



The Economic Impact of Ebola on Sub-Saharan Africa:
Updated Estimates for 2015

January 20, 2015



Summary

- This report, prepared for the 2015 World Economic Forum in Davos, presents three updates to World Bank analysis of the economic impact of the Ebola epidemic:
 - Updated reports from the three directly affected countries;
 - Country-level estimates of economic impact across sub-Saharan Africa;
 - The results of an updated general-equilibrium simulation of the impact of possible further spread of the epidemic within Africa.
- Despite evidence of progress being made against the disease itself, the economic effects on the three countries suffering intense transmission – Guinea, Liberia, and Sierra Leone – remain acute:
 - Cellphone survey data underline the severity of employment and income effects, particularly in urban areas and among private-sector wage earners and the self-employed;
 - Growth forecasts have been drastically downgraded relative to pre-Ebola expectations;
 - Output forgone due to Ebola in 2015 alone in the three countries is estimated to be more than \$1.6 billion, over 12 percent of their combined GDP.
- The transmission of the epidemic beyond these three countries has so far been successfully curtailed, mainly through preparedness in other African countries (e.g., Nigeria, Senegal, and Mali).
- World Bank country teams report that the effects of the epidemic on African economies beyond those directly hit have been muted. We estimate the overall impact on the African regional economy (beyond the directly affected countries) of just over half a billion dollars, mostly concentrated in West Africa.
- Updated general equilibrium analysis suggests that further spread of the epidemic to other African economies, if the epidemic is not contained and instances of infection continue to occur in other countries, could potentially exact an economic toll of the order of \$6 billion. The decline in the likely economic impact from our earlier “high Ebola” scenario is explained by the successful nature of policy responses in African countries since September 2014, which have reduced within-country and cross-border transmission rates.
- These results underscore the importance of:
 - (a) Ebola and broader pandemic preparedness in African countries; and
 - (b) Reaching the goal of zero new cases as soon as possible in the three most affected countries.



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1. Introduction

The most severe impact of the Ebola epidemic, which began in Guinea in December 2013 and quickly spread to Liberia and Sierra Leone, has been in lost human lives and suffering. At the time of writing, more than 21,000 cases have been reported, more than 8,000 people have died, and many more have lost family members or been orphaned.¹ The human cost is incalculable.

This report, prepared for the World Economic Forum at Davos, focuses on the indirect, economic costs, in particular the effects on economic output in 2015. Most of the economic cost is driven by “aversion behavior”, which consists of both the actions taken by individuals to avoid exposure to the illness and actions taken by investors in anticipation of those individual choices. Aversion behavior includes both rational reactions (such as altering burial practices) and irrational ones (such as cancelling vacations to countries far from the outbreak) and may affect all sectors of the economy. Schools remain closed,² certain patients avoid health services,³ agricultural communities have cut the size of the harvest teams, local businesses have reduced hours, and international companies have put investment plans on hold. Such costs also have magnitudes largely unrelated to the actual number of cases of the disease.

The report first estimates the impact of the epidemic on gross domestic product (GDP) in Guinea, Liberia, and Sierra Leone. Here the report builds on sector-specific analysis to update World Bank forecasts for the three countries,⁴ and incorporates recent results of World Bank-financed cellphone surveys in Liberia and Sierra Leone.⁵

We then evaluate the economic effects of the epidemic on the continent, beyond the three hardest-hit countries, using assessments by World Bank country economists across the 48 countries of sub-Saharan Africa. Finally, the report updates estimates from the global economic model of the research arm of the World Bank, to quantify the 2015 impact of the potential spread of the epidemic to other countries.

This report adds to a series of recent World Bank studies of the economic impact of Ebola. The first, released during the Annual Meetings of the IMF and the World Bank in early October, 2014, illustrated the severity of the impact on Guinea, Liberia, and Sierra Leone and went on to estimate two scenarios for the potential impact of spread to the rest of West Africa.⁶ Using parameters on air travel and likely rates of Ebola transmission within countries at the time, the potential damage to the West African economy in 2015 was estimated to be about \$1.6 billion under a “Low Ebola” scenario reflecting containment (rising to \$3.8 billion when 2014 losses were included). In the “High Ebola” scenario, it was estimated that the impact might have been as high as \$25 billion in 2015 (rising above \$32 billion when 2014 losses were included).

However, since October 2014 there have been major improvements in Ebola transmission rates in Guinea, Liberia, and Sierra Leone. These improvements have come from better awareness of correct

¹ World Health Organization (2015).

² UNMEER (2015) reports hopes of schools reopening soon.

³ World Bank (2015a) finds a drop in the number of women reporting utilizing health services in Sierra Leone.

⁴ World Bank (2014b).

⁵ World Bank (2015a; 2015b).

⁶ World Bank (2014a).



sanitary procedures among populations, earlier case diagnosis, and increased availability of care within Ebola treatment units (ETUs). There has also been a fall in international travel in the region. Finally, containment efforts in the neighboring countries to which Ebola cases did seep (Mali, Nigeria and Senegal) have proved to be successful to date. The expected spread of any potential outbreak of Ebola beyond Guinea, Liberia, and Sierra Leone is now lower and so, therefore, are the likely economic effects of such a spread. This report quantifies the Africa-wide impact of these improvements and arrives at new, lower estimates of the Ebola-related economic risks facing Africa, on the order of \$6 billion.

It is important to emphasize that the reduction in our “high-Ebola” economic impact estimates reflects a decline in the uncertainty about the risks of epidemic spread outside the core three countries, given certain improvements in vigilance, preparedness and containment, both within Guinea, Liberia and Sierra Leone, and in neighboring countries. These lower estimates thus largely reflect the returns to the policy response. In the absence of adequate policies, or should vigilance and preparedness be relaxed, the transmission probabilities used in our model would change once again, and so would the final impact estimates.

Our findings thus place economic values both on the attainment of the goal of zero new cases and also on pandemic preparedness in all African countries. As long as the goal of zero new cases is not reached in the three countries, there will be the risk of transmission beyond their borders. And as long as this risk continues, so will the costs associated with aversion behavior. Just as good policy has helped slow the epidemic and limit its spread, better policy is now needed to consolidate these gains.



2. Economic Impact on Guinea, Liberia, and Sierra Leone

The Ebola epidemic continues to cripple the economies of Guinea, Liberia, and Sierra Leone. Since mid-2014 all three economies have seen flat or negative income growth (and large resulting fiscal needs). All three were growing briskly in the first half of 2014. But full-year 2014 growth in Guinea collapsed to an estimated 0.5 percent from a rate of 4.5 percent expected before the crisis. Full-year growth for 2014 in Liberia fell by more than half to an estimated 2.2 percent from 5.9 percent expected before the crisis. Full-year 2014 growth in Sierra Leone fell by more than half to 4.0 percent from 11.3 percent expected before the crisis. All three of these rates imply shrinking economies in the second half of 2014. The total fiscal impact felt by the three countries in 2014 was over half a billion dollars, nearly 5 percent of their combined GDP.

Second-round effects and investor aversion make 2015 growth estimates sober: -0.2 percent in Guinea, 3.0 percent in Liberia, -2.0 percent in Sierra Leone (down from pre-Ebola estimates of 4.3 percent, 6.8 percent, and 8.9 percent, respectively: Figure 1). These projections imply forgone income across the three countries in 2015 of about \$1.6 billion (about \$500 million for Guinea, \$200 million for Liberia, and \$900 million for Sierra Leone: Table 1), more than 12 percent of their combined GDP.

Figure 1: 2015 Forecast Growth Rates

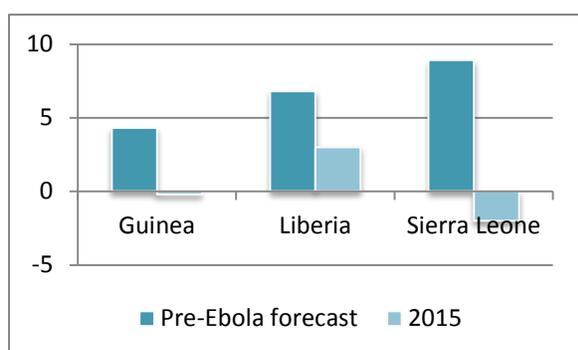


Table 1: Forgone Output

	Est. 2014 GDP (\$bn)	2015 growth forecast		GDP loss (\$m)*
		June 2014	Jan. 2015	
Guinea	6.2	4.3	-0.2	540
Liberia	2.3	6.8	3.0	180
Sierra Leone	5.0	8.9	-2.0	920
TOTAL	13.5			1,640

* Includes base effect from lost 2014 growth

Guinea

There is as yet little sign of economic activity recovering in Guinea. Our 2015 GDP growth forecast has been cut to -0.2 percent (from an October forecast of 2.0 percent). Domestic commerce and services have been hit by the drop in international travel and regional trade, while exports to neighboring countries have also slowed (e.g., fish exports have fallen by more than 40 percent), as have projects involving expatriate workers.

Agriculture has been particularly hard hit in Guinea as the epidemic began in one of the country's main agricultural regions. Rice production is estimated to have fallen by 20 percent in 2014, coffee by half, cocoa by a third, and corn by a quarter. World Food Program (WFP) telephone surveys have found some households substituting foodstuffs and reducing the quality and frequency of meals to cope with shortages. The most recent WFP estimates project 1.2 million Guineans suffering severe food insecurity



in March 2015, of whom it estimates about 470 000 as the additional effect of the Ebola epidemic.⁷ Falling commodity prices also play a role in this downward revision of economic growth.

Manufacturing, though accounting for less than 7 percent of GDP, has been hit by difficulty obtaining inputs due to port delays and logistics challenges. Cement imports have fallen by 50 percent.

Many services are tied to the mining sector, in which most major players have evacuated foreign workers. In November 2014, interviews with the private sector revealed increasing lay-offs. Hotel occupancy rates for most of the hotels in Conakry are only about 20 percent. All major construction projects remain on hold (e.g., more than \$700 million investment in the Boffa bauxite mine is now expected only beyond 2015). Still, mining output itself has not yet been severely affected as the largest mines are located outside the Ebola-affected areas, providing some firmness to overall GDP estimates.

Liberia

Several recent macroeconomic indicators point to persistent stagnation despite progress in the epidemiological fight: low diesel sales, an 11 percent contraction in money supply through 2014, and a 30 percent slump in imports between January and September are consistent indicators of this. Our growth forecast has been cut to 3.0 percent from a pre-Ebola expectation of 6.8 percent, although this is slightly up from our October forecast of 1.0 percent for 2015. Against a backdrop of declining new cases of Ebola, there are signs of domestic aversion behavior abating (with international aversion behavior perhaps slower to respond).

Although large volumes of resources are flowing into the country to finance the Ebola response, economic activity is yet to reflect this, as resource inflows have been more than offset by low exports and investment demand. Rubber exports were down 40 percent relative to 2013 over the first three quarters of 2014 (although iron ore exports have remained firm).

Household incomes have suffered from substantial loss of wage jobs and self-employment activities. In the December round of the World Bank's cellphone survey, nearly half of Liberian household heads who were working in the first half of 2014 reported being out of work, with recent job losses concentrated among urban, private-sector wage-earners. While public sector workers who have been furloughed are still receiving salaries, the later, private sector job losses represent household income forgone. There is also a disproportionate gender effect: of those working in the first half of 2014, 60 percent of women versus 40 percent of men had ceased to work by December. These trends are also consistent with the observation that the net inflow of remittances has turned positive since September, as inflows have increased and outflows fallen.

The income shock and higher prices for key staples have resulted in widespread food insecurity. More than nine out of every ten households interviewed have cited food insecurity as an issue in at least one of the three rounds of the cellphone survey.⁸

⁷ FAO & WFP (2015).

⁸ Due to sample selection and non-response issues, these surveys are informative of a selected sub-sample of the Liberian population. They should not be considered representative of the population as a whole.



Private-sector construction has been a continued source of activity even as Ebola-related construction winds down: domestic cement production remains at 90 percent of the main manufacturer's pre-Ebola projections, close to 2013 levels. Some further construction demand may stem from the planned opening of schools in February 2015. On a further upbeat note, two Chinese contractors resumed work on World Bank roads projects in late December.

The mining sector remains resilient, although investments to expand capacity remain on hold. Slowdowns in China and in Europe and the decline in iron ore prices, which fell by about half in 2014, pose a substantial challenge. The price of rubber, Liberia's second largest export, has fared little better, falling by 30 percent.

Finally, despite a return to farming by many rural workers, recent harvests appear to have done little to improve the food situation. Of surveyed households that have completed the harvest (more than half), 80 percent report a reduction in crops relative to last year. Reduced labor sharing is expected to lead to further reductions in food supply.

Sierra Leone

Sierra Leone, of the three countries, is having the greatest difficulty controlling the epidemic and this has translated into a severe downgrading of its economic prospects in 2015. Forecast GDP growth was cut to -2.0 percent by World Bank economists in December, from a pre-Ebola expectation of 8.9 percent.

Beyond the question of when the disease will be contained, the main source of uncertainty over the 2015 outlook concerns iron ore mining and related foreign direct investment. Insolvency and the shutdown in late 2014 of both the main iron ore mines (which account for nearly one-fifth of GDP) are weighing heavily on economic prospects. One of the main operators, African Minerals, is now exporting only stockpiled ore while it seeks new equity.

The first cellphone survey conducted jointly by the Government of Sierra Leone, Innovations for Poverty Action, and the World Bank shows substantial impacts on employment, particularly in urban areas. Nationally, the proportion of household enterprises that have gone out of business has tripled, with revenues for those surviving down by 40 percent.⁹ The self-employment sector has shed an estimated 170,000 jobs, with a further 9,000 lost in the already limited wage employment sector. In the crucial agricultural sector, which employs the majority of the working age population, there is no conclusive evidence of disruption due to Ebola, but more than three-quarters of households have not yet completed the harvest. These impacts also do not vary between highly affected areas and the remainder of the country – pointing to a national economic slowdown.

Food insecurity is a significant problem in Sierra Leone, with more than two-thirds of households reporting having to undertake coping strategies in the week prior to the survey, though quarantine restrictions do not seem to be a major contributing factor. Finally, there is important evidence in Freetown that the Ebola epidemic has reduced the use of non-Ebola related health services, with a sharp decline in post-natal clinic visits by women who have recently given birth.

⁹ World Bank (2015a).



3. Economic Impact on Sub-Saharan Africa

Beyond the three most affected countries, there has been limited spread of the disease itself, with a small number of cases in Nigeria (20), Mali (8), and Senegal (1). All three countries were able to contain the epidemic swiftly. Nigeria and Senegal returned to Ebola-free status in October, and Mali was declared Ebola free in January. This section reports two new sets of estimates of the impact of the epidemic for West Africa. First, we aggregate country-level assessments of expected growth and the impact the epidemic may have had. Second, it reports the results of a model-based simulation, which projects the potential impact, were the epidemic to spread further. The numbers produced by this simulation are not a forecast. They simulate a “bad case” scenario, under which Ebola does spread beyond Guinea, Liberia, and Sierra Leone with some probability in 2015.

Country-Level Monitoring

Even if Ebola is controlled and further outbreaks avoided, economic costs will be incurred across sub-Saharan Africa (SSA) in 2015. Consumer and investor confidence has been eroded by the outbreak of the virus, and disruptions to travel and cross-border trade suggest cumulative losses of more than half a billion dollars across the region in 2015, outside the three directly affected countries. Economic damage would of course be larger if the Ebola outbreak cannot be contained.

The World Bank’s Global Economic Prospects report (January 2015) expects SSA to grow at 4.6 percent in 2015, down from a 5.0 percent forecast in June 2014.¹⁰ Projections have been revised downwards on account of global events, including the West African Ebola epidemic and the net effect of winners and losers from a steep fall in global oil and commodity prices. Key risks to this projected growth include a renewed spread of Ebola, violent insurgencies, further reductions in commodity prices, and volatile global financial conditions.

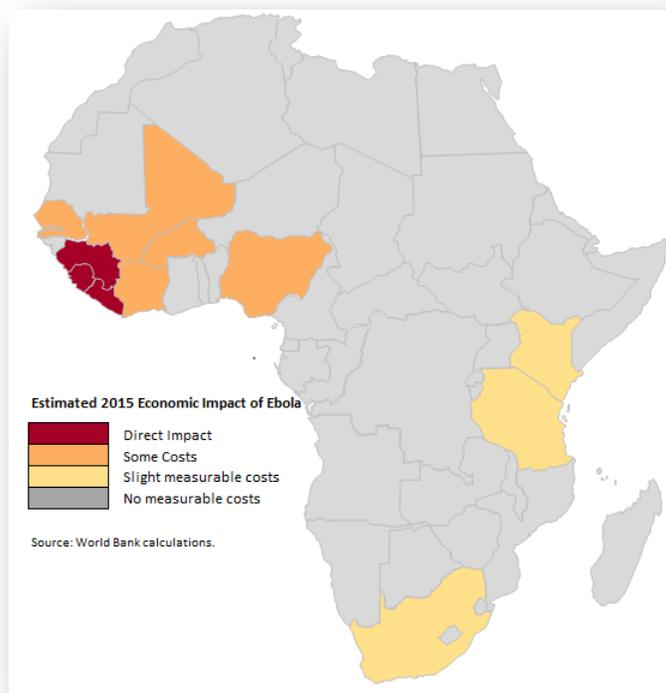
Much of the economic impact of Ebola beyond the epicenter of directly affected West African countries is based on fear, as was the case during the SARS outbreak in East Asia a decade ago. This fear – as well as the associated aversion behavior –relates to concerns that the epidemic cannot be contained (heightened by several cases in the USA and the EU) and in some cases to misperceptions about African geography (certain economically affected countries have not experienced a single case of Ebola). The impact is also uneven, with reported magnitudes of indirect impact varying greatly from country to country.

There has been a marked reduction in travel and tourism in the directly affected countries, but also across the continent. Fear and ignorance have been significant drivers of the indirect impact as many destinations experiencing cancellations and reduced bookings have not experienced a single case of the disease. Many of these countries are further from those directly affected than are the main European capitals. In many countries the trend is similar to that of SARS in 2003, when non-affected countries saw declines in travel bookings of between 15 percent and 35 percent.

¹⁰ World Bank (2015c).



Figure 2: Distribution of Indirect Economic Costs



As a powerful vehicle for economic growth and job creation, lower growth in travel and tourism creates economic concerns. The World Bank's 2013 *Tourism in Africa Report* highlights how one in every 20 jobs in Africa involves the tourism and travel industry and many more are supported indirectly by the sector.¹¹

More than 10 million people crossed international borders within SSA in 2014 (for shopping, medical needs, sports, religious events, business meetings and conferences) and although lower growth can be expected, levels of visitor numbers are not expected to decline. The UN World Tourism Organization (UNWTO) released its World Tourism Barometer in December 2014, forecasting a 1.8 percent increase in tourists in SSA in the third quarter of 2014 relative to 2013. This suggests that earlier forecasts of 4.2 percent growth in visitor numbers for 2015 will not be achieved. Furthermore, many travel and tourism decisions are subject to lags and reduced bookings are expected to have continued into the final quarter of 2014 and into 2015.

There has been large variation in level of impact. Some tourism destinations have reported a significant decline in 2014 and expected 2015 visitor numbers (e.g., The Gambia and Senegal) whilst other destinations have not reported any Ebola-related impact (e.g., Cabo Verde). Whilst the media has reported a significant drop in high-end tourism bookings (e.g., focusing on safari holidays in South Africa, Tanzania, and Kenya), a lack of hard data, booking lags, and seasonal factors prevent precise assessment

¹¹ Christie et al. (2013).



of the impact of declines in high-end tourism on economic growth. Feedback from the World Bank’s teams of country economists suggests that these effects are not large enough to have a palpable effect on national accounts, however (Figure 2 above).

Table 2: Main Economic Impact outside Directly Affected Countries in 2015

Level of impact	Countries Affected	Description	Impact Estimate for 2015 (in Lost GDP)
Some indirect impact on GDP	<ul style="list-style-type: none"> • The Gambia • Senegal • Mali • Nigeria • Burkina Faso • Côte d’Ivoire 	Lost trade through closed borders, disrupted supply chains, marked reduction in travel and tourism, and cancellation of international events.	\$550 million
Slight but traceable impact on GDP	<ul style="list-style-type: none"> • Tanzania • Kenya • South Africa 	Reported reduction in travel and tourism bookings for 2015.	
Negligible impact on GDP	Rest of sub-Saharan Africa	Small loss of commerce and drop in tourism (through aversion behavior), but too small to detect in national accounts.	

Source: World Bank calculations.

The Gambia’s tourism sector is one of the worst affected, despite the country’s not having had a single case of Ebola. The Government of The Gambia has reported 65 percent of hotel bookings and 50 percent of inward flights have been cancelled. In addition a national airline, Gambia Bird, has closed down because much its business had been generated from European tourist flights and connections to the Ebola-affected countries of Sierra Leone and Liberia. Tourism contributes 3 percent of The Gambia’s GDP, and as a consequence growth forecasts have been revised downwards for 2015 (from 6 percent to 4.5 percent, resulting in \$14 million in forgone GDP).

Similarly the Senegalese government estimates that tourism activity in 2014 will have declined by between 15 and 20 percent. Given the main tourism season runs from November to April, the negative economic impact is expected to continue into 2015. In contrast, the government of Cabo Verde, a popular West African package tourism destination, has not reported any changes to economic impact that can be linked to Ebola.

Claims that foreign direct investment has been cancelled or delayed by Ebola cannot be substantiated beyond those countries directly affected. This statement holds even more strongly now that other events, notably large reductions in commodity prices (including oil), have come into play and cannot easily be disentangled from Ebola’s effects. Countries neighboring those directly affected by Ebola, such as Côte d’Ivoire and Mali, and regional hubs and trade routes (e.g., Nigeria) have experienced small but noticeable declines in cross-border trade, as travel has been restricted and borders closed. Overall, including effects on travel, tourism, and trade, the largest estimated effects on GDP from consultation with World Bank country teams were in Nigeria (about \$186 million), Côte d’Ivoire (about \$93 million), Mali (about \$75 million), and Senegal (about \$45 million). Still, the estimated effects are small in relation to these four national economies



Lastly, several international events have been cancelled in 2014, including events in Nigeria, Côte d'Ivoire, and Burkina Faso, reducing service output somewhat and numbers of international visitors. The African Cup of Nations was at risk of being cancelled, but the event has been relocated from Morocco to Equatorial Guinea. The net effect of this change on sub-Saharan Africa could thus be expected to be mildly positive, although this has not changed the impact assessment in this report (Table 2).

Simulation-Based Projections of Potential Economic Impact

The preceding section is based on optimistic assumptions, that the disease is contained in 2015 without further instances of Ebola having an appreciable effect on economies outside Guinea, Liberia, and Sierra Leone. We now turn to the question of quantifying less optimistic scenarios, allowing for the possibility that the disease does spread beyond those three countries.

In October 2014, the World Bank published projections of the potential impact of the Ebola epidemic on the regional economy of West Africa.¹² This report updates those projections with new data on the likely speed and patterns of transmission of the disease and extends the discussion to all of sub-Saharan Africa.

Modeling Approach

Potential impact is calculated in three stages. In the first stage, independent academic researchers produce epidemiological estimates of the likely spread of the Ebola epidemic, assuming it is not contained in the original three affected countries. Our earlier impact projections used estimates of potential spread published in September 2014,¹³ based on a stochastic model that connects patterns of air travel between African countries (direct flights and subsequent connecting flights) and data on the distribution of population within each country. That model was simulated 50,000 times. Although airplane flights are not the only way that individuals carrying Ebola have traveled between countries, they serve as the best available proxy for the potential spread of the epidemic between countries.

Much has changed since those estimates were produced. First, a massive containment effort has taken place within the three most affected countries, including the establishment of Ebola Treatment Units, safe burial teams, home protection kits, and other measures. This containment effort showed visible results in October and November 2014 and has slowed the growth of the epidemic within the affected countries, leading to a significantly reduced probability of spread beyond national borders. Second, international travel to and from the affected countries fell, partly because of restrictions placed by neighboring countries, but largely as a result of endogenous aversion behavior.¹⁴ Both these factors are now reflected in updated, reduced estimates of the likelihood of any case being imported into another country and the subsequent probable number of cases in that country.¹⁵

¹² World Bank (2014a).

¹³ Gomes et al. (2014).

¹⁴ Poletto et al. (2014).

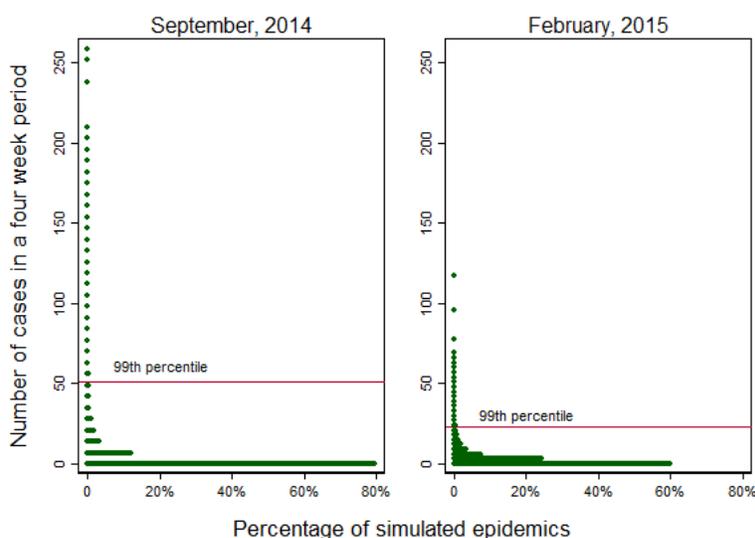
¹⁵ The estimates of spread were most recently calibrated by the Laboratory for the Modeling of Biological and Socio-Technical Systems at Northeastern University on November 24, 2014.



Figure 3 below shows the difference in the probability of spread between the earlier estimates (through September) and the current estimates (through February) over a four week period for a representative West African country. The potential number of cases has dropped dramatically.

For the projections in this report, we use two estimates from these epidemiological models. First, we take the expected probability of a single case arriving in a given country. Second, we also take from them the probability distribution of the number of cases in each country conditional on one case occurring in that country. Since we are simulating “downside” scenarios, we then take from this distribution an extreme scenario, the number of cases that occur in the worst 1 percent of simulations of the model in each country. That corresponds to the red line in Figure 3. This allows us to simulate significant spread of Ebola that nevertheless falls within the parameters of an existing epidemiological model calibrated to current behaviors and conditions.¹⁶

Figure 3: Improved Containment Reduces Epidemic Severity in a Representative West African Country



Source: Simulation results from Gomes et al. (2014) and Poletto et al. (2014).

In the second stage of modeling, each country is assigned an index (its “Ebola Impact Index”) based on the probability and potential size of an outbreak, as well as on the country’s ability to contain the outbreak. Spread probabilities are used from the preceding stage, while countries’ per-capita GDP serves as a proxy for the quality of healthcare systems, as well as other factors determining containment capacity.¹⁷

¹⁶ Of three scenarios that Gomes et al. produce, we use the middle scenario in terms of intensity of transmission (which the authors call “marginal containment”). This is the most serious scenario that reflects the behavioral responses and reductions in travel that have occurred and the progress of the epidemic in the three most affected countries. Gomes et al produce a more catastrophic scenario that does not incorporate the containment measures that have taken place and, at the time of writing, produces epidemiological estimates of the spread of Ebola that do not appear realistic and were therefore not relied upon for the analysis in this report.

¹⁷ To capture the non-linearity of the relationship between health outcomes and wealth, the square root of GDP is used in the index calculation.



Finally, in a third stage, Ebola Impact Indices are introduced into the World Bank’s global computable general equilibrium (CGE) model of the world economy, the “Linkage” model.¹⁸ In this model, the effects of catastrophic events such as natural disasters and epidemics can be captured, inter alia, through changes in labor supply, capital utilization, and trade and transaction costs. Changes to these parameters due to Ebola have already been estimated using a country-specific model of the Liberian economy.¹⁹ These effects are then scaled down for other countries, based on their number in the Ebola Impact Index in relation to Liberia’s.

These reductions in labor supply, capital utilization, and transaction costs are then input into “Linkage”, generating simulated estimates of output at the country level under scenarios with and without the further spread of Ebola. These scenarios capture the general equilibrium demand and supply effects of changes within each country in sub-Saharan Africa. Because of the cross-sector linkages built into the computable general equilibrium model, the estimates account for the knock-on (or “second-round”) effects of the initial shock on the rest of the economy. Such effects include, for example, reduced consumption by hotel workers that lose their jobs, or the effect on bars and restaurants of higher food prices. Differences between these scenarios then allow us to estimate the impact of Ebola spreading beyond the three currently affected countries.

Simulation Results

The simulation results suggest an estimated cost to the African economy of \$6.25 billion.²⁰ Of this amount, the vast majority – \$6.05 billion – is incurred within West Africa, with negligible impact elsewhere. Interestingly, the geographical distribution of impact from our simulation of this downside scenario accords well with the results derived from the country monitoring exercise reported above. This impact translates into a reduction in the continent’s regional economic growth rate of about 0.2 percentage points (from 5.3 percent to 5.1 percent): not huge but not insignificant. The growth impact within West Africa is larger, about 0.5 percentage points (from 6.4 percent to 5.9 percent, as in Figure 4).

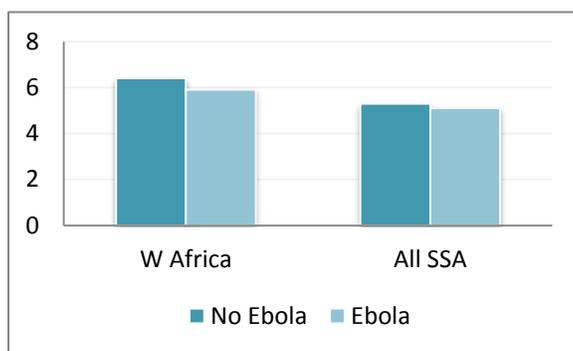
¹⁸ The “Linkage” model and its underlying database are described in greater detail in World Bank (2014a).

¹⁹ This process is explained in detail in World Bank (2014a).

²⁰ All cost estimates are in 2013 US dollars.



Figure 4: 2015 Growth Rates in “Linkage”



Comparison with Earlier Estimates

In October 2014 the World Bank published estimates of the potential economic damage of Ebola spreading to other West African countries, based on the “Linkage” model and using parameters that did not reflect the subsequent improvements in health system responses described above. The most pessimistic scenario in that analysis (“High Ebola”) used Ebola transmission predictions from the same epidemiological model, but calibrated these predictions to the rates of transmission observed until that point.²¹ A more optimistic scenario (“Low Ebola”) assumed that the epidemic would be contained by early 2015.

The “High Ebola” scenario from our October study used the CGE model to estimate 2014/2015 potential economic impact, at \$32.6 billion. Of this, the 2015 component was \$25.2 billion. Extending to the whole of SSA (not reported earlier), the simulated 2015 impact was \$31.6 billion, which can now be viewed as a “non-response” estimate of potential Ebola costs to Africa. In light not only of recent improvements made to public health management in Guinea, Liberia, and Sierra Leone, but also of successful containment efforts in Nigeria, Senegal, and Mali, the reduction in this cost estimate can be viewed as a return on investments in public health systems and practices in Africa (Figure 5).

The October 2014 “Low Ebola” scenario generated simulated economic losses to West Africa of \$3.8 billion, of which about \$1.6 billion would accrue in 2015. These cost estimates are relatively close to the economic monitoring estimates for 2015 reported here, emanating from World Bank country teams. In fact, the current country-level monitoring estimates (reported above) are \$1.6 billion just for the core three countries of Guinea, Liberia, and Sierra Leone, rising to approximately \$2 billion for West Africa as a whole.

At this point, therefore, we feel that our original simulations in October 2014 under-estimated the economic impact in the core three countries where the epidemic was already raging. Losses in output and incomes in Guinea, Liberia and Sierra Leone in 2015 are now forecast to be even greater. On the other hand, the probabilities of epidemic spread outside those countries are now estimated to be considerably lower than the October forecasts, so likely economic impacts elsewhere in West Africa are

²¹ Gomes et al (2014).

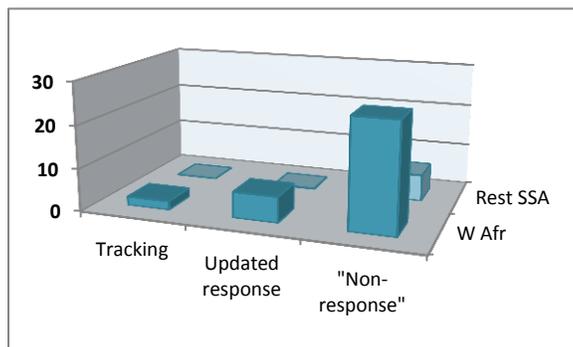


lower than forecast earlier. All in all, the current country-reporting estimates for West Africa are just slightly higher than our earlier “Low Ebola” scenario.

It is important to note that these probabilities of epidemic spread (recently re-calculated by the Laboratory for the Modeling of Biological and Socio-Technical Systems at Northeastern University) are lower precisely because of the public policy and behavioral responses that have been observed since September and October: improved management in the affected countries from establishing ETUs, safe burials, home protection kits, and other health and sanitary measures, many changes in behavior within and outside the three countries, and improved preparedness in at-risk countries, such as has been exhibited in Nigeria, Senegal, and Mali. In this sense, the large fall in estimated impact places a value on the Africa-wide benefits from the policy and behavioral responses: these are the potential costs Africa may have avoided by ramping up its prevention efforts. The relative contribution of different policy and behavioral responses to containment is a matter of considerable importance. New research is urgently needed on which interventions and behavioral changes were most effective at slowing the epidemic.

Analogously, the difference between our updated, more than \$6 billion Ebola impact measure on Africa and the more optimistic “tracking” impact of around \$2 billion puts a short-term lower bound on the value of reaching zero new cases in the affected countries. As long as this objective is not met, the risk remains of further contagion, with consequences for the entire African economy.

Figure 5: Comparison of Model Results (Cost, \$billion)





4. Conclusion

Guinea, Liberia, and Sierra Leone were not prepared for the occurrence of Ebola in their communities, particularly in densely populated urban and peri-urban areas. The human and economic costs they have borne as a result have been immense.

Despite the undoubted severity of the effects in the three countries, the limited economic impact on the rest of Africa so far is in part a policy success. Potential outbreaks have hitherto been averted and, finally, the progress of the disease is being curtailed in parts of the originally affected countries, although imminent victory is far from guaranteed at the time of writing this report. Precisely because transmission probabilities respond to behavior and policy, there is absolutely no room for complacency. Reduced vigilance and preventive measures could easily lead to substantial spread and much higher economic costs.

The analysis in this report begins to put a price on the success of recent efforts, as well as on the risk of backsliding. The likely impact of Ebola on the African economy has been reduced, through containment and preparedness efforts, by an order of magnitude: from perhaps more than \$30 billion, the annual output of a large African economy, to perhaps \$6 billion.

To reduce these costs further, and set Africa back on a more secure economic course, the sole acceptable objectives must be short-term elimination of Ebola from Guinea, Liberia, and Sierra Leone and enhanced pandemic preparedness across the entire African continent. Only then will we be able to avoid not only the economic costs that this report has attempted to quantify, but also the untold human suffering entailed by any future repeat of West Africa's recent experience.



References

Christie, Iain, Eneida Fernandes, Hannah Messerli, and Louise Twining-Ward. 2013. *Tourism in Africa: Harnessing Tourism for Growth and Improved Livelihoods*. Washington, DC: World Bank. [\[Link\]](#)

Food and Agriculture Organization and World Food Program. 2015. *FAO/WFP Crop and Food Security Assessment – Liberia, Sierra Leone, and Guinea*. Special Report. January 5. [\[Link\]](#)

Gomes, Marcelo FC, Ana Pastore y Piontti, Luca Rossi, Dennis Chao, Ira Longini, M. Elizabeth Halloran, and Alessandro Vespignani. 2014. “Assessing the International Spreading Risk Associated with the 2014 West African Ebola Outbreak.” *PLOS Currents: Outbreaks*. September 2. [\[Link\]](#)

Poletto, C, Marcelo FC Gomes, Ana Pastore y Piontti, Luca Rossi, L Bioglio, Dennis Chao, Ira Longini, M. Elizabeth Halloran, V Colizza, and Alessandro Vespignani. 2014. “Assessing the Impact of Travel Restrictions on International Spread of the 2014 West African Ebola Epidemic.” *Eurosurveillance* 19(42). October 23. [\[Link\]](#)

UNMEER. 2015. *External Situation Report*. January 6. [\[Link\]](#)

World Bank. 2014a. *The Economic Impact of the 2014 Ebola Epidemic: Short- and Medium-Term Estimates for West Africa*. Washington, DC: World Bank. [\[Link\]](#)

World Bank. 2014b. *Update on the Economic Impact of the 2014 Ebola Epidemic on Liberia, Sierra Leone, and Guinea*. December 2. [\[Link\]](#)

World Bank. 2015a. *The Socio-Economic Impacts of Ebola in Sierra Leone: Results from a High Frequency Cell Phone Survey – Round 1*. January 12. [\[Link\]](#)

World Bank. 2015b. *The Socio-Economic Impacts of Ebola in Liberia: Results from a High Frequency Cell Phone Survey – Round 3*. January 12. [\[Link\]](#)

World Bank. 2015c. *Global Economic Prospects, January 2015: Having Fiscal Space and Using It*. Washington, DC: World Bank, doi: 10.1596/978-1-4648-0444-1. [\[Link\]](#)

World Health Organization. 2015. *Ebola Situation Report*. January 14. [\[Link\]](#)