to other major historical epidemics. Unlike AIDS, the duration of hospitalisation of the infected patients is short, with more than 90 per cent of patients soon recovering fully, so medical costs are low. The SARS-related demographic or human capital consequences are also currently estimated to be insignificant. But SARS has had detrimental economic effects in other ways.

SARS influences the global economy in three ways. First, fear of SARS leads to a substantial decline in consumer demand, especially for travel and in retail since the fast rate of contagion makes people avoid social interactions. The decrease in consumption has a more detrimental effect on regions with more service industries and higher population densities, such as Beijing and Hong Kong.

Table 2.3 Chronology of SARS and major responses by the Chinese government

16 November 2002	First known case of atypical pneumonia occurred in Foshan City, Guangdong Province, China, but was not identified until much later.
11 February 2003	The Chinese Ministry of Health informed the WHO of an outbreak of acute respiratory syndrome with 300 cases and 5 deaths in Guangdong Province.
14 February 2003	The Chinese Ministry of Health informed WHO that the outbreak in Guangdong Province was clinically consistent with atypical pneumonia. The outbreak was said to be coming under control.
12 March	WHO issued a global alert about cases of severe atypical pneumonia following mounting reports of spread among staff at hospitals in Hong Kong and Hanoi.
17 March	China provided a first brief report to WHO about the Guangdong outbreak. The outbreak was said to have tapered off.
26 March	China reported a cumulative total of 792 cases and 31 deaths in Guangdong Province from 16 November 2002 to 28 February 2003. Officials had previously reported 305 cases and 5 deaths from mid November to 9 February. Hong Kong announced the closure of schools until 6 April and placed 1,080 people under quarantine. Chinese authorities reported SARS cases in other parts of China. China joined WHO collaborative networks.
30 March	Hong Kong health authorities announced that 213 residents of the Amoy Gardens housing estate had been hospitalised with SARS since reporting on the disease had begun.
2 April	WHO recommended that persons travelling to Hong Kong and Guangdong Province considered postponing all but essential travel until further notice. This was the most stringent travel advisory issued by WHO in its 55-year history.
3 April	WHO team arrived in Guangdong and started work immediately. All team requests for access to sites and interviews with health staff at all levels were granted.
4 April	China began daily electronic reporting of cases and deaths nationwide by province.
16 April 2003	WHO announced that a new pathogen, a member of the coronavirus family never before seen in humans, is the cause of SARS.
18–20 April	China's top leaders advised officials not to cover up cases of SARS.
20 April	The mayor of Beijing and the Minister of Health were removed from their Communist Party posts. The State Council cancelled the week-long May Day holidays.

23 April

3 May

8 May

11 May 2003

21 May

23 May

13 June

23 June

24 June

5 July

Sources: Compiled
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23 April	The government established a national SARS task force headed by Vice-Premier Wu Yi, and a national fund of two billion yuan (US$243 million) for SARS prevention and control. Beijing officials suspended all primary and secondary schools for two-weeks.
	Chinese authorities reported a cumulative total of 2305 probable cases of SARS and 106 deaths, including 693 probable cases in Beijing.
3 May	WHO sent a team to Taiwan, which was reporting a cumulative total of 100 probable cases.
8 May	Travel recommendations were extended to Tianjin and Inner Mongolia in China and to Taipei, Taiwan.
11 May 2003	The Ministry of Finance announced that it would allocate an additional 812.6 million yuan (US$98.3 million) to improve the infrastructure and capacity of local medical institutes in a bid to prevent SARS from spreading to rural areas, which was on top of 1.55 billion yuan (US$187 million) already channelled to the construction of a nationwide disease prevention and control network. It also announced that taxes and administrative fees levied by the government on some industries affected by the outbreak of SARS would be waived or reduced.
21 May	Travel recommendations were extended to all of Taiwan.
23 May	Travel recommendations for Hong Kong and Guangdong Province were removed.
	Research teams in Hong Kong and China announced detection of a SARS-like virus in the masked palm civet and racoon-dog.
13 June	Travel recommendations for Hebei, Inner Mongolia, Shanxi and Tianjin provinces, China, were removed. Guangdong, Hebei, Hubei, Inner Mongolia, Jilin, Jiangsu, Shaanxi, Shanxi and Tianjin provinces were removed from the list of areas with recent local transmission.
23 June	Hong Kong was removed from the areas with recent local transmission.
24 June	Travel recommendations were removed for Beijing, the last remaining area subject to WHO travel advice. Beijing was also removed from the list of areas with recent local transmission.
5 July	Taiwan, the last area with recent local transmission, was removed from the list.
	WHO declared that SARS outbreaks had been contained worldwide, but called for continued vigilance.

Sources: Compiled from World Health Organization, n.d. CSR SARS homepage, 'SARS: Chronology of a Serial Killer', World Health Organization, Geneva. Available online at http://www.who.int/csr/don/2003_07_04/en/; and Asian Development Bank, n.d. Asia Recovery Information Center, SARS WATCH homepage, 'Chronology of Country Responses', Asian Development Bank, Manila. Available online at http://aric.adb.org/infocus/sars/chronology_sars_policy.asp.

Second, uncertainty concerning any future epidemics reduces confidence in the future and this effect is very important, particularly in China, which has been a key recipient of foreign investment.

Third, SARS undoubtedly increases the cost of disease prevention, especially in the most affected industries, such as travel, retail and the service industries. As long as the disease is transmitted only by close human contact, this cost may not be substantial, but if it were found to be transmitted by other channels, such as international cargo, the global cost would be enormous.

ESTIMATING THE ECONOMIC IMPACT OF SARS

We use the G-Cubed (Asia Pacific) Model to quantify the effects of SARS on China.[2] We first generate a baseline projection of the world economy from 2002 to 2100 under assumptions about exogenous inputs such as productivity growth rates by sector and country, population growth rates by country and settings for fiscal and monetary policies by country.[3] We then apply the shocks outlined below to this underlying baseline projection.

Design of simulation

We make two alternative assumptions about the duration of SARS. In an original paper we assumed in the first scenario that the shock would last a year. In reality, it lasted only six months so we have scaled down the shocks by 50 per cent. This is called a temporary shock. The second assumption is that future shocks are of the same magnitude in the first year as the temporary shock but are more persistent in that they fade out proportionally over ten years. This gives some insight into what might happen to the region if the SARS virus were the beginning of a series of annual epidemics emerging from China.

We first calculate the shocks to the Chinese and Hong Kong economies and then develop some indices summarising how these shocks would be likely to occur in other economies. There are three main shocks based on financial market analysts' observations about the data emerging from China and Hong Kong.

Initial shock to China and Hong Kong. In our representation of SARS, we assume three broad shocks to China and Hong Kong. These are

- a sector-specific demand shock to retail sales: a 15 per cent drop in demand for the exposed industries in the service sector
- a 5 per cent increase in costs in the exposed activities in the service sector
- a 200 basis point increase in the country risk premium.

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- geographical distance tc
- health expenditures and
- government response
- climate
- per capita income
- population density.

We develop indices that er
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Simulation results

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These shocks are scaled to last six months (by dividing by two) rather than a year, which is the frequency of the model.

We could also consider several other shocks, such as the impact on health expenditure and fiscal deficits. It is not clear how large this would be or for the persistent shock. Nor is even the direction of change clear. Since SARS kills a higher proportion of vulnerable people in a short time it follows that a large amount of expenditure for these people would thereafter be reduced. We might also anticipate the effect of the reaction of medical authorities with substantial investments in public health.

Shocks to other countries. In Lee and McKibbin (2003) we note that the transmission of SARS, as distinct from the economic transmission through global markets, depends on a number of factors. We refer to this as the global exposure to SARS. The speed of spread is likely to depend, among other things, on

- tourist flows
- geographical distance to China (and Hong Kong)
- health expenditures and sanitary conditions
- government response
- climate
- per capita income
- population density.

We develop indices that enable us to estimate the likely transmission of SARS to other countries. We do not present these in this chapter but use them in the simulations.

Simulation results

We apply the shocks outlined in the previous section to the global economy. We begin the simulation in 2003, assuming that the SARS outbreak was completely unanticipated. Both the temporary and persistent shocks are assumed to be understood by the forward-looking agents in the model. Clearly this is problematic when it comes to a new disease like SARS, which is likely to be associated with a period of learning about the nature of the shock. In this case, an assumption of rational expectations might not be justified. Yet there is no clear alternative. In our modelling we presume that only 30 per cent of agents have rational expectations and 70 per cent of agents are using a rule of thumb in adjusting to contemporaneous information about the economy.

Table 2.4 sets out results for the percentage change in GDP in 2003 as a result of the temporary and permanent SARS shocks, as well as the contribution of each

Table 2.4 Percentage change in GDP in 2003 due to SARS

	Temporary shock				Persistent shock over 10 years			
	Total effects	Demand shift	Cost rise	Country risk	Total effects	Demand shift	Cost rise	Country risk
United States	-0.07	-0.01	-0.06	0.00	-0.07	-0.01	-0.06	0.00
Japan	-0.07	-0.01	-0.06	0.00	-0.06	-0.01	-0.06	0.01
Australia	-0.07	0.00	-0.06	0.00	-0.06	0.00	-0.06	0.01
New Zealand	-0.08	0.01	-0.08	0.00	-0.08	0.00	-0.08	0.00
Indonesia	-0.08	0.01	-0.09	0.00	-0.07	0.01	-0.08	0.00
Malaysia	-0.15	0.01	-0.16	0.00	-0.17	0.01	-0.15	-0.02
Philippines	-0.10	0.04	-0.14	0.00	-0.11	0.03	-0.13	-0.02
Singapore	-0.47	-0.02	-0.45	0.00	-0.51	-0.01	-0.44	-0.05
Thailand	-0.15	0.00	-0.15	0.00	-0.15	0.00	-0.15	0.00
China	-1.05	-0.37	-0.34	-0.33	-2.34	-0.53	-0.33	-1.48
India	-0.04	0.00	-0.04	0.00	-0.04	0.00	-0.04	0.00
Taiwan	-0.49	-0.07	-0.41	-0.01	-0.53	-0.07	-0.39	-0.07
Korea	-0.10	-0.02	-0.08	0.00	-0.08	-0.01	-0.08	0.00
Hong Kong	-2.63	-0.06	-2.37	-0.20	-3.21	-0.12	-2.37	-0.71
ROECD	-0.05	0.00	-0.05	0.00	-0.05	0.00	-0.05	0.00
Non-oil developing countries	-0.05	-0.01	-0.04	0.00	-0.05	0.00	-0.04	0.00
Eastern Europe and Russia	-0.06	-0.01	-0.05	0.00	-0.05	-0.01	-0.05	0.00
OPEC	-0.07	-0.01	-0.05	0.00	-0.09	-0.01	-0.06	-0.02

Source: G-cubed (Asia Pacific) Model version 50n. Table 4 from Lee and McKibbin, 2003. 'Globalization and disease: the case of SARS', *Asian Economic Papers* (forthcoming).

component (that is, demand decline for services, cost increase for services and country risk premium).

The full dynamics of adjustment will be outlined shortly. Focusing on the effects on GDP, there are interesting differences between the various components of the overall shock as well as between the temporary and permanent shocks. The temporary shock has the largest impact on China and Hong Kong. The loss to Hong Kong of 2.63 per cent of GDP is much larger than the 1.05 per cent for China. This reflects the larger role of the service sector in Hong Kong and Hong Kong's greater reliance on trade. Taiwan is next most affected, losing 0.49 per cent of GDP in 2003, followed closely by Singapore, with a loss of 0.47 per cent. For Hong Kong, the increase in costs in the service sector is by far the largest contributing factor to the loss of GDP. In China, the contributions are evenly spread across the three factors.

A persistent SARS shock would be much more serious for Hong Kong and China. The primary impact would be from the rise of the country risk premium. Although the initial shock in 2003 is the same as for the temporary shock, persistent elevation of the country risk premium causes a much larger capital outflow from China and Hong Kong. This results in a sharp contraction in investment and an ongoing decrease in production. The growth of capital stock declines, which in turn further reduces investment.

The results for GDP just illustrated how the costs of SARS can be very different in 2003 depending on expectations of how the disease will unfold. It could also be instructive to examine the economic impact over time on other variables.

Figure 2.1 compares the adjustment over time for China under the two scenarios—when SARS is temporary, and when it is expected to be persistent. This figure contains six panels. Results for real GDP, investment, net capital outflows, real effective exchange rates, real interest rates and price levels are presented. Detailed discussion of these dynamics can be found in Lee and McKibbin (2003). The more persistent SARS is expected to be, the larger the impact on expectations, the larger the capital outflow and the larger the negative effects on investsment and real GDP. With an exchange rate pegged to the US dollar, the real exchange rate adjustment is achieved through a fall in the price level induced by a spike in real interest rates. Thus the exchange rate regime causes a larger GDP loss than would be the case if the Chinese exchange rate were flexible.

Other studies have estimated the potential effects of SARS, but it is difficult to compare their results directly with our own. Table 2.5 contains the various forecasts

-0.09 -0.01 -0.06 -0.02

Source: G-cubed (Asia Pacific) Model version 50n. Table 4 from Lee and McKibbin, 2003. 'Globalization and disease: the case of SARS', *Asian Economic Papers* (forthcoming).

Table 2.5 Forecasts for China's GDP growth

	Pre-SARS forecast	Height of SARS forecast	Post-SARS forecast
Asian Development Bank	7.5	7.3	7.3
World Bank	8.0	7.5	n.a
JP Morgan Chase	8.0	7.4	7.4
Morgan Stanley	7.0	6.5	7.5
Goldman Sachs	7.5	6-7	n.a
Citigroup	7.6	7.0	7.5

Source: Asian Development Bank, 2003. 'Social and economic impacts of SARS in the PRC', Asian Developement Bank, Manila. http://aric.adb.org/infocus/sars/SARSImpact_PRC.pdf

of Chinese GDP growth made before SARS and after SARS from a recent ADB study. There are more changes in the forecasts than just the impact of SARS. Nonetheless our estimate for temporary SARS of a cost of around 1 per cent of GDP in 2003 is larger than the results in this table. Our estimates are, however, a touch lower than those of Garnaut and Findlay (2003).

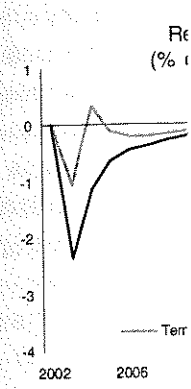
Policy lessons

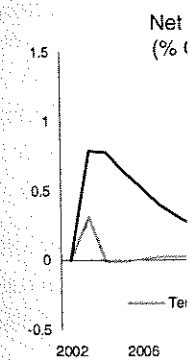
The large short-run economic impact of SARS on China is not the consequence of the disease itself for the affected people, but of effects on the behaviour of many people within China and abroad. Estimation of impacts also depends on the adjustment of expectations as reflected in real and financial markets. The more persistent SARS is expected to be, the larger the negative economic impacts will be in 2003 and in the future in affected economies.

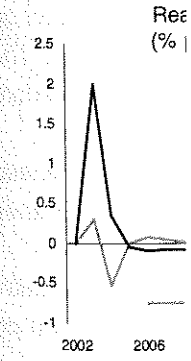
There are some important lessons for policy. Transparency is vital, especially when dealing with uncertainty (Grant 2003). The experience of SARS has moved China towards more transparency, but much more could be done. It is important to manage unnecessary public fears and maintain people's confidence. Transparency is more important in a globalised world in which a loss of foreign investors' confidence could have large impacts on foreign investment flows and consequently economic growth. This is shown in our simulations. It also emphasises the need to strengthen international cooperation regarding disease response.[4]

There is a strong economic case for the improvement of public health in China. Public health expenditure has been inadequate and there has not been enough investment in research into disease prevention.

Figure 2.1 Impac







Source:APG3 model

;ARS ;t	Post-SARS forecast
	7.3
	n.a
	7.4
	7.5
	n.a
	7.5

acts of SARS in the PRC',
/SARSImpact_PRC.pdf

SARS from a recent ADB
just the impact of SARS.
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is not the consequence of
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of public health in China.
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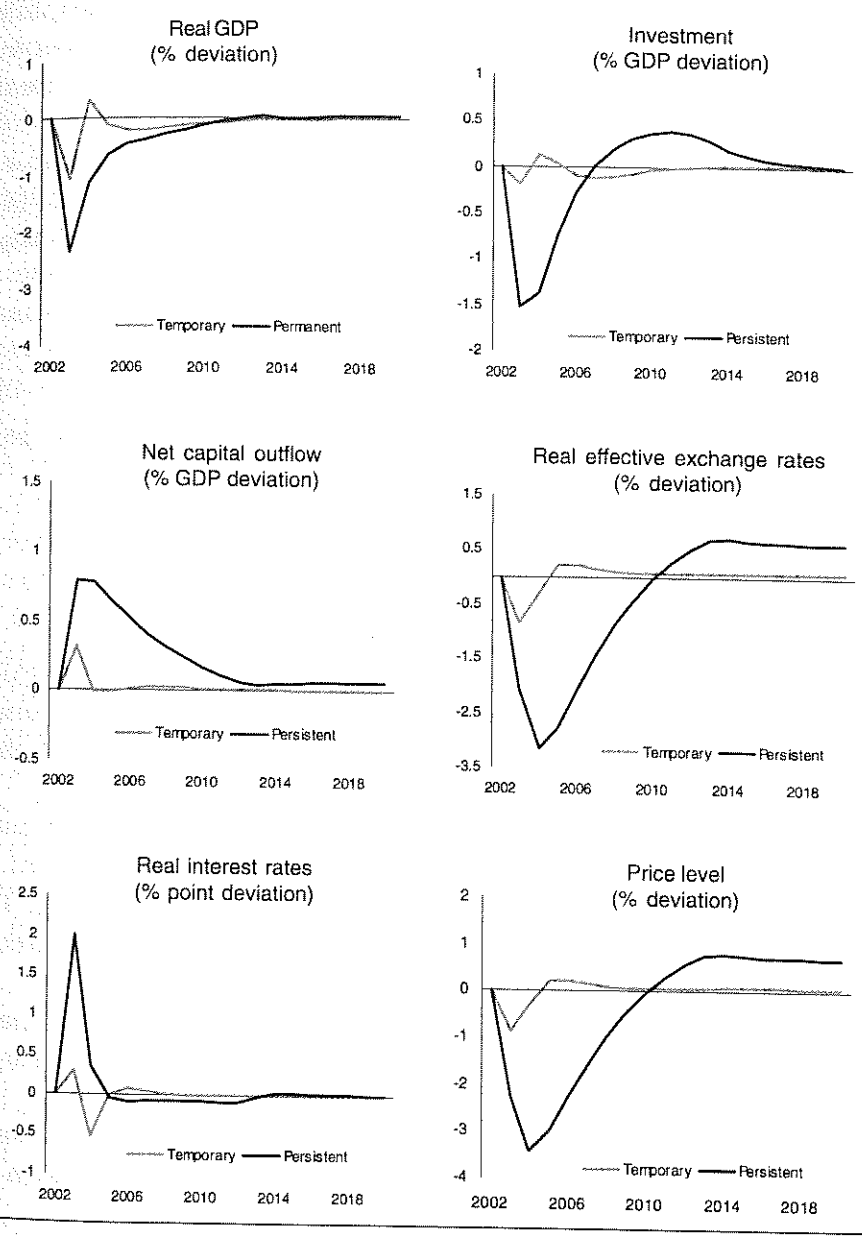
Figure 2.1 Impacts on China of temporary versus persistent SARS shock



Source:APG3 model version 50N

There is a need to improve the quality of government responses such as coordination between agencies and between central and local governments in China. A large part of the short-term costs that we estimate derive from the rigidity of the exchange rate. Given the underlying pressure for an appreciating yuan in the baseline, the lack of a depreciation may have been less pressing in practice, but still causes the costs of SARS to the larger in China and Hong Kong.

Finally, the outbreak of SARS has reinforced the idea that an important role of governments in an interdependent but uncertain world is to manage risk; to establish processes for responding appropriately to unforeseen events, and to coordinate policy responses and information sharing globally.

NOTES

[1] See WHO SARS website (www.who.int/csr/sars/en/).

[2] See McKibbin and Wilcoxen (1998) for the theoretical specification and McKibbin and Vines (2000) for an overview of key features and applications of the model.

[3] See Bagnoli et al. (1996) for an overview.

[4] A point made by Richard Cooper in Cooper (1989).

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