

Ebola Scenarios for Liberia: A General Equilibrium Analysis

Hans Lofgren
World Bank

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1. INTRODUCTION

In Liberia and other countries in West Africa, the Ebola virus is bringing about severe losses in human lives, accompanied by major disruptions to production and trade. This brief note offers a rapid assessment of the possible impact on Liberia's economy from two alternative Ebola scenarios: a moderate case underpinned by effective policies and a severe case with an inadequate policy response. The assessment is based on simulations with MAMS, a Computable General Equilibrium (CGE) model developed by the World Bank for analysis of the impact of policy changes and economic shocks in developing countries.¹ The main advantage of using a model of this type to analyze the impact of the Ebola virus is that, when considering the repercussions of the disruptions that the virus imposes, the model imposes basic economic mechanisms, including markets with flexible prices and the constraints and linkages that are important in any economy: employment of labor and capital and other factors is limited to what is available; the spending of the nation as a whole and its different agents (the government, firms and households) must be fully financed (by some combination of current incomes, grants, and net borrowing, some of which may come from abroad).

The purpose of this application is to assess the impact of two alternative Ebola scenarios for 2015, compared to each other and to a base scenario that reflects the expected development of Liberia's economy before the emergence of Ebola. This comparison assesses the effects of Ebola on country-level macro, sectoral, welfare, and poverty indicators. In sum, a comparison between two possible Ebola scenarios, representing success and failure to contain the epidemic, demonstrate the dramatic importance of making sure that workers can access their places of work and trade can continue without interruptions and excessive transactions costs. This requires that the epidemic be stopped in the very near future.

In outline, the note proceeds as follows: Section 2 discusses the key assumptions of the two Ebola scenarios and the main channels through which Ebola likely affects Liberia's economy in 2014 and 2015. Section 3 presents and analyzes the simulations and their results.

2. SCENARIO ASSUMPTIONS

- The analysis looks at the impact of two Ebola scenarios, contrasting them with a base scenario without Ebola.
- The first Ebola scenario, labeled Ebola-low, assumes that an effective policy response is rapidly implemented, by the end of 2014 putting an end to new cases and deaths. As a result, the economic repercussions are kept in check.
- The second Ebola scenario, Ebola-high, assumes that the policy response is slow and ineffective, leading to a much larger number of cases and deaths in 2014 as well as additional deaths in 2015 before the virus is contained and defeated. Accordingly, the economic repercussions are much more severe.

¹ For more on MAMS, including earlier applications of MAMS to Liberia, visit www.worldbank.org/mams.

- Table 1 summarizes the key assumptions for the two scenarios. The assumptions are based on the fragmentary evidence that is available at the time of writing this note. In addition to losses in life, such evidence indicates that Ebola makes itself felt through multiple economic channels, the most important of which are:
 - Labor. Due to fear, controls and restrictions on movement, workers do not go to work, reducing the productive capacity of the economy.
 - Mining. Like other sectors, production in mining is reduced. The mining sector is singled out given its importance and the fact that its production and exports depend critically on the presence of expatriates, i.e. not on the general reduction in the labor supply in the economy.
 - Foreign Direct Investment (FDI) declines because of added uncertainty about the future and interruptions to international travel and communication.
 - Trade (or transactions) costs increase. Such costs arise when goods are brought from the border to domestic demanders (for imports) and from domestic suppliers to the border or to domestic demanders (for exports and sales of domestic output domestically, respectively). These costs increase due to same forces that keep workers away from their work places. In the context of the simulations, they require labor and other inputs and contribute to relatively strong growth for private services. They represent a productivity loss since additional inputs are needed to bring goods to their demanders inside or outside Liberia's economy instead of being available for consumption and investment. For the agricultural sectors, these effects are milder since a substantial part of production is consumed by the producers themselves are in the local community, mitigating the impact of higher trade costs.
 - Foreign grants. The international community is increasing its aid, especially for health spending to contain Ebola.

3. SIMULATION RESULTS

Ebola-low

The simulation results are summarized in Figures 1-5. Figure 1 compares the growth rates of Ebola-low to the base scenario. In 2014, the impact on several variables is moderate, in part due to the fact the crisis emerged during the second half of the year. For the government – here defined to also include the government-type activities of NGOs and other donors – the effects are relatively mild since foreign grants, its major revenue source, increase at the same time as the decline in the economic activities that generate tax revenues is moderate. It is assumed that the government maintains its domestic borrowing unchanged in real terms (i.e., compared to the base increasing as a share of GDP due to a lower GDP level). In response to the health crisis, the government reallocates spending, compared to the base significantly raising its consumption and reducing its investment. As a result of the decline in the employment of labor, household incomes, savings, and consumption all decline. Coupled with the decline in FDI, lower household savings translate into less financing of private investment.

The increase in transactions costs also raises the prices households pay for their consumption items with a more limited increase for locally produced agricultural products. It also discourages exports and imports, even though the effects under this scenario are quite small. In Figure 1, household consumption is measured in per-capita terms to correct for the fact that the population is slightly smaller than under base. The fact that Liberia suffers from a demographic dividend in reverse (its dependency ratio increases due to Ebola deaths) and a larger share of its population in labor-force age is inactive exacerbates the decline in consumption per capita.

In 2015, thanks to a successful health intervention, no additional Ebola cases or deaths are recorded and the negative economic shocks of 2014 are mostly reversed, most importantly the lifting of restrictions on people's movements makes it possible to most of the labor back into production while trade costs return to normal levels. Moreover, the emergency response is pulled back, reducing public consumption and raising public investment, bringing the economy toward its original trajectory. Still, due to the need for some time to restart the economy, including time lags in production processes in agriculture and elsewhere, lingering uncertainties (affecting mining and FDI), and less investment in 2014, GDP is still below the base level in 2015. The net results of these developments are shown in Figure 1: most importantly, the changes in public and private investment and household consumption are reversed, while public consumption, supported by continued aid, remains above the base 2015 level even though its growth has slowed. The impact on households is reflected in Figure 3, which shows the headcount poverty rate under different scenarios: for Ebola-low, the 2015 poverty rate is has returned to the (still substantial) base-year rate.²

Figure 4 shows how growth in sector value-added under Ebola-low deviates from the base scenario. In 2014, the economy shifted temporarily toward higher public and private service production at the expense of agriculture and industry, including mining. In 2015, the opposite happened, bringing the economy closer to initial shares.

Ebola-high

Compared to Ebola-low, Ebola-high demonstrates that, in the absence of a concerted policy response, a much more severe calamity may afflict Liberia and other countries in its neighborhood and beyond.

Under Ebola-high, as the number of cases and deaths spiral out of control in the last few months of 2014, the economy is near collapse, with large-scale withdrawal of labor from production and more severe increases in trade costs, accompanied by very limited aid increases (see Table 1). Figure 2 summarizes the macro consequences. In 2014, due to access to fewer resources, the public investment cut is more dramatic. Household income losses are larger and their purchasing power suffers from the additional increase in trade costs, translating into more

² The poverty calculation assumes that inequality (measured by the Gini coefficient) does not change and that consumption follows a log-normal distribution.

dramatic cuts in savings, private investment, and household per-capita consumption. Exports (for mining and other sectors) decline, adding to the need to cut imports due to the decline in FDI and lower grant aid. Only public consumption growth increases compared to the base but is below the level for Ebola-low.

As a result of the failure to put an end to the epidemic during 2014, the crisis becomes more severe in 2015, with continued new Ebola cases and deaths; stronger negative shocks from additional withdrawal of labor from production; further cuts in FDI; continued high trade costs; and only a moderate increase in aid from the international community. The end result is continued growth below base scenario rates for GDP, private and public investment, private consumption, and imports. Exports return to slightly above base growth (after the strong decline in 2014) whereas public consumption, thanks to the aid increase and public investment cut, grows faster than under the base (Figure 2). The continued decline in per-capita household consumption dramatically raises the headcount poverty rate (Figure 3). Growth in sector value-added matches these developments: after the sharp decline in 2014, growth is negative or only moderately positive for all sectors except public services.

Table 1. Key scenario assumptions.

	Ebola-low (1)		Ebola-high	
	2014 (2)	2015	2014	2015
Ebola cases	12,000	0	120,000	30,000
Ebola deaths (3)	6,900	0	69,000	17,000
Labor employment (% decline from BASE in same year) (4)	2.9	0.5	11.3	14.1
Mining resource use (% decline from BASE in same year)	5.7	0.4	16.3	19.1
Foreign Direct Investment (% decline from BASE in same year)	-41.5	-14.7	-41.5	-57.3
Additional export and import trade costs (% of border price) (5)	15.0	0.0	22.5	22.5
Additional domestic trade costs (% of producer price) (6)	17.5	0.0	26.3	26.3
Additional foreign grants (million 2014 US dollars)	47.7	95.4	15.7	31.5

Notes

- 1 Ebola-low and Ebola-high reflect moderate (strong policy) and severe (weak policy) impact scenarios, respectively.
- 2 The years are calendar years.
- 3 The vast majority (in the simulations all) of the deaths afflict persons in working age (15-64 years old)
- 4 The decline in labor force is due to fear and movement restrictions and is in addition to the loss due to death. In the model, this is the decline that is due to a lower labor force participation rate among the population aged 15-64. The labor force is also lower due to Ebola deaths (on preceding line).
- 5 These trade costs reflect use of services to bring goods from the supplier to the border (for exports) and from the border to the domestic demander (for imports). For exports, the added trade costs reduce the price of the producer relative to the border price; for imports, it adds to the price paid by demanders relative to the border price. These cost additions are at base prices; they may be smaller or larger depending on changes in the prices of trade services.
- 6 These trade costs reflect use of services to bring goods from the domestic supplier to the domestic demander. These added trade costs raise the price paid by the demander relative to the price received by the supplier. These cost additions are expressed at base prices; they may be smaller or larger depending on changes in the prices of trade services compared to the base scenario.

Figure 1. Ebola-low: Macro growth

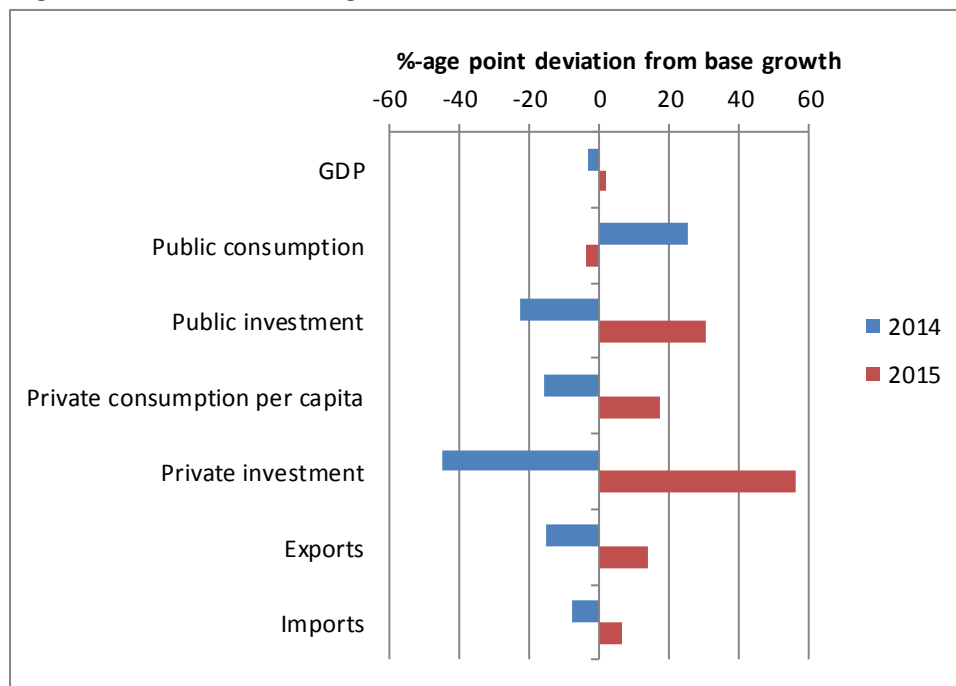


Figure 2. Ebola-high: Macro growth

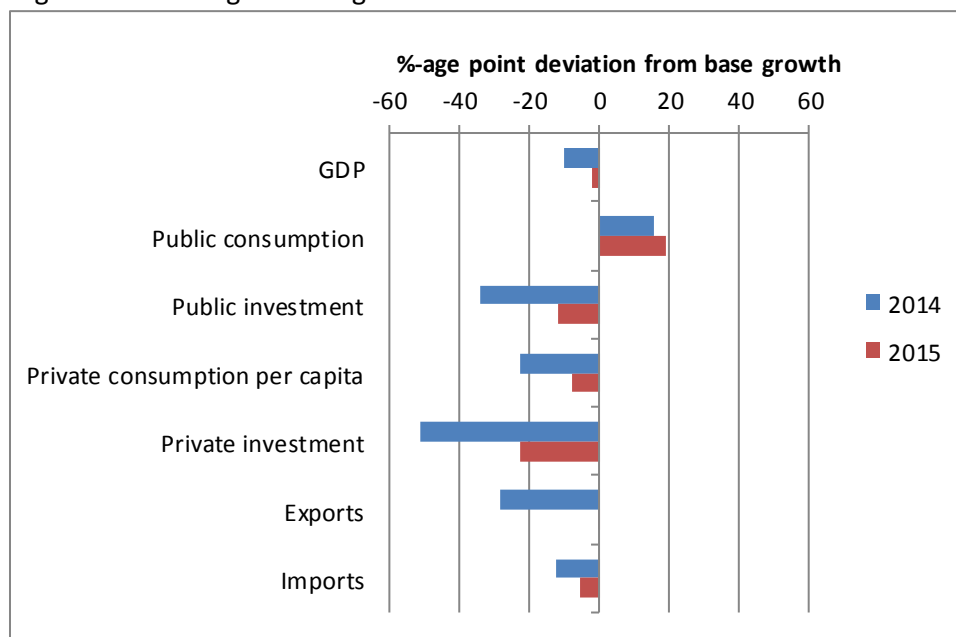


Figure 3. Headcount poverty rate under alternative scenarios.

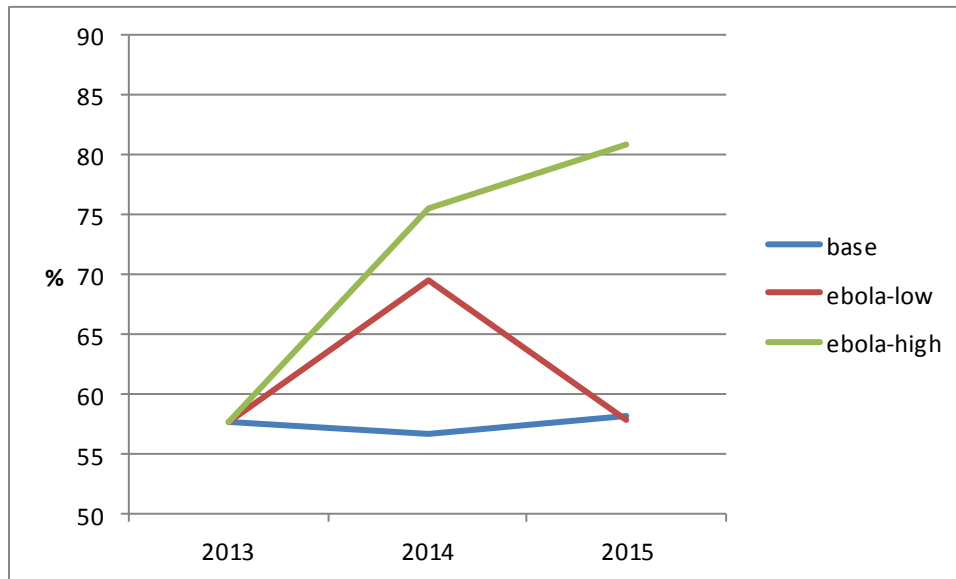


Figure 4. Ebola-low: Sector growth

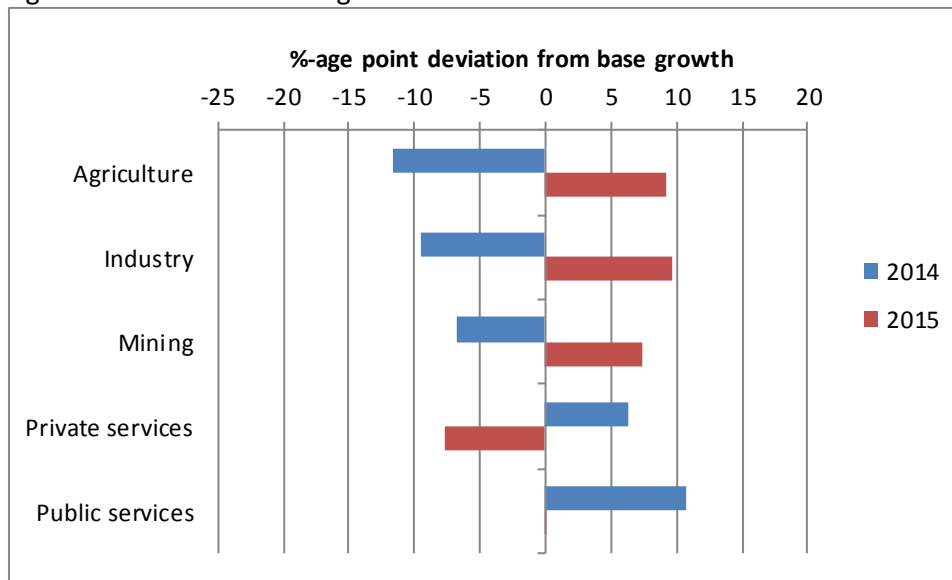


Figure 5. Ebola-high: Sector growth

