An Assessment of Ebola-related Food Security Threat in Guinea

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Abstract

The Ebola outbreak which is currently striking three countries in West Africa, including Guinea, can have serious socioeconomic consequences. Its implications for the food security and economic well-being of the three countries are understudied. Our analysis contributes to anticipating and reducing the risk of socioeconomic contagion of the health crisis. It uses economic modeling to test the sensitivity of the national economy and households' well-being to various transmission channels of the epidemic, including agricultural labor force and production, and domestic and international trade. Our analysis demonstrates that food consumption is seriously affected by the disruption of trade transactions between rural and urban markets, and national and international markets. Farmers pay the heaviest price when confronted by the Ebola outbreak. The simulation results confirm that greater socioeconomic impacts of the outbreak should be associated with the behavioral responses – i.e. domestic and international trade disruptions.

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1. Introduction

Since the beginning of 2014, the West Africa region has been affected by an unprecedented Ebola outbreak, which has caused thousands of victims, mostly in three countries: Guinea, Liberia, and Sierra Leone (WHO, 2015). These countries have experienced tens of thousands of Ebola cases and deaths, and many more people have been quarantined due to contact with a sick person. Large numbers of displaced persons have been reported after the rapid spread of the disease during the second half of 2014 (ACAPS, 2014). Other challenges have added to the health issues in these countries, primarily higher transaction costs due to the disruption of transportation and trade between the most affected areas and the rest of the country (FEWS NET, 2014). Furthermore, border closures have affected trade between the most affected countries and their neighbors in the sub-region, and reduction of air and maritime connections has also considerably impacted trade between countries affected by the disease and the rest of the world.[2]

Through its economic ramifications, the Ebola outbreak could have serious implications for the economies of the three most affected countries (World Bank, 2014). The implications of the outbreak for the food security and economic well-being of the population in these countries have been insufficiently studied. Our analysis contributes to anticipating and reducing the risk of socioeconomic contagion of the health crisis. It uses economic modeling to test the sensitivity of the economy to major transmission channels of the epidemic, including disruptions in domestic and international trade. The analysis focuses on Guinea, for which the underlying economic data are available and accessible.

Guinea is a coastal country of West Africa covering an area of 246,000 square kilometers with an estimated population of 11 million inhabitants in 2014 (General Population and Housing Census, 2014). The epidemic started in December 2013 in South-East Guinea[3] and spread to Liberia and Sierra Leone.[4] The World Health Organization (WHO) reported that as of January 4, 2015, the number of Ebola cases and deaths amounted to over twenty thousand, mainly distributed between Liberia (39 percent), Sierra Leone (47 percent) and Guinea (13 percent) (WHO, 2015). In Guinea, the accumulation of confirmed, probable, and suspected cases amounted to 2,775 on January 4, 2015, among which were 1,781 deaths (64 percent). The WHO report highlights a major propagation of the disease starting during the second half of August 2014. The

[2] Although some analysts reported normal import levels (FEWS NET, 2014), anecdotal evidences suggest a reduction in shipping and cargo service and an increase in international shipping cost and time.

[3] The epidemic started in the region of Nzerekore, the district of Gueckedou and the village of Meliandou.

[4] Guinea is divided into 4 natural regions (Lower Guinea, Middle Guinea, Upper Guinea, and Forested Guinea), 8 administrative regions (Kindia, Boke, Mamou, Labe, Faranah, Kankan, Nzerekore, and the Capital, Conakry), 33 administrative centers, 33 urban municipalities including the 5 municipalities of Conakry, and 303 rural development communities. Guinea is bordered to the west by the Atlantic Ocean on 320 km and shares a border with six countries: Mali – 858 km of border to the north and north-east; Sierra Leone – 652 km of border to the south; Côte d'Ivoire, 610 km of border to the east; Liberia – 563 km of border to the south; Guinea Bissau – 386 km of border to the northwest; and Senegal – 330 km of border to the north.

number of registered cases in this period increased rapidly throughout the fall of 2014. The age distribution of the number of cases and deaths shows an important propagation among people aged 15 and older. The region of Nzerekore that comprises the most affected districts—Macenta and Gueckedou—is the epicenter of the Ebola epidemic. Nzerekore plays an important role in the food production system in Guinea, particularly in the supplies of vegetables and tubers.

The rapid propagation of the disease during the harvest period has put the harvesting of many crops at risk. Moreover, a large number of working population is involved in agricultural activities in the most affected area, on the one hand, and harvesting activities appear to be highly intensive in agricultural labor force requirements, on the other.[5]

At the time of this writing (March 2015), the health situation had improved greatly, although significant numbers of new cases were still being reported in Sierra Leone and particularly in Guinea. The socioeconomic consequences of the disease can be expected to continue long after the health crisis is over.

Epidemics can have significant economic impacts both in the short and long term, as indicated by the review of the literature in section 2. Although evidence on the long term impacts of past epidemics is inconclusive, short term impacts are often sizable, and stem both from the direct costs of the disease and the indirect costs associated with the behavioral response to the epidemic. Avenues through which the disease can affect the economy in the short term, which we hereafter refer to as "transmission channels," include labor force decline and disruption of trade. As the data limitation has not permitted an assessment of the impact of Ebola epidemic in Guinea, this study simulates the short term effects of the disease on food security and economic well-being of the population. Our goal is to complement the limited data on the ground with an analysis of the likely effects of the disease and the relative importance of the different transmission channels. The assessment framework presented in section 3 relies on an economywide general equilibrium model to estimate the impacts of several transmission channels. Finally, the simulation results confirm that greater socioeconomic impacts of the outbreak are associated with the behavioral responses—in particular the disruption of domestic trade—compared to the direct impacts on affected people.

2. Economic Impacts of Past Infectious Diseases

Past studies on the economic impacts of epidemics have highlighted numerous distinct channels through which a health shock can affect the overall economy in the short and long term. Some of these are related to the direct impacts of the disease, including deaths, reduced labor productivity, and medical expenses. Other channels are indirect, stemming from behavioral responses to the threat of disease. Overall, the empirical evidence on the long term economic impacts of health shocks is inconclusive. Brainerd and

[5] Details on the agricultural labor force are depicted in the annexed figures I and II.

Siegler (2002) find a robust positive impact of the 1918–1919 influenza[6] epidemic on per capita income growth over the 1920s across the United States. However, Bloom and Mahal (1997a) find no significant impact of the epidemic on output and income in England, France, and India. Bloom and Mahal (1997b) use cross-country data and find little impact of AIDS on economic growth. In contrast, studies by Haacker (2002) argue for significant negative effects of AIDS on growth and per capita income. Thus, the long term impact of epidemics can be negative or positive depending on the flexibility and resilience of economies to shocks. Bloom and Canning (2006) argue that sizeable economic impacts of epidemics are more likely to happen in the short term.

Sachs and Malaney (2002) use the accounting technique to evaluate the economic and social cost of malaria. This approach highlights the direct effects of the disease, including public and private medical costs and foregone income, but does not account for the indirect effects of malaria through behavioral responses. Other direct channels through which epidemics affect the larger economy are impacts on labor supply and labor productivity. Brainerd and Siegler (2002) also investigate the impact of changes in the population and labor force stock in 1918 and 1919 due to the influenza epidemic. Epidemics like influenza and AIDS primarily affect prime-age adults (Brainerd and Siegler, 2002). Haacker (2002) argues that AIDS affects the economy and per capita income in southern African countries mainly through human capital as measured by the supply of experienced workers. Influenza differs from AIDS in the period of illness, which has serious implications on the way the disease affects the economy. In other words, influenza claims victims within days of infection while AIDS is associated with a long period of illness, reducing productivity, which in turn affects the economy differently (Brainerd and Siegler, 2002). Epidemics also affect labor productivity by restricting workers' ability to move to the places where they would be the most productive. Indeed, epidemics affect the mobility of labor within a country and across countries, and mobility limitations can be an important transmission channel to the economy.

Like influenza and AIDS, Ebola claims many more cases and deaths among individuals aged 15 years and older (Guinea and WHO, 2014) and is likely to affect the economy through the supply of labor. Unlike AIDS, labor productivity should not be a major transmission channel to the economy in the short run, because like influenza, Ebola removes victims from the labor force almost immediately rather than reducing their productivity. Bloom and Mahal (1997a) find no evidence linking changes in acreage sown per capita and the large population decline in India due to the influenza epidemic.

Disease shocks may increase real wages as a consequence of a reduction of the size of the working population. This is confirmed by the very short term increase in wages due to the Black Death (Hirshleifer,

[6] The 1918–1919 influenza epidemic, also known as the Spanish flu epidemic, killed about 40 million people worldwide.

1987). The long run evidence is more conflicting, as shown by Bloom and Mahal (1997a) who reexamine the effect of the Black Death epidemic in England and France and find a positive but statistically insignificant relationship between real wages of unskilled agricultural laborers and population growth.[7]

Other studies have focused more explicitly on the indirect effects of an epidemic. Lee and McKibbin (2003) find that the related medical expenses and demographic consequences of the Severe Acute Respiratory Syndrome (SARS) are insignificant compared to the economic impact through other important channels of transmission. The cost of an epidemic also includes the estimated risk to the economy and society stemming from people's and institutions' responses to the disease. Lee and McKibbin find that the consequences of the disease for the affected people are far less important than the behavioral effects. In the same vein, Bloom and Canning (2006) argue that the panic caused by SARS and Bovine Spongi-form Encephalitis (BSE) outbreaks led to disproportionate economic costs.

The fear of contagion during an epidemic leads people to avoid social interactions (Lee and McKibbin, 2003). The direct consequence of this change in people's behavior is a decline in consumer demand for services such as travel, tourism, and trade. By the middle of 2014, the fear of infection had started to cause serious damage to the Guinean economy. "Airlines have reduced travel to Guinea, Senegal and Côte d'Ivoire have sealed their Guinean borders, […] hotel occupancy rates in Conakry have fallen by half, to less than 40 percent compared with an average of 80 percent occupancy before the crisis" (World Bank, 2014). Given the greater linkages among regions of the affected countries, and between these countries and the rest of the world through the trade of goods and services, the analysis of the trade-related consequences of epidemics is important. Domestic and international trade may not appear to be a significant channel if the disease is found to be transmitted only by "close" human contact (e.g. AIDS). On the other hand, the economies of the affected countries can pay a heavy price in cases where the disease is transmitted without or with only simple human contact (e.g. influenza and Ebola).

Although the situation has not permitted for detailed studies of the trade effects of Ebola to be undertaken, it is clear that the disease has resulted in significant trade disruptions. The Famine Early Warning Systems Network (FEWS NET) gathered data from partners, key informants, and an SMS-based survey of traders, and found that significant trade disruption was occurring in the affected countries. In Guinea, international trade has been affected by the closure of several borders. Domestic trade and travel is not restricted, but the fear of contagion has reduced agricultural trade between the areas of greatest transmission and the rest of the country (FEWS NET, 2014).

[7] The authors conclude that the lack of evidence is due to data limitations.

Government management of the epidemic and uncertainty around the disease's evolution and consequences on the economy are key elements that impact national and foreign investors' confidence in the future. The long run economic impact of epidemics are affected by changes in savings and investments, mortality and fertility (Sachs and Malaney, 2002), and human and health capital destruction and accumulation (Brainerd and Siegler, 2002; and Haacker, 2002). Given data limitations and the high uncertainty associated with the future epidemiological path of the disease at the time the study was undertaken, our study integrates only transmission channels associated with the short term economic impact of the Ebola disease in Guinea.

We investigate effects of the disease through four channels that are likely to be the most relevant in the short run: agricultural production, domestic trade, and international imports and exports. We do not consider the effects of medical expenses as foreign aid has been used to cover a large part of the expenses, and based on the assumptions that public budget reallocation to medical expenses would negatively affect discretionary expenses in the short run, such as investments, with long run economywide consequences. Among the transmission channels considered in our analysis, disruptions in domestic and international trade are indirect channels, while changes in agricultural production reflect both a direct channel (the reduction in agricultural labor supply due to agricultural workers who are ill, have died or are quarantined) and an indirect channel (the reduction in labor supply due to the displacement of workers who were not directly affected by the disease but who left their homes attempting to avoid exposure).

3. The Assessment Framework

The analysis uses an economywide simulation model to assess the possible impacts of the Ebola epidemic on agricultural production, food prices and consumption in Guinea. Our assessment framework differs from that used in previous studies of the effects of disease epidemics. Sachs and Malaney (2002) use an accounting approach to evaluate the economic and social cost of malaria. Their assessment is based on the estimation of the average cost for a sick person, which is then multiplied by the total number of cases encountered, and added to fixed cost of prevention and treatment. The average cost includes private and public costs (expenditures on prevention, diagnosis, treatment and care of the disease) and forgone income (value of lost workdays). The authors recognize that the accounting technique provides a good estimate of the direct impact of the disease but does not include the related feedback effects resulting from behavioral changes and other important channels by which the epidemic affects the economy (trade, foreign investments, etc.). Lee and McKibbin (2003) use a simulation model based on the theoretical structure of the G-Cubed model outlined in McKibbin and Wilcoxen (1998) to assess the global cost of the 2001-02 SARS epidemic. The model is based on intertemporal optimization by the agents and is solved for perfect-foresight equilibrium over multiple periods. However, the model is designed to capture linkages between multiple countries through the trade of goods and services and capital flows, and is better suited to analysis

of long term effects. This study is focused on a single country, Guinea, and aims to provide a short-run perspective on the economic effects of the Ebola outbreak through major transmission channels, including indirect impacts.

The analysis of the outbreak is performed using a Computable General Equilibrium (CGE) model. The latter fits into the neoclassical general equilibrium theory and uses the standard archetype developed by Decaluwé, Martens and Savard (2001) and adapted to the Guinean economy by Fofana (2011). The macroeconomic constraints include the market-clearing prices assumption. The producer and consumer prices are adjusted by the transaction costs—taxes and duties, subsidies, and margins.

The labor market is segmented into rural and urban areas, and workers are grouped into salary and self-employed categories in each area. Perfect mobility of labor among industries results in uniform wage rates which equalize supply and demand with the assumption of exogenous excess supplies of labor.

A Constant Elasticity of Transformation (CET) relationship specifies the trade-off between the national and international markets. Exported products face international market constraints reflected by the finite export demand function. The latter reflects the degree of competitiveness between national and foreign products on international markets, on the one hand, and changes in the national and international economic environments, on the other hand. In the case of the Ebola outbreak, a low export elasticity reflects an unfavorable environment for Guinean exported products. Evidence of higher costs of insurance and freight applied to Guinean exports, excluding mining products, are reflected through an increasing gap between the international market prices and the F.O.B. (border) prices. Under fixed international prices—the small country assumption—the export F.O.B. prices and volumes decline. In the same vein, imports are imperfect substitutes for local products—the Armington assumption. The study simulates the increasing C.I.F. (border) prices relative to international prices to reflect the rise of insurance and freight costs applied to Guinean imports.

The assumption of fully integrated food markets is rejected under the Ebola outbreak to reflect the disruptions of domestic and international trade. The agricultural and food markets are segmented into production and consumption markets. This constitutes an innovation in the modeling of domestic trade within a CGE framework. Agricultural goods are either self-consumed or sold to the local market. Then, trade services are used to move products from production to consumption markets. The analysis assumes that agricultural and food products are transformed while geographically moving them from one area to another. This is equivalent to physically transforming them to manufactured products. Food trading activities, as well as food manufacturing, require inputs, labor and capital. The technology specified for food trading activities is similar to that of the overall trade sector reflected in the national accounts databases. The assumption of perfectly integrated markets holds for other goods and services.

The CGE model is calibrated to the Guinean economy using the 2005 Social Accounting Matrix (SAM) constructed by Fofana and Balma (2011). The macro structure of the SAM is updated in order to reflect the Guinean economy in 2012.[8]

4. Scenarios and Results

Our analysis focuses on comparing the food security implications of major transmission channels of the Ebola epidemic, i.e. agricultural production, domestic trade, and international trade. At the time the study was undertaken, the scarcity of economic data was the major challenge to undertake a rigorous impact assessment of the epidemic on the economy.

This section discusses the decomposition of the socioeconomic effects of the health shock by transmission channel—agricultural production, domestic trade, imports and exports. We successively simulate the effects of a one-percent reduction in agricultural output, domestic trade, international imports and exports. Performing these simulations separately allows us to gain insights into the effects of each channel on household food security and well-being. The reduction in agricultural output reflect the effects of the decrease in labor supply due to workers who have been sickened or killed by Ebola or have been quarantined due to contact with a sick person, as well as those who have been displaced. The disruption in domestic trade services is simulated through a decline in capital productivity.[9] The slowdown of international imports mainly affects the supplies of food and manufactured products. Thus, the simulated increase in C.I.F. prices is translated into less demand for imported products. On the other hand, export supplies and F.O.B. prices decline with the simulated slowdown of export demand.

Table 1 shows the percentage changes in the prices faced by various groups of households following a one-percent decrease in each transmission channel. As expected, the reduction in agricultural production increases the food prices faced by all groups, and particularly by farmers because of the increase in their purchasing power. The increase of food prices is less pronounced for nonagricultural households because of the decline in their purchasing power associated with the higher cost of their food basket. Low purchasing power negatively affects the demand and, consequently, the prices of nonfood products (higher income-elasticity). The decrease in domestic trade, which prevents the movement of agricultural products from net producing to net consuming areas, causes rural food prices to decrease, while urban food prices increase. The disruption of international trade shows less sizable effects than those of the first two channels. The decrease in imports reduces rural food prices slightly, but raises food and total prices overall. Lower imports increase prices, reduce purchasing power and the demand for food and nonfood products. The disruption in exports reduces rural food prices more significantly. The reduction of external market opportunity increase

[8] The procedure use the program developed by Lemelin, Fofana, and Cockburn (2014).
[9] Capital in the trade sector becomes partially unproductive because of the outbreak.

the local supply and, consequently, reduce local prices. However, the export-related effect will accounts for a much smaller share in rural food price declines than the domestic trade channel. This is due to the lower share of exports in the local agricultural production.

Table 1: Price Effect by Channel (percent)

Group of Households	Agriculture production		Domestic Trade		Imports		Exports	
	All	Food	All	Food	All	Food	All	Food
Farmers	2.7	4.5	-11.3	-17.5	0.1	-0.2	-1.0	-2.4
State employees	-0.4	0.2	4.1	4.6	0.4	0.2	0.9	0.2
Private sector employees	-0.5	0.0	3.8	4.2	0.5	0.3	1.1	0.3
Informal food traders	-0.6	0.4	4.3	5.0	0.4	0.2	1.0	0.1
Informal nonfood traders	-0.6	0.3	4.1	4.8	0.5	0.2	1.0	0.0
Other informal self-employed	-0.3	0.6	3.7	4.0	0.4	0.2	0.8	-0.1
Formal self-employed	-0.6	0.2	4.3	5.0	0.4	0.2	1.0	0.3
Unemployed and inactive	-0.5	0.4	3.6	4.3	0.5	0.3	1.1	0.1
All Groups	0.4	1.7	-0.3	-2.6	0.4	0.1	0.4	-0.7

Source: Authors, from the simulation results (2014).

A decrease in agricultural production alone is expected to increase farmers' incomes due to higher prices (Table 2). However, this effect is countered by large decreases in income due to the disruption of domestic trade, and to a lesser extent the disruption of international trade, particularly exports. Informal food traders, on the other hand, see their margins erode with increasing agricultural prices due to the agricultural production shock. Conversely, they are the largest beneficiaries of the domestic trade shock, as the widening price differential between rural and urban areas allows them to expand their profits.

Table 2: Income Effect by Channel (percent)

Group of Households	Agriculture production	Domestic trade	Imports	Exports
Farmers	5.2	-24.1	-0.5	-4.1
State employees	-0.8	1.9	-0.1	1.2
Private sector employees	-2.0	4.5	0.0	1.1
Informal food traders	-4.2	45.5	0.0	1.8
Informal nonfood traders	-0.9	1.6	-0.1	-0.1
Other informal self-employed	-1.6	3.3	-0.1	0.1
Formal self-employed	-1.9	4.6	-0.1	0.1
Unemployed and inactive	-1.1	0.9	-0.1	-0.4
All Groups	0.4	-2.2	-0.2	-0.9

Source: Authors, from the simulation results (2014).

As reflected in the income effects shown in Table 2, the disruption of domestic trade appears to be the most serious threat to food consumption (Table 3). It reduces rural food prices and farmers' incomes, while increasing food prices in urban areas. Consequently, purchasing power falls in both rural and urban areas. The domestic trade shock primarily disadvantages farmers while it benefits food traders. The latter take advantage of the increasing price differential between rural and urban markets.

Table 3: Changes in Food Consumption, by Ebola Transmission Channel (percent)

Household Groups	Agriculture production	Domestic trade	Imports	Exports
Farmers	0.8	-6.8	-0.2	-1.4
State employees	-0.6	-1.6	-0.2	0.6
Private sector employees	-1.1	0.1	-0.1	0.6
Informal food traders	-3.6	30.9	0.0	1.7
Informal nonfood traders	-0.9	-1.6	-0.1	0.3
Other informal self-employed	-1.5	-0.1	-0.1	0.4
Formal self-employed	-1.3	0.0	-0.1	0.1
Unemployed and inactive	-0.9	-1.7	-0.1	0.1
All Groups	-0.5	-1.8	-0.1	-0.2

Source: Authors, from the macroeconomic simulation results (2014).

The contrast in the trade impact between farmers and food traders also appears under the export shock (Table 3). When mining and non-private products are excluded, agricultural products constitute more than one half of exports (Annexed Table I). Under the export shock, famers' incomes fall (Table 2), as well as their consumption of food products and economic well-being.[10] The induced increase in domestic supply of local food products keeps the prices of food products low and improves the food consumption of other categories of household. All other things being equal, the decline of exports is translated into fewer imports due to the depreciation of the exchange rate. Consumption prices rise due to the decline in imports as well as inelastic domestic supply in the short term (Table 1). As a consequence, urban households are more impacted by the price effects of the export shock. The negative impact of the export shock is higher on households' well-being in general compared to their food consumption (Table 4).

Table 4: Changes in Economic Well-being, by Ebola Transmission Channel (%)

Household Groups	Agriculture production	Domestic trade	Imports	Exports
Farmers	2.4	-12.8	-0.5	-2.9
State employees	-0.4	-1.8	-0.4	0.2
Private sector employees	-1.1	0.5	-0.4	0.0
Informal food traders	-3.6	38.7	-0.3	1.1
Informal nonfood traders	-0.5	-2.2	-0.6	-1.1
Other informal self-employed	-0.9	0.1	-0.3	-0.3
Formal self-employed	-0.7	0.4	-0.2	-0.4
Unemployed and inactive	-0.6	-2.4	-0.6	-1.4
All Groups	0.0	-1.9	-0.5	-1.2

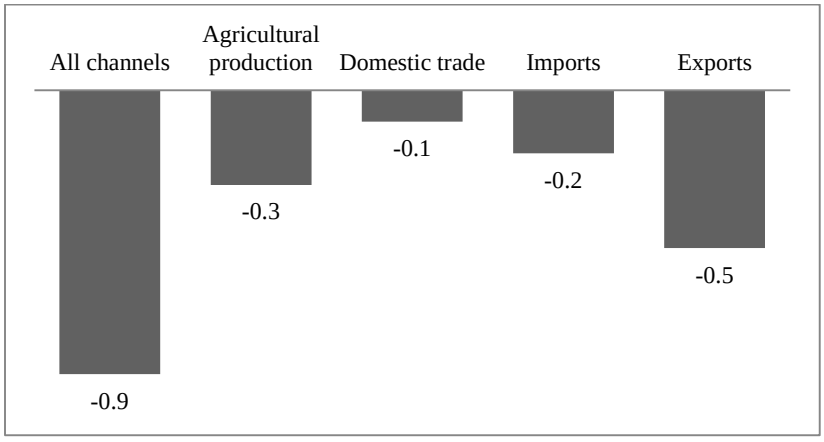
Source: Authors, from the macroeconomic simulation results (2014).

[10] Farmers increase their consumption of own-grown agricultural and food products, but the related income loss reduce their purchases of marketed food.

A marginal decline in import volumes does not have a major impact on incomes and consumer prices (Tables 1 and 2). However, its distributive impact is more pro-rural than the export shock. The income effect on rural households is less negative under the import shock compared to the export shock. This is explained by the price-related effects of both external shocks. On the one hand, import shocks put an upward pressure on food prices which, in the end, are beneficial to famers. On the other hand, export disruptions reduce market opportunities for agricultural products and reduce prices and income of farmers. However, further declines in imports would have greater negative impacts on households' purchasing power, food consumption and economic well-being, as discussed in the section on sensitivity tests below.

Figure 1 indicates that the decline in exports is the most serious transmission channel for effects on national wealth as measured by the gross domestic product (GDP). It is followed by the agricultural production channel. On the other hand, domestic trade is the least important channel for the economy. The simulation of a 1 percent fall in output through all channels is translated into a 0.9 percent loss in aggregate output.[11] This situation highlights the greater sensitivity of the economy to these transmission channels as a whole.

Figure 1: Changes in GDP (percent)



Source: Authors from macroeconomic simulation results (2014)
Note: The simulation consists of a one-percent reduction of agricultural output, trade service, import and export volumes, and all these channels together.

The simulation of the production and trade channels jointly indicates a negative impact of the outbreak on food consumption (-0.9 percent) due to a fall in real incomes (Table 5). The decline in households' economic well-being is more pronounced (-1.8 percent) because of the greater increase in the cost of living due to rising nonfood prices. As indicated earlier, the disruptions in the supply of food and nonfood products emanating from the outbreak are the main cause of rising consumption prices (0.9 percent) and,

[11]Agriculture and trade contributed 24.4 and 21.4 percent of the aggregate value added in 2012; the ratio of imports and exports to GDP was estimated at 23.5 and 25.3 percent over the same period.

consequently, a decline in consumers' purchasing power and aggregate demand. The latter is translated into reduced economic activities and a fall in employment and earnings (-1.1 percent).

Table 5: Changes in Food Consumption and Economic Well-being (Percent)

Household Groups	Food Consumption	Economic Well-Being	Income	Consumption price index	Food prices
Farmers	-1.4	-2.4	-2.4	0.2	-0.4
State employees	-0.3	-0.7	0.2	1.2	0.9
Private sector employees	-0.6	-1.4	-0.7	1.1	0.6
Informal food traders	2.3	2.6	3.6	1.2	1.3
Informal nonfood traders	-0.9	-2.4	-1.1	1.0	1.0
Other informal self-employed	-1.2	-1.4	-1.1	1.2	1.1
Formal self-employed	-1.0	-1.0	-1.0	1.0	0.9
Unemployed and inactive	-1.2	-2.8	-1.7	1.4	1.4
All Groups	-0.9	-1.8	-1.1	0.9	0.6

Source: Authors' calculations from the simulation results (2014)

Households headed by farmers, unemployed and inactive persons, and nonfood traders appear to be highly vulnerable to the economic ramifications of the outbreak. They record greater decreases in food consumption and economic well-being due to a substantial fall in their real income (Table 5). Disruptions in transport and trade services between rural and urban areas affect the sales of agricultural products and incomes. In addition, the declines in consumer purchasing power accentuate the fall in food product consumption and demand and, consequently, the decline in agricultural output. Food product traders benefit from an increase in their earnings, which compensates for the rising prices they face. This group benefits from the increase in the price differential of food products between rural and urban markets.

Early estimates of the current situation on the ground confirm price declines in rural areas due to limited local demand and disruptions in domestic trade and in exports (FEWS NET, 2014). However, FEWS NET does not find effects of a drop in imports, suggesting that urban prices remain more stable than indicated by our simulations. The FEWS NET report confirms that purchasing power has fallen overall, affecting farmers' incomes. The food security of poor households is particularly threatened in Nzérékoré as well as in Conakry. The data limitation did not permit a regional disaggregation on the economywide simulation outputs.

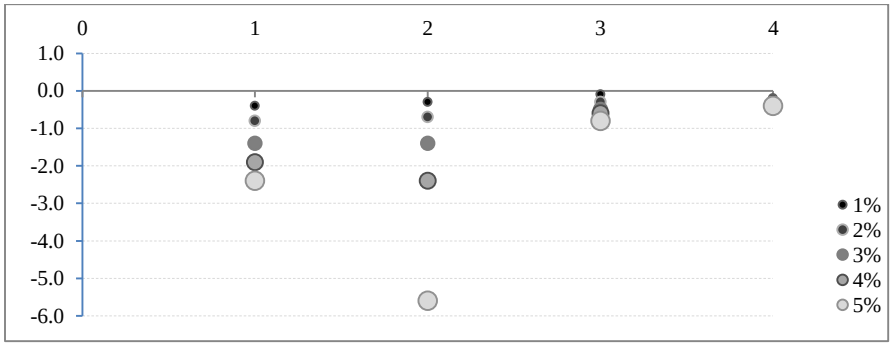
5. Sensitivity Analysis

A set of simulations are undertaken to gain more insights into the vulnerability of the economy and households to the health shock through the transmission channels discussed above. In the preceding analysis, we assumed one percent decreases in agricultural production and in domestic and international trade. In the absence of data on the size of the Ebola-related impact on the transmission channels considered

in our study, this section progressively scales up the shocks in each of them to evaluate the sensitivity of the economy.

The simulations confirm the disruption of domestic trade and agricultural production as the most serious transmission channels for food consumption (Figure 2). A sizeable impact on food consumption is felt when domestic trade activities and agricultural output both fall by 3 percent. At that threshold, marginal increases in domestic trade disruption have a far greater negative impact than marginal declines in agricultural output. International trade—imports and exports—becomes a major channel when shocks are larger, i.e. more than 5 percent.

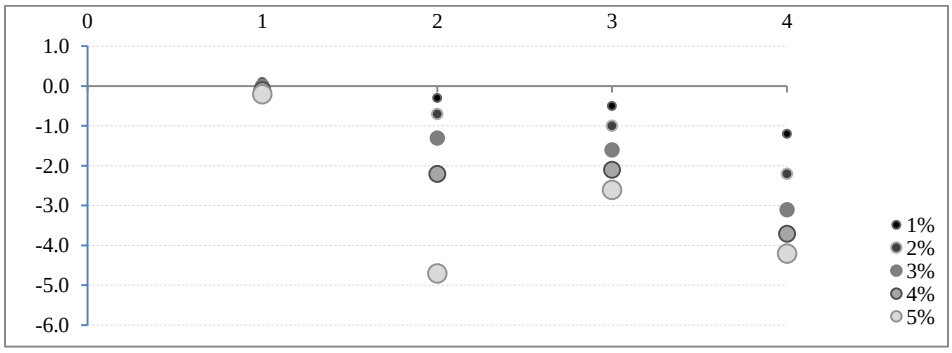
Figure 2: Changes in Food Consumption (Percent)



Source: Authors from the macroeconomic simulation results (2014).
Note: 1: Agricultural production; 2: Domestic trade; 3: Imports; 4: Exports.

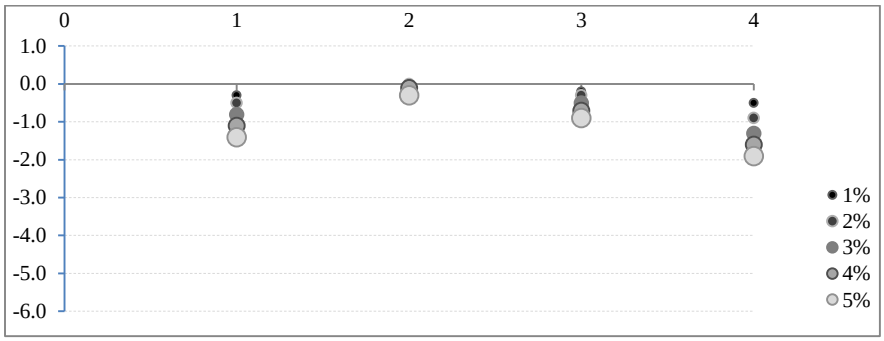
Economic well-being is more sensitive to the international trade channels (Figure 3). Welfare effects become sizeable at 1 and 2 percent export and import shocks, respectively. The domestic trade channel has a substantial welfare effect at the 3 percent threshold. The effect increases rapidly so that this channel becomes the most important at the 5 percent threshold. Exports and agriculture production are the most important channels for GDP (Figure 4). To a lesser extent, larger imports shocks (5 percent and more) have significant impacts on the economy.

Figure 3: Changes in Economic Well-Being (Percent)



Source: Authors from the macroeconomic simulation results (2014).
Note: 1: Agricultural production; 2: Domestic trade; 3: Imports; 4: Exports.

Figure 4: Changes in GDP (Percent)



Source: Authors from the macroeconomic simulation results (2014).
Note: 1: Agricultural production; 2: Domestic trade; 3: Imports; 4: Exports.

6. Conclusion

The Ebola outbreak which is currently striking three countries in West Africa, including Guinea, is likely to have serious socioeconomic consequences. Its implications on food security and economic well-being of these countries are understudied. Our analysis contributes to anticipating and reducing the risk of socioeconomic contagion of the health crisis. It uses economic modeling to simulate the impact of the epidemic on the national economy through agricultural labor force and production channels, as well as domestic and international trade channels. The analysis focuses on Guinea, for which the underlying micro- and macroeconomic data are accessible.

Food consumption is most strongly affected by the disruption of transportation and trade transactions between rural and urban markets. Agricultural prices and farmers' incomes fall in rural areas, on the one hand; food prices rise in urban areas, on the other. Consequently, purchasing power falls in both rural and urban areas. The slowdown in exports is also a threat to food security, because it reduces agricultural incomes and increases the prices of imported food and non-food products through the deterioration of the exchange rate. The outbreak has serious consequences on the market integration and trade openness efforts that the affected countries have been promoting over the last decades. It considerably reduces trade flows between urban and rural markets, as well as between the affected countries and the rest of the world through imports and exports.

Farmers pay the heaviest price when confronted by the Ebola outbreak. The sales of agricultural products fall due to domestic trade disruption and, to a lesser extent, the decrease in the purchasing power of consumers. Sales also fall due to decreasing export options. The winners are the food-product traders because they benefit from the increasing price differential between rural and urban markets. However, their margin erodes rapidly with the seriousness of the agricultural production shock, which is reflected by a rise in agricultural prices.

Early evidence supporting our findings is provided by a FEWS NET (2014) report which confirms the negative effects of domestic trade disruptions on rural food prices and farmers' incomes, particularly in the most affected areas. These income effects may have implications for agricultural production in 2015, as farmers' ability to purchase inputs will be limited by their reduced sales in 2014.

The simulation results imply a series of political measures needed to limit the contagion effects of the health crisis on the economy and on the food security and economic well-being of the population. First, support to farmers for the next agricultural season should be considered in order to compensate for their loss of income because of the outbreak. This support should focus mostly on the regions most affected by the disease. Supporting agricultural marketing will also contribute to sustaining demand and mitigating the fall in agricultural prices and famers' income. In the same vein, the resumption of regional trade with the re-opening of borders will also have positive effects on agricultural prices and incomes. However, as trade between Guinea and its neighbors in the sub-region was already weak, the resumption of extra-regional trade is seen to be the major mitigating factor of the food-related threat of the outbreak.

This study analyzes the Ebola outbreak from the perspective of food security and investigates major transmission channels of the disease to the national economy. At this time, the lack of key economic data did not permit an assessment of the outbreak's impacts on the national economy and food security. Rather, we compare the food security implications of the agricultural supply shock to the domestic and international trade shocks. As in previous studies of the effects of epidemics, we find that behavioral responses to the disease, in particular the disruption of domestic trade, have more serious socioeconomic effects than do the direct impacts on affected people. Our study highlights the need for policy interventions needed to mitigate the effects of these behavioral responses to limit the ongoing impacts on food security and well-being.

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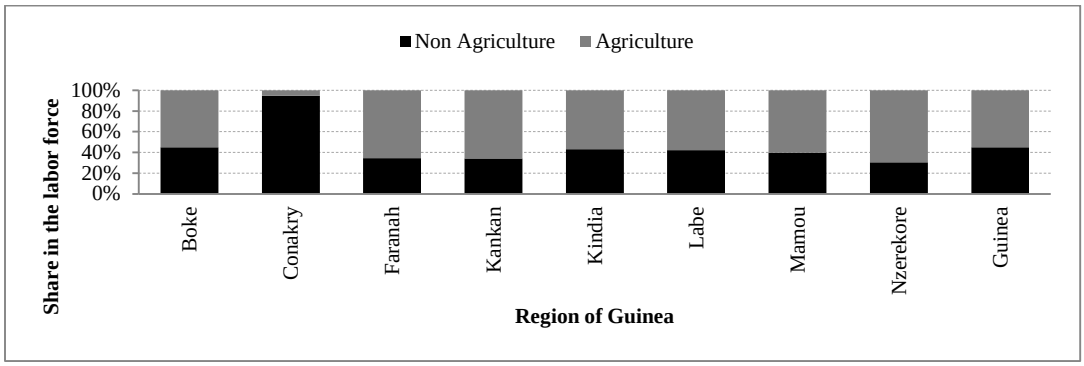
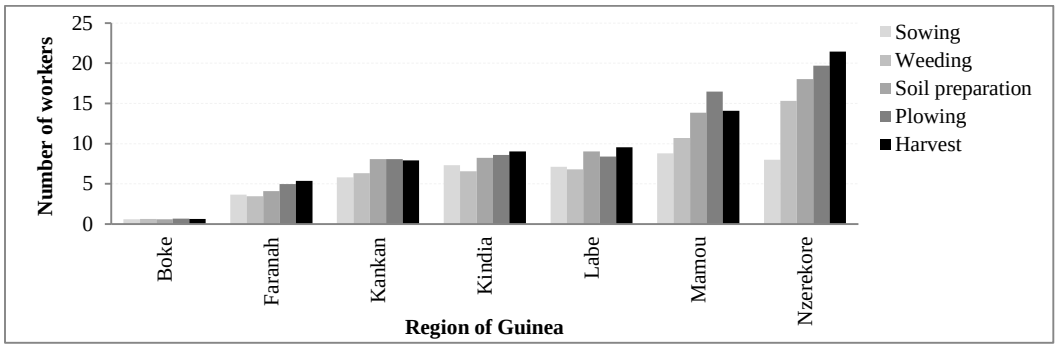
Figure I: Share of Workforce Employed in Agricultural and Non-Agricultural Sectors



Source: Authors from the Household Survey (ELEP, 2012).

Figure II: Average Number of Farm Workers



Source: Authors from the Household Survey (ELEP, 2012).

Table I: Imports and Exports Statistics (Percent)

Group of Products	Share		Ratio	
	Imports	Exports	Imports	Exports
Cereals	5.4	0.0	8.8	0.0
Tubers	0.0	0.0	0.0	0.0
Legumes	0.0	0.0	0.3	0.0
Other plant productions	0.6	2.2	4.4	13.1
Livestock farming	0.9	0.0	1.6	0.0
Forestry	0.0	0.1	0.0	0.4
Fishing	0.0	4.4	0.1	23.4
Bauxite, diamond and gold mines	0.0	81.7	0.0	94.5
Other mines and extractions	0.0	0.0	0.0	0.0
Food manufacturing	9.9	0.8	45.9	6.4
Manufacturing industries	52.1	1.1	66.9	3.9
Electricity, gas and water	0.0	0.0	0.0	0.0
Construction	0.0	0.0	0.0	0.0
Trade	0.0	0.0	0.0	0.0
Transports, storage and communications	7.6	0.9	19.9	2.6
Other private services	11.4	3.7	25.0	9.2
Non-private services	12.0	5.1	22.1	10.1
All categories	100.0	100.0	17.7	16.7

Source: Authors calculations from the MCS 2005.Ta