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Economic Costs of Ebola Virus Disease in the DRC: A Heterogeneous-Agent DSGE Approach*

Jean-Paul K. Tsasa[†]

Abstract

We assess the economic costs of Ebola virus disease (EVD) outbreaks in the Democratic Republic of the Congo (DRC), a country that recorded seventeen episodes between 1976 and 2026. We develop a dynamic stochastic general equilibrium model for a small open economy, characterized by the coexistence of Ricardian and non-Ricardian households, formal and informal sectors, and industrial and artisanal mining activities. The epidemiological shock operates through the disruption of informal production, avoidance behavior, the degradation of health-system capacity, and increased emergency public spending. The simulations indicate that a severe EVD episode leads, on impact, to a contraction of 17.5 % in non-mining informal output and of 22.4 % in artisanal mining output. The consumption of non-Ricardian households falls by 6.7 %, nearly three times the decline recorded by Ricardian households. Emergency health spending further reduces transfers targeted at non-Ricardian households by 29.8 %, which amplifies the regressive nature of the shock. Finally, the persistent deterioration of health-system capacity prolongs the economic contraction beyond the active phase of the epidemic.

Keywords: Ebola virus disease, economic costs, DRC.

JEL Code: I15, O17, O55, Q38.

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1 Introduction

Ebola virus disease (EVD) was first identified in September 1976 (Li and Chen 2014, Muyembe et al. 2015, Holmes et al. 2016, WHO 2025d), during two simultaneous outbreaks: one caused by the Sudan virus in Nzara, in present-day South Sudan, and the other caused by the Ebola virus in Yambuku, in Équateur Province¹, in the present-day Democratic Republic of the Congo (DRC). This virus had affected a village located near the Ebola River, which gave its name to the disease². The virus identified during the Yambuku outbreak was later designated Ebola Zaire virus, in reference to the former name of the country where it was discovered³. Since then, the DRC has recurrently experienced more confirmed EVD outbreaks than any other region in the world⁴. The various episodes that occurred between 1976 and 2026 affected 12 of the country’s 26 provinces (see Figure 1 below). Their recurrence, their geographic concentration, and their frequent overlap with areas characterized by high informality, substantial artisanal mining, and weak health-system capacity raise the question of their economic consequences beyond the directly observed human losses alone.

Epidemiological research has contributed substantially to identifying the factors that explain the emergence and recurrence of EVD episodes in the DRC, but also in other regions of the world. Among these factors are in particular proximity to natural forest reservoirs, hunting practices and bushmeat consumption, as well as

¹Let us note here that before the 2015 decentralization reform, the DRC was organized into eleven provinces, including Équateur Province. Following that reform (cf. JO RDC 1998, 2015a,b; Englebert and Kasongo 2016), the former administrative structure was reorganized into twenty-six provinces. The correspondence between the former and the new provinces is as follows: Bandundu≡(Kwango, Kwilu, Maï-Ndombe); Bas-Congo≡Kongo Central; Équateur≡(Équateur, Mongala, Nord-Ubangi, Sud-Ubangi, Tshuapa); Kasai-Occidental≡(Kasai, Kasai-Central); Kasai-Oriental≡(Kasai-Oriental, Lomami, Sankuru); Katanga≡(Haut-Katanga, Haut-Lomami, Lualaba, Tanganyika); Kinshasa (unchanged); Maniema (unchanged); Nord-Kivu (unchanged); Province Orientale≡(Bas-Uélé, Haut-Uélé, Ituri, Tshopo); Sud-Kivu (unchanged).

²From a biological standpoint, as Hussein (2023, p. 1) notes, EVD is a severe and highly lethal zoonotic disease, caused by viruses belonging to the *Filoviridae* family and the *Ebolavirus* genus. It generally produces symptoms such as high fever, vomiting, and diarrhea. It can also lead to muscle pain, headaches, and hemorrhaging, and often results in death (Muyembe et al. 2015, p. 2).

³The territory known today as the DRC has borne several successive names, reflecting major political and institutional transformations: Congo Free State (1885–1908), the personal property of King Leopold II; Belgian Congo (1908–1960), under Belgian colonial administration; Republic of the Congo (1960–1964) after independence; DRC (1964–1971); Zaïre (1971–1997) under Mobutu’s regime within the policy of authenticity; and finally, DRC since 1997 (Nzongola-Ntalaja 2002, Payanzo et al. 2026).

⁴See the details in Appendix A.

the limitations of health-surveillance systems (Peters and LeDuc 1999, Muyembe et al. 2015, Tully 2026). It has also highlighted the aggravating role of armed-conflict settings in the spread and control of epidemic flare-ups (Moran 2018, Nakkazi 2018, Muyembe et al. 2019), while analyzing prevention and response strategies adapted to these complex environments (Sy and Copley 2015, Schieffelin 2020, Raesi et al. 2025).

Beyond these health-related and structural determinants, an emerging economic literature has sought to understand how the shocks induced by EVD episodes are transmitted to the affected economies⁵. This work has shown in particular that an EVD flare-up produces not only direct health-related losses, but also affects economic activity through several mechanisms: production disruptions, behavioral changes, mobility restrictions, labor-market disorganization, and local socioeconomic vulnerabilities. However, these contributions remain mainly centered on the analysis of certain specific episodes, territories, or mechanisms⁶. Although they have substantially enriched the understanding of the economic consequences of EVD, these studies still offer few frameworks that allow one to study jointly the interactions among the different transmission channels of the epidemiological shock, the heterogeneity of economic agents, the segmentation between formal and informal sectors, as well as the financial constraints likely to amplify or attenuate their effects.

⁵In this perspective, World Bank (2014) provides one of the first macroeconomic assessments of the Ebola epidemic in West Africa, estimating its short- and medium-term effects on economic growth, public finances, trade, and household incomes. PDR (2015) offers an analysis of the economic consequences of the 2014 West African epidemic, highlighting the role of behavioral changes. Bowles et al. (2016) study the effects of the Ebola epidemic on economic activity in Liberia. Elmahdawy et al. (2017) analyze the economic consequences and public-health challenges associated with the Ebola epidemic in West Africa. Grépin, Poirier, and Fox (2020) examine the socioeconomic distribution of exposure to Ebola risk in Liberia and Sierra Leone. Maffioli (2021) analyzes the indirect economic costs of Ebola epidemics. More recently, UNDP (2026b) provides a rapid socioeconomic assessment of the recent Ebola outbreak in the DRC and documents its potential effects on livelihoods, local markets, essential services, and the affected populations.

⁶For example, UNECA (2015), in its report, assessed the socioeconomic consequences of EVD at the national, regional, and continental scales, highlighting the contraction of activity, the deterioration of public finances, the reduction in investment and labor supply, as well as the worsening of social vulnerabilities in the most affected countries. From a complementary perspective, UNDG (2016) analyzes the macroeconomic and social effects of this epidemic in West Africa, in particular on growth, poverty, and food security, and stresses the need to articulate national and regional mechanisms for prevention, response, and recovery. For the DRC, UNDP (2021) studies the macroeconomic and microeconomic implications of the outbreak that occurred in 2018 in Équateur Province, showing its effects on production, employment, household incomes, food security, and trade, as well as the role of the structural weaknesses of the health system and the local economy in amplifying them.

The issue is therefore no longer merely to establish that EVD episodes generate economic costs, but to understand through which mechanisms these costs are transmitted across the economy and with what magnitude they affect the behavior of agents, labor markets, household incomes, and macroeconomic equilibria. This article thus examines the extent to which the economic consequences of an EVD episode depend on its duration, its geographic extent, and the structural characteristics of the affected economy, in particular household heterogeneity, the segmentation between formal and informal activities, liquidity constraints, and local dependence on artisanal mining.

Our analysis devotes particular attention to four dimensions. It first examines whether EVD episodes are concentrated disproportionately in areas that depend heavily on artisanal mining and are located near forest ecosystems likely to harbor natural reservoirs of the virus. It then studies whether the documented economic losses are more closely associated with the duration and geographic extent of the epidemics than with their lethality alone. It also identifies the main channels of economic transmission, in particular the disruption of informal labor, the reduction in mobility, avoidance behavior, the disorganization of exchange among rural, mining, and urban areas, as well as indirect health effects. Finally, it examines the extent to which the weakness of health infrastructure and of local institutional capacity amplifies and prolongs the economic consequences of EVD.

To organize these mechanisms within a coherent framework, we develop a dynamic stochastic general equilibrium model with heterogeneous agents for a small open economy. The model distinguishes Ricardian households from non-Ricardian households, formal activities from informal activities, and industrial mining from artisanal mining. The epidemiological shock affects the economy through the disruption of informal production, avoidance behavior, the persistent deterioration of health-system capacity, and increased emergency public spending.

The simulations show that a severe epidemiological shock leads, on impact, to a contraction of 17.5% in non-mining informal output, of 22.4% in artisanal mining output, and of 7.2% in real GDP. The consumption of non-Ricardian households falls by 6.7%, nearly three times the decline of 2.3% recorded by Ricardian households. Emergency health spending further reduces transfers targeted at non-Ricardian households by 29.8%, which reinforces the regressive nature of the shock. Finally, the persistent deterioration of health-system capacity prolongs the economic contraction beyond the active phase of the epidemic. The sensitivity analysis shows that the magnitude of the GDP decline depends mainly on the intensity with which the shock disrupts informal production.

The remainder of the article is organized as follows. Section 2 discusses the contri-

bution of the paper and its relation to the literature. Section 3 provides a condensed comparative chronicle of the seventeen recorded EVD episodes and discusses the main documented facts, in particular the geographic overlap with artisanal mining areas, the available economic assessments, and the relationship between epidemiological severity and documented economic severity. Section 4 then formalizes, by means of a small-open-economy DSGE model augmented with an epidemiological shock, the main transmission channels identified by the empirical analysis (disruption of the informal sector, behavioral aversion, persistent degradation of the health system, and fiscal response), and specifies its calibration targets. Finally, Section 5 concludes.

2 Scientific contribution

The value of this study lies above all in shifting the analysis of Ebola epidemics from their health severity alone toward the mechanisms that determine their economic severity. Two episodes with a comparable number of cases or deaths may produce very different economic effects depending on their duration, their location, their spatial diffusion, and the nature of the economic agents affected.

For the DRC, this angle is particularly relevant because the affected areas often combine high informality, high labor mobility, cross-border trade, weak social-protection mechanisms and, in several territories, the importance of artisanal mining. An epidemic can therefore affect activity well beyond the directly infected individuals, in particular through reduced travel, market closures, the interruption of commercial chains, absenteeism, the decline in trade, and avoidance behavior.

To this end, the study makes four main contributions: it makes it possible to determine whether conventional epidemiological indicators suffice to predict economic losses; it highlights the potential importance of the duration and geography of the epidemic; it identifies the channels of economic transmission, in particular the informal economy, mobility, and artisanal mining activity; and finally, it can improve the targeting of public policies by showing that the economically most vulnerable territories are not necessarily those where lethality is highest.

Moreover, it is worth delimiting the scope of this exercise at the outset. This is not a study aimed at identifying, in a causal manner, the effect of an EVD episode on a particular macroeconomic indicator. The high-frequency provincial data required for such a strategy (in particular on production, formal and informal employment, mobility, and cross-border trade) are, to our knowledge, neither systematically available nor sufficiently comparable across all seventeen episodes recorded in the DRC. The empirical exercise therefore rests mainly on a comparative and descriptive anal-

ysis based on primary and institutional sources. It consists in setting side by side, episode by episode, the available epidemiological information, the existing economic assessments, and the structural characteristics of the affected areas, and then interpreting the observed regularities in light of the literature on the mechanisms of economic transmission of epidemic shocks.

This empirical limitation does not, however, mean that the analysis remains exclusively descriptive. In order to formalize the mechanisms highlighted by the historical and documentary examination, we also develop a dynamic stochastic general equilibrium (DSGE) model adapted to the main structural characteristics of the Congolese economy. The model makes it possible to organize, within a coherent framework, the main channels likely to transform an epidemic shock into a macroeconomic disturbance. Our model is used as a device for quantitative interpretation and counterfactual analysis, and not as a substitute for a causal identification that the available data would not support.

The economic literature distinguishes several non-mutually-exclusive channels through which an infectious epidemic affects an economy. Bloom, Kuhn, and Pretzner (2020) provide a recent synthesis: a direct labor-supply channel, via morbidity and mortality; a behavioral channel, often quantitatively dominant, through which individuals voluntarily reduce their consumption, mobility, and labor supply out of fear of contagion, generating a demand contraction independent of the direct health effect; a human-capital channel, through which a reduced life expectancy lowers the expected return on investment in education; and a fiscal channel, through which the reallocation of public spending toward prevention and treatment may crowd out other items of public investment. The benchmark assessment carried out by the World Bank in the context of the 2014–2016 West African epidemic highlights the preeminence of the behavioral channel. It attributes most of the estimated economic costs to the increased cost of economic activity within and across national borders, mainly as a result of avoidance behavior linked to fear of contagion, rather than to direct health spending alone or to labor losses resulting from morbidity and mortality (World Bank, 2014). For West Africa as a whole, this assessment estimates production losses at 2.2 billion dollars in 2014 and 1.6 billion in 2015 in the “Low Ebola” scenario, i.e., a cumulative loss of 3.8 billion dollars. In the “High Ebola” scenario, characterized by slower control of the epidemic and by its spread to other countries in the region, cumulative losses would reach 32.6 billion dollars over 2014–2015. A complementary theoretical contribution (cf. Efayena 2016), drawing on a neoclassical growth framework, further stresses that the economic cost of an epidemic such as EVD decomposes into direct, indirect, and deferred indirect effects; this last type of cost, bearing in particular on the deferred accumulation of physical and human

capital, being structurally underestimated by short-term assessments.

Unlike the 2014–2016 West African epidemic, whose economic cost was the subject of an abundant literature as it unfolded, the episodes that occurred specifically in the DRC have, with rare exceptions, not been the subject of a quantified and publicly documented macroeconomic assessment. The 2018–2020 Nord-Kivu/Ituri epidemic, the most severe in the country’s history until 2025, mobilized World Bank financing exceeding, according to its own communiqués, half the total cost of the response since its onset, via the International Development Association (IDA) fund and the cash window of the *Pandemic Emergency Financing Facility* (World Bank, 2019). This financing, however, documents the cost of the response, not the macroeconomic impact of the epidemic on production, employment, or poverty. Thus, we found no assessment of this second type in the various sources consulted for this article, for this specific episode.

The outbreak ongoing in 2026, by contrast, was the subject of a detailed socioeconomic assessment by the United Nations Development Programme, published on 30 June 2026 under the title *Rapid Socioeconomic Assessment of Ebola Outbreak in the DRC* (UNDP 2026a,b). Based on a multiregional computable general equilibrium model and on microeconomic simulations, this study examines three scenarios: containment of the epidemic to the DRC and Uganda, a regional diffusion of its economic repercussions without generalized viral spread, and a polycrisis combining these repercussions with global geopolitical disruptions. It estimates the aggregate GDP loss at 2.37 billion dollars in the regional economic-spillover scenario and at 3.6 billion in the polycrisis scenario, the latter amount not being attributable, however, to the epidemic alone. In the containment scenario, the GDP loss exceeds one billion dollars in the DRC and is accompanied by about 55 000 job losses. The assessment also estimates that an additional 985 000 people could fall into extreme poverty and that daily consumption of the poorest 20 % of households would decline by 1.76 % (UNDP 2026a,b). It finally highlights an important indirect health channel: the diversion of human and financial resources away from essential health services could lead to between 2 406 and 2 520 additional deaths of children under five due to preventable conditions other than EVD. This is, however, a result derived from the model’s simulations, and not a directly observed empirical estimate.

The third strand of the literature considered in this article concerns the economic geography of artisanal mining in the DRC, independently of the health issue. According to the *Delve* platform, a database on artisanal and small-scale mining supported by the World Bank, artisanal diamond mining is historically concentrated in the provinces of Kasai-Oriental and Kasai-Central; artisanal gold mining is concentrated in Haut-Uélé, Ituri, Nord-Kivu, Sud-Kivu, Maniema, and Tanganyika, with

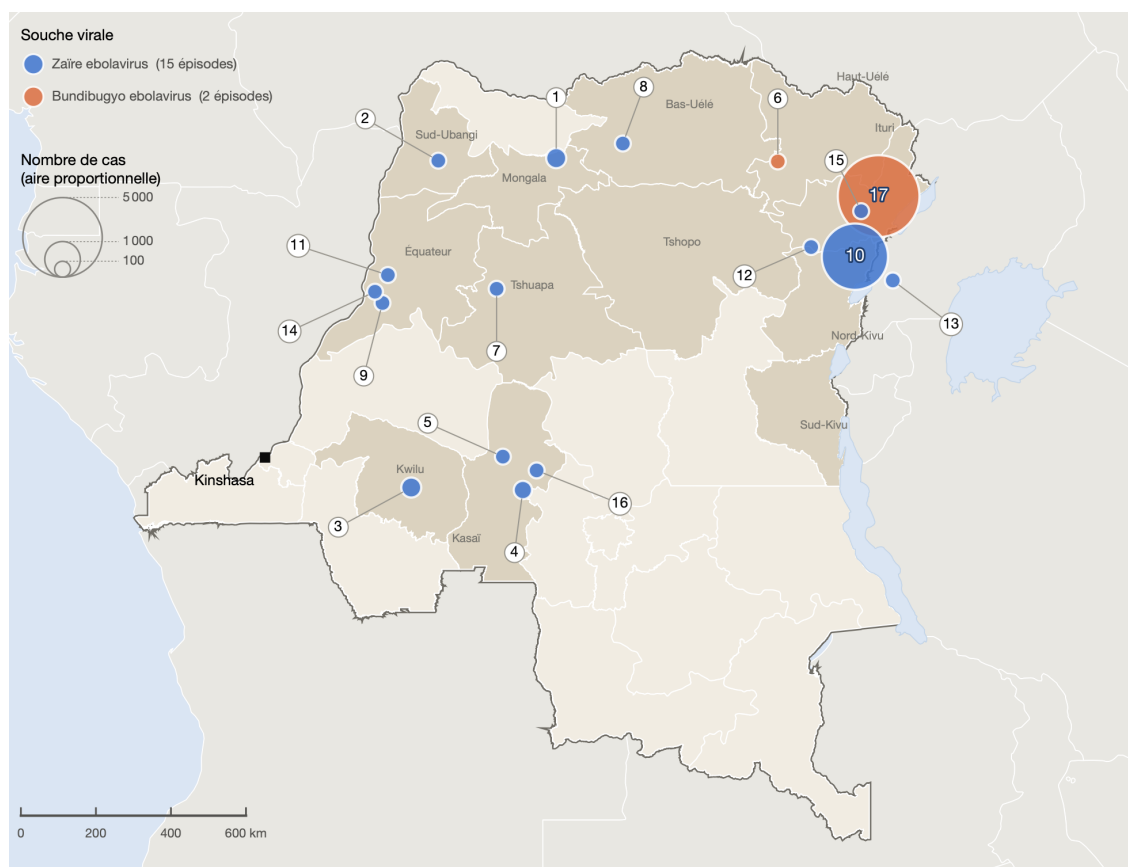
the “Kibaran gold province,” which extends over Nord-Kivu, Sud-Kivu, and eastern Maniema, concentrating the most heavily exploited gold reserves in the country; artisanal coltan and cassiterite mining is concentrated in the same two Kivu provinces as well as in Tanganyika, Haut-Lomami, and Maniema (Delve Database, 2026). According to the same work, between 500 000 and 2 million people are thought to depend directly on artisanal mining activity in the DRC, with the World Bank estimating that between 8 and 10 million people, i.e., up to 16 % of the Congolese population, depend on it indirectly. A detailed mapping by the *International Peace Information Service* (IPIS), a Belgian independent research organization specializing in the monitoring of artisanal mining sites in the eastern DRC, counts more than 2 800 artisanal and small-scale mining sites recorded in the provinces of Nord-Kivu, Sud-Kivu, Ituri, and Tanganyika (Leysen et al., 2023).

3 Data, conceptual framework, and regularities

The articulation between the spatial characteristics of epidemic episodes and the general mechanisms of economic transmission of health shocks suggests that their economic effects depend not only on their medical severity, but also on the productive and social structures of the affected territories. Local economies characterized by formal and informal segments, high population mobility, low social coverage, and limited access to savings and credit mechanisms are likely to be particularly vulnerable to the disruptions induced by health-control measures and avoidance behavior. This configuration leads one to examine whether the economic consequences of EVD episodes are more closely linked to their duration, their geographic extent, and the structural characteristics of the affected areas than to their epidemiological severity alone, and whether the main transmission mechanisms operate through disruptions to labor, mobility, and economic activity. Given the small number of episodes and the scarcity of quantified economic assessments, the empirical analysis remains descriptive and comparative and aims to document associative regularities rather than to establish causal relationships. We nonetheless complement this analysis with the development of a DSGE model adapted to the structural characteristics of the Congolese economy, in order to formalize the main transmission channels identified and to examine their macroeconomic implications within a coherent quantitative framework.

The data used in this article come from primary and institutional sources, comprising the official publications of national health authorities, international organizations, and specialized agencies, complemented by the peer-reviewed scientific literature.

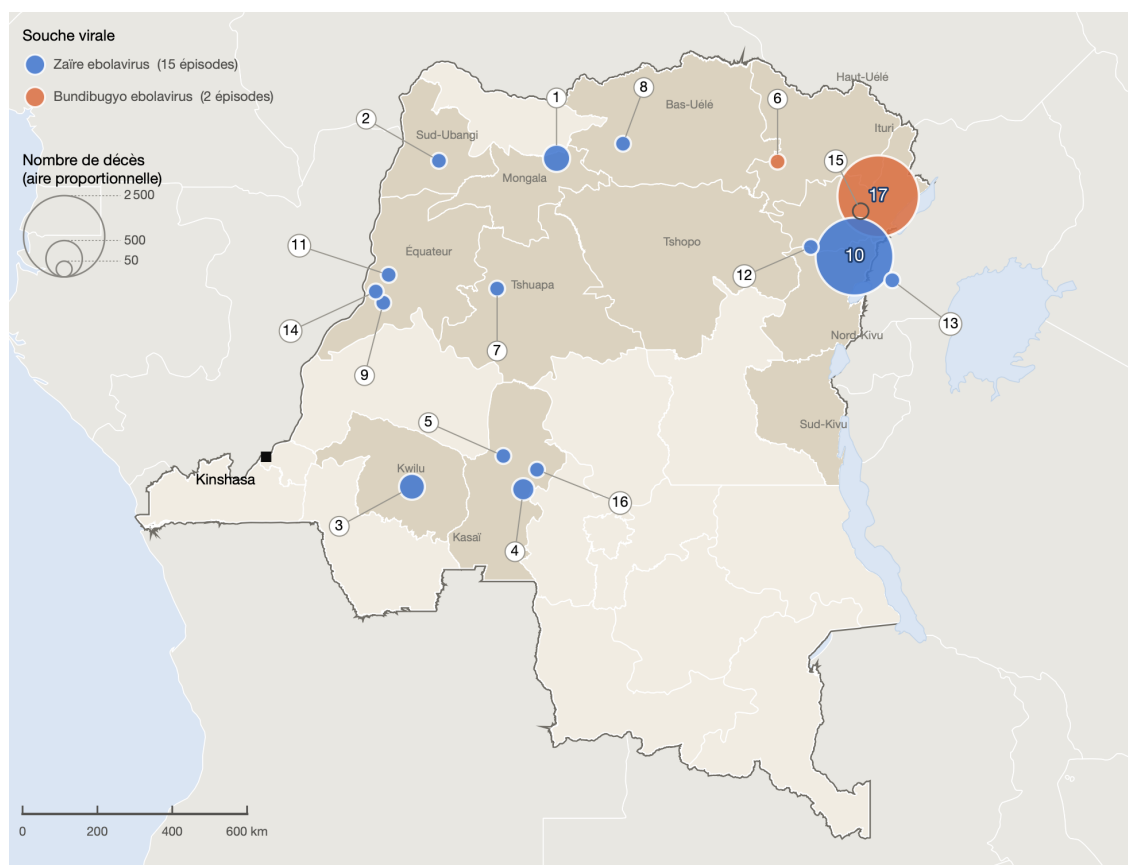
Figure 1: Geographic distribution and scale of EVD episodes in the DRC by viral strain, 1976–2026.



Note: Figure 1 presents the geographic distribution of the 17 EVD episodes recorded in the DRC between August 1976 and August 2026. The numbers refer to the chronological order of the episodes. The color of the circles indicates the identified viral strain: blue for *Zaire ebolavirus* (15 episodes) and orange for *Bundibugyo ebolavirus* (2 episodes). The area of each circle is proportional to the number of confirmed cases reported for the corresponding episode. The positioning of the circles represents the main declared focus or, in the case of epidemics extending across several health zones, an indicative geographic location. The overlap of some circles reflects the proximity of the foci and is not a measure of their spatial extent. The data relating to the 2026 episode are provisional and correspond to the situation available at the data cut-off date, i.e., 19 August 2026. The data come from the World Health Organization (WHO), the WHO Regional Office for Africa (WHO-AFRO), the Centers for Disease Control and Prevention (CDC), and the National Institute of Public Health of the DRC (INSP-DRC).

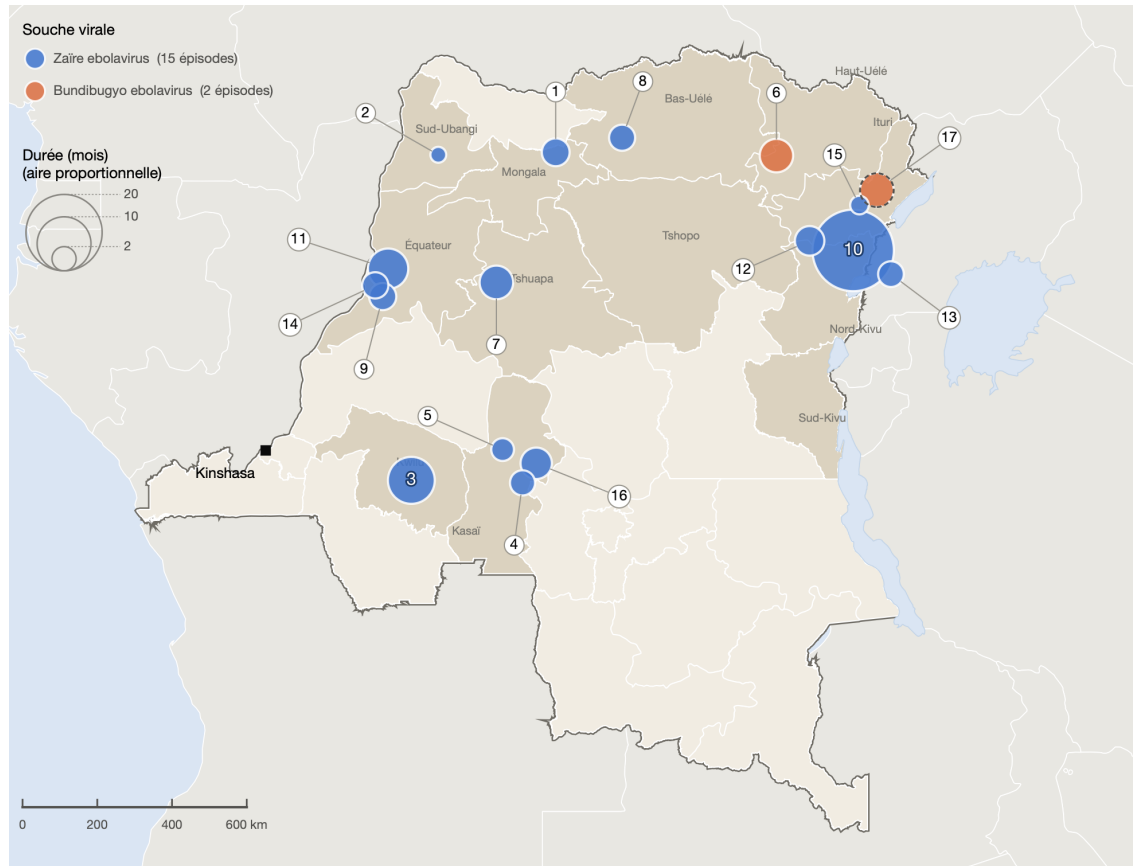
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Figure 2: Geographic distribution and scale of EVD episodes in the DRC by viral strain, 1976–2026.



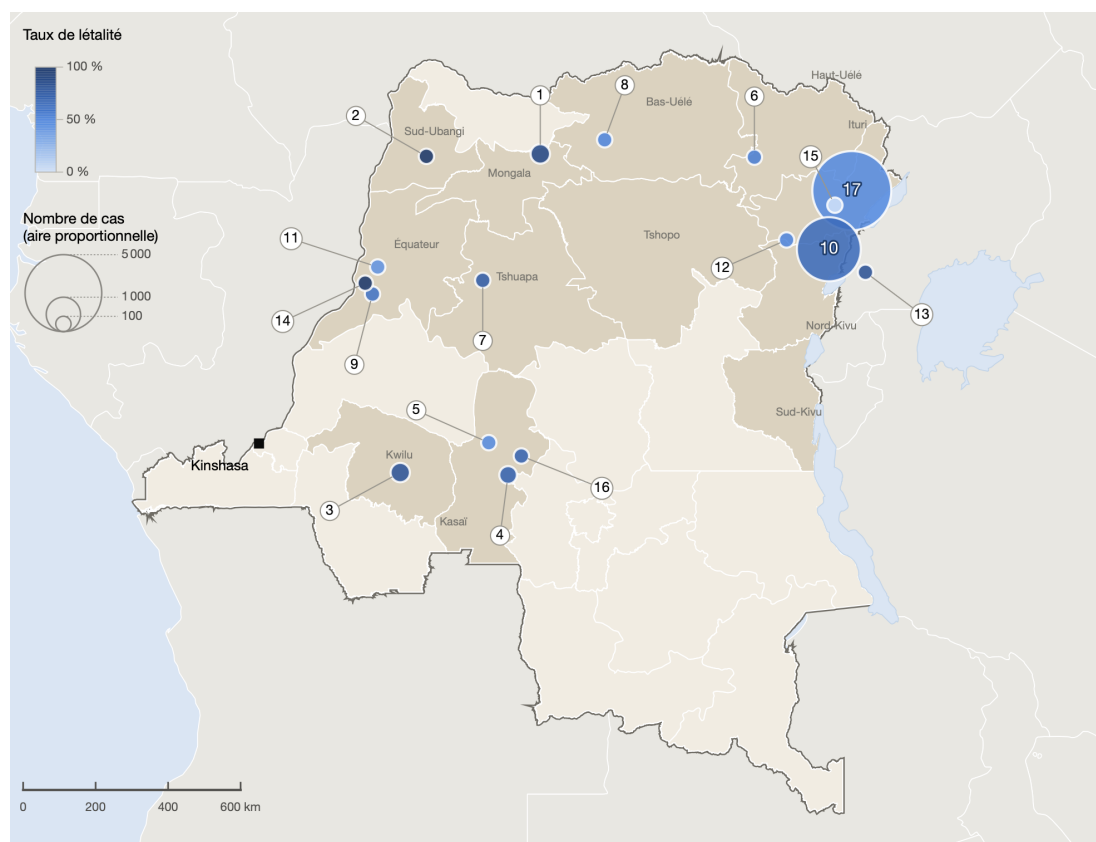
Note: Figure 2 presents the geographic distribution of the 17 EVD episodes recorded in the DRC between August 1976 and August 2026. The numbers indicate the chronological order of the episodes. The color of the circles corresponds to the identified viral species: blue for *Zaire ebolavirus* (15 episodes) and orange for *Bundibugyo ebolavirus* (2 episodes). The area of each circle is proportional to the number of deaths reported for the corresponding episode. The positioning of the circles indicates the main declared focus or, for epidemics extending across several health zones or provinces, an indicative geographic location. The overlap of some circles results from the geographic proximity of the foci and measures neither the territorial extent nor the effective transmission area of each episode. The figures relating to the 17th episode are provisional and correspond to the data available as of 19 August 2026, the epidemic still being active at that date. The data come from the World Health Organization (WHO), the WHO Regional Office for Africa (WHO-AFRO), the Centers for Disease Control and Prevention (CDC), and the National Institute of Public Health of the DRC (INSP-DRC).

Figure 3: Geographic distribution and scale of EVD episodes in the DRC by viral strain, 1976–2026.



Note: Figure 3 presents the duration and geographic distribution of the 17 EVD episodes recorded in the Democratic Republic of the Congo (DRC) between August 1976 and August 2026. The numbers indicate the chronological order of the episodes. The color of the circles corresponds to the identified viral species: blue for *Zaire ebolavirus* (15 episodes) and orange for *Bundibugyo ebolavirus* (2 episodes). The area of each circle is proportional to the duration, expressed in months, of the corresponding episode. The positioning of the circles indicates the main declared focus or, for epidemics extending across several health zones or provinces, an indicative geographic location. The overlap of some circles results from the geographic proximity of the foci and measures neither the territorial extent nor the effective zone of transmission of each episode. The dashed outline of the 17th episode indicates that it was still active as of the data cut-off date. Its duration is therefore provisional and corresponds to the period observed up to 19 August 2026. The data come from the World Health Organization (WHO), the WHO Regional Office for Africa (WHO-AFRO), the Centers for Disease Control and Prevention (CDC), and the National Institute of Public Health of the DRC (INSP-DRC).

Figure 4: Geographic distribution and scale of EVD episodes in the DRC by viral strain, 1976–2026.



Note: Figure 4 presents the number of cases and the case fatality rate associated with the 17 Ebola virus disease (EVD) episodes recorded in the Democratic Republic of the Congo between August 1976 and August 2026. The numbers indicate the chronological order of the episodes. The area of each circle is proportional to the number of cases reported for the corresponding episode. The intensity of the color represents the case fatality rate, computed as the ratio of the number of deaths to the number of cases, multiplied by 100. A darker shade thus indicates a higher case fatality rate. The positioning of the circles indicates the main declared focus or, for epidemics extending across several health zones or provinces, an indicative geographic location. The overlap of some circles results from the geographic proximity of the foci and measures neither the territorial extent nor the effective zone of transmission of each episode. The number of cases and the case fatality rate of the 17th episode are provisional and correspond to the data available as of 19 August 2026, the epidemic still being active at that date. The data come from the World Health Organization (WHO), the Regional Office of the WHO for Africa (WHO-AFRO), the Centers for Disease Control and Prevention (CDC), and the National Institute of Public Health of the DRC (INSP-DRC).

2025a, 2026a,b; WHO Africa 2025, 2026a; WHO 2022), the reference page of the *Centers for Disease Control and Prevention, History of Ebola Outbreaks* (CDCP, 2024), and the articles published in peer-reviewed journals dealing with a given episode, in particular Muyembe et al. (2015) for the period 1976–2014; Kratz et al. (2015) for the Isiro episode (2012); Grimes et al. (2020) for the Likati episode (2017); Muyembe et al. (2019) and Vossler et al. (2022) for the Nord-Kivu/Ituri episode (2018–2020); Zomahoun et al. (2026) for the ongoing episode (2026).

Second, for the economic dimension, the following institutional assessments and communiqués: the World Bank’s benchmark report on the economic cost of the 2014–2016 West African epidemic (World Bank, 2014); the World Bank financing documents relating to the Nord-Kivu/Ituri episode (World Bank, 2019); the rapid socioeconomic assessment of the United Nations Development Programme concerning the ongoing episode (UNDP, 2026b,a); and the theoretical contribution of Efayena (2016) for the conceptual framing of direct, indirect, and deferred indirect costs.

Third, for the geographic and sectoral dimension, the *Delve* platform, supported by the World Bank (Delve Database, 2026), and the mapping of the *International Peace Information Service* (Leysen et al., 2023), for the verifiable identification of the provinces of artisanal mining extraction.

Fourth, for the most recent episodes, the dispatches of specialized public-health press, in particular the *Center for Infectious Disease Research and Policy* (CIDRAP) and the United Nations bulletins (UN News), retained only when they directly report figures attributed to the WHO or to the Congolese health authorities (CIDRP, 2025; UN News, 2021, 2022).

Every numerical statement appearing in this article is tied to at least one of the aforementioned sources. When two independent sources report different numerical tolls for the same episode, both values are reported explicitly rather than reconciled arbitrarily. It is explicitly noted, for each of the fifteen episodes other than those of 2018–2020 and 2026, that no quantified economic assessment was found in the sources consulted; this absence is treated as a datum in itself (absence of documentation), and not interpreted as an absence of real economic impact. The data relating to the epidemic ongoing in 2026 are, by construction, provisional.

We now proceed, step by step, to the comparative chronicle of EVD episodes between 1976 and 2026.

Table 1 brings together the chronology and the epidemiological toll of the seventeen episodes recorded since the identification of the virus in 1976. Four periods can be distinguished. A first period of sporadic emergence (1976–1995) comprises the Yambuku episode (318 cases, 280 deaths, 88 % case fatality) and that of Kikwit in 1995. A second period (2007–2014) sees the recurrence of four episodes in the Kasai

and Équateur basin, including that of Isiro (2012), the only episode prior to 2026 caused by the species *Orthoebolavirus bundibugyoense*. A third period (2017–2022) concentrates most of the cumulative burden of morbidity and mortality, with at its heart the Nord-Kivu/Ituri/Sud-Kivu epidemic (2018–2020): 3 463 cases (3 317 confirmed and 146 probable) and 2 280 deaths according to the WHO’s official closing toll (WHO, 2020), i.e., a case fatality of 66 %, in a context of active armed conflict that directly hampered the response (Muyembe et al., 2019). A fourth period (2025–2026) comprises the Bulape episode, in Kasai (64 cases, 45 deaths, 70.3 % case fatality, closed on 1 December 2025) (WHO Africa, 2025; CIDRP, 2025), and then the ongoing epidemic, declared on 15 May 2026 and caused by *Orthoebolavirus bundibugyoense*, which already constitutes, as of 12 August 2026, the largest EVD epidemic ever recorded in the DRC: at least 4 665 confirmed cases and 2 184 deaths for the DRC alone, expanding toward a sixth province (WHO, 2026b; WHO Africa, 2026a).

Table 2 sets side by side, for each of the provinces that experienced at least one EVD episode, the artisanal minerals extracted there according to the *Delve* platform and the IPIS mapping (Delve Database, 2026; Leysen et al., 2023). Of the six distinct provincial groupings affected by at least one of the seventeen episodes, i.e., Bandundu (Kwilu), Équateur (Mongala, Sud-Kivu, Tshuapa), Kasai-Occidental (Kasai), Nord-Kivu, Province Orientale (Bas-Uélé, Haut-Uélé, Ituri, Tshopo) and Sud-Kivu; four are explicitly recorded by these sources as leading artisanal mining extraction areas, namely Kasai (diamond), Province Orientale (Haut-Uélé, Ituri; gold), Nord-Kivu, and Sud-Kivu (gold, coltan, cassiterite). These provinces alone concentrate nine of the seventeen recorded episodes: episodes 4, 5, and 16 (Kasai; diamond); episode 6 (Haut-Uélé; gold); and episodes 10, 12, 13, 15, and 17 (Nord-Kivu, Sud-Kivu, and/or Ituri; gold and coltan). Eight episodes, by contrast, fall outside this overlap. Indeed, the six episodes that occurred in Équateur (1, 2, 7, 9, 11, 14), a province not recorded by Gerig et al. (2020) and Delve Database (2026) among the leading artisanal extraction areas, episode 3 (Bandundu/Kikwit, 1995), and episode 8 (Bas-Uélé/Likati, 2017), also outside documented artisanal mining areas. This observation is consistent with the idea of geographic overlap with artisanal mining areas: the geographic recurrence of EVD epidemic foci in the DRC, already noted by the epidemiological literature (Muyembe et al., 2015), substantially overlaps, without being reducible to it, the geography of artisanal mining extraction as documented independently by the literature on the mining sector.

Table 3 records, for each of the seventeen episodes, the existence or absence of a quantified economic assessment found in the sources consulted, as well as the duration and the number of provinces affected by each episode. Only two episodes, namely

Table 1: Chronology and comparative toll of Ebola virus disease episodes in the DRC, 1976–2026.

No.	Period	Location	Province	Cases	Deaths	CFR	Source
1	Aug.–Oct. 1976	Yambuku	Équateur	318	280	88.0 %	CDCP (2024); Muyembe et al. (2015)
2	1977	Tandala	Équateur	1	1	100.0 %	CDCP (2024)
3	Jan.–Jul. 1995	Kikwit	Bandundu	315 ^a	254 ^a	81.0 % ^a	CDCP (2024); Muyembe et al. (2015)
4	Apr.–Oct. 2007	Luebo, Mweka	Kasaï-Occ.	264	187	70.8 %	CDCP (2024)
5	Dec. 2008–Feb. 2009	Mweka, Luebo	Kasaï-Occ.	32	15	46.9 %	CDCP (2024)
6	Aug.–Nov. 2012	Isiro, Viadana	Orientale	62	34	54.8 %	Kratz et al. (2015)
7	Aug.–Nov. 2014	Djera, Boende	Équateur	69	49	71.0 %	CDCP (2024)
8	Apr.–Jul. 2017	Likati	Bas-Uélé	8	4	50.0 %	Grimes et al. (2020)
9	May–Jul. 2018	Bikoro, Mbandaka	Équateur	54	33	61.1 %	CDCP (2024)
10	Aug. 2018–Jun. 2020	N.-Kivu, Ituri, S.-Kivu	N.-Kivu/ Ituri	3 463 ^b	2 280 ^b	65.8 % ^b	WHO (2020)
11	Jun.–Nov. 2020	Mbandaka	Équateur	130	55	42.3 %	ECDPC (2020)
12	Feb.–May 2021	Nord-Kivu	N.-Kivu	12	6	50.0 %	ECDPC (2021)
13	Oct.–Dec. 2021	Beni	N.-Kivu	11	6	54.5 %	UN News (2021)
14	Apr.–Jul. 2022	Mbandaka	Équateur	5	5	100.0 %	UN News (2022)
15	Aug.–Sep. 2022	Beni	N.-Kivu	1	1	100.0 %	WHO (2022)
16	Aug.–Dec. 2025	Bulape	Kasaï	64	45	70.3 %	WHO Africa (2025)
17	Since May 2026	Ituri, N.-Kivu, S.-Kivu, Haut-Uélé, Tshopo, Bas-Uélé	6 provinces	$\geq 4\,665^c$	$\geq 2\,184^c$	46.8 % ^c	WHO (2026b)

Note: ^aMuyembe et al. (2015) reports, for the same episode, 317 cases and 248 deaths (78.0 % case fatality); the discrepancy with the CDC figure reflects a retrospective revision of case classification. ^bWHO official closing toll (WHO, 2020); Vossler et al. (2022) report, based on reconstructed individual-level data from the Ministry of Health, a toll of 3 481 cases and 2 299 deaths. ^cProvisional data for the DRC only, as of 12 August 2026; epidemic active at the time of writing (WHO Africa, 2026a).

the 10th (2018–2020) and the 17th (2026, ongoing), are accompanied by such an assessment. These are also the two longest episodes (22 months and, as of 16 August 2026, more than three months and still active) and the most geographically extensive

Table 2: Overlap between the provinces affected by EVD and the documented artisanal mining extraction areas.

Province(s)	Documented artisanal minerals	EVD episodes	Source
Kasaï (former Kasaï-Occidental)	Diamond	4, 5, 16	Delve Database (2026)
Nord-Kivu, Sud-Kivu	Gold, coltan, cassiterite, wolframite	10, 12, 13, 15, 17	Delve Database (2026); Leysen et al. (2023)
Ituri	Gold	10, 17	Delve Database (2026); Leysen et al. (2023)
Haut-Uélé (former Orientale)	Gold	6, 17	Delve Database (2026)
Équateur	Not recorded as a leading artisanal extraction area	1, 2, 7, 9, 11, 14	Delve Database (2026)
Kwilu (Kikwit, former Bandundu)	Not recorded as a leading artisanal extraction area	3	Delve Database (2026)
Bas-Uélé	Not recorded as a leading artisanal extraction area	8	Delve Database (2026)

Note: The numbers refer to the chronological order of the EVD episodes presented in Table 1 (see also Appendix A for further details). The provincial names have been harmonized as far as possible in order to account for the changes in the DRC's administrative divisions. The presence of artisanal mining activities is established from the areas documented in the cited sources; their absence in these databases does not therefore necessarily mean that no artisanal mining activity exists in the province considered. Finally, the geographic overlap presented in this table is descriptive and does not, by itself, allow one to establish a causal relationship between artisanal mining and the occurrence of EVD episodes.

Table 3: Duration, geographic extent, and availability of a documented economic assessment, by episode

No.	Approximate duration	Number of provinces	CFR	Economic assessment	Documented estimate and source
1	2 months	1	88.0 %	No	...
2–9 and 11–16	≤ 6 months for each episode	1 for each episode	42.3–100 %	No	...
10	22 months	3	65.8 %	Partial	More than 50 % of the total response cost financed with IDA and PEF resources; overall amount not specified (World Bank, 2019). No documented estimate of the GDP loss was found.
17	≥ 3 months; active episode	6 provinces as of 19 August 2026	46.8 %	Yes	Regional economic losses estimated between 2.37 and 3.6 billion dollars; loss exceeding 1 billion dollars for the DRC; 985 000 additional people below the poverty line; 55 000 jobs lost in the DRC; and a 1.76 % decline in the consumption of the poorest 20 % (UNDP, 2026a).

Note: The numbers refer to the chronological order of the EVD episodes presented in Table 1 (see also Appendix A for further details). The case fatality rate is computed as the ratio of the number of deaths to the total number of cases reported for each episode. For episodes grouped in a single row, the interval presented corresponds to the minimum and maximum values observed. The number of provinces is established according to the administrative division applicable or reconstructed for the period considered. “Economic assessment” indicates whether a quantified estimate of the costs or of the economic consequences of the episode was found in the sources consulted. The entry “No” does not therefore demonstrate the absence of economic costs, but only the absence of a documented assessment within the scope of the bibliographic search. IDA denotes the International Development Association and PEF the Pandemic Emergency Financing Facility. The health and economic data relating to episode 17 are provisional and liable to revision as the epidemic evolves.

(three provinces for the first, six for the second, as of 12 August 2026) of the entire series. Conversely, the proportionally most deadly episode, that of Yambuku (1976, 88 % case fatality), confined to a duration of two months, was not, in the sources consulted, the subject of any quantified economic assessment; the same holds for the Mbandaka episode of April–July 2022, whose case fatality reaches 100 %. This qualitative association (i.e., economic documentation correlated with duration and geographic extent rather than with clinical lethality) suggests that the absence of an assessment found in the sources consulted cannot be interpreted as evidence of an absence of real economic impact; it may equally well reflect the absence of an incentive, for international institutions, to commission a dedicated macroeconomic assessment for a brief and geographically circumscribed episode, even one that is clinically severe.

For the two episodes accompanied by economic documentation, the available sources make it possible to identify the dominant channel they emphasize. For episode 10 (2018–2020), the available documentation bears almost exclusively on the *cost of the health response* itself (IDA/PEF financing) and on the armed-conflict channel, which directly hampered vaccination and clinical care (Muyembe et al., 2019; World Bank, 2019); it does not separately quantify a behavioral or informal channel. For episode 17 (2026), by contrast, the UNDP assessment explicitly quantifies several distinct channels: a contraction in employment (55 000 jobs in the DRC), a contraction in the consumption of the poorest households (−1.76 %, a channel consistent with a contraction in informal income), a disruption of cross-border trade, and an indirect health channel, up to 2 520 additional child deaths attributable to the disruption of routine health services rather than to EVD itself (UNDP, 2026a). This last channel, although not explicitly listed by Bloom, Kuhn, and Prettnner (2020) among the four general channels, is consistent with their fiscal channel: the reallocation of health-system capacity toward the EVD response in effect crowds out the provision of other essential health services. It emerges from the evidence available for episode 17 that when an economic assessment exists, it documents a set of channels extending well beyond direct mortality alone, including behavioral, informal, and fiscal-reallocation effects.

4 Quantitative assessment

The empirical regularities established by the historical and documentary analysis that precedes this section, in particular the geographic concentration of epidemic foci in artisanal mining extraction areas, the documented preeminence of the informal and behavioral channel, and the existence of an indirect health channel distinct from

direct mortality, motivate the construction of a formal framework allowing one to organize these channels coherently and to study their quantitative implications.

4.1 Baseline model

We develop an epidemiological extension of a dynamic stochastic general equilibrium (DSGE) model for a small open economy, adapted to the main structural characteristics of the Congolese economy highlighted above, in particular the coexistence of formal and informal production segments and the concentration of artisanal mining activity in the provinces most exposed to EVD episodes.

4.1.1 Households

The economy is populated by a continuum of mass one of households, divided into two types indexed by $h \in \{o, r\}$. A fraction $\lambda \in (0, 1)$ of households is *Ricardian* ($h = o$): it has access to domestic and international financial markets, holds physical capital, bank deposits, government securities, and a direct external financial position, and smooths its consumption intertemporally. The remaining fraction, $1 - \lambda$, is *non-Ricardian* ($h = r$): lacking any savings or borrowing instrument, it consumes, each period, the entirety of its disposable income (a hand-to-mouth subsistence constraint). Each household, regardless of its type, supplies labor to both the formal and the informal sector, $L_t^{h,F}$ and $L_t^{h,I}$.

Ricardian households. The representative Ricardian household maximizes

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t^o, L_t^{o,F}, L_t^{o,I}), \quad (1)$$

where $\beta \in (0, 1)$ is the discount factor and U is increasing and concave in consumption, decreasing and convex in hours worked in each of the two segments of the labor market, subject to the nominal budget constraint

$$\begin{aligned} P_t C_t^o + P_t I_t^o + M_t^o + D_t^o + \varepsilon_t D_t^{*,o} + B_t^{g,o} + \varepsilon_t B_t^{*,o} \\ = W_t^F L_t^{o,F} (1 - \tau_t^L) + W_t^I L_t^{o,I} + R_t^K K_{t-1}^o + \Pi_t^o \\ + M_{t-1}^o + (1 + i_{t-1}^D) D_{t-1}^o + \varepsilon_t (1 + i_{t-1}^*) D_{t-1}^{*,o} + (1 + i_{t-1}) B_{t-1}^{g,o} + \varepsilon_t (1 + \tilde{i}_{t-1}^*) B_{t-1}^{*,o}, \end{aligned} \quad (2)$$

where I_t^o is private investment, subject to the standard capital accumulation

$$K_t^o = (1 - \delta) K_{t-1}^o + I_t^o, \quad (3)$$

with $\delta \in (0, 1)$ the depreciation rate, M_t^o domestic-money holdings, D_t^o and $D_t^{\star,o}$ domestic and foreign-currency bank deposits, $B_t^{g,o}$ domestic government securities, $B_t^{\star,o}$ the direct external financial position remunerated at the country-risk-adjusted rate $\tilde{i}_t^{\star} = i_t^{\star} \Phi_t$ defined in Equation (33) below, and Π_t^o the profit income distributed to Ricardian households by the formal and informal activities. The first-order conditions with respect to consumption and capital are the Euler equation

$$\frac{U_C(C_t^o, \cdot)}{P_t} = \beta \mathbb{E}_t \left[\frac{U_C(C_{t+1}^o, \cdot)}{P_{t+1}} (1 + i_t) \right], \quad (4)$$

and the capital arbitrage condition

$$1 = \beta \mathbb{E}_t \left[\frac{U_C(C_{t+1}^o, \cdot)}{U_C(C_t^o, \cdot)} \left(\frac{R_{t+1}^K}{P_{t+1}} + 1 - \delta \right) \right], \quad (5)$$

while labor supply on each of the two segments satisfies

$$-\frac{U_{L^F}(\cdot)}{U_C(\cdot)} = \frac{W_t^F(1 - \tau_t^L)}{P_t}, \quad -\frac{U_{L^I}(\cdot)}{U_C(\cdot)} = \frac{W_t^I}{P_t}. \quad (6)$$

Non-Ricardian households. The representative non-Ricardian household holds neither assets nor liabilities from one period to the next and consumes its entire current disposable income,

$$P_t C_t^r = W_t^F L_t^{r,F} (1 - \tau_t^L) + W_t^I L_t^{r,I} + P_t T R_t, \quad (7)$$

where $T R_t$ denotes the real public transfers targeted at this type of household, defined in Equation (30) below. This absence of intertemporal smoothing implies that any variation in informal labor income or in public transfers passes through fully, and without delay, to the consumption of non-Ricardian households: it is this channel that the epidemiological shock of Subsection 4.2 mobilizes directly, and which governs most of the quantitative amplification reported in Section 4.4.3.

4.1.2 Formal and informal non-mining production

Formal sector. A representative firm combines private capital, formal labor, and imported intermediate inputs, while benefiting from the productive externality of public capital,

$$Y_t^{N,F} = A_t K G_t^{\chi} K_{t-1}^{\alpha} \left(L_t^{N,F} \right)^{\theta} I M_t^{1-\alpha-\theta}, \quad (8)$$

where A_t denotes the total factor productivity of the formal non-mining sector, KG_t the stock of productive public capital, $\chi > 0$ the elasticity of output with respect to public capital, $\alpha \in (0, 1)$ the share of private capital, $\theta \in (0, 1)$ the share of formal labor, with $\alpha + \theta < 1$. Formal non-mining productivity follows

$$\ln A_t = (1 - \rho_A) \ln \bar{A} + \rho_A \ln A_{t-1} + \sigma_A \epsilon_t^A, \quad (9)$$

with $\bar{A} > 0$, $\rho_A \in [0, 1)$, $\sigma_A > 0$, and ϵ_t^A an i.i.d. innovation of zero mean and unit variance. Cost minimization implies the usual factor-demand conditions, including the demand for formal labor

$$\frac{W_t^F}{P_t} = \theta \frac{Y_t^{N,F}}{L_t^{N,F}}, \quad (10)$$

which equalizes the formal real wage to the marginal productivity of labor in the formal non-mining sector.

Informal sector. The informal non-mining sector is competitive, uses no productive private capital, and has no access to formal bank credit; the income it generates escapes the base of the formal labor-income tax. Its output is

$$Y_t^{N,I} = A_t^{N,I} \left(L_t^{N,I} \right)^{\gamma_N}, \quad (11)$$

where $A_t^{N,I} > 0$ is its total factor productivity and $\gamma_N \in (0, 1)$ the elasticity of output with respect to informal labor, with

$$\ln A_t^{N,I} = (1 - \rho_{A,NI}) \ln \bar{A}^{N,I} + \rho_{A,NI} \ln A_{t-1}^{N,I} + \sigma_{A,NI} \epsilon_t^{A,NI}. \quad (12)$$

The representative informal producer chooses labor so as to equalize the informal nominal wage to the value of its marginal productivity,

$$W_t^I = P_t^{N,I} \gamma_N A_t^{N,I} \left(L_t^{N,I} \right)^{\gamma_N - 1}, \quad (13)$$

a labor-demand condition on which the informal-disruption shock $\mathcal{D}_t^I$ defined in Equation (47) below operates directly.

4.1.3 Formal and informal mining sectors

Mining activity comprises a formal industrial segment and an informal artisanal and small-scale segment, $Y_t^M = Y_t^{M,F} + Y_t^{M,I}$. The world price of mining commodities, expressed in foreign currency and deflated by the foreign price level, follows

$$\ln p_t^{M,*} = (1 - \rho_{p^M}) \ln \bar{p}^M + \rho_{p^M} \ln p_{t-1}^{M,*} + \sigma_{p^M} \epsilon_t^{p^M}, \quad (14)$$

with $\rho_{p^M} \in [0, 1)$ and $\sigma_{p^M} > 0$.

The formal segment combines domestic formal labor with a quasi-fixed composite of industrial capacity and natural resource,

$$Y_t^{M,F} = A_t^{M,F} \bar{Z}_F^{1-\varrho_F} \left(L_t^{M,F} \right)^{\varrho_F}, \quad (15)$$

with

$$\ln A_t^{M,F} = (1 - \rho_{A,MF}) \ln \bar{A}^{M,F} + \rho_{A,MF} \ln A_{t-1}^{M,F} + \sigma_{A,MF} \epsilon_t^{A,MF}, \quad (16)$$

and, under an effective royalty rate $\tau^{M,F} \in [0, 1)$, the labor-demand condition

$$W_t^F = (1 - \tau^{M,F}) \varepsilon_t p_t^{M,*} P_t^* \varrho_F \frac{Y_t^{M,F}}{L_t^{M,F}}. \quad (17)$$

The informal artisanal and small-scale segment combines informal labor with a fixed composite of natural resource and small-scale productive capacity,

$$Y_t^{M,I} = A_t^{M,I} \bar{Z}_I^{1-\varrho_I} \left(L_t^{M,I} \right)^{\varrho_I}, \quad \varrho_I > \varrho_F, \quad (18)$$

reflecting a higher labor intensity than that of the industrial segment, with

$$\ln A_t^{M,I} = (1 - \rho_{A,MI}) \ln \bar{A}^{M,I} + \rho_{A,MI} \ln A_{t-1}^{M,I} + \sigma_{A,MI} \epsilon_t^{A,MI}, \quad (19)$$

and, under an effective tax or royalty rate $\tau^{M,I} \in [0, \tau^{M,F})$, capturing the markedly lower effective taxation that applies to informal mineral production, the labor-demand condition

$$W_t^I = (1 - \tau^{M,I}) \varepsilon_t p_t^{M,*} P_t^* \varrho_I \frac{Y_t^{M,I}}{L_t^{M,I}}, \quad (20)$$

on which the informal-disruption shock $\mathcal{D}_t^I$ also operates in its version extended by the epidemiological shock, Equation (49) below.

4.1.4 Banking sector

A representative and competitive commercial bank intermediates the savings of Ricardian households toward the working-capital credit of formal firms. In the absence of reserve requirements and bank capital, aggregate domestic deposits, $D_t = \lambda D_t^o$, fully finance working-capital loans,

$$D_t = L_t^{loan}, \quad (21)$$

The real intermediation costs, represented in reduced form by a wedge $\varsigma_{spread} > 0$, imply, under competition and zero economic profit, the rate condition

$$1 + R_t^L = (1 + i_t^D)(1 + \varsigma_{spread}), \quad (22)$$

which defines the equilibrium lending rate as the domestic deposit rate augmented by the intermediation wedge; ς_{spread} is calibrated to reflect the high cost of financial intermediation and the limited access to bank credit characteristic of shallow financial systems (Honohan, 2007).

4.1.5 Fiscal authority

Public revenues come mainly from the formal labor-income tax, at the constant rate

$$\tau_t^L = \bar{\tau}^L, \quad (23)$$

and from mining royalties. To account for the governance inefficiencies of public finances, only a fraction of gross revenues $\mathcal{R}_t$ effectively reaches the state budget,

$$\mathcal{T}_t = (1 - \xi_c)\mathcal{R}_t, \quad \xi_c \in [0, 1), \quad (24)$$

where ξ_c measures the fraction of revenue lost through governance-related leakage (Mauro, 1995; Kaufmann, Kraay, and Mastruzzi, 2010). Public consumption follows the rule partially responsive to revenue

$$\hat{G}_t = \rho_G \hat{G}_{t-1} + (1 - \rho_G)\zeta \hat{t}_t, \quad (25)$$

where $t_t \equiv \mathcal{T}_t/P_t$ denotes effective real budget revenue, $\rho_G \in [0, 1)$ the persistence, and $\zeta \geq 0$ the responsiveness of current spending to revenue. Public investment follows the level rule

$$IG_t = \varkappa t_t, \quad \varkappa \in [0, 1], \quad (26)$$

and accumulates into productive public capital, $KG_t = (1 - \delta_G)KG_{t-1} + IG_t$.

One-period domestic public debt, D_t^g , is held partly by Ricardian households and partly by the central bank,

$$D_t^g = \lambda B_t^{g,o} + D_t^{g,cb}, \quad (27)$$

where $D_t^{g,cb}$ denotes the central bank's holdings of government securities, a predetermined state whose evolution reflects the degree of monetization of the public deficit. The state's nominal flow budget constraint is

$$P_t G_t + P_t T R_t + P_t I G_t + (1 + i_{t-1})D_{t-1}^g = \mathcal{T}_t + D_t^g + SE I G_t, \quad (28)$$

where $SEIG_t$ denotes nominal seigniorage,

$$SEIG_t = M_t - M_{t-1}, \quad (29)$$

with $M_t = \lambda M_t^o$ the aggregate money supply. Public transfers, targeted at non-Ricardian households via Equation (7), constitute the residual fiscal instrument that ensures, each period, the balance of the budget constraint:

$$TR_t = \frac{\mathcal{T}_t + D_t^g + SEIG_t - P_t(G_t + IG_t) - (1 + i_{t-1})D_{t-1}^g}{P_t}. \quad (30)$$

4.1.6 Monetary authority and exchange rate

Monetary policy follows a monetary-base growth rule partially accommodating fiscal-financing pressures,

$$g_t^M - \bar{g}^M = \rho_M (g_{t-1}^M - \bar{g}^M) + (1 - \varsigma_{mon})\phi_{FD} (fd_t - \bar{fd}) + \sigma_M \epsilon_t^M, \quad (31)$$

where $g_t^M \equiv \Delta \ln M_t$, fd_t is a normalized indicator of primary fiscal-financing pressure, $\varsigma_{mon} \in [0, 1]$ measures the degree of insulation of money creation from fiscal pressures ($\varsigma_{mon} = 1$: no accommodation), $\phi_{FD} \geq 0$ the strength of the monetary response, and ϵ_t^M an i.i.d. innovation of unit variance and standard deviation $\sigma_M > 0$. The foreign nominal interest rate, exogenous for the small open economy, follows

$$\ln(1 + i_t^*) = (1 - \rho_{i^*}) \ln(1 + \bar{i}^*) + \rho_{i^*} \ln(1 + i_{t-1}^*) + \sigma_{i^*} \epsilon_t^{i^*}. \quad (32)$$

The country-risk premium, increasing with the normalized net external indebtedness $nfa_t = \varepsilon_t NFA_t / GDP_t^n$, is

$$\Phi_t = \exp \left[-\psi_{nfa} (nfa_t - \bar{nfa}) + \sigma_{rp} \epsilon_t^{rp} \right], \quad \psi_{nfa} > 0, \quad (33)$$

which provides the stationarity mechanism for the direct external financial position, in the tradition of Schmitt-Grohé and Uribe (2017). The uncovered, country-risk-adjusted interest-rate parity is written, in log-deviations,

$$\hat{R}_t - \hat{R}_t^* = \mathbb{E}_t [\Delta \hat{\varepsilon}_{t+1}] + \hat{\Phi}_t. \quad (34)$$

4.1.7 External sector and market clearing

The economy imports intermediate inputs and final consumption goods. The domestic resource cost associated with the transaction wedge on imports is

$$TC_t^{IM} = \tau^{tc} \varepsilon_t P_t^{IM,*} IM_t, \quad \tau^{tc} \geq 0, \quad (35)$$

interpreted as a real domestic cost of transport, logistics, and transaction (World Bank, 2026), and not as an additional payment to foreign suppliers or as tariff revenue. Informal non-mining goods, in the benchmark closure, are entirely absorbed by household consumption,

$$Y_t^{N,I} = C_t^{N,I}, \quad (36)$$

where $C_t^{N,I} \equiv \lambda C_t^{o,N,I} + (1 - \lambda) C_t^{r,N,I}$ is the aggregate consumption of informal non-mining goods. Total mining output is exported, $X_t^M = Y_t^M$, and the balance-of-payments identity, written in foreign currency in the aggregate net financial-account form, is

$$NFA_t = (1 + \tilde{i}_{t-1}^*) NFA_{t-1} + p_t^{M,*} X_t^M - p_t^{IM,*} IM_t - p_t^{C,*} C_t^{imp}, \quad (37)$$

where NFA_t denotes the economy's net external asset position (deposits and foreign-currency bank assets, direct external financial position of Ricardian households), C_t^{imp} aggregate imported consumption, and $p_t^{IM,*}$, $p_t^{C,*}$ the relative foreign prices of intermediate and consumption imports.

Nominal net exports and nominal gross domestic product, measured in value added, are respectively

$$NX_t^n = \varepsilon_t p_t^{M,*} P_t^* X_t^M - \varepsilon_t [P_t^{IM,*} IM_t + P_t^{C,*} C_t^{imp}], \quad (38)$$

$$GDP_t^n = P_t^{N,F} Y_t^{N,F} + P_t^{N,I} Y_t^{N,I} + \varepsilon_t p_t^{M,*} P_t^* X_t^M - \varepsilon_t P_t^{IM,*} IM_t. \quad (39)$$

The formal labor market and the informal labor market clear, respectively, according to $L_t^F = \lambda L_t^{o,F} + (1 - \lambda) L_t^{r,F} = L_t^{N,F} + L_t^{M,F}$ and $L_t^I = \lambda L_t^{o,I} + (1 - \lambda) L_t^{r,I} = L_t^{N,I} + L_t^{M,I}$, and the private capital market clears according to $K_{t-1} = \lambda K_{t-1}^o$.

4.1.8 Definition of the recursive competitive equilibrium

Let $s_t = (A_t, A_t^{N,I}, A_t^{M,F}, A_t^{M,I}, p_t^{M,*}, i_t^*, \epsilon_t^M, \epsilon_t^{rp})$ be the vector of exogenous states, following the stochastic processes of Equations (9), (12), (16), (19), (14), (32), and the innovations of Equations (31) and (33), and let $z_{t-1} = (K_{t-1}, D_{t-1}^g, D_{t-1}^{g,cb}, KG_{t-1})$ be the vector of predetermined endogenous states.

Definition 1 (Recursive competitive equilibrium). *A recursive competitive equilibrium is a collection (i) of household policy functions*

$$\{C_t^o, C_t^r, L_t^{o,F}, L_t^{o,I}, L_t^{r,F}, L_t^{r,I}, M_t^o, D_t^o, D_t^{*,o}, B_t^{g,o}, B_t^{*,o}, K_t^o\};$$

(ii) of firm policy functions

$$\{Y_t^{N,F}, L_t^{N,F}, IM_t, Y_t^{N,I}, L_t^{N,I}, Y_t^{M,F}, L_t^{M,F}, Y_t^{M,I}, L_t^{M,I}\};$$

(iii) of a banking-sector allocation $\{L_t^{loan}, R_t^L\}$; (iv) of fiscal- and monetary-policy sequences $\{\tau_t^L, G_t, IG_t, TR_t, D_t^g, M_t, i_t\}$; and (v) of a price system

$$\{P_t^{N,F}, P_t^{N,I}, P_t, W_t^F, W_t^I, R_t^K, i_t^D, \tilde{i}_t^*, \varepsilon_t, \Phi_t\},$$

such that, given the exogenous state s_t and the predetermined state z_{t-1} : (a) the household policy functions solve the Ricardian and non-Ricardian optimization problems, characterized by Equations (4)–(6), subject to the constraints of Equations (2) and (7); (b) the firm policy functions solve the optimization problems of the four productive activities, characterized by Equations (8), (10), (11), (13), (15), (17), (18), and (20); (c) the banking sector satisfies Equations (21) and (22); (d) the fiscal authority satisfies Equations (23), (25), (26), and (28); (e) the monetary authority satisfies Equation (31), and the exchange rate satisfies the interest-rate parity condition, Equation (34); and (f) all goods, labor, capital, and asset markets clear, as specified in Equation (36), in the public-debt decomposition of Equation (27), and in the labor- and private-capital-market clearing conditions stated above.

This definition completes the description of the benchmark model. It combines the optimality conditions of Ricardian and non-Ricardian households; the production, factor-demand, and pricing conditions of the four productive activities (formal and informal non-mining, formal and informal mining); the intermediation and balance-sheet conditions of the banking sector; fiscal and monetary policies; and the clearing conditions for goods, labor, capital, and external-asset markets. The following subsection introduces the epidemiological shock as an extension of this benchmark model.

4.2 Epidemiological shock

4.2.1 Empirical motivation and modeling strategy

The DRC recorded seventeen distinct Ebola virus disease (EVD) episodes between 1976 and 2026 (CDCP, 2024). Two characteristics of this history are directly relevant to the way an epidemiological shock should be introduced into the model developed in this section. First, the epidemics are episodic rather than continuous: each of the seventeen recorded episodes has a clearly identified onset and, with the exception of the episode ongoing at the time of writing, a clearly identified containment date, with durations ranging from about two months to nearly two years (WHO, 2020; CDCP, 2024). Second, the epidemics are geographically concentrated rather than diffuse at the scale of the economy: nine of the seventeen episodes occurred in provinces identified independently by the *Delve* platform, supported by the World Bank, and by

the *International Peace Information Service* as centers of artisanal and small-scale mining extraction (diamond in Kasai; gold in Ituri and Haut-Uélé; gold, coltan, and cassiterite in Nord-Kivu and Sud-Kivu), activities that are overwhelmingly informal (Delve Database, 2026; Leysen et al., 2023). Institutional impact assessments, for their part, are available only for the two episodes combining the longest duration and the widest geographic extent: the 2018–2020 epidemic in Nord-Kivu/Ituri/Sud-Kivu, for which the World Bank financed more than half the cost of the response through the International Development Association (IDA) and the Pandemic Emergency Financing Facility (World Bank, 2019), and the epidemic ongoing since May 2026, for which a computable general equilibrium assessment carried out by the United Nations Development Programme estimates a regional production loss of 2.4 to 3.6 billion dollars, a production loss exceeding 1 billion dollars for the DRC alone, nearly one million additional people falling into poverty, about 55 000 jobs lost, a 1.76 percent contraction in the consumption of the poorest quintile of households, and up to 2 520 additional child deaths attributable not to EVD itself but to the disruption of routine health services (UNDP, 2026a).

These regularities motivate a specific modeling choice. Rather than embedding a national susceptible-infected-recovered-deceased (SIR-macro) block, such as the one developed by Eichenbaum, Rebelo, and Trabandt (2020) for an epidemic spreading to the entire population and interacting with consumption and hours-worked choices at the scale of the whole economy, this section models the epidemiological shock as an exogenous *regime process*, geographically and sectorally asymmetric, that directly targets the informal segment of the economy, in which artisanal mining activity and the transmission episodes documented above are concentrated. This choice follows directly from the empirical history just described: since the epidemics are confined, in each documented episode, to a small number of health zones representing a negligible share of the national population (CDCP, 2024), a national SIR block calibrated on national-scale susceptible and infected shares would imply, counterfactually, national-scale transmission dynamics that no episode between 1976 and 2026 exhibited.

4.2.2 The epidemic regime process

Let $E_t \in \{0, 1\}$ be a discrete epidemic-regime indicator, with $E_t = 1$ if the domestic economy experiences, at date t , an active EVD epidemic in at least one exposed health zone, and $E_t = 0$ otherwise. The regime follows a two-state Markov chain,

$$\Pr(E_t = 1 \mid E_{t-1} = 0) = p_E, \quad \Pr(E_t = 0 \mid E_{t-1} = 1) = q_E, \quad (40)$$

where $p_E \in (0, 1)$ is the per-period onset risk and $q_E \in (0, 1)$ is the per-period containment risk, so that the ergodic frequency of active regimes is $p_E/(p_E + q_E)$

and the expected duration of an active episode is $1/q_E$. These two risks are directly identifiable from the history of the seventeen episodes and their durations (CDCP, 2024; WHO, 2020; WHO Africa, 2025), which provides a calibration target that requires no auxiliary assumptions.

Conditional on an active regime, the intensity of the epidemic is stochastic and persistent,

$$\ln \iota_t = \rho_\iota \ln \iota_{t-1} + \sigma_\iota \epsilon_t^\iota, \quad E_t = 1, \quad (41)$$

with ι_t reset to a small strictly positive value at the beginning of each new episode ($E_t = 1, E_{t-1} = 0$) and returned to zero when the regime is inactive, where $\rho_\iota \in [0, 1)$ governs the persistence of intensity within an episode, $\sigma_\iota > 0$ is the standard deviation of the innovation, and ϵ_t^ι is an i.i.d. innovation of zero mean and unit variance. The composite epidemic-intensity index used in the remainder of this section is

$$\Theta_t \equiv E_t \iota_t \in [0, 1], \quad (42)$$

which is zero when the regime is inactive and equal to the stochastic intensity ι_t when an episode is active. Θ_t is the unique sufficient statistic through which the epidemiological shock enters the household, firm, public-finance, and external-sector blocks presented below.

4.2.3 A restricted SIR microfoundation

Equations (40)–(42) can be understood as the reduced form of an epidemiological process operating within an exposed sub-economy of relative size $\omega^{epi} \in (0, 1)$, calibrated on the population share of the health zones and provinces in which the nine episodes near the mining sites identified above occurred. Within this sub-economy, a standard discrete-time SIR-type block, following the transmission and transition structure of Eichenbaum, Rebelo, and Trabandt (2020), tracks the shares of susceptible, infected, recovered, and deceased within the exposed population, S_t^{epi} , I_t^{epi} , R_t^{epi} , and D_t^{epi} ,

$$S_{t+1}^{epi} = S_t^{epi} - \beta^{epi} S_t^{epi} I_t^{epi}, \quad (43)$$

$$I_{t+1}^{epi} = I_t^{epi} + \beta^{epi} S_t^{epi} I_t^{epi} - (\gamma^{epi} + \delta^{epi}) I_t^{epi}, \quad (44)$$

$$R_{t+1}^{epi} = R_t^{epi} + \gamma^{epi} I_t^{epi}, \quad D_{t+1}^{epi} = D_t^{epi} + \delta^{epi} I_t^{epi}, \quad (45)$$

where $\beta^{epi} > 0$ is the transmission rate within the exposed zone, $\gamma^{epi} \in (0, 1)$ is the recovery rate, and $\delta^{epi} \in (0, 1)$ is the case fatality rate, all defined solely over the exposed sub-population ω^{epi} and not over the whole domestic economy. The correspondence between this microfounded block and the reduced-form index of Equation (42)

is

$$\Theta_t = I_t^{epi}, \quad E_t = \mathbb{1}\{I_t^{epi} > 0\}, \quad (46)$$

so that Equations (40)–(41) constitute the aggregate, reduced-form representation of an infectious process which, by construction, remains confined to the exposed sub-economy and therefore never generates the economy-wide susceptible and infected shares that a national SIR-macro block would require. This restriction is testable against the history: across all seventeen episodes, the cumulative number of confirmed and probable cases never exceeded a low single-digit multiple of one per thousand of the national population, which is consistent with $\omega^{epi} \ll 1$ and with transmission dynamics that remain, in each episode recorded to date, confined well within the exposed sub-economy (CDCP, 2024; WHO, 2026b).

4.2.4 Informal-sector disruption

The economic transmission of the epidemiological shock operates mainly through the informal segment of the economy, which is consistent with the geographic overlap documented above and with the finding that most of the economic cost of the 2014–2016 West African EVD epidemic came from disruptions to informal trade and activity rather than from health spending or direct mortality (World Bank, 2014). Let

$$\mathcal{D}_t^I \equiv 1 - \delta_L \Theta_t - \delta_{HC} HC_{t-1} \in (0, 1] \quad (47)$$

be the informal-activity disruption wedge, where $\delta_L > 0$ governs the contemporaneous elasticity of informal activity to epidemic intensity, jointly capturing the morbidity, mortality, absenteeism, and mobility restrictions (cordons sanitaires, market closures) documented for the episodes examined above, and where HC_{t-1} is a slow-moving state of health-system degradation, defined in Equation (52) below, which captures the persistent component of the shock. The disruption wedge multiplies non-mining informal output and artisanal mining output, which replaces the benchmark production functions of Equations (11) and (18) with

$$Y_t^{N,I} = \mathcal{D}_t^I A_t^{N,I} \left(L_t^{N,I} \right)^{\gamma_N}, \quad (48)$$

$$Y_t^{M,I} = \mathcal{D}_t^I A_t^{M,I} \bar{Z}_I^{1-\varrho_I} \left(L_t^{M,I} \right)^{\varrho_I}. \quad (49)$$

Because $\mathcal{D}_t^I$ enters multiplicatively alongside sectoral total factor productivity, it operates, formally, as an additional productivity shock specific to the informal sector, but a shock directly linked to the epidemic regime rather than to the independent productivity processes of Equations (12) and (19), and whose sign is restricted to

be weakly negative. The corresponding labor-demand conditions, Equations (13) and (20), are modified accordingly, so that the informal wage falls, all else equal, during an active episode, a mechanism through which the epidemiological shock directly compresses the labor income of both Ricardian and non-Ricardian households via their income in the informal sector; and, for non-Ricardian households in particular, propagates with its full intensity to current consumption through the hand-to-mouth subsistence constraint. Formal non-mining output and formal industrial mining output, Equations (8) and (15), are not modified, which is consistent with the finding that formally organized mining and manufacturing operations, in the episodes examined above, generally continued to function during the epidemics, unlike informal and artisanal activity.

4.2.5 Behavioral aversion

A distinct channel, separate from the direct production disruption of Equation (47), operates through precautionary behavioral responses to infection risk (market avoidance, reduced mobility, and a generalized rise in the transaction cost) identified as the main component of the economic cost of the West African epidemic (World Bank, 2014). The benchmark model already contains a domestic resource cost associated with import transactions, Equation (35). This subsection generalizes this transaction-cost wedge so that it also applies to domestic purchases of informal goods, and allows it to respond to the epidemic index,

$$\tau_t^{av} = \bar{\tau}^{av} + \psi^{av} \Theta_t, \quad \psi^{av} \geq 0, \quad (50)$$

where $\bar{\tau}^{av} \geq 0$ is the steady-state wedge and ψ^{av} governs its sensitivity to epidemic intensity. Households' effective consumption of informal non-mining goods is

$$C_t^{h,NI,eff} = (1 - \tau_t^{av}) C_t^{h,NI}, \quad h \in \{o, r\}, \quad (51)$$

so that a fraction τ_t^{av} of the informal goods purchased is dissipated as a real resource cost linked to the transaction in a context of high infection risk, rather than providing consumption services, and Equation (36) is reformulated accordingly as a function of $C_t^{h,NI,eff}$. Because Equation (50) operates on the demand side while Equation (47) operates on the supply side, the two channels are conceptually and quantitatively distinct, and their relative magnitudes, δ_L versus ψ^{av} , determine whether an episode is better characterized, in the terms of World Bank (2014), as a production-side shock or as a behavioral-aversion shock.

4.2.6 Persistent degradation of the health system

The United Nations Development Programme’s assessment of the epidemic ongoing in 2026 attributes a substantial part of its human cost not directly to EVD, but to the crowding-out of routine health services (vaccination, antenatal care, malaria treatment) as health-system capacity is redeployed toward the epidemic response, an effect estimated at up to 2 520 additional child deaths for the DRC alone (UNDP, 2026a). This channel differs from the contemporaneous disruption captured by Θ_t because it persists beyond the active phase of the epidemic. It is captured by a slow-moving state of health-system degradation,

$$HC_t = \rho_{HC} HC_{t-1} + \kappa_{HC} \Theta_t, \quad \rho_{HC} \in (0, 1), \quad \kappa_{HC} > 0, \quad (52)$$

with ρ_{HC} close to unity, reflecting the slow recovery of health-system capacity, vaccination coverage, and human-capital accumulation within the affected cohort, relative to the much faster resolution of the active epidemic regime governed by q_E in Equation (40). As specified in Equation (47), HC_{t-1} reappears in informal-sector production with the coefficient δ_{HC} , so that an economy that has experienced a severe or repeated epidemic episode exhibits depressed informal productivity for a period following the end of the active regime, which is consistent with the distinction the empirical literature draws between the direct costs and the deferred indirect costs of EVD epidemics (Efayena, 2016).

4.2.7 Fiscal response and external financing

An active epidemic regime requires emergency public health spending, over and above the public consumption and investment rules of Equations (25) and (26). Real emergency spending linked to the epidemic response is

$$G_t^H = g^H \Theta_t \bar{y}, \quad g^H \geq 0, \quad (53)$$

where $\bar{y}$ denotes steady-state real output and g^H scales the resource cost of the response with epidemic intensity. Consistent with the World Bank’s financing of more than half the cost of the 2018–2020 response through IDA and the Pandemic Emergency Financing Facility (World Bank, 2019), a fraction $\varpi^H \in [0, 1]$ of this spending is financed by exogenous emergency external health grants rather than by domestic resources,

$$\Gamma_t^H = \varpi^H \frac{P_t G_t^H}{\varepsilon_t}, \quad (54)$$

expressed in units of foreign currency. The state's nominal flow budget constraint, Equation (28), is reformulated as

$$P_t G_t + P_t G_t^H + P_t TR_t + P_t IG_t + (1 + i_{t-1})D_{t-1}^g = \mathcal{T}_t + D_t^g + SEIG_t + \varepsilon_t \Gamma_t^H, \quad (55)$$

so that residual transfers, Equation (30), are reformulated accordingly as

$$TR_t = \frac{\mathcal{T}_t + D_t^g + SEIG_t + \varepsilon_t \Gamma_t^H - P_t (G_t + G_t^H + IG_t) - (1 + i_{t-1})D_{t-1}^g}{P_t}. \quad (56)$$

Because $\varpi^H < 1$ in general, a domestically financed residual, $(1 - \varpi^H)G_t^H$, remains, which is absorbed, as in the benchmark model, by the residual transfer instrument, so that an active epidemic episode tightens the disposable resources of non-Ricardian households through the fiscal channel in addition to the informal labor-income channel of Equation (48), unless offset by a sufficiently high value of ϖ^H .

For the sake of parsimony, it is assumed that emergency health grants finance, contemporaneously and in full, additional epidemic-related imports of medical supplies and equipment, $IM_t^H = \Gamma_t^H$, so that the balance-of-payments identity, Equation (37), remains unchanged in its implications for net external assets and is reformulated only to make explicit this additional flow of imports and grants,

$$NFA_t = (1 + \tilde{i}_{t-1}^*)NFA_{t-1} + P_t^{M,*}X_t^M - P_t^{IM,*}IM_t - P_t^{C,*}C_t^{imp} + \underbrace{\Gamma_t^H - IM_t^H}_{=0}. \quad (57)$$

This identity implies that real GDP is fully allocated, each period, among consumption, private investment, current and emergency public spending, public investment, and net exports.

4.2.8 Characterization of the equilibrium in the presence of the epidemiological shock

The five parameters introduced in this subsection, δ_L , ψ^{av} , δ_{HC} , g^H , and ϖ^H , together with the regime parameters p_E , q_E , ρ_ι , and σ_ι , are calibrated jointly from the history and the institutional assessments examined above, rather than from a single episode. The regime parameters p_E and q_E are set directly from the observed frequency (seventeen episodes over fifty years) and the average duration of epidemic episodes (CDCP, 2024). The informal-disruption and aversion parameters, δ_L and ψ^{av} , are jointly constrained so that the model, subjected to a shock calibrated on the intensity and duration of the epidemic ongoing since May 2026, reproduces the order of magnitude of the job loss comparable to the ILO estimates (about 55 000

jobs) and the 1.76 percent contraction in the consumption of the poorest households estimated by the United Nations Development Programme (UNDP, 2026a). The health-system-degradation parameters, ρ_{HC} and δ_{HC} , are disciplined by the requirement that the model generate a persistent, rather than purely contemporaneous, output cost, consistent with the non-epidemic excess mortality documented by the same assessment. The fiscal parameters, g^H and ϖ^H , are calibrated so that the model’s implicit domestically financed share of emergency health spending is consistent with the World Bank’s own characterization of its financing as covering *more than half* the cost of the 2018–2020 response (World Bank, 2019), which constrains ϖ^H to lie well above one-half.

Table 4: Calibration targets adopted for the parameters of the epidemiological shock.

Parameters	Target or empirical moment	Source
p_E, q_E	Frequency (seventeen episodes over fifty years) and average duration of recorded episodes	CDCP (2024)
δ_L, ψ^{av}	Order of magnitude of $\approx 55\,000$ jobs lost and -1.76% consumption of the poorest households, 2026 epidemic	UNDP (2026a)
ρ_{HC}, δ_{HC}	Persistence of the output cost beyond the active phase, consistent with the documented non-epidemic excess mortality	UNDP (2026a)
g^H, ϖ^H	Share of emergency external financing $>50\%$ of the 2018–2020 response	World Bank (2019)

These targets reflect the fact that only two episodes are associated with a quantified macroeconomic assessment. The introduction of the epidemiological shock enlarges the vector of exogenous states of Definition 1 to become

$$s_t = (A_t, A_t^{N,I}, A_t^{M,F}, A_t^{M,I}, p_t^{M,*}, i_t^*, \epsilon_t^M, \epsilon_t^{rp}, E_t, \iota_t)$$

and the vector of predetermined endogenous states to become

$$z_{t-1} = (K_{t-1}, D_{t-1}^g, D_{t-1}^{g,cb}, KG_{t-1}, HC_{t-1}).$$

The fiscal-policy sequence in point (iv) of Definition 1 is augmented to include G_t^H and Γ_t^H , and condition (d) is reformulated to require that the fiscal authority satisfy Equation (55) in place of Equation (28). The firm policy functions in point (ii) satisfy Equations (48) and (49) in place of Equations (11) and (18), and market clearing in

condition (f) is reformulated as a function of $C_t^{h,NI,eff}$ as in Equation (51). All other elements of Definition 1 remain unchanged. In the special case where $\Theta_t \equiv 0$ for all t , $HC_t \equiv 0$ for all t , and $\Gamma_t^H = G_t^H = 0$, the model of this subsection reduces exactly to the benchmark model of Subsection ?? above, so that the epidemiological extension encompasses the benchmark specification as a special case rather than substituting for it.

4.3 Steady state and calibration strategy

4.3.1 Calibration

Table 5 reports the full set of model parameters, their value, and their justification. Three categories are distinguished: (C) parameters calibrated on a directly citable Congolese source or empirical regularity; (S) standard conventional values from the DSGE/RBC literature, adopted in the absence of a structural alternative for the DRC; (O) values chosen to respect a qualitative order of magnitude documented previously (for example $\varrho_I > \varrho_F$, $\tau^{M,I} < \tau^{M,F}$), without any claim to a precise point estimate.

Table 5: Calibration.

Parameter	Value	Description and justification	Type
<i>Households and technology</i>			
β	0.96	Annual discount factor (implies $r_{ss} = 1/\beta - 1 \approx 4.17\%$)	S
σ	1.5	Relative risk aversion (inverse of the IES)	S
δ	0.06	Depreciation rate of private capital	S
α	0.35	Share of private capital, formal non-mining sector	S
χ	0.10	Elasticity of formal output with respect to public capital	O
γ_N	0.65	Elasticity of non-mining informal output with respect to labor	O
ϱ_F	0.55	Elasticity of formal mining output with respect to labor	O
ϱ_I	0.85	Elasticity of informal mining output with respect to labor ($\varrho_I > \varrho_F$, higher labor intensity of the artisanal segment)	O
χ_F, χ_I	3.0 ; 6.0	Scales of formal/informal labor disutility	O
φ_F, φ_I	1.0 ; 1.0	Inverse Frisch elasticities (unit Frisch elasticity)	S

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(continued)

Parameter	Value	Description and justification	Type
λ	0.35	Share of Ricardian households (access to financial markets)	O
<i>Taxation and royalties</i>			
τ^L	0.15	Formal labor-income tax rate	O
$\tau^{M,F}$	0.25	Effective royalty/taxation, formal industrial mine	O
$\tau^{M,I}$	0.05	Effective royalty/taxation, informal artisanal mine ($\tau^{M,I} < \tau^{M,F}$)	O
ξ_c	0.35	Governance leakage on gross public revenue (Mauro, 1995; Kaufmann, Kraay, and Mastruzzi, 2010)	C
$\varkappa$	0.20	Public investment rate (share of real revenue)	O
ρ_G	0.60	Persistence of the public consumption rule	S
ζ	0.30	Responsiveness of public consumption to revenue	O
δ_G	0.05	Depreciation of public capital	S
<i>Banking sector and risk premium</i>			
ς_{spread}	0.15	Bank intermediation wedge (15 annual percentage points) (Honohan, 2007)	C
ψ_{nfa}	0.01	Elasticity of the country-risk premium to the net external position (Schmitt-Grohé and Uribe, 2017)	S
μ_{imp}	0.25	Average propensity to import (consumption)	O
<i>Exogenous processes (TFP, mining price, foreign rate)</i>			
$\rho_A, \rho_{A,NI}, \rho_{A,MF}, \rho_{A,MI}$	0.70 (each)	Annual persistence of the four sectoral productivity processes	S
$\sigma_A, \sigma_{A,NI}, \sigma_{A,MF}, \sigma_{A,MI}$	0.02 (each)	Standard deviation of the sectoral productivity innovations	S
ρ_p^M	0.60	Persistence of the real mining price	S
σ_p^M	0.15	Standard deviation of the mining-price innovations (high volatility of commodity prices)	S
ρ_{i^*}	0.70	Persistence of the foreign interest rate	S
σ_{i^*}	0.005	Standard deviation of the foreign-rate innovations	S
<i>Epidemiological block</i>			
$\bar{\Theta}$	0.02	Approximate ergodic mean of the epidemic index (CDCP, 2024)	C
ρ_{Θ}	0.55	Persistence of the condensed AR(1) process of Θ_t	O

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(continued)

Parameter	Value	Description and justification	Type
σ_Θ	1.00	Standard deviation normalized so that a one-standard-deviation shock brings Θ_t close to the documented peak intensity	O
δ_L	0.15	Contemporaneous elasticity of informal output to Θ_t (World Bank, 2014)	O
δ_{HC}	0.05	Health-scarring effect on informal output (UNDP, 2026a)	O
ρ_{HC}	0.85	Persistence of the health-degradation state (slow recovery) (UNDP, 2026a)	O
κ_{HC}	0.30	Sensitivity of health-degradation accumulation to Θ_t	O
ψ^{av}	0.10	Sensitivity of the behavioral-aversion wedge to Θ_t (World Bank, 2014)	O
$\bar{\tau}^{av}$	0.02	Aversion wedge at the steady state (non-epidemic transaction frictions)	O
g^H	0.03	Scale of epidemic emergency spending (share of steady-state GDP per unit of Θ_t)	O
ϖ^H	0.55	Share of emergency spending financed by external grants (World Bank, 2019)	C
$\overline{nfa}$	$= nfa_{ss}$	Net external position target (Schmitt-Grohé–Uribe mechanism)	—
$\bar{y}$	$= gdp_{ss}$	Steady-state real GDP, reference of Equation (53)	—

4.3.2 Steady state

Table 6 reports the deterministic steady state of the model.

Table 6: Deterministic steady state of the model.

Variable	Description	Steady-state value
C^o	Ricardian consumption	1.319
C^r	Non-Ricardian consumption	0.791
C	Aggregate consumption	0.976
$L^{o,F}, L^{o,I}$	Ricardian labor supply, formal/informal	0.202 ; 0.133
$L^{r,F}, L^{r,I}$	Non-Ricardian labor supply, formal/informal	0.435 ; 0.286
L^F, L^I	Aggregate labor supply, formal/informal	0.354 ; 0.233
K	Private capital	1.354
I	Private investment	0.081

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Variable	Description	Steady-state value
R^K	Real return on capital	0.1017
r	Domestic real interest rate	0.04167
W^F, W^I	Real wages, formal/informal	1.082 ; 1.209
$Y^{N,F}, L^{N,F}$	Output and employment, formal non-mining	0.393 ; 0.236
$Y^{N,I}, L^{N,I}$	Output and employment, informal non-mining	0.311 ; 0.167
$Y^{M,F}, L^{M,F}$	Output and employment, formal mine	0.308 ; 0.117
$Y^{M,I}, L^{M,I}$	Output and employment, informal mine	0.098 ; 0.065
KG	Public capital	0.362
IG	Public investment	0.0181
G	Public consumption	0.0272
$\mathcal{T}$	Net real budget revenue	0.0905
TR	Residual transfers	0.0450
NFA	Net external position	0.000 (<i>target</i>)
NX	Net exports	0.000
GDP	Real GDP	1.103
Θ	Epidemic index	0.020
$\mathcal{D}^I$	Informal-disruption wedge	0.995
HC	Persistent health degradation	0.040
τ^{av}	Behavioral-aversion wedge	0.022
G^H	Epidemic emergency spending	0.00066
Γ^H	External emergency health grants	0.00036
R^L	Lending rate (reporting)	0.1979

Two steady-state results are worth emphasizing. On the one hand, the structure of the non-Ricardian labor market differs from that of Ricardian households, but to a markedly more moderate extent than an earlier run suggested: non-Ricardian households supply about 2.15 times more labor in each segment than Ricardian households ($L^{r,F}/L^{o,F} = 0.435/0.202 \approx 2.15$, and identically for the informal segment, a result that follows directly from the ratio $C^o/C^r \approx 1.67$ and from the unit Frisch elasticity common to both segments). This 2.15-to-1 ratio replaces a gap close to 7 to 1 that resulted from an incompletely closed resource constraint: Ricardian consumption, correctly disciplined by the aggregate resource identity, now settles at a level closer to non-Ricardian consumption, which mechanically attenuates the labor-supply gap between the two household types. On the other hand, the informal sector (non-mining and artisanal mining combined) represents, at the steady state, about 37.1 % of real GDP ($(Y^{N,I} + Y^{M,I})/GDP = (0.311 + 0.098)/1.103$), a share consistent with the documented importance of the informal economy and artisanal mining in the Congolese economy, and which directly conditions the magnitude of the transmission of the epidemic shock discussed below.

4.4 Responses to the epidemic shock

4.4.1 Method

The model is solved by first-order perturbation around the steady state, and the impulse-response functions are computed over a horizon of twenty periods (years) following a one-standard-deviation shock to the innovation ε_t^Θ , with the six other shocks of the model (sectoral productivity, mining price, foreign interest rate) held at zero. This shock brings Θ_t from its ergodic mean (0.02) to a peak of about 1.02 in the first period, before a geometric decay at the rate $\rho_\Theta = 0.55$: it thus represents, by construction, the linearized analogue of an episode whose intensity reaches the peak value documented in the history of the seventeen recorded episodes, and not an average episode.

4.4.2 Results

Figure 5 presents the impulse responses of the main model variables. Table 7 reports their numerical values at selected horizons (1, 2, 3, 5, 10, and 20 years).

Table 7: Impulse responses to an epidemic shock.

Variable	$h = 1$	$h = 2$	$h = 3$	$h = 5$	$h = 10$	$h = 20$
<i>Absolute deviations (variables with no relevant percentage normalization)</i>						
Θ_t	1.000	0.550	0.303	0.092	0.0046	0.00001
$\mathcal{D}_t^I$	-0.150	-0.098	-0.066	-0.035	-0.012	-0.0023
HC_t	0.300	0.420	0.448	0.393	0.194	0.0388
<i>Relative deviations from the steady state (%)</i>						
W_t^I (informal wage)	-13.8	-8.8	-6.1	-3.3	-1.2	-0.31
$Y_t^{N,I}$ (non-mining informal output)	-17.5	-11.6	-7.7	-4.0	-1.2	-0.08
$Y_t^{M,I}$ (informal mining output)	-22.4	-15.3	-9.8	-4.8	-1.1	+0.23
C_t^r (non-Ricardian consumption)	-6.7	-3.6	-2.8	-1.5	-0.67	-0.25
C_t^o (Ricardian consumption)	-2.3	-2.3	-2.2	-2.1	-1.7	-1.1
C_t (aggregate consumption)	-4.6	-3.0	-2.5	-1.8	-1.1	-0.65
GDP_t (real GDP)	-7.2	-3.4	-2.5	-1.1	-0.25	+0.004
L_t^F (aggregate formal labor)	+6.3	+5.0	+3.2	+1.8	+0.76	+0.28
$\mathcal{T}_t$ (real revenue)	+2.46	+1.52	+1.18	+0.75	+0.42	+0.22
TR_t (residual transfers)	-29.8	-16.5	-8.8	-2.4	+0.22	+0.20

Réponses impulsionnelles à un choc épidémique ε_t^Θ d'un écart-type
(intensité de pointe documentée, modèle SOE-TANK augmenté, ordre 1)

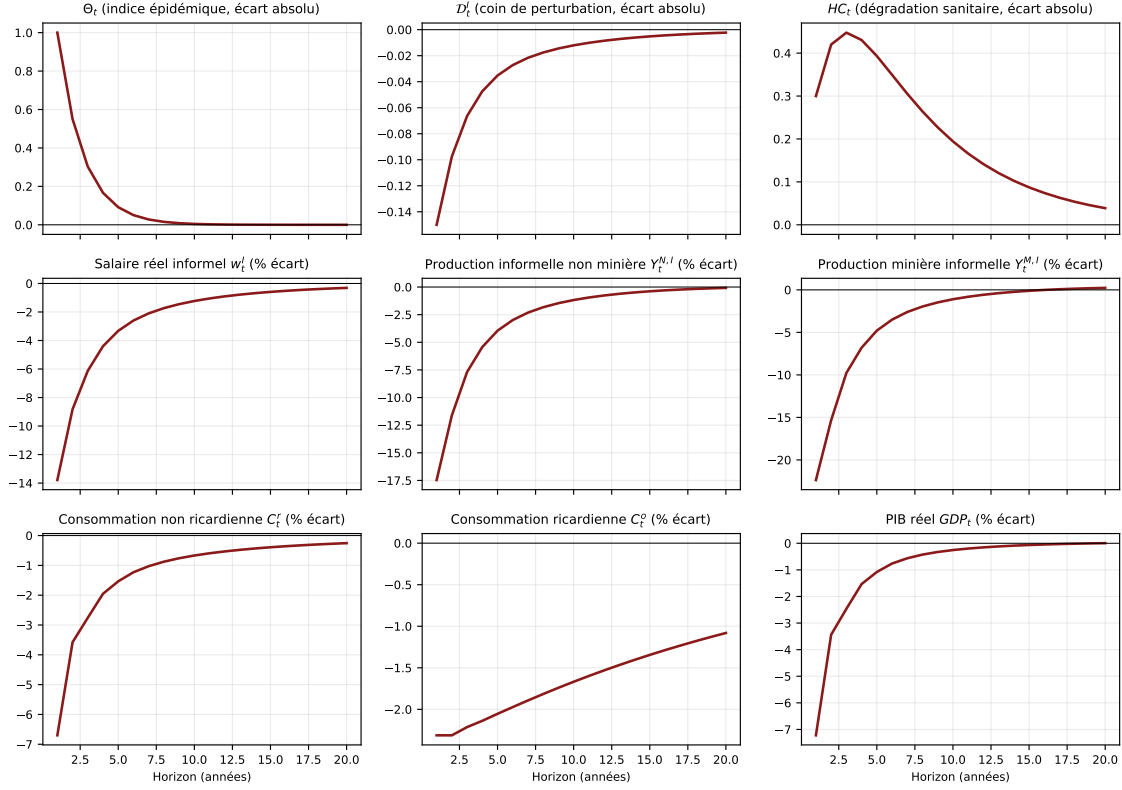


Figure 5: Impulse-response functions to a one-standard-deviation epidemic shock ε_t^Θ . The three top panels are expressed in absolute deviation from the steady state (their steady state not being zero, a percentage deviation would be misleading for Θ and D^I , and undefined for HC whose steady state is close to zero on the scale of the graph). The following six panels are expressed in relative deviation (%) from the steady state.

4.4.3 Mechanisms

Informal contraction and transmission to labor income. The shock propagates first, as the model’s construction predicts, through the informal-sector channel: the disruption wedge $\mathcal{D}_t^I$ falls by 15 percentage points on impact (from 0.995 to 0.845), which directly compresses non-mining informal output (-17.5%) and artisanal mining output (-22.4% , more heavily affected owing to its higher labor elasticity, $\varrho_I = 0.85$). The informal wage W_t^I falls by 13.8% on impact, the decline in labor demand dominating the adjustment.

Amplification by the hand-to-mouth subsistence constraint. Non-Ricardian consumption C_t^r falls by 6.7% on impact, against 2.3% for Ricardian consumption C_t^o : the ratio of about 2.9 to 1 between these two responses illustrates the amplification mechanism specific to the model’s TANK structure. This ratio should be reported explicitly: an earlier run of the code, in which the aggregate resource constraint was only partially closed, indicated a ratio close to 14 to 1 (C_t^r at -7.0% against C_t^o at -0.48% , almost insensitive to the horizon). It emerges that non-Ricardian households are, indeed, more exposed than Ricardian households. The result remains directly comparable to the World Bank’s finding (World Bank, 2014) that most of the economic cost of the 2014–2016 West African epidemic came from the disruption of informal activity and avoidance behavior rather than from direct mortality. This channel translates into a fall in the consumption of households without access to financial markets about three times larger than that of households with such access.

Reallocation of labor toward the formal sector: a distress labor supply. A less immediate but economically coherent result is the rise in the aggregate supply of formal labor L_t^F ($+6.3\%$ on impact), even as the real formal wage W_t^F falls slightly (-2.4% , available in the output files but not reported in Table 7). This result, counterintuitive at first sight, is explained by the structure of the non-Ricardian household’s problem: deprived of the possibility of smoothing its consumption, it must offset the collapse of its informal income by supplying more labor in the formal segment, which is not directly affected by the shock. Formally, the fall in C_t^r raises the marginal utility of non-Ricardian consumption, which shifts its formal labor-supply curve upward despite the slight decline in the real formal wage, a “distress labor supply” mechanism specific to households without savings, which partly attenuates, without eliminating, the contraction of aggregate GDP.

Persistence via health-system degradation. While the epidemic index Θ_t itself resorbs quickly (returning to less than 1 % of its peak by the eighth year, consistent with $\rho_\Theta = 0.55$), the health-degradation state HC_t reaches its maximum in the third year (0.448, more than ten times its steady-state value) and returns below half this peak only after the tenth year, owing to its high persistence ($\rho_{HC} = 0.85$, implying a half-life of about 4.3 years). This profile, entirely governed by the epidemiological block upstream of the resource constraint, faithfully reproduces the empirical mechanism documented by the UNDP (UNDP, 2026a): a substantial part of the human and economic cost of an epidemic episode is deferred and does not resorb with the end of the active regime, but with the much slower rebuilding of health-system capacity. Real GDP, consequently, also takes longer to recover than the epidemic index itself: its decline, of 7.2 % on impact, does not fall back below 1 % until after the ninth year, and becomes marginally positive beyond the twentieth year, a second-order effect linked to the labor-reallocation dynamics described above.

Fiscal channel. Net real budget revenue $\mathcal{T}_t$ rises on impact (+2.46 %), the increase in the formal tax base (driven by the labor reallocation described above) offsetting the slight decline in the formal wage and the absence of a direct effect of the shock on the formal industrial mine, which is unaffected by $\mathcal{D}_t^I$. This revenue increase does not, however, benefit non-Ricardian households: epidemic emergency spending G_t^H absorbs a growing fraction of the budget (it is, by construction, proportional to Θ_t), and residual transfers TR_t , which constitute the fiscal instrument of last resort in the model’s closure, fall by 29.8 % on impact, a regressive fiscal channel that amplifies, rather than offsets, the informal-income shock borne by non-Ricardian households. This result depends directly on the fraction $\varpi^H = 0.55$ of emergency spending financed by external grants: a lower value of ϖ^H would worsen this channel, a higher value would attenuate it.

4.4.4 Systematic sensitivity analysis

The first numerical exercise carried out so far considered a single sensitivity variant, bearing on δ_L . We now systematize this exercise. Indeed, five parameters identified, in Table 5, as category O values rather than conventional (S) or directly source-calibrated (C) parameters, and each governing a distinct transmission channel among those discussed in Section 4.4.3, are modified one at a time: δ_L (elasticity of the informal disruption), λ (Ricardian share), σ (risk aversion), ϖ^H (share of emergency external financing), and ρ_{HC} (persistence of health degradation). Each of the eight resulting calibrations, i.e., the benchmark calibration and seven variants, is solved

independently, with its own steady state recomputed in two passes (Section 4.3) and not by a simple rescaling of the benchmark trajectory. The shock simulated in each variant is identical to that of Section 4.4: a one-standard-deviation shock to ε_t^Θ , the other innovations being held at zero.

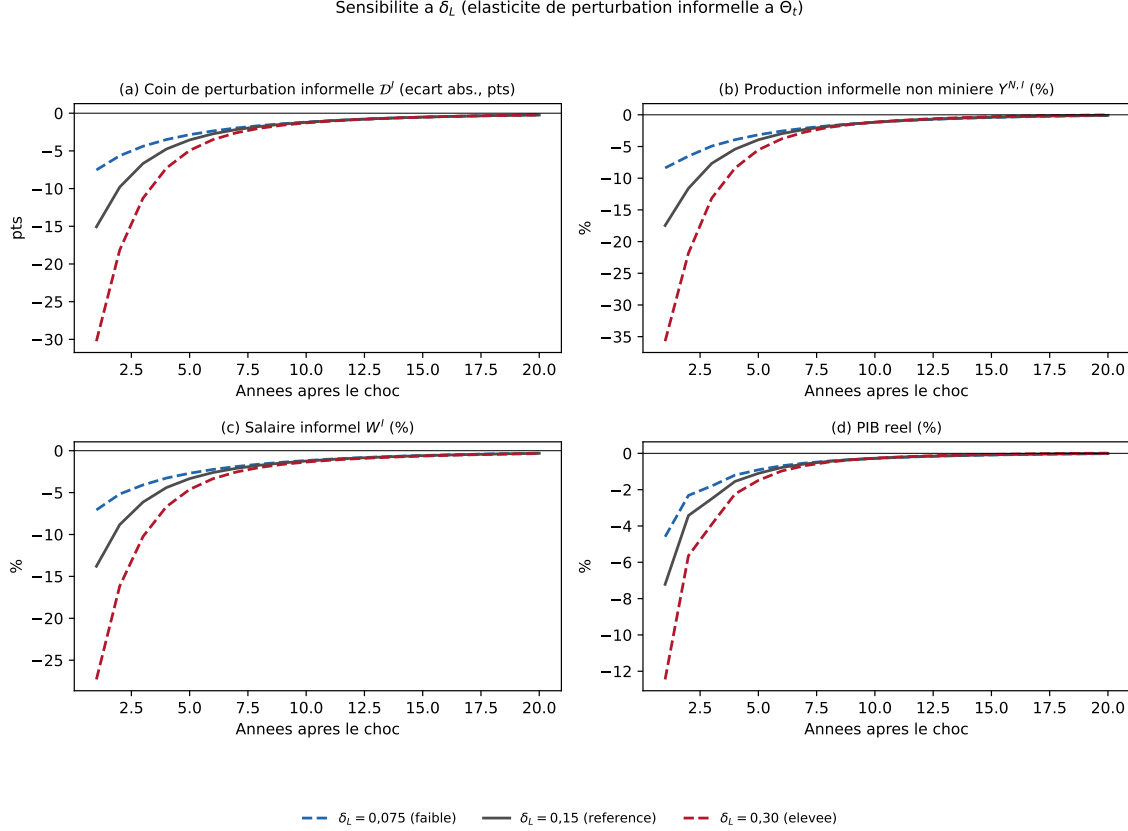


Figure 6: Sensitivity to δ_L (elasticity of the informal disruption to Θ_t): $\delta_L = 0.075$ (low), $\delta_L = 0.15$ (benchmark), and $\delta_L = 0.30$ (high). Panel (a) in absolute deviation (percentage points), panels (b)–(d) in relative deviation (%).

Elasticity of the informal disruption (δ_L , Figure 6). The impact decline in real GDP goes from -4.59% for $\delta_L = 0.075$ to -12.45% for $\delta_L = 0.30$, against -7.21% for the benchmark calibration: a range of 7.9 percentage points, by far the widest of the five parameters examined in this subsection. The low-elasticity variant reproduces, to within 0.01 percentage point, the value of -4.60% . The informal disruption $\mathcal{D}_t^I$, non-mining informal output $Y_t^{N,I}$, and the informal wage W_t^I

(panels a–c) respond almost proportionally to δ_L on impact, as Equation (47) directly implies; aggregate GDP (panel d), by contrast, responds less than proportionally: a doubling of δ_L between the benchmark variant and the high variant multiplies the impact decline of GDP by 1.73 rather than by 2, reflecting the partial cushioning provided by the labor-reallocation channel described in Section 4.4.3.

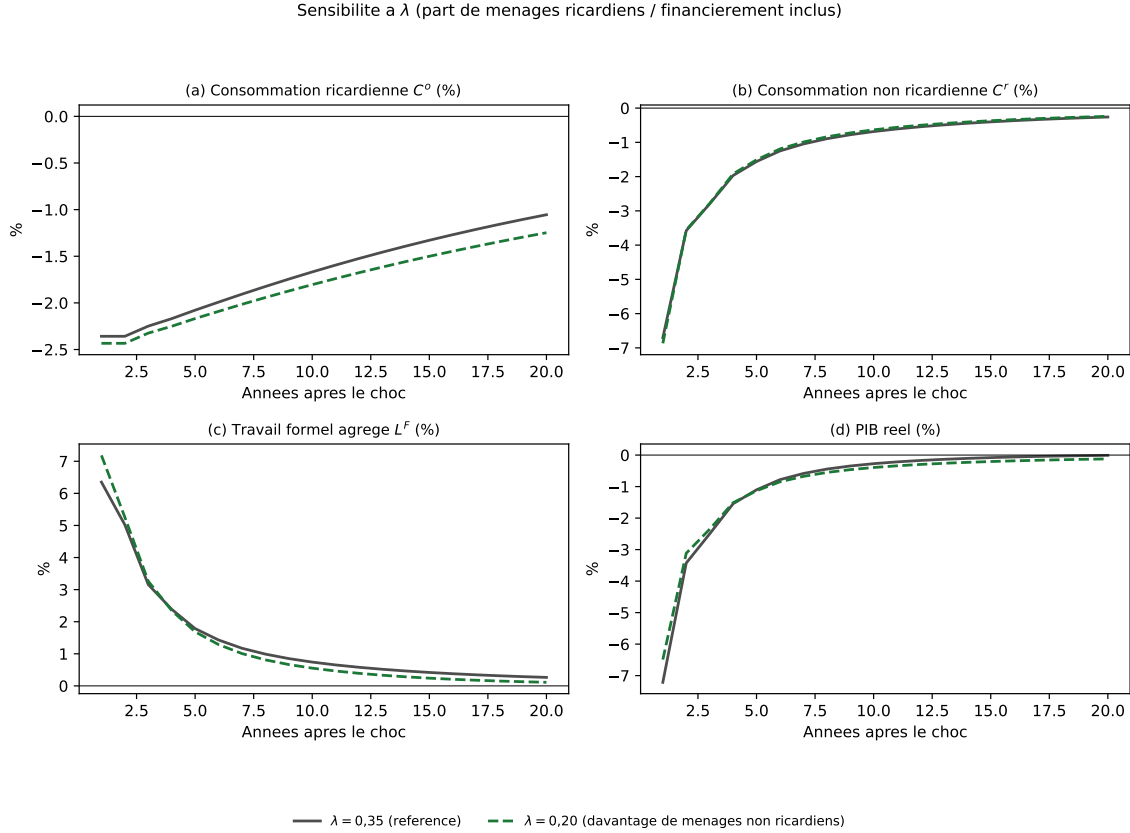


Figure 7: Sensitivity to λ (share of Ricardian households): $\lambda = 0.35$ (benchmark) and $\lambda = 0.20$ (more non-Ricardian households). Relative deviations (%) from the steady state specific to each calibration.

Ricardian share (λ , Figure 7). Reducing λ from 0.35 to 0.20 raises the steady state of C_t^o from 1.319 to 1.911 in model units, a direct and mechanical consequence of the aggregate resource constraint: the same volume of aggregate Ricardian resources is now distributed among a smaller Ricardian population; while the steady state

of C_t^r is almost unchanged (0.791 against 0.790). On impact of the shock, non-Ricardian consumption contracts very slightly more when λ is lower (C_t^r : -6.87% against -6.70% for the benchmark), but the distress formal labor supply (panel c) responds more strongly (L_t^F : $+7.18\%$ against $+6.35\%$), a mechanism mechanically linked to the larger relative size of the non-Ricardian population. The net result is a slightly *less* contracted aggregate GDP on impact when λ decreases (-6.49% against -7.21%): the share of the population directly exposed to the hand-to-mouth subsistence constraint increases, but the cushioning provided by the reallocation of labor toward the formal sector increases more than proportionally, a result that illustrates that λ acts on the aggregate magnitude of the shock through two channels of opposite sign rather than through a single one.

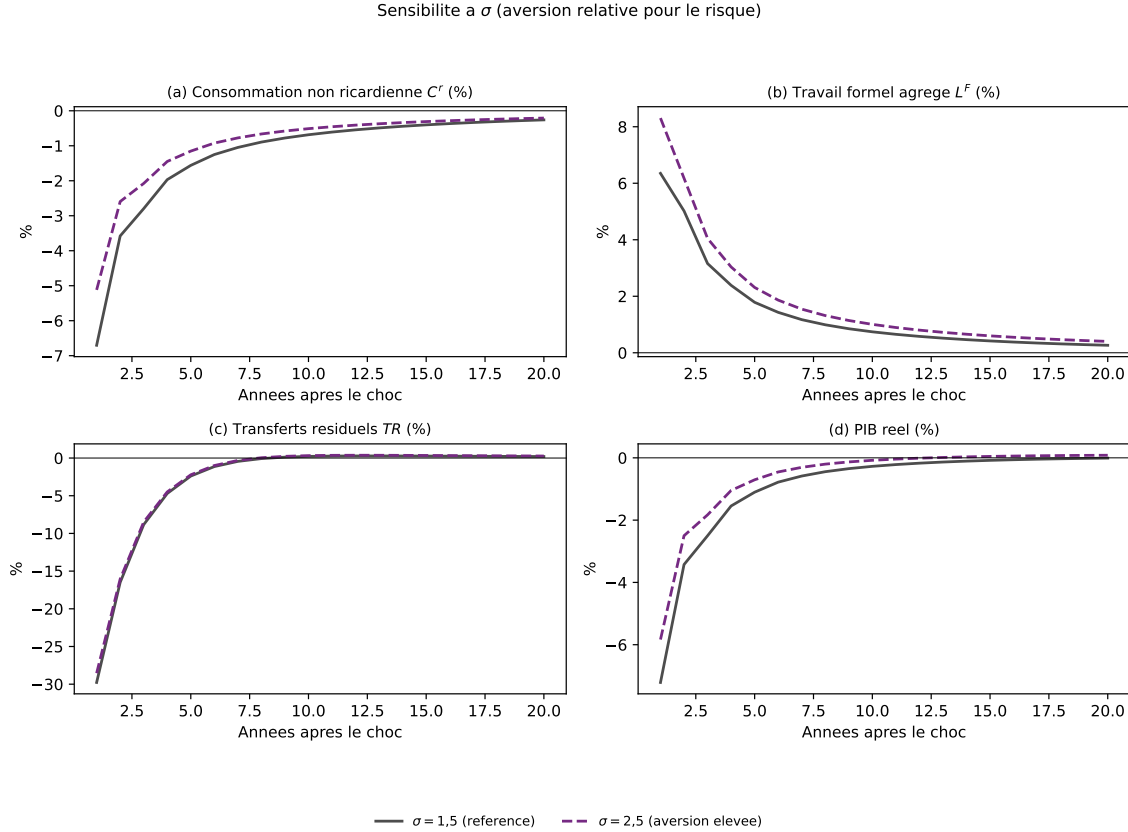


Figure 8: Sensitivity to σ (relative risk aversion): $\sigma = 1.5$ (benchmark) and $\sigma = 2.5$ (high aversion). Relative deviations (%) from the steady state.

Risk aversion (σ , Figure 8). A higher risk aversion attenuates the impact decline in real GDP (-5.83% against -7.21% for the benchmark) as well as that of non-Ricardian consumption (C_t^r : -5.12% against -6.70%), while markedly amplifying the response of the distress formal labor supply (L_t^F : $+8.31\%$ against $+6.35\%$). This relationship is consistent with the marginal-consumption-disutility mechanism that governs the labor-supply response of non-Ricardian households (Section 4.4.3): a higher curvature of the utility function amplifies, for a given fall in C_t^r , the rise in the marginal utility of consumption, which shifts the formal labor-supply curve more and cushions more strongly, in general equilibrium, the aggregate contraction of GDP. Residual transfers TR_t (panel c), by contrast, are practically insensitive to σ at all periods: this channel is governed by the state’s budget constraint, Equation (56), which does not directly involve the household preference parameter.

Share of emergency external financing (ϖ^H , Figure 9). Epidemic emergency spending G_t^H (panel a) is, by construction (Equation (53)), identical in the three variants: only its composition between external and domestic financing varies. This variation has a first-order, and strictly monotonic, effect on the distributive channel: residual transfers TR_t fall by 48.0% on impact when $\varpi^H = 0.30$, against 29.8% for the benchmark and only 8.1% when $\varpi^H = 0.85$ (panel b), and non-Ricardian consumption is correspondingly better protected (C_t^r : -7.24% , -6.70% , then -6.05% , panel c). The effect on aggregate GDP (panel d), by contrast, is quantitatively minor and non-monotonic: -6.92% , -7.21% , then -7.57% on impact for increasing ϖ^H , i.e., less than one percentage point of difference between the extreme variants. This apparently counterintuitive result is explained by the fact that ϖ^H redistributes resources between non-Ricardian households and the state budget without modifying the aggregate volume of resources absorbed by the epidemic response: Ricardian consumption C_t^o is very slightly more affected when ϖ^H is high (-2.51% against -2.23% for $\varpi^H = 0.30$), and the distress formal labor supply, in turn, responds very slightly less (L_t^F : $+5.82\%$ against $+6.79\%$), a second-order general-equilibrium feedback channel that almost fully offsets, at the aggregate level, the relief of the distributive channel documented in panels (b)–(c). The role of ϖ^H in this model is therefore, above all, distributive: it determines *who*, of the non-Ricardian households or the state budget, absorbs the cost of the response, more than it determines the aggregate magnitude of the GDP contraction.

Persistence of health degradation (ρ_{HC} , Figure 10). The two calibrations produce, by construction, the same impact response ($HC_1 = 0.300$ in both cases, Equation (52) involving ρ_{HC} only from $t = 2$), but diverge strongly thereafter: the

Sensibilité à ϖ^H (part de la dépense d'urgence financée par dons extérieurs)

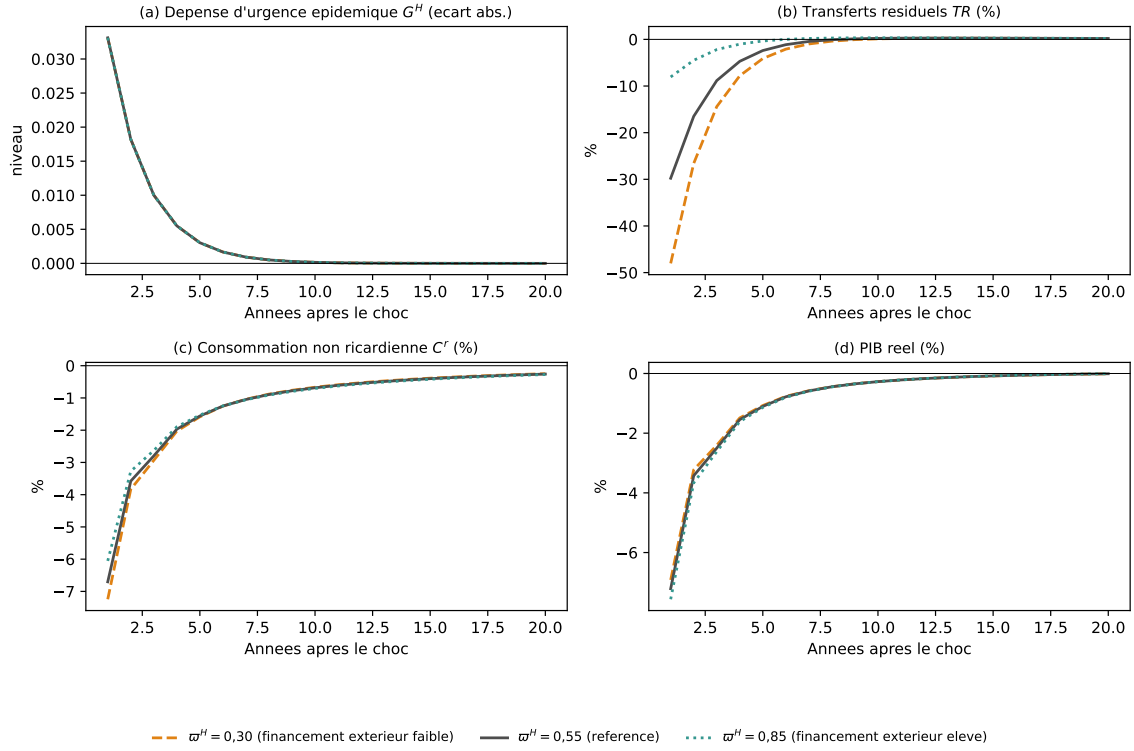


Figure 9: Sensitivity to ϖ^H (share of emergency spending financed by external grants): $\varpi^H = 0.30$ (low external financing), $\varpi^H = 0.55$ (benchmark), and $\varpi^H = 0.85$ (high external financing). Panel (a) in absolute deviation (level), panels (b)–(d) in relative deviation (%).

Sensibilité à ρ_{HC} (persistance de la dégradation du système de santé)

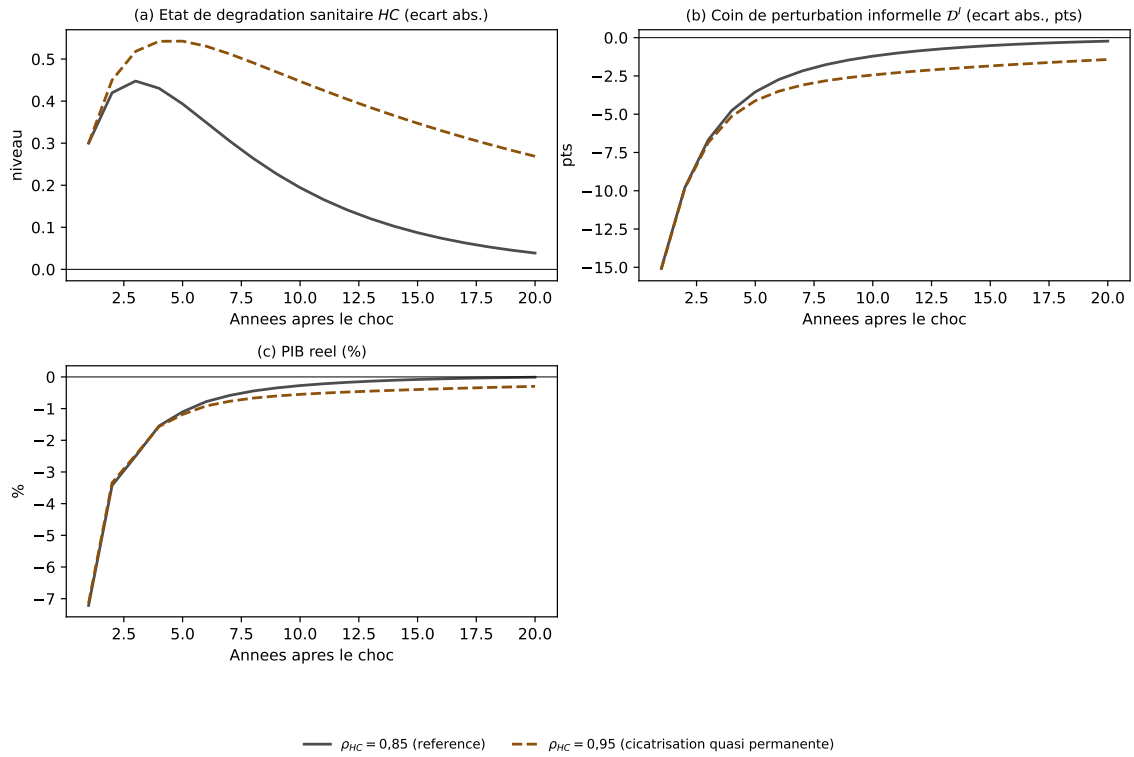


Figure 10: Sensitivity to ρ_{HC} (persistence of health-system degradation): $\rho_{HC} = 0.85$ (benchmark) and $\rho_{HC} = 0.95$ (near-permanent scarring). Panels (a)–(b) in absolute deviation (level and percentage points), panel (c) in relative deviation (%).

health-degradation state HC_t reaches a higher peak (0.518 against 0.448 at $h = 3$) and resorbs much more slowly when $\rho_{HC} = 0.95$ ($HC_{10} = 0.447$, i.e., more than double the benchmark value 0.194; $HC_{20} = 0.269$, against 0.039). The informal-disruption wedge $\mathcal{D}_t^I$ (panel b), which incorporates HC_{t-1} with the coefficient δ_{HC} (Equation (47)), directly inherits this increased persistence: at $h = 20$, the deviation is -1.42% against -0.23% for the benchmark, i.e., a factor close to 6. Real GDP (panel c) is almost identical in the two calibrations on impact (-7.14% against -7.21%), but diverges markedly thereafter: at $h = 10$, the decline is -0.55% against -0.27% for the benchmark, and at $h = 20$ it is -0.30% against practically nil (-0.01%). This result quantitatively illustrates the “scarring” mechanism described in Section 4.4.3: ρ_{HC} does not determine the magnitude of the initial impact of an episode, governed by δ_L and ψ^{av} , but the duration for which the economy continues to bear its cost after the active regime has died out.

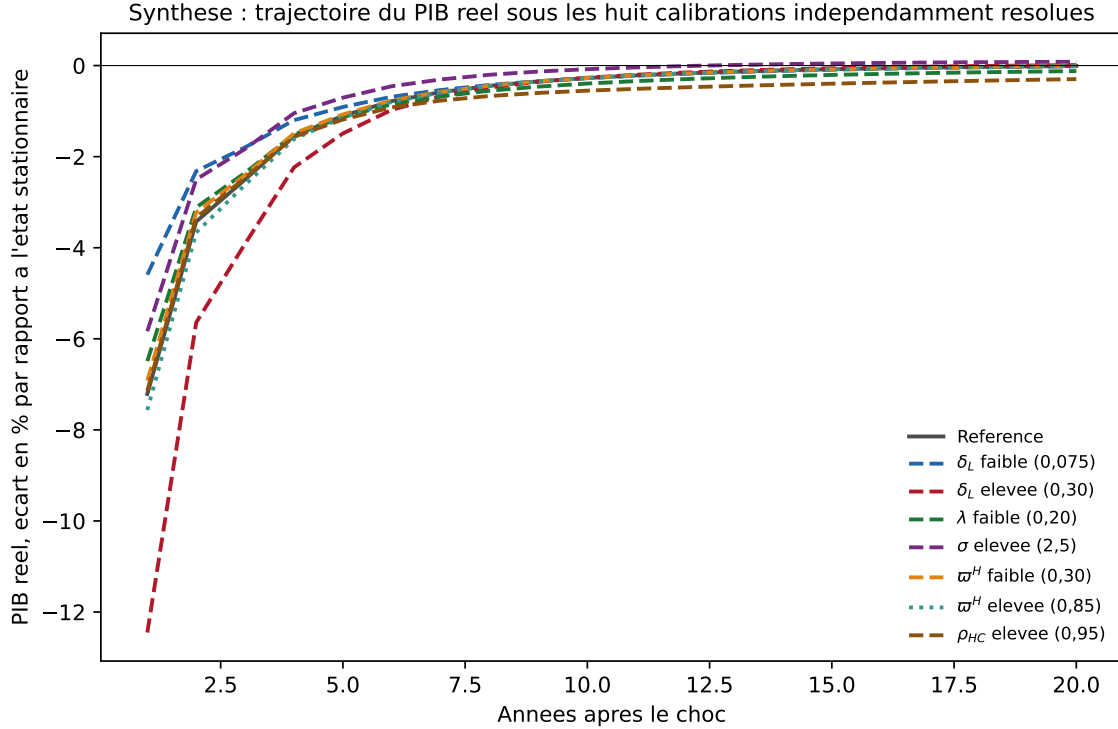


Figure 11: Synthesis: trajectory of real GDP (deviation in % from the steady state) under the eight independently solved calibrations of this subsection.

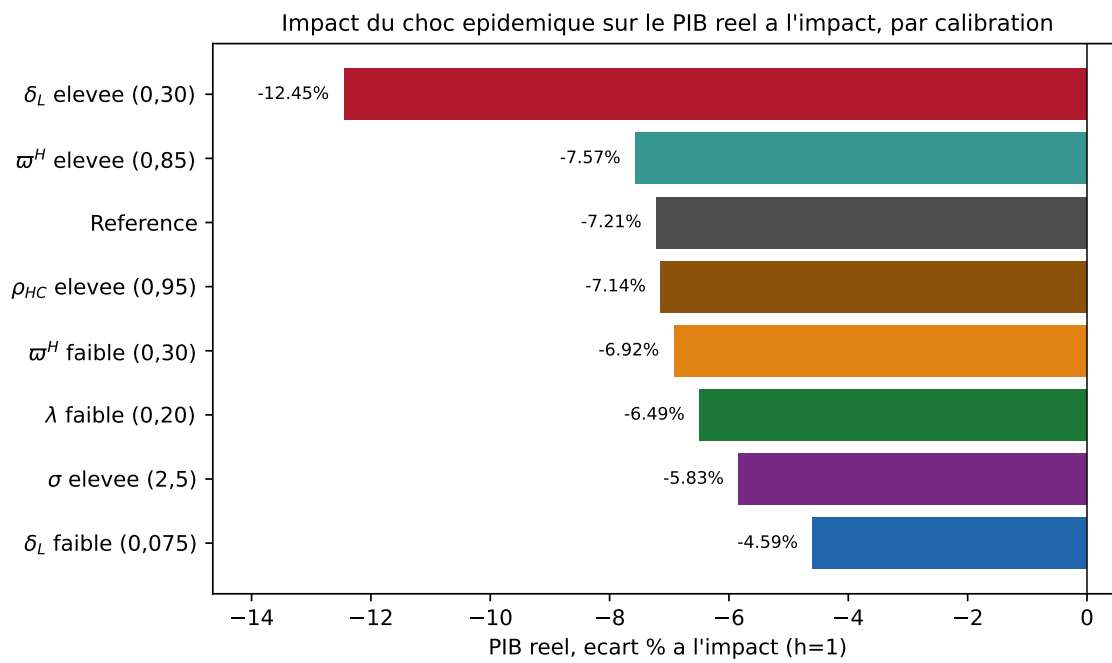


Figure 12: Impact of the epidemic shock on real GDP on impact ($h = 1$), by calibration, ranked in increasing order of severity.

Synthesis (Figures 11 and 12). Ranked in increasing order of severity of the impact on real GDP at $h = 1$, the eight calibrations range from -4.59% (low δ_L) to -12.45% (high δ_L), passing through -5.83% (high σ), -6.49% (low λ), -6.92% (low ϖ^H), -7.14% (high ρ_{HC}), -7.21% (benchmark), and -7.57% (high ϖ^H). The range associated with δ_L (7.9 percentage points between its two variants) very largely dominates that associated with each of the four other parameters taken in isolation (at most 1.7 points, for σ): it is this parameter, precisely identified in Table 5 as a category O value not estimated on Congolese data, that most conditions the quantitative magnitude of the results reported in Section 4.4.3, which corroborates and quantifies, on a basis extended to five parameters, the reservation already formulated in the following paragraph on the basis of δ_L alone.

4.4.5 Perspective, sensitivity, and limitations

The magnitude of the peak decline in real GDP (-7.2%) is appreciably larger than the estimates available for the 2014–2016 West African epidemic, for which the World Bank (World Bank, 2014) quantified cumulative production losses, depending on the scenario adopted, between 2.2 and 32.6 billion dollars over 2014–2015, orders of magnitude which, relative to the GDP of the affected countries, generally remain below -7% for a single fiscal year, except in the most pessimistic scenarios for the smallest economies (Liberia). Three elements, specific to the present calibration, must be kept in mind to interpret this gap. First, the shock simulated here corresponds, by construction, to the documented *peak* intensity, the analogue of a worst-case scenario rather than of an episode representative of all seventeen recorded, whose severity is highly heterogeneous. Second, the weight of the informal sector in simulated GDP (37.1% at the steady state, Section 4.3) is deliberately high, consistent with the structural characteristics of the Congolese economy, and markedly higher than that of several of the West African economies affected in 2014–2016; a GDP more dependent on the informal sector mechanically amplifies, all else equal, the transmission of a shock that operates specifically through this sector. Third, the elasticity $\delta_L = 0.15$ that governs the contemporaneous sensitivity of informal output to Θ_t is a category O value.

A sensitivity analysis shows that an elasticity twice as low ($\delta_L = 0.075$) brings the impact decline of GDP to -4.60% rather than -7.22% , a reduction factor of 0.637, that is, a less-than-proportional response to the decline in δ_L , which indicates that the general equilibrium of the model amplifies rather than attenuates a reduction in the direct sensitivity of the informal sector, via the wage–income–consumption loop. The impact decline remains, even in this alternative scenario, larger than

the median orders of magnitude reported by the World Bank for 2014–2016, which confirms that the gap is due mainly to the markedly higher weight of the informal sector in simulated GDP rather than to the choice of δ_L alone. This single variant is taken up and complemented by a five-parameter sensitivity exercise, presented in Subsection 4.4.4 above, which confirms that δ_L dominates, among the model’s category O parameters, the quantitative uncertainty about the magnitude of the simulated contraction.

5 Conclusion

This article shows that the economic costs of EVD episodes in the DRC do not depend solely on their lethality. Their duration, their geographic extent, and the characteristics of the affected local economies, in particular the importance of informality and artisanal mining, also play a decisive role.

The simulations show that a severe epidemiological shock affects mainly informal activities and artisanal mining, leading to a contraction in economic activity. Non-Ricardian households experience a more pronounced decline in consumption than Ricardian households owing to their limited access to smoothing instruments. The loss of informal income leads them to increase their labor supply in the formal sector, revealing a mechanism of formalization by necessity. The reduction in public transfers reinforces these distributive effects, while the deterioration of health-system capacity prolongs the economic contraction after the end of the active phase of the epidemic.

These results call for a public response combining health intervention and economic protection. Targeted transfers can limit the decline in the consumption of financially constrained households. Preserving routine health services makes it possible to reduce the persistent effects of the shock. In mining regions, the response must also protect the local networks of production, transport, and marketing.

The quantitative results remain conditional simulations and not causal estimates of the average effect of the seventeen episodes. Their magnitude depends in particular on the intensity with which the epidemic disrupts informal production. Ultimately, the economic severity of an EVD episode results from the interaction among the health shock, informality, mining dependence, liquidity constraints, and the capacity of public policy to protect livelihoods.

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A The 17 EVD episodes in the DRC between 1976 and 2026

This appendix summarizes the available information on the 17 EVD epidemics officially recorded in the DRC between 1976 and 2026, according to the numbering adopted by the World Health Organization (WHO), the WHO Regional Office for Africa (WHO-AFRO), the Centers for Disease Control and Prevention (CDC), and the National Institute of Public Health of the DRC (INSP-DRC), where the epidemics of 1976 (Yambuku) and 1977 (Tandala) count as two distinct episodes. The data are cut off on 19 August 2026. They were compiled and verified from primary sources (CDC, WHO, WHO-AFRO, ECDC, INSP-DRC, UN News) and from a few peer-reviewed academic articles, in particular Muyembe et al. (2015, 2019), Kratz et al. (2015), Moran (2018), Nakkazi (2018), Grimes et al. (2020), Vossler et al. (2022), Tully (2026), and Zomahoun et al. (2026).

Table A1 presents an epidemiological overview (province, strain, cases, deaths, case fatality) and Table A2 the chronology and precise location of each episode. Tables A3 and A4 offer an aggregated reading of them, respectively by viral strain and by period. Confirmed cases include, depending on the data availability for each episode, the probable and suspected cases retained at the time of official closure; the confirmed/probable/suspected breakdown, as well as all the primary sources by episode, appear in the attached data workbook.

Table A1: Overview of the 17 EVD episodes in the DRC: province, strain, confirmed cases, deaths, and case fatality rate

No.	Year(s)	Province(s)	Strain	Confirmed cases	Deaths	CFR
1	1976	Équateur	Zaire	318	280	88.1%
2	1977	Équateur	Zaire	1	1	100%
3	1995	Bandundu (now Kwilu)	Zaire	315	254	80.6%
4	2007	Kasaï-Occidental	Zaire	264	187	70.8%
5	2008–2009	Kasaï-Occidental	Zaire	32	15	46.9%
6 ^a	2012	Province Orientale (now Haut-Uélé)	Bundibugyo	62	34	54.8%
7	2014	Équateur	Zaire	66	49	74.2%
8	2017	Bas-Uélé	Zaire	8	4	50.0%
9	2018	Équateur	Zaire	54	33	61.1%
10	2018–2020	Nord-Kivu, Ituri, Sud-Kivu	Zaire	3 470	2 287	65.9%
11	2020	Équateur	Zaire	130	55	42.3%

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No.	Year(s)	Province(s)	Strain	Confirmed cases	Deaths	CFR
12	2021 (Feb.–May)	Nord-Kivu	Zaire	12	6	50.0%
13	2021 (Oct.–Dec.)	Nord-Kivu	Zaire	11	9	81.8%
14	2022 (Apr.–Jul.)	Équateur	Zaire	5	5	100%
15	2022 (Aug.–Sep.)	Nord-Kivu	Zaire	1	0	0.0%
16	2025	Kasaï	Zaire	64	45	70.3%
17 ^b	2026 (ongoing)	Ituri (epicenter), Nord-Kivu, Sud-Kivu, Haut-Uélé, Tshopo, Bas-Uélé	Bundibugyo	5 290	2 516	47.6%
				10 103	5 780	57.2%

^a Episode no. 6 (2012): figures of 62 cases / 34 deaths confirmed both by the current CDC page and by Kratz et al. (2015) (36 confirmed + 21 probable + 5 suspected). An earlier figure of 38 cases / 13 deaths, used in an earlier compilation of the project, could not be found in either of the two verified primary sources; it likely corresponds to an intermediate count (WHO situation report of August–September 2012, prior to the official closure of 26 November 2012). Discrepancy flagged, not silently resolved; this figure of 38 cases / 13 deaths is, moreover, exactly the one reproduced by Table A6 of Appendix B for this same episode, which relies on a CDC chronology distinct from the one used here; the two tables should therefore not be combined without explicit mention of this source discrepancy (see the summary note at the end of Appendix B).

^b Episode no. 17 (2026): active epidemic whose toll continues to rise. Figure adopted (5 290 cases / 2 516 deaths) as of 19 August 2026 (ONU Info, 2026; INSP, 2026); it is later than, and therefore preferred to, the figure of 4 665 cases / 2 184 deaths (DRC only, data as of 12 August 2026) published in WHO DON-2026-615 (WHO, 2026b). This figure will be superseded by later publications.

Table A2: Chronology and location of the 17 EVD episodes in the DRC

No.	Start date	End date	Duration	Health zone / locality
1	26 August 1976	Not identified ^a	≈ 2 months	Yambuku and surrounding villages (≈ 70 km)

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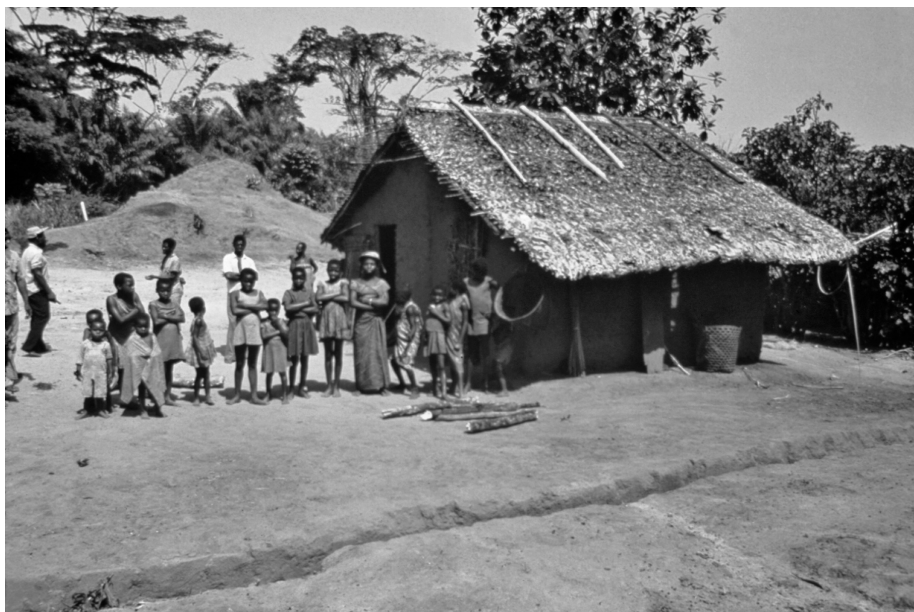
No.	Start date	End date	Duration	Health zone / locality
2	June 1977 ^b	Single case	Isolated case	Tandala
3	Not identified ^c	Not identified ^c	≈ 5–7 months	Kikwit and surroundings
4	Mid-Sep. 2007 ^d	20 November 2007	≈ 2 months	Luebo, Mweka
5	Not identified ^e	16–17 February 2009	≈ 2 months	Mweka, Luebo
6	Not identified ^f	26 November 2012	≈ 3.5 months	Isiro
7	26 July 2014	21 November 2014	≈ 4 months	Boende (Inkanamongo)
8	22 April 2017	2 July 2017	≈ 2.5 months	Likati
9	8 May 2018	24 July 2018	≈ 2.5 months	Bikoro, Iboko, Wangata (Mbandaka)
10	1 August 2018	25 June 2020	≈ 23 months	Up to 207 health zones (Beni, Butembo, Katwa, Mabalako, etc.)
11	1 June 2020	18 November 2020	≈ 5.5 months	Mbandaka (13 health zones)
12	1 February 2021	3 May 2021	3 months	Biena
13	8 October 2021	16 December 2021	≈ 2 months	Beni (Butsili health area)
14	23 April 2022	4 July 2022	≈ 2.5 months	Mbandaka
15	22 August 2022	27 September 2022	≈ 5 weeks	Beni
16	Not identified ^g	1 December 2025	≈ 4 months	Bulape, Mweka
17	25 April 2026	Active epidemic (not ended)	Ongoing (≈ 4 months to date)	Mongbwalu (Ituri) and 56 health zones across 6 provinces

^a Closure of the Yambuku hospital on 30 September 1976; end generally placed in late October / November 1976, with no single official date found. ^b Month confirmed, exact day not found. ^c Retrospective index case placed in early January 1995, first recognized hospital case on 4 April 1995; end of epidemic estimated at August 1995 (active phase documented up to 1 July 1995), with no single official date found.

^d Exact day not found. ^e Official declaration on 25 December 2008, last death on 1 January 2009.

^f First deaths reported in early August 2012, official declaration on 17 August 2012. ^g Official declaration on 4 September 2025, with already 28 suspected cases and 15 deaths at that date (actual onset therefore earlier, placed in the course of August 2025).

Figure A1: Image of the inhabitants of Yambuku in 1976.



Note: This photograph of a community in Yambuku comes from the Public Health Image Library (PHIL) of the Centers for Disease Control and Prevention (CDC), under identification number 7186. It shows residents being examined by CDC staff during the 1976 Ebola epidemic. Yambuku is a small village in Mongala Province, in the north of the DRC, located 1 098 kilometers northeast of Kinshasa, the capital. During the 1976 Ebola epidemic in Zaire, the village lacked running water and electricity. It had a hospital, but neither radio, nor telephone, nor ambulances; communications were carried out solely by motor-cycle courier.

The two points of vigilance flagged in notes ^a and ^b of Table A1 above concern, respectively, a discrepancy between sources for episode no. 6 (2012), resolved in favor of the figures corroborated independently by the CDC and by Kratz et al. (2015), and the evolving nature of the data for episode no. 17, still active at the time of writing. They should not be smoothed over in an aggregated reading without mention of their origin.

Tables A3 and A4 aggregate the same 17 episodes, respectively by viral strain and by period, as a cross-check: in both cases, the sum of confirmed cases and deaths reproduces exactly the total of 10 103 cases and 5 780 deaths of Table A1.

Table A3: Distribution of the 17 EVD episodes in the DRC, confirmed cases, and deaths, by viral strain (1976–2026)

Strain	Number of episodes	Confirmed cases	Deaths	CFR
Ebola Bundibugyo	2	5 352	2 550	47.6%
Ebola Zaire	15	4 751	3 230	68.0%
Total	17	10 103	5 780	57.2%

Note: the 17 episodes recorded in the DRC involved only two of the five known strains of the Ebola virus (Zaire, Sudan, Bundibugyo, Taï Forest, Reston). The Bundibugyo strain, a minority in number of episodes, concentrates more than half of the cumulative cases owing to episode no. 17 (2026), still active. See Table A1.

Table A4: Distribution of the 17 EVD episodes in the DRC, confirmed cases, and deaths, by period (1976–2026)

Period	Number of episodes	Confirmed cases	Deaths	CFR
1976–1979	2	319	281	88.1%
1990–1999	1	315	254	80.6%
2000–2009	2	296	202	68.2%
2010–2019	5	3 660	2 407	65.8%
2020–2026	7	5 513	2 636	47.8%
Total	17	10 103	5 780	57.2%

Note: the period 2020–2026 (7 episodes) alone concentrates 54.6 % of the cumulative cases, driven by episodes nos. 10 (2018–2020, begun in 2018 but counted here according to its closure year) and 17 (2026, ongoing). The CFR decreases over the recent period, partly owing to the improvement in clinical care and, for episode 17, to the provisional nature of a toll that is still rising.

Regarding the two recent episodes, it is worth noting that the first, in Kasai/Bulape, was declared on 4 September 2025 and closed on 1 December 2025 (64 cases, 45 deaths) (WHO, 2025b). The second, the epidemic ongoing at the time of writing, caused by the Bundibugyo virus, was confirmed in the laboratory on 15 May 2026 in the Mongbwalu health zone (Ituri) (WHO, 2026c); the WHO declared, on 17 May 2026, a public health emergency of international concern (PHEIC) for this epidemic (WHO, 2026d). Uganda recorded, within the framework of this same epidemic, 20 imported cases without sustained local transmission, and declared the end of its own episode on 28 July 2026 (Forbes, 2026). According to the CDC, the situation as of 19 August 2026 reports about 2 516 confirmed or probable cases and 2 378 deaths in the DRC,

the epidemic remaining active (CDCP, 2026; NPR, 2026). An isolated case was confirmed in France within the framework of this epidemic (Table A8) (CNN, 2026). Moreover, Uganda also experienced, independently of this epidemic, a Sudan-virus episode declared on 30 January 2025 and closed on 26 April 2025 (14 cases, 4 deaths) (WHO, 2025c).

B A brief history of EVD epidemics

The first known epidemic of Ebola virus disease (EVD) occurred in 1976, with simultaneous foci in the Yambuku region, in northern Zaire (now the DRC), and in southern Sudan. The strain identified at Yambuku was named Ebola Zaire virus, after the Ebola River. In 1994, an ethnologist fell ill after examining a dead chimpanzee in Taï National Park, in Côte d’Ivoire. The virus involved was distinct from those associated with the epidemics that occurred in the DRC and in Sudan; it was, consequently, designated Ebola Taï Forest virus. An epidemic of a then-unidentified disease occurred in 1990 in Reston, Virginia (United States), among crab-eating macaques imported from the Philippines. It was later established that this was a strain of the Ebola virus of Asian origin, named Ebola Reston virus. In 2007, a new strain of the Ebola virus appeared in western Uganda, in the locality of Bundibugyo, marking the discovery of a fifth strain of the virus, Ebola Bundibugyo virus. Between 2013 and 2015, West Africa experienced the deadliest EVD epidemic ever recorded. This epidemic, initially reported in Guinea in March 2014 but whose origin was eventually traced to late 2013, was the first occasion on which a variant of the Ebola virus spread within human populations over such a long duration. The Bombali Ebola virus (BOMV) was first discovered in bats in Sierra Leone in 2018; it remains unknown to this day, however, whether it is pathogenic in animals or in humans.

Let us specify here that only EVD in the strict sense is recorded. Thus, Marburg virus disease, caused by a distinct filovirus, is excluded from it and has not been documented within the framework of this document. Moreover, the Reston virus, an Ebolavirus species that has never been associated with confirmed human disease, is not counted on the same basis as the human epidemics. The Philippines (1989, 1996, 2008), the United States (1989, 1996), and Italy (1992) recorded incidents involving the Reston virus, in quarantined primates or exposed laboratory and farm personnel. No confirmed human disease has ever been associated with this viral species; only asymptomatic seroconversions have been reported in exposed personnel (CDCP, 2024). These countries are, consequently, not counted in Tables A7 to A9. Finally, the convention adopted by the CDC and the WHO attributes a case to the country

where it was diagnosed, not to the one where the patient was subsequently evacuated for treatment: countries that hosted only patients already diagnosed elsewhere are, consequently.

The main EVD cases and epidemics recorded in humans are summarized chronologically in Table A6. This table, whose original source (CDC) ends in 2022, has been extended to 2026 from separately verified WHO and ECDC sources; the paragraph immediately following the table details its sources and flags the provisional nature of the figures relating to the epidemic ongoing at the time of writing. Table A5 offers an aggregated reading of it by country, obtained by directly summing the rows of Table A6; the two tables have been verified as mutually consistent (see the verification note following Table A5).

Table A5: Distribution of Ebola virus disease episodes, confirmed cases, and deaths, by country (1976–2026)

Country	Number of episodes	Confirmed cases	Deaths	CFR
South Africa	1	2	1	50.0%
Congo-Brazzaville	4	249	211	84.7%
Côte d’Ivoire	1	1	0	0.0%
United States	1	4	0	0.0%
France	1	1	0	0.0%
Gabon	4	207	150	72.5%
Guinea	1	23	12	52.2%
Uganda	8	772	335	43.4%
Philippines	2	9	0	0.0%
DRC	17	9 457	5 428	57.4%
United Kingdom	1	1	0	0.0%
Russia	2	2	2	100%
Sudan	3	335	180	53.7%
West Africa	1	28 646	11 323	39.5%
Total	47	39 709	17 642	44.4%

Table A6: Chronological list of the main Ebola virus disease epidemics in humans, extended to 2026

Year	Place	Strain	Confirmed cases	Deaths
1976	DRC	Ebola Zaire virus	318	280

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Year	Place	Strain	Confirmed cases	Deaths
1976	Sudan	Ebola Sudan virus	284	151
1976	United Kingdom	Ebola Zaire virus	1	0
1977	DRC	Ebola Zaire virus	1	1
1979	Sudan	Ebola Sudan virus	34	22
1989	Philippines	Ebola Reston virus	3	0
1989	United States	Ebola Reston virus	4	0
1994	Gabon	Ebola Zaire virus	51	31
1994	Côte d'Ivoire	Taï Forest virus	1	0
1995	DRC	Ebola Zaire virus	315	254
1996	Gabon	Ebola Zaire virus	60	45
1996	Gabon	Ebola Zaire virus	31	21
1996	Russia	Ebola Zaire virus	1	1
1996	South Africa	Ebola Zaire virus	2	1
2000	Uganda	Ebola Sudan virus	425	224
2001	Gabon	Ebola Zaire virus	65	53
2001	Congo-Brazzaville	Ebola Zaire virus	59	44
2002	Congo-Brazzaville	Ebola Zaire virus	143	128
2003	Congo-Brazzaville	Ebola Zaire virus	35	29
2004	Sudan	Ebola Sudan virus	17	7
2004	Russia	Ebola Zaire virus	1	1
2005	Congo-Brazzaville	Ebola Zaire virus	12	10
2007	DRC	Ebola Zaire virus	264	187
2007	Uganda	Ebola Bundibugyo virus	131	42
2008	Philippines	Ebola Reston virus	6	0
2008	DRC	Ebola Zaire virus	32	15
2011	Uganda	Ebola Sudan virus	1	1
2012	Uganda	Ebola Sudan virus	11	4
2012	Uganda	Ebola Sudan virus	6	3
2012	DRC	Ebola Bundibugyo virus	38	13
2014	DRC	Ebola Zaire virus	69	49
2014	West Africa, United States, and United Kingdom	Ebola Zaire virus	28 646	11 323
2017	DRC	Ebola Zaire virus	8	4
2018	DRC and Uganda	Ebola Zaire virus	3 470	2 287
2018	DRC	Ebola Zaire virus	54	33
2020	DRC	Ebola Zaire virus	130	55
2021	DRC	Ebola Zaire virus	12	6
2021	DRC	Ebola Zaire virus	11	9
2021	Guinea	Ebola Zaire virus	23	12
2022	Uganda	Ebola Sudan virus	164	55

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Year	Place	Strain	Confirmed cases	Deaths
2022	DRC	Ebola Zaire virus	5	5
2022	DRC	Ebola Zaire virus	1	1
2025	Uganda	Ebola Sudan virus	14	4
2025	DRC (Kasaï/Bulape)	Ebola Zaire virus	64	45
2026	DRC	Ebola Bundibugyo virus	4 665	2 184
2026	Uganda	Ebola Bundibugyo virus	20	2
2026	France	Ebola Bundibugyo virus	1	0

Table A7: Countries that recorded an epidemic with sustained community transmission

Country	Year(s)	Source
DRC (Congo-Kinshasa)	1976, 1977, 1995, 2007, 2008, 2012, 2014, 2017, 2018 ($\times 2$), 2020, 2021 ($\times 2$), 2022 ($\times 2$), 2025, 2026; 17 episodes in total	CDCP (2024); WHO Africa (2025); WHO (2026a)
Sudan (<i>territory now in South Sudan, see note 2</i>)	1976, 1979, 2004	CDCP (2024)
Uganda	2000, 2007, 2011, 2012 ($\times 2$), 2022, 2025	CDCP (2024); WHO (2025c)
Gabon	1994, 1996 ($\times 2$), 2001	CDCP (2024)
Congo (Congo-Brazzaville)	2001, 2003 ($\times 2$), 2005	CDCP (2024)
Guinea	2013–2016 (origin focus of the West African epidemic), 2021	CDCP (2024)
Liberia	2014–2016	CDCP (2024)
Sierra Leone	2014–2016	CDCP (2024)

Note: Table A7 distinguishes the countries that experienced sustained community transmission from the countries that recorded only imported cases (cf. Table A8), laboratory-acquired infections (cf. Table A9), incidents involving the Reston virus, and countries of medical evacuation only. Moreover, the list of Ugandan episodes (i.e., 2000, 2007, 2011, 2012 $\times 2$, 2022, 2025) does not count the 2026 episode, which constitutes the Ugandan component of a single epidemic whose epicenter is in the DRC; it is therefore not added here as a separate Ugandan episode.

Table A8: Countries that recorded only imported cases, with or without limited secondary transmission

Country	Year	Detail	Source
Côte d’Ivoire	1994	1 case (Taï Forest virus), non-fatal, without secondary transmission	CDCP (2024); O’Neill Institute (s.d.)
South Africa	1996	Imported case + 1 secondary nosocomial transmission (nurse)	CDCP (2024)
Nigeria	2014	Index case imported from Liberia, 20 cases in total (Lagos/Port Harcourt)	CDCP (2024)
Mali	2014	Imported, small local transmission chain (8 cases)	CDCP (2024)
Senegal	2014	1 imported case, without secondary transmission	CDCP (2024)
Spain	2014	1 local transmission (nurse infected in Madrid); see note 4 on the two evacuated priests	CDCP (2024); CIDRP (2014)
Italy	2014	1 imported case, diagnosed on return from Sierra Leone	CDCP (2024)
United Kingdom	2014–2015	2 patients diagnosed on return from Sierra Leone; see note 3 on the count	CDCP (2024)
United States	2014	4 cases: 1 imported (Dallas, died), 2 local transmissions among care staff, 1 imported (New York)	CDCP (2024)
France	2026	1 imported case, tested positive after arrival (ongoing DRC/Uganda epidemic)	ECDPC (2026); CNN (2026)

Table A9: Laboratory infections unrelated to a documented African epidemic

Country	Year(s)	Source
United Kingdom	1976 (Porton Down, accidental needle-stick)	CDCP (2024)
Russia	1996, 2004 (fatal laboratory accidents)	CDCP (2024)

The following countries hosted patients already diagnosed positive in another country, evacuated for treatment: Germany (2014, 2026), Switzerland (1994), Norway (2014), as well as Spain for two of the three patients who stayed there in 2014

(see note 4). The CDC/WHO convention attributes the case to the country of diagnosis and not to the country of treatment; these countries are therefore not counted as having had a “national case” in the tables above (Al Jazeera, 2014; Washington Post, 2026; Médecins Sans Frontières, 2014; NBC News, 2014). Finally, let us raise a few points of vigilance:

1. Côte d’Ivoire, 2021: retracted case, not to be counted. A case initially announced as positive (traveler from Guinea, confirmed by the Institut Pasteur of Côte d’Ivoire on 14 August 2021) triggered announcements evoking the first Ivorian episode since 1994. A recheck carried out by the French National Reference Center for Viral Hemorrhagic Fevers (Lyon) found, however, no trace of the virus, and the WHO officially concluded that the patient did not have EVD (WHO Africa, 2021). This episode is therefore not included in Table A8.
2. Sudan / South Sudan. The episodes of 1976, 1979, and 2004 (Table A7) occurred in a territory that is now South Sudanese, but administered as part of undivided Sudan at the time, hence the CDC/WHO attribution to “Sudan.” South Sudan, as an independent state since 2011, has to date recorded no confirmed EVD case, despite sustained preparedness activity owing to its proximity to the foci in the DRC and Uganda (WHO Africa, 2026b).
3. United Kingdom, 2014–2015 count. The CDC table indicates a single case for the United Kingdom in 2014, but the historical record documents two patients diagnosed separately on return from Sierra Leone: William Pooley (August 2014) and Pauline Cafferkey (December 2014, with a documented meningoencephalitic relapse in October 2015). No CDC or WHO source explicitly reconciles this figure with two; this point is flagged as unresolved rather than arbitrarily settled.
4. Spain, the two evacuated priests. Miguel Pajares and Manuel García Viejo were diagnosed positive in Sierra Leone and Liberia respectively, before being evacuated to Madrid, where they both died (NBC News, 2014). Under the country-of-diagnosis counting convention, they are not counted as “Spanish cases” by the CDC or the WHO; only the nurse infected in Madrid (Table A8) is.
5. Kenya, 2025: suspected cases, never confirmed. Several suspected cases linked to the screening of travelers from Uganda were reported in Kenya in 2025 and widely relayed by the local press; all turned out negative and were never confirmed (Daily Nation, 2025). Kenya is therefore included in none of the tables above.

C Artisanal mining in the DRC: socioeconomic weight and geographic distribution

The examination of artisanal mining in the DRC is of particular interest for the analysis of Ebola virus disease (EVD) episodes. Several foci have been observed in territories characterized by strong dependence on natural resources, high labor mobility, an increased human presence in forest spaces, and limited access to health infrastructure. The conditions specific to artisanal mining economies, in particular the informal economy, the remoteness of the sites, the precariousness of working conditions, and the intensity of movements between extraction sites and commercial centers, influence the exposure of populations to epidemiological risk and amplify the local economic consequences of an epidemic.

Indeed, artisanal and small-scale mining (ASM) occupies an important place in the economy and in livelihoods in the DRC. It is thought to employ directly nearly two million people, i.e., more than five times the workforce of the industrial mining sector. Taking into account those indirectly dependent on this activity, it is thought to have contributed, in 2008, to the livelihoods of 8 to 10 million people, i.e., up to 16 % of the Congolese population (Delve Database, 2026). ASM may constitute a main or a seasonal activity and presents, in particular in rural and fragile areas, low barriers to entry as well as incomes sometimes higher than those of agriculture. Women are thought to represent between 20 and 40 % of the artisanal workforce depending on the years and the sources. However, they remain mostly concentrated in the transport and processing of minerals, activities that are generally less well paid, and continue to face obstacles related to access to capital, social norms, and gender-based violence.

Artisanal mining activity is distributed across several regions of the country, with a particular concentration in the eastern DRC, the former Kasai provinces, and the former Katanga province. The main minerals concerned are diamond, gold, copper, cobalt, the so-called 3T minerals (cassiterite, coltan, and wolframite), as well as tourmaline. Diamond is mainly associated with the Kasai spaces, but it is also documented in the Kivus, Maniema, and former Katanga. Gold is mainly mined in Haut-Uélé, Ituri, Nord-Kivu, Sud-Kivu, Maniema, and Tanganyika, while copper and cobalt are concentrated in the copper belt of Haut-Katanga and Lualaba. The 3T minerals and tourmaline are mainly extracted in the eastern provinces. This geographic distribution shows that ASM constitutes a structuring component of many local economies, even if the importance of informality and smuggling makes production and export statistics particularly uncertain.

Despite its economic weight, ASM is characterized by significant health-related,

social, and institutional vulnerabilities. Workers are frequently exposed to the absence of sanitary facilities, water pollution, respiratory diseases, accidents, the collapse or flooding of pits and, in gold mining, the toxic effects of mercury. To these risks are added the length of the working days, the insufficiency of protective equipment, the presence of children at some sites, the limited access to formal credit, and the often asymmetric relationships among diggers, pit owners, traders, and industrial firms. In certain areas of the east of the country, the interference of armed groups or members of the security forces, informal taxation, and smuggling further aggravate these vulnerabilities. It is nonetheless advisable to avoid any generalization: the IPIS data indicate that a majority of the artisanal sites recorded in the east are not subject to armed interference. The progress achieved in certification and traceability, particularly in the 3T mineral chain, moreover remains uneven and has not entirely eliminated the informal circuits (Delve Database, 2026; Leysen et al., 2023).

Table A10: Provincial distribution of the main minerals from documented artisanal mining in the DRC

Province or geographic area	Documented artisanal minerals
Haut-Katanga	Copper, cobalt
Haut-Lomami	Coltan (tantalum)
Haut-Uélé	Gold
Ituri	Gold
Kasaï-Central	Diamond
Kasaï-Oriental	Diamond
Lualaba	Copper, cobalt
Maniema	Diamond, gold, cassiterite (tin), coltan (tantalum), and wolframite (tungsten)
Nord-Kivu	Diamond, gold, cassiterite, coltan, wolframite, and tourmaline
Sud-Kivu	Diamond, gold, cassiterite, coltan, wolframite, and tourmaline
Tanganyika	Gold, coltan, wolframite, and tourmaline
Former Katanga province ^a	Diamond and cassiterite

Note: The table records only the minerals and provinces explicitly mentioned in the documentation consulted (Delve Database, 2026). The absence of a province or a mineral does not necessarily mean the absence of artisanal mining, but may reflect the limits of documentary coverage. Cassiterite is the main tin ore, coltan is associated with tantalum, and wolframite with tungsten.

^a The source attributes diamond and cassiterite to the former Katanga province without systematically specifying their distribution among the provinces resulting from the 2015 administrative division. These two minerals are therefore not arbitrarily reassigned to the current provinces.