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Economic impact of a cholera epidemic on Mozambique and Bangladesh

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Contents

Executive Summary

- This report presents quantitative estimates of the macroeconomic impact of cholera in Bangladesh and Mozambique.

- A cholera epidemic would affect the economy via supply channels (employees unable to work) and demand channels (drop in tourism, in exports of food and in consumption of food away from home).

- The analysis is based on assumptions about the severity of the epidemic provided by the IVI. We also rely on assumptions about the drop in business and tourism travel to the countries, in exports of foods and in consumption of food away from home, drawn from historical experience of previous cholera and other infectious diseases epidemics.

- We use Oxford Economics' macroeconomic model to account for spillovers of the initial shocks through the economy.

- Since Oxford Economics' macroeconomic model does not include simulation models for Bangladesh and Mozambique we use models for India and South Africa respectively. We calibrate the shock so that we take into account economic features specific to Bangladesh and Mozambique.

- We find that the economic cost would amount to around 2% of GDP. This represents a significant, albeit manageable cost.

- In some sectors, such as tourism, some of this loss would probably be temporary. In others such as food exports, some of the loss risks to last several years.

Table: Scenario results – Impact of cholera epidemic

Impact of cholera epidemic *% difference from baseline unless otherwise stated*				
	Bangladesh		Mozambique	
	Year 1	Year 2	Year 1	Year 2
GDP	-2.2%	-0.6%	-2.1%	-0.5%
GDP (US$ million)	-2,179	-594	-245	-58
GDP per capita (US$)	-13	-4	-10	-2.5
Private consumption	-1.2%	-1.4%	-1.2%	-0.3%
Private consumption (US$ million)	-884	-1,032	-114	-28
Private consumption per capita (US$)	-5	-6	-5	-1
Consumer prices	0.1%	0.0%	0.2%	0.5%
Employment	-0.8%	-0.7%	-0.7%	-0.2%
Employment ('000s)	-613	-536	-56.3	-16.1

Source: Oxford Economics

1 Introduction

As a highly infectious, acute disease, cholera spreads very quickly within and between regions and countries. According to the WHO, there are an estimated 3-5 million cases and 100,000-200,000 deaths due to cholera every year. Outbreaks vary in intensity: incidence rates typically vary from below 0.1% to around 0.4%, case fatality rates range from 0.5% to 10% and epidemics last from a couple of months to more than one year.

The disease is transmitted through the consumption of contaminated water and food, and as a result, is much more prevalent in developing countries where access to improved water is limited. Around 75% of the population can be infected but show no sign of illness, resulting in the disease spreading when people travel between regions. Prompt treatment coupled with access to safe water and proper sanitation and health education can greatly limit the impact of the disease. With adequate treatment, the case fatality rate for those infected is around 1%, but this can rise dramatically if no treatment is administered or if distribution is inefficient. For instance, the WHO reports a case fatality rate of 6% at the beginning of the 2009 epidemic in Zimbabwe. Therefore, access to treatment and the underlying water infrastructure and education levels determine both the infection and death rates present within a country, and thereby the social and economic costs of a cholera outbreak.

In this report, using historical benchmarks of previous cholera epidemics as reported in the literature and documented by the International Vaccine Institute (IVI), we estimate the economic impact of a cholera outbreak in Bangladesh and Mozambique. We use Oxford Economics macroeconomic model to capture the main channels of transmission, including demand and supply effects. Since Oxford Economics' model does not include Bangladesh and Mozambique, we use models for India and South Africa and scale the shocks according to the economic features of Bangladesh and Mozambique. India and South Africa share many similar economic features that imply that the transmission of the shock through the economy is likely to be similar to what would happen in Bangladesh and Mozambique.

This note explains our approach and results. The note is structured as follows:

- Section 2 briefly summarises previous studies of cholera outbreaks with the view to extract a few key parameters for our quantitative assessment.

- Section 3 explains the economic channels of transmission of the pandemic shock, separating supply from demand shocks and outlining likely policy responses and explains the assumptions used in this analysis.

- Section 4 presents the quantitative results.

- Section 5 concludes.

- The Appendix in Section 6 presents the estimated economic impacts for India and South Africa that we have used to benchmark our estimations for Bangladesh and Mozambique respectively.

2 Benchmark from previous episodes and studies

A few studies have estimated the economic costs of a cholera epidemic. Suarez & Bradford (1993) compute a fuller estimate the cost of the 1991 cholera epidemic in Peru. They calculate the supply channels outlined by Kirigia et al, and three demand effects: reduced tourism revenue, reduced revenue on exports of goods and lower domestic consumption. The tourism channel is significant, with revenues from international visitors 72% of their level in 1990 . Export revenues were expected to decline drastically, as importers put up barriers to prevent transmission of the disease. However this was not the case, as it was found that the disease was not transmitted in most food products. As a result only fresh fish exports were limited and total exports in 1991 were just 0.5% lower than the previous year.

Turning to the consumption effects, unlike influenza, cholera is not easily spread through human-to-human contact, at least not outside the household, and as a result there is no need for people to isolate themselves to avoid the epidemic. Suarez & Bradford found that the only sectors significantly affected were fresh fish, where demand fell by 33.6%, and street food vendors, although the authors mention that this estimate may be exaggerated. However, they note that there is likely to be general equilibrium effects, as consumers substitute potentially infected food with safe alternatives, and a fall in discretionary spending as consumers avoid restaurants. The WHO quotes an estimated cost of US$770 million to Peruvian GDP in 1991 (around 2% of GDP) from the epidemic, citing food trade embargo and the impact on tourism as the main channels.

Despite WHO guidelines suggesting that travel and trade do not need to be restricted during an epidemic, many countries limit imports from infected areas. Kimball et al (2005) attempt to estimate the loss of export earnings using data from Mozambique, Kenya, Tanzania and Uganda, which suffered epidemics in 1997-2002 and were subject to EU restrictions on fish imports. They find that these countries lost around 4% of total exports earnings in 1998, rising up to more than 10% in 2002. The latter estimate seems large, especially given that the EU restrictions only lasted six months and had therefore long been lifted by 2002. However, this study suggests that for poorer, less developed countries that are more reliant on fresh food exports this channel could be significant.

Poulos et al (2008) calculate the public (i.e. treatment and hospitalisation) and private (payments for medical care, lost earnings of the patient and caretakers at home) short-term costs of an epidemic using patient data from Bangladesh, Mozambique, India and Indonesia. They find that the majority of the costs is borne by the public sector, but that from an individual level the private costs can be significant, particularly if the patient has to be hospitalised . Kirigia et al (2009) conduct a similar analysis, calculating both the short-term and long-term costs of cholera in the WHO's Africa Region in 2005. Their costs include hospitalisation and treatment, laboratory diagnosis of the disease, short-term loss of earnings of patients and their families and lost productivity and output due to limited working ability and premature death . They estimate a total

economic loss of USD 53.2 million as a result of the 125,018 cases reported in the WHO Africa Region in 2005, equivalent to slightly less than 1% of GDP.

These studies addressed some of the main transmission channels of the economic impact of a cholera epidemic on the economy. In this report, we use Oxford Economics' macroeconomic model to obtain quantitative estimates of the overall economic impact, accounting for spillovers through the economy.

3 Economic channels

In this section we discuss the nature of the impacts that are likely to result from a cholera outbreak and we explain how these shocks are implemented in Oxford Economics' macroeconomic model. A macroeconomic model allows us to account for the transmission of the shock from, say, exports to employment, to incomes and hence private consumption. It is a unique tool to be able to get a comprehensive estimate of the economic impact of cholera.

Oxford Economics' global macroeconomic model encompasses both demand and supply aspects of each economy. On the demand side, consumers' expenditure is a function of incomes, employment and real interest rates. So if a cholera outbreak has a negative impact on economic activity that reduces demand for labour, this will feed through to consumer spending via lower incomes, which in turn will affect overall GDP and demand for labour (amongst other variables). Investment is determined by the level of real interest rates and competitiveness, but is mainly driven by an 'accelerator' mechanism – that is, lower output leads to lower investment. On the supply side, the long-run trend rate of growth of the economy depends on the growth in the population of working age, the speed with which the capital available to workers increases, and total factor productivity growth. So if a cholera outbreak affects availability of labour, that will tend to dampen potential growth. In turn, the (mis)match between demand and supply has an impact on prices. If weaker demand leaves large amounts of production capacity unused, this will tend to depress prices as companies are forced to reduce margins.

These are examples of the channels at play in the estimation of the economic impact of the cholera. The remainder of this section details the main economic transmission channels and the assumptions used in these studies.

3.1 Supply channels

3.1.1 Labour supply

We use data provided by the IVI to calibrate the size of the supply shock. These data include

- Incidence rates of 0.214% and 0.275% for Bangladesh and Mozambique respectively

- Case fatality rates of 1.5% and 3.8% for Bangladesh and Mozambique respectively

- Duration of illness of 6 days

- Duration of epidemic of 9 months

Based on these parameters, the temporary negative impact on labour supply is 0.05% and 0.13% for Bangladesh and Mozambique respectively, over 9 months. The permanent negative impact on labour supply is 0.03% in Bangladesh and 0.05% in Mozambique.

At the macroeconomic level, these shocks are very small and are unlikely to represent significant costs. With around half the work force employed in agriculture, employers should be able to find replacements for absent employees.

Table 3.1.1: Assumptions about severity of cholera epidemic

Assumptions about severity of cholera epidemic		
	Bangladesh	Mozambique
Incidence rates	0.214%	0.275%
Case Fatality Rates	1.5%	3.8%
Duration of illness	6 days	6 days
Duration of epidemic	9 months	9 months

3.1.2   Total factor productivity

A cholera outbreak is likely to restrict the ability of companies to carry out business normally.

For instance, Oxford Economics has carried out some work on air travel and total factor productivity (TFP). We have estimated that a 10% reduction in air travel reduces TFP by 0.6% in the long term. This estimate was based on a sample of countries with higher income levels than Mozambique and Bangladesh. In this study, we assume that the elasticity of TFP to business travel is half as large, at 0.3%. Given the assumed 60% drop in travel, this implies a productivity shock of 1.8%.

3.1.3   Production costs

The impact of a cholera outbreak on production costs is ambiguous and is likely to depend on when the outbreak occurs in the country's economic cycle. Disruptions in transport and logistics could lead to a rise in production costs if spare capacity is scarce. But if the outbreak occurs when the economy has surplus capacity, the impact of the epidemic on production costs is likely to be minimal. In practice, it is likely that prices of some goods like food go up while prices of other goods and services for which demand falls go down. Agricultural products account for 29% and 16% of total imports in Bangladesh and Mozambique respectively (WTO data). A rise in food prices would therefore have a significant impact on overall prices in the economy. And since food consumption tends to be price-inelastic, this would put a significant burden on households' purchasing power.

3.2   Demand channels

3.2.1   International travel and tourism

Suarez & Bradford (1993) suggest that the impact of a cholera epidemic on international travel and tourism can be very large. Their estimate of a 72% fall in

tourism revenue in Peru is of a similar order of magnitude to the fall in foreign tourist arrivals in Asia that was around 60%.

We use the Peru example to calibrate the shock to travel and tourism in this study. Tourism is then assumed to gradually return to more normal levels.

It should be noted that this may overstate the actual impact of the cholera outbreak as other factors, such as terrorist attacks at the time, are likely to have deterred tourists. Different countries have very different exposures to travel and tourism as shown in the table below. A given fall in tourism inflows will therefore affect various economies very differently. In this respect, as shown in the table below, Mozambique is much more reliant on the tourism sector than Bangladesh.

Table 3.2.1: Weight of travel and tourism in the economy

	Bangladesh	Mozambique
% of total exports	0.5%	7.0%
% of GDP	0.1%	1.5%

3.2.2   Exports of goods

Although the WHO states that embargoes are unnecessary, a country affected by a cholera outbreak is likely to experience a fall in exports of food, as reported in Kimball et al (2005). In this respect, Bangladesh and Mozambique are similarly exposed, with exports of food accounting for 2-2.5% of GDP.

Table 3.2.2: Exports of agriculture products

	Bangladesh	Mozambique
% of total exports	9.6%	12.2%
% of GDP	1.9%	2.6%

To calibrate the shock, we take the data from Kimball et al. Assuming that the 4% shortfall in total exports is accounted for by exports of food products implies a 8% shortfall in exports of foods (food accounted for around 50% of exports of these countries in 1997-2002). In our simulation, we apply a negative shock of 8% to exports of food in Bangladesh and Mozambique. As for travel and tourism, exports of foods are assumed to return to normal levels gradually once the epidemic is over.

3.2.3   Discretionary consumer spending

Experience suggests that consumers cut spending on non-essential goods and services during epidemic outbreaks and health scares as they seek to avoid crowded places such as markets and restaurants.

For cholera however, this channel is likely to be of little significance. As mentioned in Suarez & Bradford, there may be cuts in food consumption from

street vendors and restaurants but the fall in overall discretionary consumer spending is likely to be much smaller.

We make the assumption that consumption of food away from home drops by 20%. Data on the share in total consumption of spending on food away from home are not available for Bangladesh and Mozambique. However, looking at other countries in the region, we can assume that this share is around 5%.

3.2.4   Fixed investment

Beyond the dampening impact of slower activity and higher interest rates (see below), domestic and foreign investment is also likely to be postponed while the economic impact of the epidemic is uncertain. The calibration of this shock is more difficult. There is no visible impact on investment in Peru in 1991 for instance. Investment was broadly unchanged in real terms in Peru in 1991, after a small increase the year before. The experience of other epidemics or health scares like the SARS episode in 2003 shows no clear and consistent fall in investment in the affected countries either.

In this study, we assume a shock of the same size as the productivity shock explained above (-1.8%). This is the assumption that we have retained in previous analyses of the economic impact of epidemics. If anything, risks are that investment falls by a larger amount.

3.3   Summary of assumptions

The table below shows summarises the assumptions for Bangladesh and Mozambique. The shocks are applied from the beginning of 2011 for three quarters and then gradually fade off.

Table 3.3: Summary of assumptions

Summary of assumptions		
	Bangladesh	Mozambique
Incidence rates	0.214%	0.275%
Case Fatality Rates	1.50%	3.80%
Duration of illness	6 days	6 days
Duration of epidemic	9 months	9 months
Productivity shock	-1.8%	-1.8%
Shock to travel and tourism	-72%	-72%
Shock to exports of food	-8%	-8%
Consumption shock	-1%	-1%
Investment shock	-1.8%	-1.8%
Monetary policy	No change	No change
Fiscal policy	Endogenous	Endogenous

4 Scenario results

The table below shows a summary of the estimated impact of a cholera pandemic on Bangladesh and Mozambique.

- We find that GDP is lowered by around 2-2.5% in the year of the epidemic and 0.5-1% in the following year. This represents a loss of more than US$2 billion for Bangladesh and around US$257 million for Mozambique.

- The main direct effect is the loss of exports as a result of the cholera outbreak.

- In the year of the epidemic, consumer spending is reduced by US$884 million for Bangladesh (1.2%) and US$114 million for Mozambique (1.2%).

- The negative impact is more persistent in Bangladesh than in Mozambique due to different labour market structures that imply that job losses continue in the second year in Bangladesh while they are relatively small in Mozambique.

- The impact on consumer prices is small, with only a slight increase in both countries.

- In terms of jobs, the epidemic would cause the loss of more than 600,000 jobs and 56,000 in Bangladesh and Mozambique respectively.

Table 4: Scenario results – Impact of cholera epidemic

Impact of cholera epidemic *% difference from baseline unless otherwise stated*				
	Bangladesh		Mozambique	
	Year 1	Year 2	Year 1	Year 2
GDP	-2.2%	-0.6%	-2.1%	-0.5%
GDP (US$ million)	-2,179	-594	-245	-58
GDP per capita (US$)	-13	-4	-10	-2.5
Private consumption	-1.2%	-1.4%	-1.2%	-0.3%
Private consumption (US$ million)	-884	-1,032	-114	-28
Private consumption per capita (US$)	-5	-6	-5	-1
Consumer prices	0.1%	0.0%	0.2%	0.5%
Employment	-0.8%	-0.7%	-0.7%	-0.2%
Employment ('000s)	-613	-536	-56.3	-16.1

Source: Oxford Economics

These results are consistent with the findings of previous studies that estimated the impact at 1-2% of GDP. This analysis suggests that a cholera epidemic can have significant, albeit manageable, adverse economic effects. A GDP loss of the order of 2-2.5% can typically be recouped within a few years.

In this study, we have assumed that the cholera epidemic is contained to Bangladesh and Mozambique. If the epidemic were to spread across countries,

the impact on international trade and hence the economy as a whole would be larger.

5 Conclusion

We have analysed the economic impact of cholera in Bangladesh and Mozambique. The analysis is based on assumptions about the severity of the epidemic provided by the IVI. We also rely on assumptions about the drop in business and tourism travel to the countries, in exports of foods and in consumption of food away from home, drawn from historical experience of previous cholera and other infectious diseases epidemics.

We find that the economic cost would amount to around 2-2.5% of GDP in the first year of the epidemic. This represents a significant, albeit manageable cost. In some sectors, such as tourism, some of this loss would probably be temporary. In others such as food exports, some of the loss risks to last several years.

6 Appendix

This Appendix shows the estimation of the impacts for India and South Africa. We used these two countries to benchmark the results for Bangladesh and Mozambique respectively. Using a macroeconomic model is essential to account for all the multipliers in the economy. India and South Africa share many similar economic features that imply that the transmission of the shock through the economy is likely to be similar to what would happen in Bangladesh and Mozambique.

The results, summarised in the table below, are qualitatively similar. Starting with India, the economic features that are relevant for this analysis are similar to those of Bangladesh. The export shocks is somewhat larger in India given a slightly higher share of exports in GDP and larger contribution of tourism to total exports, but this is offset by a lesser impact of the consumption shock given the lower GDP share of consumer spending.

For South Africa, the impact is slightly larger than what we estimate for Mozambique. This is mainly due to a higher share of exports in GDP and a higher reliance on tourism as a source of export revenues.

% difference from baseline unless otherwise stated				
	India		South Africa	
	Year 1	Year 2	Year 1	Year 2
GDP	-2.5%	-0.7%	-2.6%	-0.6%
GDP (US$ million)	-37,725	-10,563	-9,249	-2,134
GDP per capita (US$)	-31	-9	-183	-42
Private consumption	-1.0%	-1.4%	-1.0%	-0.2%
Private consumption (US$ billion)	-8,480	-11,873	-2,096	-419
Private consumption per capita (US$)	-7	-10	-42	-8
Consumer prices	0.1%	0.0%	0.3%	0.7%
Employment	-0.8%	-0.7%	-0.9%	-0.2%
Employment ('000s)	-3,951	-3,457	-117	-26

Source: Oxford Economics

7 References

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