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Disruptions and the Path to Resilience in Egypt¹

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Abstract

This paper examines the complex disruptions that Egypt has encountered, drawing on the framework of The Rumsfeld Matrix to categorize and understand these events. It analyzes four main disruption types—war and conflict, debt and financial shocks, natural disasters, and disease outbreaks—focusing on both the “known knowns” and the “unknown unknowns” that have influenced Egypt’s resilience. Key pillars in Egypt’s response to these disruptions are identified, along with the opportunities and risks they entail for sustainable development. Additionally, the paper explores how the trajectory toward sustainability is shaped by factors that fall across the spectrum of predictability. Central to this analysis is the question of whether Egypt can harness these disruptions to reshape its future in a sustainable and resilient direction.

Keywords: Disruptions; Egypt; sustainable development; Rumsfeld Matrix; resilience.

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1. Introduction

In the study of disruptions, The Rumsfeld Matrix offers a useful framework for understanding the varying degrees of predictability in Egypt's trajectory, distinguishing between "known knowns," "known unknowns," and "unknown unknowns." This categorization helps to distinguish between gradual, predictable megatrends, and sudden, less predictable events or disruptors—the "black swans" that appear unexpectedly and with wide-ranging impact. The unpredictability inherent in disruptions such as these makes resilience and preparedness essential, enabling Egypt to adapt to changes that are challenging to forecast accurately.

Disruptions affecting Egypt can be broadly classified into six categories: political and geopolitical (e.g., wars, conflicts, political instability), economic (e.g., financial crises, trade conflicts, currency volatility), social (e.g., demographic shifts, social unrest), environmental and natural (e.g., natural disasters, climate-related events), health (e.g., pandemics, epidemics), and technological (e.g., cybersecurity threats, rapid technological advancements). Applying The Rumsfeld Matrix to these areas reveals that some disruptions are "known knowns," like ongoing regional tensions, while others, such as sudden financial crises or pandemics, fall into the "unknown unknowns" category. For Egypt, a blend of known and unknown factors has shaped its modern path, underscoring the need for robust contingency planning.

Since the 1970s, Egypt has encountered numerous disruptions that are "known knowns" in the sense of being recognized as potential risks, yet unpredictable in timing and magnitude. Politically, for instance, events like the 1973 October War, the assassination of President Anwar Sadat, the 2011 January 25 Revolution, and the 2013 military intervention were all high-impact disruptions, though some were anticipated. Economically, recurrent inflationary pressures, the 1980s debt crisis, and the 2016 currency flotation illustrate the interplay between "known unknowns" and unforeseen economic shocks. The temporary blockage of the Suez Canal in 2021, a result of a large container ship grounding, underscores Egypt's exposure to global trade risks, highlighting both "known" dependencies and the sudden impacts of "unknown" crises.

Internationally, Egypt's stability has been shaped by a regional landscape filled with both expected and unexpected conflicts. The Gulf Wars, the Arab Spring, and the Syrian crisis serve as examples of both "known unknowns" and "unknown unknowns," where underlying risks were anticipated but not the scale or timing of their effects on Egyptian stability. Disruptions from conflicts over the Grand Ethiopian Renaissance Dam (GERD), while a "known known" in terms of water security, present unknown outcomes affecting diplomatic and resource strategies. Meanwhile, global events such as the 2008 financial crisis and the Covid-19 pandemic are illustrative of Egypt's vulnerability to "unknown unknowns" in the global economic and health sectors.

Socially, persistent issues like unemployment, gender inequality, and social unrest fit within The Rumsfeld Matrix as both "known knowns" and "known unknowns." Social unrest and challenges around shifting cultural norms bring disruptive impacts that are challenging to predict, as witnessed in various protests and ideological shifts. Natural disasters and disease outbreaks, spanning from earthquakes to pandemics, bring "unknown unknowns" that repeatedly test the nation's capacity to respond swiftly.

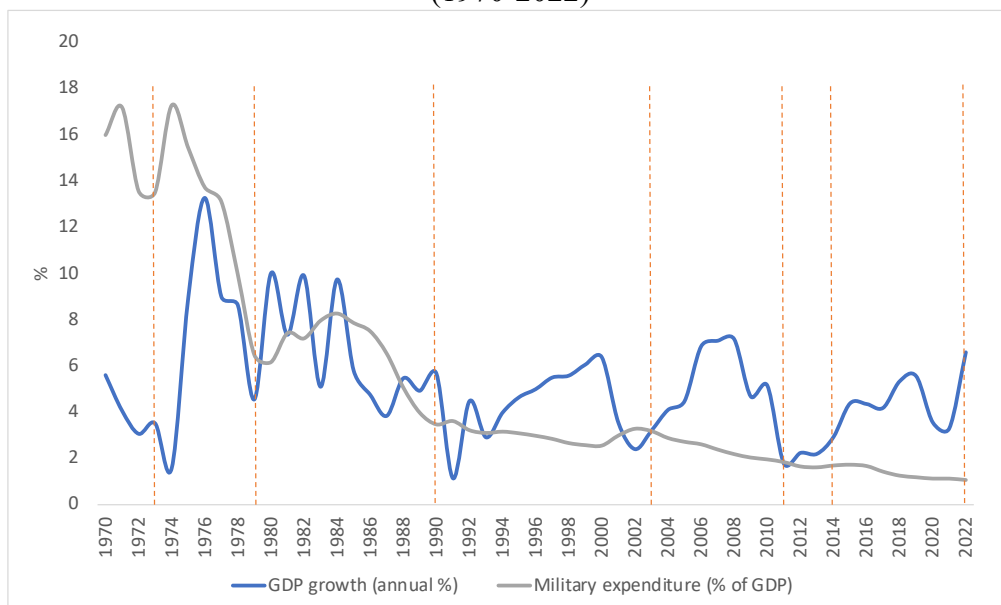
Egypt’s experience with technological disruptions is relatively modest compared to other nations, yet technological transformations (e.g., the rapid adoption of digital services) illustrate the “known unknowns” associated with the country’s economic modernization.

The range of disruptions Egypt has encountered over the decades underscores the importance of preparedness across The Rumsfeld Matrix’s categories. Each disruption—whether rooted in domestic affairs or originating globally—has challenged Egypt’s resilience. To navigate these complexities and leverage the transformative potential of disruptions, Egypt requires both adaptive strategies for the “knowns” and resilient frameworks for handling the “unknowns” that may arise, positioning the country to respond flexibly to shape a sustainable future trajectory.

2. War and Conflict

The political economy of Egypt has been significantly influenced by wars and geopolitical events, shaping the country’s economic trajectory (see Figure 1). Utilizing frameworks like The Rumsfeld Matrix underscores the uncertainties inherent in Egypt’s political economy, highlighting the importance of distinguishing between known knowns, known unknowns, and unknown unknowns in assessing the impacts of geopolitical tensions on economic stability and resilience.

Figure 1. Egypt’s GDP growth, wars and geopolitical disruptions, and military spending (1970-2022)



Source: World Bank national accounts data, Stockholm International Peace Research Institute.

The 1973 October War strained Egypt’s national budget due to military mobilization costs, negatively impacting critical sectors such as health and education. Research indicates that military expenditure adversely affected Egypt’s GDP from 1980 to 2021 (Eliesh et al., 2023). The conflict also exacerbated inflation and economic downturns, particularly following the oil crisis, which increased living costs and disrupted trade routes with Western nations. Tourism, a crucial economic sector, suffered as regional instability deterred visitors, leading to lost revenues and rising unemployment.

The 1978 Camp David Accords, which led to the Egypt-Israel Peace Treaty in 1979, stabilized relations with Israel but strained ties with other Arab states. While this brought significant U.S. financial and military assistance, balancing these relationships posed ongoing challenges. Egypt's involvement in the Gulf War in 1990 yielded financial aid and debt relief but complicated regional relations and disrupted trade routes.

The 2003 U.S.-led invasion of Iraq introduced further instability, impacting Egypt's trade and investment patterns. The subsequent oil price volatility had mixed effects on Egypt's economy, increasing revenue from oil exports but raising import costs. The reliance on remittances from Egyptians abroad illustrated the interconnectedness of regional economies.

The Arab Spring, beginning in late 2010, led to substantial economic disruptions. Tourist arrivals dropped from 14.7 million in 2010 to 9.8 million in 2011—a 33% decline—while foreign direct investment (FDI) plummeted from \$6.4 billion to \$0.4 billion, reflecting lost investor confidence. Concurrently, foreign exchange reserves fell sharply from around \$36 billion to approximately \$15 billion, undermining the government's capacity to stabilize the economy. These developments highlight the need for resilient strategies amid political upheaval.

Following the Arab Spring, environmental sustainability concerns were often deprioritized. The construction of the GERD has intensified water security concerns, prompting Egypt to undertake assessments and implement domestic water management initiatives.

Ongoing instability in the Sinai Peninsula has necessitated increased defense spending, further diverting resources from public services. Additionally, Egypt currently hosts around half a million registered refugees from regional conflicts, straining social services and resources. The Libyan Civil War along Egypt's western border has also disrupted the Egyptian economy, notably through reduced remittances and increased refugee flows. The potential for future geopolitical conflicts remains, necessitating a comprehensive approach to bolster resilience.

Egypt can strengthen its resilience against disruptions from war and geopolitical conflicts by implementing a multifaceted strategy. This approach involves enhancing knowledge of known factors, such as existing geopolitical relationships and economic dependencies. By conducting comprehensive assessments of these known factors, Egypt can develop informed policies that leverage its strengths and mitigate vulnerabilities, particularly in areas like trade partnerships, military alliances, and historical contexts that influence regional stability.

In addition to addressing known factors, Egypt must prepare for known unknowns, including potential regional conflicts and economic shocks. This preparation involves scenario planning and strategic foresight to anticipate possible disruptions and their implications for trade, investment, and social stability. Strengthening diplomatic relations with neighboring countries is essential for mitigating risks associated with potential conflicts, thus fostering a more stable regional environment.

To navigate the uncertainties of the geopolitical landscape, Egypt should focus on building a flexible and adaptive governance structure capable of responding rapidly to unexpected crises—what The Rumsfeld Matrix identifies as unknown unknowns. Establishing early warning systems and enhancing intelligence capabilities will enable the government to monitor emerging threats in real time, allowing for proactive rather than reactive measures.

Economic diversification is critical to reducing reliance on specific sectors vulnerable to geopolitical disruptions, such as tourism and remittances. By promoting investment in technology, manufacturing, and renewable energy, Egypt can create new economic opportunities and build resilience against external shocks. Strengthening institutional frameworks is also crucial; enhancing governance, transparency, and public trust will facilitate more effective crisis management and recovery efforts.

Finally, fostering regional cooperation through active participation in regional organizations can enhance collective security and economic resilience. Egypt's engagement in initiatives that promote stability, trade, and investment will help reduce the likelihood of conflicts adversely impacting its economy.

3. Debt and Financial Shocks

Since the 1970s, Egypt has faced a succession of debt and financial crises, each significantly influencing its economic trajectory. The challenges have included managing external debt, maintaining fiscal discipline, and addressing structural issues. As articulated within The Rumsfeld Matrix, Egypt operates within a realm of known knowns—such as existing geopolitical relationships and economic dependencies—while also confronting known unknowns, like potential financial shocks and regional instability, along with unknown unknowns that can unpredictably disrupt economic stability.

In the late 1970s, escalating borrowing to fund development projects and military expenditures led to a severe external debt crisis, pushing the debt-to-GDP ratio to approximately 122% by 1980. Attempts at economic reform throughout the 1980s included currency devaluation and subsidy reductions aimed at addressing these imbalances. However, the debt crisis resurfaced by the late 1980s, leaving Egypt with a debt burden of around 85% of GDP by 1990. The early 1990s saw Egypt entering into agreements with the International Monetary Fund (IMF) to implement structural adjustment programs focused on fiscal consolidation and trade liberalization, yet the debt-to-GDP ratio remained high at about 97% in 1995. The subsequent decades were marked by additional economic hurdles, including high unemployment, inflation, and a growing budget deficit.

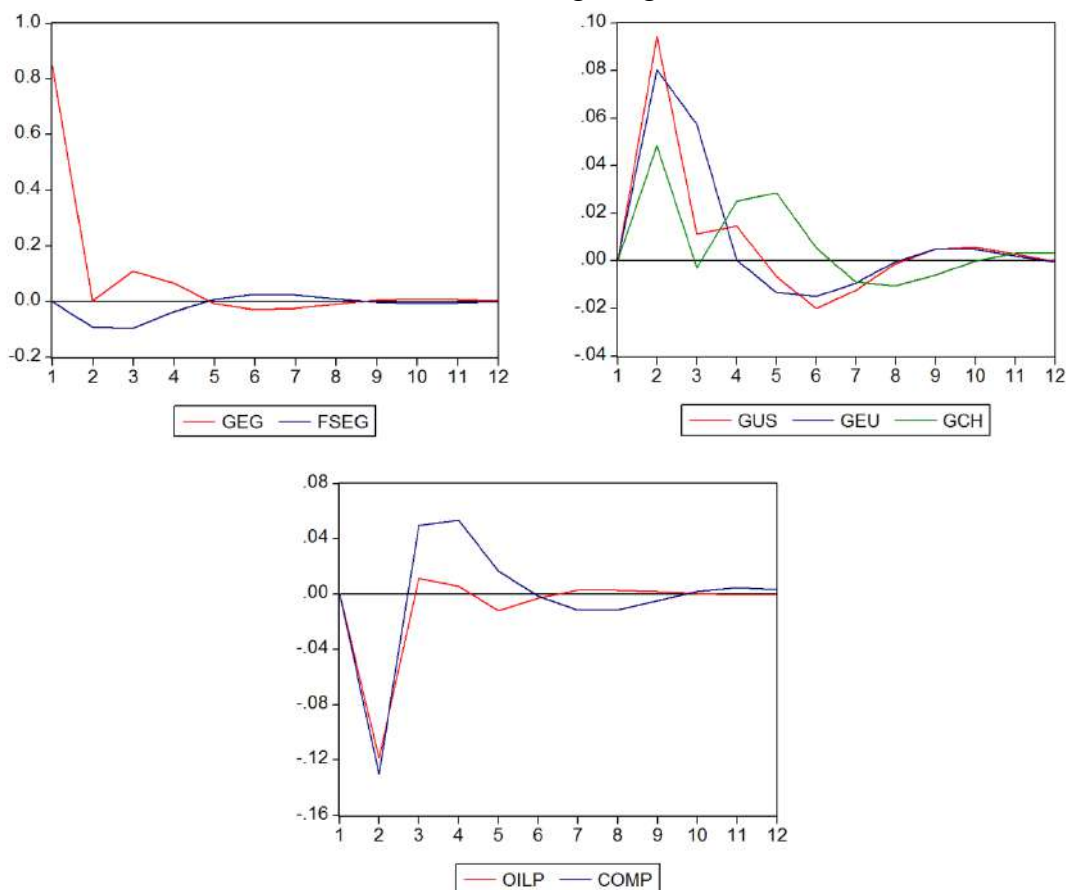
The global financial crisis of 2008 further exacerbated Egypt's economic landscape, resulting in a debt-to-GDP ratio of around 70% in 2010. Analyzing the spillover effects from the crisis, Figure 2 illustrates how increased financial stress and diminished economic activity among Egypt's primary trade partners negatively impacted its real GDP growth. The most pronounced adverse effects stemmed from the economic slowdown of these partners (El-Shal, 2012).

The political upheaval of 2011 triggered a decline in foreign investment and tourism, resulting in significant economic repercussions. In 2016, Egypt secured a \$12 billion loan from the IMF, marking a pivotal step toward reform. Despite this, the debt-to-GDP ratio remained elevated, at approximately 98% in 2017. The Covid-19 pandemic in 2020 introduced additional complexities, with downturns in tourism and global trade leading to a gross debt-to-GDP ratio of 92.7% in 2023—the highest among emerging markets and middle-income economies.

These crises have severely tested the resilience of the Egyptian economy, limiting its capacity to absorb and recover from economic shocks. High debt levels restrict the government's fiscal space, inhibiting countercyclical responses during downturns. Austerity measures often become necessary, reducing public spending and impeding economic recovery. Moreover,

excessive debt heightens vulnerability to external shocks, such as fluctuations in global commodity prices and interest rate changes, further complicating recovery efforts.

Figure 2. Growth rate of Egypt (GEG) impulse response functions to changes across different transmission mechanisms during the global financial crisis



Note: FSEG: Financial Stress Index of Egypt. GUS: Growth rate of the United States. GEU: Growth rate of the European Union. GCH: Growth rate of China. OILP: Year-on-year oil prices change. COMP: Year-on-year commodity prices change.

Source: El-Shal (2012).

The implications of high debt extend beyond fiscal constraints; they also undermine economic resilience through additional channels. Austerity measures have reduced public and private investment, hampering productivity and long-term growth. Currency devaluation has introduced exchange rate volatility, impacting businesses and consumer confidence. Furthermore, increased borrowing costs and limited access to credit restrict business investments, further diminishing economic resilience. Social repercussions, including heightened unemployment and potential unrest, pose additional challenges to the country's political stability. Credit rating downgrades, spurred by persistent debt issues, exacerbate borrowing costs and limit fiscal resources available for critical investment.

Looking to the future, potential debt and financial disruptions loom on the horizon. Egypt's economy may face increased vulnerability due to global economic uncertainties, rising interest rates, and potential geopolitical conflicts that could impact trade and investment flows. The need for robust financial management and proactive measures to mitigate these risks has never been more critical.

To strengthen resilience against these impending challenges, Egypt should implement a comprehensive approach within the framework of The Rumsfeld Matrix. This includes recognizing known knowns, such as economic dependencies, and addressing known unknowns, like potential financial shocks. It is crucial not to wait until crises occur, especially regarding debt crises, as the signs of impending challenges are often evident. Instead, Egypt must focus on addressing the root causes of these issues rather than merely firefighting the symptoms. This entails tackling known knowns and unknown knowns through comprehensive reforms aimed at creating a more stable economic environment. Key initiatives should focus on implementing sustainable fiscal policies, reducing reliance on specific sectors through diversification, and promoting a favorable business environment. Strengthening institutional frameworks, fostering good governance, and investing in long-term reforms are essential steps to enhance Egypt's ability to navigate and recover from economic challenges.

4. Natural Disasters

Natural disasters have emerged as one of the most pressing long-term global risks, ranking among the top five according to the World Economic Forum's 2020 report (Eckstein et al., 2018). This classification encompasses extreme weather events, climate action failures, natural disasters, biodiversity loss, and human-made environmental calamities. The Emergency Event Database (EM-DAT) has documented a staggering increase in the number of individuals impacted by natural disasters over the past decade, tripling to reach approximately 2 billion. In 2022 alone, 387 natural disasters were recorded globally, resulting in 30,704 fatalities and affecting 185 million people, with the economic cost estimated at \$223.8 billion. Europe suffered over 16,000 excess deaths due to heat waves, while Africa dealt with droughts impacting 88.9 million individuals.

While Egypt's geography contributes to a relatively low incidence of natural disasters, the country has still faced significant environmental challenges. Since 1970, Egypt has recorded a total of 32 natural disasters, predominantly floods (13 occurrences) and storms (8 occurrences). Although the frequency of such disasters is lower compared to many regions, issues such as water scarcity, rising temperatures, and sporadic extreme weather events pose ongoing threats to various sectors, including agriculture and infrastructure. These challenges, although not always classified as discrete "natural disasters," represent chronic environmental stressors with potential long-term implications for the nation's resilience and sustainability.

Three major events have marked Egypt's experience with natural disasters since 1970. The 1992 Cairo earthquake caused notable damage to buildings and infrastructure. In 1994, heavy rains led to floods that devastated crops and infrastructure, underscoring the critical importance of effective water resource management. More recently, the Nile Delta floods of 2010-2011, driven by unusual rainfall, highlighted the increasing vulnerability of the region to climate change impacts.

Overall, floods and storms represent the predominant natural disaster threats, necessitating improved preparedness and resilience strategies to mitigate future risks. Between 1970 and 2022, Egypt experienced a variety of natural disasters, with floods being the most significant, resulting in a total of more than 777 deaths and affecting more than 261,133 people across various events. Earthquakes accounted for 552 deaths during the notable 1992 event, impacting 92,649 people. Storms, including sand/dust storms and thunderstorms, caused approximately 152 fatalities and affected thousands, with the 2016 thunderstorms impacting 32,572 people.

Additionally, extreme temperature events, particularly heat waves, have become increasingly concerning, highlighting the growing threat of climate-related disruptions in Egypt.

The relationship between extreme natural events and disaster outcomes is contingent not only on the nature of the events but also on societal resilience and resource availability. As shown in the WorldRiskIndex, Egypt ranks 28th globally, reflecting a significant risk profile with an index score of 17.76, where very high exposure coincides with substantial deficiencies in coping capacities.

Weather-related and health disasters, accounting for nearly 95% of global natural disasters since 1900 (CRED), pose significant threats to economic stability and fiscal sustainability. Our analysis employing a two-way fixed-effects and two-step system general method of moments (GMM) indicates that weather-related disasters in the MENA region from 1980 to 2021 led to immediate growth reductions of approximately 1.1 and 2.0 percentage points, respectively, with long-term declines of about 11.7 and 3.4 percentage points after one year. Health disasters similarly result in short-term growth impacts of around 2.0 and 0.3 percentage points, escalating to reductions of 22.3 and 5.4 percentage points in subsequent years (Table 1). These figures underscore the known knowns of disaster impacts, necessitating proactive strategies to mitigate these predictable threats.

Table 1. Calculated long-run impact of weather-related and health disasters on GDP growth from a dynamic model specification

Explanatory variable	Long-run effect estimate			
	Weather disasters		Health disasters	
	(1)	(2)	(3)	(4)
Long-run disaster dummy	-11.654*		-22.334**	
	(6.687)		(12.949)	
Long-run disaster damage		-3.429*		
		(2.251)		
Long-run total affected				-5.413*
				(3.465)

Note: Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' estimations from Moustafa & El-Shal (2023).

From 1990 to 2020, weather disasters reduced budget and overall fiscal balances in the MENA region by 2.1% and 2.2%, respectively, increasing to 5.4% and 6.2% after one year. Health disasters caused immediate reductions of 0.4% and 0.3% in budget and fiscal balances, with no long-term effects (Table 2). This situation exemplifies the challenges posed by known unknowns, where the lack of preparedness amplifies the fiscal repercussions of these events. The role of government debt in managing such disruptions becomes crucial, as domestic resources like sovereign wealth funds and business taxation have proven more effective than external financing in mitigating the impacts of weather disasters.

Moreover, countries with greater foreign reserves and net savings demonstrate enhanced fiscal resilience against health disasters (Moustafa & El-Shal, 2021). This observation aligns with The Rumsfeld Matrix, highlighting the need for countries to address both known knowns and unknown unknowns. By prioritizing domestic resource mobilization during crises, nations can reduce vulnerability and bolster recovery efforts, ensuring a more robust response framework in the face of emerging disruptions.

Table 2. Calculated long-run impact of weather and health disasters on budget balances from a dynamic model specification

Explanatory variable	Long-run effect estimate			
	Weather disasters		Health disasters	
	Net lending/ borrowing (1)	Overall fiscal balance (2)	Net lending/ borrowing (3)	Overall fiscal balance (4)
Long-run disaster dummy	-5.439** (2.582)	-6.155* (3.570)	-3.350 (13.958)	-26.478 (23.707)
Long-run GDP per capita growth	-0.103 (0.520)	0.261 (0.637)	0.525 (0.787)	-0.398 (0.844)
Long-run debt ratio	-0.057** (0.024)	-0.039 (0.057)	-0.025 (0.029)	-0.010 (0.082)

Note: Robust standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' estimations from Moustafa & El-Shal (2021).

Looking ahead, the frequency and intensity of natural disasters are likely to escalate, driven by climate change and environmental degradation. As global temperatures rise and weather patterns become increasingly erratic, countries like Egypt may face heightened risks from heat waves, flooding, and water shortages. The Nile's variable flow exacerbates concerns about water scarcity, particularly in the context of Egypt's dependence on this vital resource. The predicted increase in extreme weather events necessitates a reevaluation of existing disaster management strategies and underscores the importance of proactive adaptation measures.

The Aswan High Dam, completed in 1970, is essential for regulating the Nile River's flow, preventing floods, storing agricultural water, and generating hydroelectric power, significantly contributing to Egypt's water management and energy needs. Egypt has also modernized its irrigation infrastructure and focused on resilient urban planning to mitigate the effects of population growth and urbanization. Investments in resilient buildings, transportation networks, and critical infrastructure aim to minimize the impact of natural disasters on communities. Furthermore, Egypt has enhanced its early warning systems for weather forecasting and implemented earthquake early warning systems, despite not being on a tectonic plate boundary. Technological innovations, such as modern communication for rapid alert dissemination and Geographic Information Systems (GIS) for mapping vulnerable areas, play a crucial role in disaster preparedness.

While Egypt has made notable strides in disaster preparedness, challenges remain, particularly in high-density urban areas like Cairo, which houses over 20 million people, complicating evacuation logistics. In 2021, total government expenditure was 26.1% of GDP, indicating a need for budget allocation toward disaster preparedness initiatives. Climate change has also intensified challenges, with a 1.8°C temperature rise above pre-industrial levels in 2020, requiring enhanced adaptation strategies. Water scarcity is a critical concern, with per capita availability at 600 cubic meters in 2021, well below the international threshold of 1,000 cubic meters. Approximately 60% of Cairo's population lives in informal settlements, adding further vulnerability during disasters.

To enhance its resilience against natural disasters, Egypt should focus on addressing known vulnerabilities and preparing for potential unknown risks, as highlighted in The Rumsfeld Matrix. This framework emphasizes understanding the known knowns, known unknowns, unknown knowns, and unknown unknowns in disaster preparedness. Specifically, the country needs to transition from reactive firefighting measures to proactive strategies that address root

causes of vulnerability, particularly in high-risk urban areas and informal settlements. Integrating climate resilience into national policies and investing in infrastructure improvements will be critical for reducing the impacts of future natural disasters.

Additionally, enhancing early warning systems and fostering community awareness will improve response times and minimize casualties. By leveraging technological advancements, such as GIS and improved meteorological capabilities, Egypt can better anticipate and respond to environmental challenges. Moreover, investing in sustainable urban planning and infrastructure can help mitigate the effects of natural disasters, particularly in densely populated areas like Cairo, which faces unique logistical challenges during emergencies.

5. Disease Outbreaks

Since 1970, Egypt has faced multiple disease outbreaks, challenging public health and impacting the economy.

5.1 The Road to Covid-19

Egypt has faced repeated avian influenza (H5N1) outbreaks since 2006, with over 350 human cases and 120 fatalities (36% case fatality rate) recorded from 2006 to 2017, making it one of the few endemic countries for this virus (FAO, 2023). The avian flu's impact extended to poultry production, which supports around 30% of income for Egypt's small-scale farmers, and disruptions resulted in significant economic losses, including a \$0.5 billion hit to the economy between late 2005 and early 2006 (Hosny, 2006).

The Egyptian government (GoE) took extensive action to control the disease, including mass poultry vaccinations, the culling of over 40 million birds, and forming the National Influenza Pandemic Executive Committee (NIPEC) in collaboration with WHO and FAO. These interventions were complemented by the establishment of 230 epidemiological units nationwide, the training of 15,000 veterinary personnel, and the improvement of laboratory facilities, all geared toward increasing Egypt's capacity to manage disease outbreaks (FAO, 2023). However, persistent challenges remain due to widespread backyard farming and limited biosecurity measures across Egypt's 40,000 poultry farms, which continue to elevate food security risks. Additionally, building public trust, especially in rural communities where skepticism persists, remains critical for fostering cooperation in adopting public health advisories.

Egypt's response to the H1N1 swine flu outbreak in 2009, which resulted in over 16,400 cases and 282 fatalities, underscored key gaps in pandemic preparedness and led to several improvements. These included the need for clearer pandemic plans, enhanced electronic surveillance, expanded stockpiles for antiviral drugs, and improved PPE manufacturing capacity. Despite implementing an updated pandemic response strategy, a low public demand for vaccines highlighted the need for stronger health education and vaccine marketing efforts. Furthermore, coordination between public and private health sectors was strengthened after the outbreak to avoid overburdening the public sector.

Following the 2009 pandemic, the GoE enhanced its surveillance system, which proved essential during the 2014 MERS-CoV scare. While Egypt experienced limited MERS cases due to low human-to-human transmission, proactive surveillance and infection control were applied, including hospital-based measures and airport screenings for high-risk individuals. To

curb MERS's spread, travel advisories targeted high-risk groups, particularly during pilgrimage seasons. Overall, these health disruptions reinforced the importance of resilient infrastructure, coordinated responses, and public trust—factors critical to managing future infectious threats.

Egypt's ongoing battle with health crises underlines the unpredictability of disease outbreaks, positioning them within the “known unknowns” of The Rumsfeld Matrix. As global warming and urban population growth continue, Egypt faces heightened vulnerability to future natural disasters like extreme weather events, which may escalate both known and emerging disease risks. The economic disruptions caused by climate change underscore the need for Egypt to prepare for more frequent health and environmental challenges. Proactively strengthening health and disaster response systems will be vital in reducing the impact of future natural disasters and disease outbreaks on the economy and public health.

Applying The Rumsfeld Matrix framework, Egypt can enhance resilience by addressing both known and unknown risks associated with future outbreaks. Strengthening biosecurity in the poultry sector, enhancing public health outreach, and integrating real-time data and surveillance technologies can bolster preparedness against known threats. For unknown threats, Egypt should invest in adaptive response frameworks that include emergency stockpiles, flexible healthcare infrastructure, and rapid response teams equipped to handle unforeseen disruptions. By fostering public trust and establishing strong communication channels, especially in rural areas, Egypt can also increase public compliance with health guidelines, thereby reinforcing the country's resilience against diverse health threats.

5.2 Covid-19 Onset

The onset of the Covid-19 pandemic in 2019 profoundly affected Egypt, prompting extensive public health measures and causing significant disruptions to the healthcare system, economy, and social protection framework. Since previous research has addressed Covid-19's impacts on public health and the macroeconomy, this section focuses on three areas: (1) the resilience of Egypt's healthcare system, (2) household resilience prior to the pandemic, and (3) the role of social protection in strengthening resilience.

5.2.1 Preparedness and Resilience in Healthcare

During disease outbreaks, healthcare systems experience increased demand to manage affected populations, compounded by potential fatalities and illnesses among healthcare providers, damage to health facilities, and interruptions to essential services (e.g., electricity, water, sanitation, and supply chains). These disruptions strain the resilience of a country's healthcare system, disproportionately impacting vulnerable groups, such as pregnant women and children, both during and after outbreaks. Effective emergency preparedness and response can help alleviate these impacts, alongside other factors, such as healthcare personnel density, water, sanitation, and hygiene (WASH) access, universal health coverage (UHC), education, gender equality, and financial inclusion (El-Shal et al., 2022).

Egypt's health system, prior to the emergence of Covid-19, demonstrated a mix of strengths and weaknesses. A relatively well-established health infrastructure comprised 1,798 hospitals, 5,352 basic health units, and various healthcare facilities strategically distributed across urban and rural areas in 2020. Furthermore, a workforce of 121,394 doctors and 225,765 nurses contributed significantly to healthcare capacity (CAPMAS, 2023). However, Egypt's health

system faced major challenges, particularly in resource allocation, which were evident in stark disparities between urban and rural access to healthcare. While urban regions, home to 43% of the population, had superior healthcare access, rural areas with 57% of the population suffered from limited facilities and resources. Financial barriers further compounded these issues, with around 59% of healthcare costs being paid out-of-pocket, raising concerns about equitable healthcare accessibility and financial feasibility for the Egyptian population (WHO, 2023). Government spending on healthcare remained limited, with health expenditure declining from 5.4% of the total budget in FY 2014/15 to 4.7% in FY 2019/20.

These disparities led to inconsistencies in healthcare access and service quality. Furthermore, coordination gaps in emergency response were exposed during the initial stages of the Covid-19 pandemic, revealing the need for enhanced readiness for large-scale health emergencies. Subsequent to the early phases of the pandemic, Egypt, along with many other countries, reevaluated and sought to bolster its health system in response to global health crises, while simultaneously preparing for future outbreaks. The 2019 WHO Global Preparedness Monitoring Board (GPMB) report highlighted this necessity, emphasizing the urgent need for countries to strengthen preparedness against health emergencies that could threaten to erode recent gains in health outcomes (GPMB, 2019).

Egypt ranks in the lowest quartile for global health preparedness, as evidenced by its Global Health Security (GHS) Index score. This index, which assesses 195 countries' capacity to prevent and manage epidemics, assigned Egypt an average score of 28 out of 100 in 2021, placing it at 153rd worldwide (Bell & Nuzzo, 2021) (Table 3).

Table 3. Global Health Security (GHS) Index for Egypt

	2019 Score	2021 Score	2021 Global average
Prevention	19.1	15.7	28.4
Detection and reporting	18.3	18.9	32.3
Rapid response	32.7	20.9	37.6
Health system	16.5	18.8	31.5
Compliance with international norms	34.2	33.3	47.8
Risk environment	61.0	60.3	55.8
Total	30.3	28.0	38.9

Source: GHS Index

These statistics underscore the need for Egypt to focus on UHC, as well as to address gaps in public health emergency response. Egypt's UHC index of service coverage improved from 50 in 2000 to 62 in 2010 and further to 68 in 2017. Notably, while Egypt's UHC score matches the MENA regional average, it lags behind the LAC region (75). The absence of sufficient political and budgetary commitment has been a significant obstacle to Egypt's UHC advancement.

Historically, Egypt's drive toward UHC began in the early 1990s with an emphasis on extending health insurance coverage. However, a focus on rapid expansion neglected the financial sustainability of healthcare services, leading to compromised quality. Later, in 1997, the Health Sector Reform Program (HSRP) sought to offer universal access to a "basic benefits package (BBP)," improving maternal and child health outcomes. However, challenges in financial stability and waning political commitment limited its long-term impact (El-Shal et al., 2021a; El-Shal et al., 2021b; El-Shal et al., 2023).

The Egyptian constitution's Article 18 in 2014 aimed to achieve UHC, followed by the issuance of a universal health insurance law in 2017, though implementation has been slow. The health insurance scheme, designed in six phases over 14 years, was initially rolled out in 2018 but has yet to be comprehensively evaluated.

Our analysis of data from 2000 to 2019 across 111 countries shows that health disasters significantly elevate key health indicators, including Maternal Mortality Ratio (MMR), Under-5 Mortality Rate (U5MR), and Neonatal Mortality Rate (NMR). Disasters are associated with immediate increases of 0.3%, 0.3%, and 0.2% in maternal, under-5, and neonatal mortalities, respectively, with prolonged effects leading to increases of 35%, 80%, and 26% after one year (El-Shal et al., 2022).

Our findings demonstrate that preparedness factors within healthcare, macroeconomic, and institutional domains can mitigate the effects of disasters. Healthcare system readiness, including detection, assessment, notification, and response capacity, notably reduces the impact of health disasters. For example, a one-unit increase in preparedness correlates with a 0.3%, 0.1%, and 0.01% reduction in the impacts on maternal, under-5, and neonatal mortality in LMICs, respectively. Risk communication also proved vital, reducing maternal and under-5 mortality impacts by 0.2% and 0.05% per unit increase in its index.

Additionally, economic resilience factors such as GDP per capita, physician density, and UHC play pivotal roles. For instance, each 1% increase in GDP per capita mitigates maternal, under-5, and neonatal mortality by 26%, 5%, and 0.4%, respectively. Gender equality and educational attainment also correlate with disaster impact reductions, with increased female education completion rates and legal rights access for women decreasing maternal, under-5, and neonatal mortality rates.

Infrastructural factors, particularly WASH, further buffer populations against disaster impacts. A 1% increase in access to safe drinking water, sanitation, and handwashing facilities absorbs nearly 1% of the adverse maternal mortality effects of disasters.

To enhance resilience against health disasters, we propose a series of recommendations grounded in the Rumsfeld Matrix framework, which categorizes knowledge into known knowns, unknown knowns, known unknowns, and unknown unknowns.

First, strengthening emergency management policies addresses known knowns—the strategies and protocols that are already understood to improve disaster responses. By enhancing policies related to surveillance, response, and risk communication, we can significantly mitigate the impacts of health disasters. Preparing for pandemics, a known risk, will yield high returns by establishing public trust and aligning with Sustainable Development Goals (SDGs), as emphasized in the Global Preparedness Monitoring Board (GPMB) report from 2019.

Second, prioritizing UHC is essential for addressing known unknowns—areas where we understand the need for equitable access to healthcare but face uncertainties in implementation and coverage. UHC facilitates access to necessary services and alleviates financial strain, thereby strengthening the system's ability to absorb the impacts of health disasters.

Third, promoting gender equality and supporting female education are crucial strategies for navigating both known unknowns and unknown unknowns. Enhancing female education improves household capacities to respond effectively to health shocks. Societies that prioritize

gender equality are typically better positioned to mitigate the effects of disasters through collaborative action and community resilience, even in the face of unforeseen challenges.

Fourth, enhancing financial inclusion and infrastructure tackles unknown knowns—the gaps in existing systems that are recognized but not fully utilized. Strengthening financial systems, particularly by incorporating remittances and inclusive finance mechanisms, provides an economic buffer during crises, helping families and communities navigate the aftermath of health disasters.

Finally, investing in health infrastructure addresses known knowns and known unknowns related to public health preparedness. Expanding WASH systems and healthcare facilities is crucial for controlling outbreaks, especially following disasters that disrupt essential services. By focusing on these areas, Egypt can improve its overall public health response, bolster resilience, and better prepare for both anticipated and unanticipated health emergencies.

5.2.2 Community Resilience

Household resilience in Egypt before the Covid-19 pandemic was influenced by a complex interplay of socio-economic factors, with many families facing challenges in maintaining stability amid economic uncertainties. Factors such as income levels, access to social support networks, and exposure to economic shocks contributed to varying degrees of resilience. Urban-rural disparities were significant, as rural households often experienced higher poverty rates and limited resources. Informal employment was widespread, particularly in urban areas, leading to income instability and limited access to formal social protection mechanisms.

The Covid-19 pandemic significantly impacted the well-being of Egyptian households, affecting both the poor and non-poor in the short and long terms. According to the Covid-19 Egypt multiplier model by Breisinger et al. (2020), average household income decreased by an estimated 7.5% (EGP 405) per month during the fourth quarter of FY2019/2020. This reduction was primarily driven by a slowdown in the services sector, followed by manufacturing and lower remittances. The absolute loss in household income was primarily incurred by the non-poor; however, the percentage loss was equal for both poor and non-poor households, with urban households being the most affected. Urban poor households lost an estimated 10% (or EGP 271) of their income, while urban non-poor households experienced a loss of 9% (or EGP 740). In rural areas, the poor faced a 6% (or EGP 168) loss, while urban non-poor households experienced a 6% (or EGP 359) loss.

Data from two waves of the Covid-19 MENA Monitor Household (CMMHH) survey conducted in February and June 2021 provide important insights into the impact of Covid-19 on Egyptian households over time. In February 2021, approximately 42% of respondents reported a decrease in household total monthly income compared to the previous year. Among those reporting a decrease, one-fifth noted a reduction of 1-25%, while 22% experienced a decline of more than 25%. By June 2021, the situation had worsened, with 47% of respondents indicating a decrease in income compared to February 2020. Among this group, approximately 22% reported a decrease of less than a quarter, and a quarter reported severe income loss.

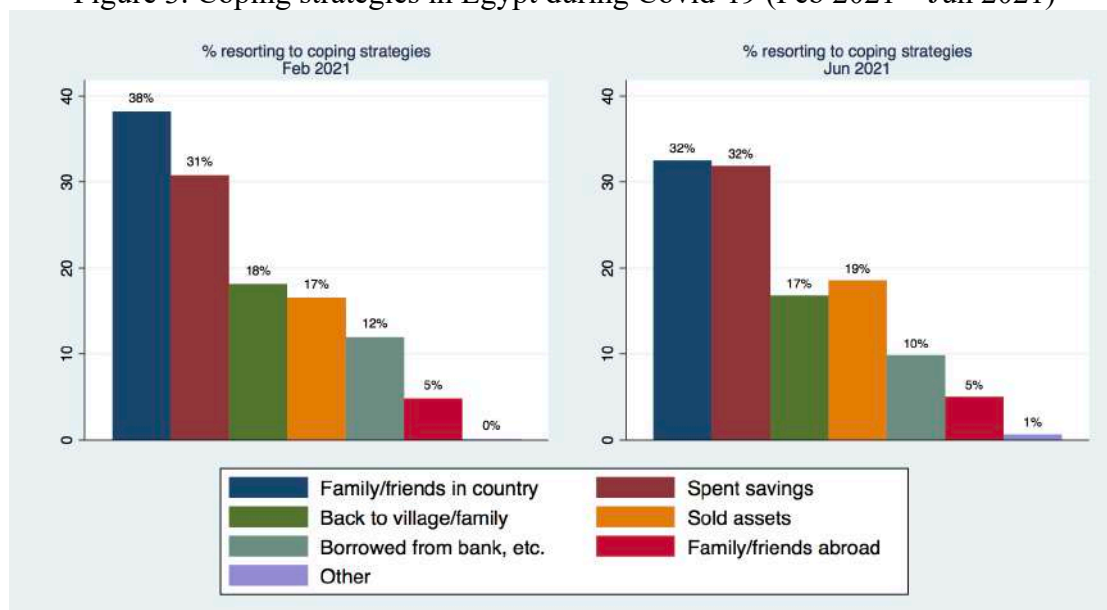
The situation was more dire for those classified as poor. Our analysis revealed that about 48% of poor respondents reported a decrease in income in February 2021, with severe income loss becoming increasingly common by June 2021. Income loss varied significantly across governorates, with more than half of the poor in 14 governorates experiencing some form of

income loss in June 2021. The burden of income loss on the poor appeared to be increasing rather than stabilizing, with severe income loss reported by more than one-third of the poor in five governorates.

Households grappling with income loss often resorted to adverse coping strategies, which hindered development and impeded poverty alleviation efforts. Our weighted analysis indicates that since February 2020, two-thirds of Egyptian households adopted coping strategies, a trend that persisted until June 2021. These strategies included depleting savings, seeking assistance from family and friends, and selling assets. Among the poorest income quartile, the percentage of households utilizing coping strategies increased from 66% in February to 70% in June 2021, while a slight decrease was observed in the wealthiest quartile.

The analysis of coping strategies revealed that resorting to family and friends was the most prevalent, with about 38% of respondents reporting this approach in February 2021, followed by utilizing savings. While depleting savings and selling assets are well-documented as short-term survival strategies, they often lead to negative long-term effects on welfare and productivity. Households that adopted these strategies risk falling into poverty traps, exacerbating their vulnerability (Figure 3).

Figure 3. Coping strategies in Egypt during Covid-19 (Feb 2021 – Jun 2021)



Source: Authors' computations based on CMMHH survey data.

The impact of income loss during Covid-19 also significantly affected food security in Egyptian households. Although the government ensured an adequate food supply, food insecurity primarily stemmed from demand-side factors, such as decreased purchasing power. Our findings indicate that approximately 46% of respondents attributed their inability to purchase sufficient food to reduced household income. In the first half of 2021, nearly two-thirds of Egyptians reported changes in their food situation, with 43% having to reduce meal sizes or the number of meals consumed.

The disproportionate effects of the pandemic on the poor highlight their vulnerability to food insecurity, as they typically allocate a large share of their income to food. In the first half of 2021, around three-quarters of poor respondents experienced changes in their food situation,

with over half reporting their inability to buy their usual amount of food due to income drops and rising prices.

Overall, the Covid-19 pandemic exposed and exacerbated existing vulnerabilities within Egyptian households, leading to significant income losses and increased reliance on harmful coping strategies. The Rumsfeld Matrix framework allows us to categorize the knowns and unknowns impacting household resilience, emphasizing the need for targeted policies to strengthen social safety nets and economic inclusion, particularly for vulnerable populations. Addressing disparities and enhancing support systems are crucial for building a more resilient household framework in Egypt.

5.2.3 Social Safety Nets for Resilience

The pre-existing social protection challenges in Egypt laid the groundwork for vulnerabilities further exacerbated by the Covid-19 pandemic. High poverty rates persisted, revealing significant disparities between urban and rural areas. Limited access to essential services like education and healthcare perpetuated poverty, particularly in marginalized regions. The prevalence of an informal economy left many without job security or social benefits, hindering access to crucial protection measures. Inequality in service access was pronounced, with rural areas facing greater challenges than urban counterparts. Youth unemployment remained significant, aggravated by a mismatch between educational qualifications and job market demands. Limited social insurance coverage left many vulnerable to economic shocks, while food insecurity persisted due to rising prices and inadequate nutrition, further impacting vulnerable populations.

In response to these challenges, the Egyptian government implemented various measures during the pandemic. According to the International Food Policy Research Institute (IFPRI), these interventions included cash transfer programs, pension increases, food price controls, and food aid. In March 2020, irregular workers applied for financial assistance of EGP 500 per month as part of a EGP 100 billion stimulus package. The initial aid distribution in April 2020 identified 1.5 million eligible workers, with subsequent batches increasing applicants to 6 million, ultimately identifying 2.26 million eligible workers. The distribution of the first batch for this second stage took place in December 2020, using e-vouchers for all distributions (Table 1).

The Takaful and Karama cash transfer program also expanded in April 2020, adding 100,000 households and increasing its budget to EGP 19.3 billion. By November 2021, beneficiaries for Takaful and Karama were approximately 2.1 million and 1.3 million, respectively, according to the Ministry of Social Solidarity (MoSS). Other measures included a 14% increase in pensions for all pensioners starting July 1, 2020, and fixed prices for flour and bran at EGP 3,600 per ton to regulate bread prices.

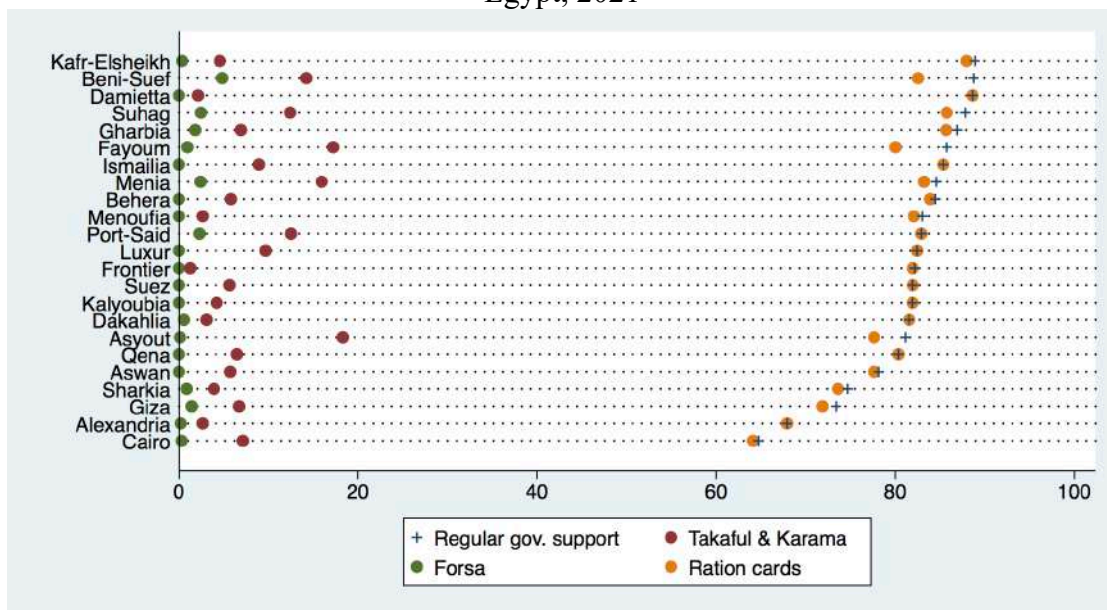
Additionally, a significant intervention was food aid provided through collaboration between the government and Misr El Kheir. In May 2020, two convoys were launched, distributing 95,000 food boxes to impoverished families. The recently released Egypt Human Development Report 2021 highlighted further support, including basic food items and medical protection gear distributed in eight governorates in Upper Egypt.

The CMMHH survey indicates that, in May 2021, 8% of respondents reported receiving non-usual government support, an increase from 4% in January 2021. However, the effectiveness

and comprehensiveness of these strategies varied, with some social protection challenges persisting. Sustaining commitment to addressing these issues is crucial for the well-being and resilience of Egypt’s population, particularly in preparing for future disruptions.

Estimating whether social safety nets (SSNs) mitigated food insecurity from November 2020 to June 2021, our findings revealed no impact of non-usual government support on food insecurity. In contrast, estimates for the MENA region show that such support effectively mitigated the adverse impact of food insecurity on resorting to detrimental coping strategies, such as selling assets (El-Shal et al., 2024). Notably, around 79% of respondents reported receiving regular government support in 2021, with over two-thirds of respondents across governorates receiving regular support, except for Cairo. While ration cards dominate government support, newer programs like Takaful and Karama are gaining traction (Figure 4).

Figure 4. Weighted percentages of beneficiaries receiving regular government support in Egypt, 2021



Source: Authors’ computations based on CMMHH survey data.

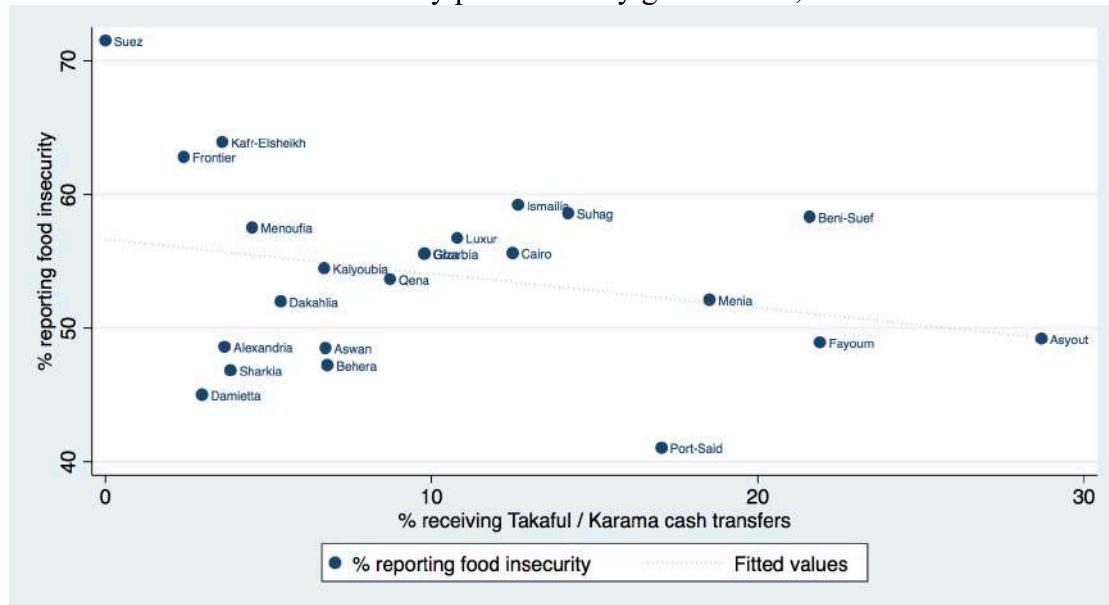
Our analysis suggests a negative association between Takaful and Karama coverage and the prevalence of food insecurity among the poor (see Figure 5). In light of The Rumsfeld Matrix, the existing challenges in social protection can be viewed as known knowns, while effective responses represent known unknowns that need to be addressed to improve resilience. Systematic challenges related to social protection in Egypt amid Covid-19 must be addressed to enhance preparedness for future disruptions. These constraints, including limited fiscal space, targeting challenges, and delivery issues, likely influence government responses.

Egypt’s fiscal capacity is constrained by suboptimal revenue generation and a rigid budget structure, exacerbated by significant interest payments on public debt and limited budget allocations for vital sectors. Achieving fiscal consolidation while increasing allocations for social protection, education, health, and infrastructure development is essential.

Targeting challenges within social protection remain significant. Although the government has sought to address the socio-economic difficulties faced by low-income households through SSNs, only a small portion of the population benefits, indicating imprecise targeting (Krafft et al., 2021). According to the CMMHH survey, only 12% of households reported receiving

regular social assistance or Covid-19-related aid, with assistance poorly targeted. The targeting appears ineffective, as only 20% of the poorest quartile in the Egyptian sample received government aid, and only 14% of informal regular wage workers benefited from government assistance.

Figure 5. Weighted percentages of Takaful and Karama coverage of poor beneficiaries and food insecurity prevalence by governorate, 2021



Source: Authors' computations based on CMMHH survey data.

Delivery challenges also persist within social protection in Egypt. While the design aligns with international best practices, implementation and delivery require thorough improvement. Ensuring effective delivery of social assistance and guaranteeing timely benefits to intended recipients is imperative. Digitizing social protection mechanisms is crucial for streamlining enrollment and facilitating the digital disbursement of assistance.

6. Conclusion

The Egyptian economy must navigate a complex landscape of disruptions, from geopolitical conflicts to natural disasters, each posing significant challenges to its stability and sustainability. By adopting a multifaceted approach that enhances resilience through economic diversification, robust social safety nets, and effective governance, Egypt can better prepare for both the known knowns and known unknowns that threaten its economic landscape. Furthermore, by acknowledging and addressing the unknown knowns and unknown unknowns—such as unforeseen crises and vulnerabilities embedded in existing systems—Egypt can build a more resilient framework that not only mitigates the impacts of current challenges but also fosters long-term stability and adaptability in an ever-evolving global context.

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