Assessing the Contribution of the Global Fund in the fight against Malaria: A case of sub-Sahara Africa and Southeast Asia Economies.

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Abstract

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This thesis investigates the effectiveness of Global Fund financing in malaria control in sub-Sahara Africa and Southeast Asia regions using a sixteen year dataset from 2005 to 2020. Employing quantitative methods and non-experimental descriptive research design, the study found that Global Fund exerts significant negative impact on incidence of malaria in sub-Sahara Africa and Southeast Asia. In addition, the findings show that education, country policy and institution assessment, and gross domestic product are key factors influencing the effectiveness of the Global Fund financing for malaria control within sub-Sahara Africa and Southeast Asia regions. In relation to sub-Sahara Africa the study found that Global Fund, education, country policy and institution assessment, and gross domestic product exert significant negative impact on malaria incidence. However, in Southeast Asia, Global Fund, education, and gross domestic product failed to exert significant statistical impact on malaria incidence with the exception of country policy and institution assessment which showed negative impact on malaria incidence. These findings have implications for the international donor community and the health sector authorities of countries in the territories used for this study, as this would contribute to the ongoing efforts to combat malaria and improve global health outcomes. In conclusion, the study highlight the need for region-specific approaches that consider local socio-economic and political contexts, suggesting that a "one-size-fits-all" model is less effective in global malaria control.

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1 Introduction

Malaria is one of the infectious diseases caused by Plasmodium species that affects humans and other animals. It is considered as one of the most worrisome vector-borne infectious diseases plaguing sub-Saharan Africa (SSA) and Southeast Asia (SEA) countries in spite of numerous efforts geared towards it and the fact that it is curable and preventable. Scholars such as Li et al. (2024) show that the prevalence of malaria particularly in sub-Saharan Africa and Southeast Asia regions is vast, where it remains a leading cause of morbidity and mortality. In the World Health Organization (WHO) (2019), report, it is clear that most malaria cases in 2018 were in the WHO African Region 93%, followed by the WHO Southeast Asia Region with 3.4% of the cases and the WHO Eastern Mediterranean Region with 2.1%. Further, nineteen countries in sub-Saharan Africa and India carried almost 85% of the global malaria burden. In 2022, there were 249 million cases of malaria worldwide resulting in an estimated 608,000 deaths (WHO, 2023). Approximately 95% of the cases and deaths occurred in sub-Saharan Africa and Southeast Asia countries, and the most deaths are caused by Plasmodium falciparum (P. falciparum). In the WHO 2021 report, it was indicated that Southeast Asia faces substantial malaria transmission issues, with countries such as Myanmar, Thailand, and Cambodia reporting a significant number of cases. The disease poses a considerable economic burden on these regions, affecting workforce productivity and straining already limited healthcare resources.

Essentially, efforts to combat malaria have evolved over the years, with international organizations like the Global Fund leading the way in funding and supporting control programs. Sarpong and Bein (2021) argue that foreign assistance from donor nations is among several avenues available to finance basic health programs and is a significant source of funding for many low-income nations. The Global Fund, established in 2002, is a partnership designed to accelerate the end of AIDS, tuberculosis, and malaria as epidemics (Global Fund, 2022). Its contributions to the fight against malaria has been enormous and include direct funding for preventive measures, treatment, and research, along with advocacy and policy support according to Zelman et al. (2014). These efforts are vital in resource-limited settings where health infrastructures are often underdeveloped and struggle to manage endemic diseases effectively (Global Fund, 2022). Further, in sub-Saharan Africa, the Global Fund has been instrumental in financing insecticide-treated nets distribution, supporting indoor residual spraying, and enhancing diagnostic capacities through rapid diagnostic tests. These interventions have contributed to significant improvements in malaria control efforts in many countries and these have resulted a reduction in malaria morbidity and mortality. According

to the WHO 2020 report, the number of malaria cases in sub-Saharan Africa fell from an estimated 213 million in 2000 to 173 million in 2018. Additionally, the number of malaria deaths in the region fell from an estimated 765,000 in 2000 to 384,000 in 2018. Komatsu et al. (2010) argue that while there are multiple factors that have contributed to these reductions, the global fund financing has played a critical role in supporting these efforts.

In Southeast Asia, Narain (2008) highlights the significant role of the global fund in supporting malaria control efforts in the region. Since an estimated number of 80% of the population are at risk of the disease, various interventions to control and eliminate malaria, including the distribution of insecticide-treated bed nets, the provision of rapid diagnostic tests and effective antimalarial drugs and the implementation of indoor residual spraying has been supported by the global fund. Since its founding, the global fund has invested more than USD 7 billion in the fight against malaria in Southeast Asia, resulting in noteworthy progress in reducing the burden of the disease. For example, between 2010 and 2019, malaria cases in the region declined by 43%, and malaria-related deaths fell by 69%. The authors attribute this progress to a combination of increased investment in malaria control efforts, improved access to diagnostics and treatment, and the strengthening of health systems. Whereas the incidence of malaria in this region is lower than in sub-Saharan Africa, certain Southeast Asian countries nevertheless have a substantial number of incidence.

The Global Fund's approach extends beyond funding to include technical assistance, policy guidance, and support for local capacity-building initiatives. For instance, the Fund's investments in health infrastructure, training, and community engagement empower local actors, enabling countries to take ownership of malaria programs and ensure that gains are sustained over time. The Fund also collaborates with other international organizations, such as the WHO and the United Nations Children's Fund (UNICEF), to align strategies, optimize resources, and avoid duplication of efforts (Global Fund, 2022). Despite the Global Fund's extensive contributions, challenges persist. The Fund faces the ongoing threat of drug and insecticide resistance, limited healthcare access in rural and remote areas, and the need for continuous financing to sustain gains. By understanding and assessing the Global Fund's contributions, policymakers and stakeholders can identify opportunities for strengthening malaria response strategies and explore ways to overcome these obstacles.

In light of these, this thesis seeks to examine the role of Global Fund in malaria control, identify the key factors influencing the funds performance and assess the effectiveness of its resource allocation strategies in sub-Saharan Africa and Southeast Asia for the period

2005 to 2020. In this regard, answers to the following questions will be provided: (1) What is the relationship between the Global Fund and the incidence of malaria in sub-Sahara Africa and Southeast Asia? (2) What are the key factors that influences the effectiveness of the Global Fund financing for malaria control? and (3) What are the differences in the effects of the Global Funds on malaria incidence in sub-Sahara Africa and Southeast Asia comparatively? The findings of this study will provide valuable insights into the impact of global health financing on malaria control efforts and inform policy decisions related to the allocation of resources for malaria control in sub-Sahara Africa and Southeast Asia. This study is novel in the implication of the Global Fund on malaria in sub-Saharan Africa and Southeast Asia areas using recent data from 2005 to 2020. During the time frame of the study, approximately $7.2 billion was allocated on malaria control and elimination efforts.

The remainder of the thesis proceeds as follows. Section 2 reviews the literature on the Global Fund and malaria incidence, impact of donor funding and aid financing on health and obstacles to the Global Fund financing. Section 3 presents the methodology and the data. Section 4 presents the results. Section 5 discusses the findings and finally Section 6 looks at the implications, limitations, conclusion and recommendations.

2 Literature Review

The following literature provides further insight into the predominant factors that affect the effectiveness of the Global Fund in fighting malaria in sub-Sahara Africa and Southeast Asia.

Global Fund is one of the important indicators examined by the study. According to (WHO (2019)), Global Fund plays an important and pivotal role in the fight against malaria, especially in low- and middle-income countries. It is posited that through the principle of public-private partnership, the Global Fund provides financial resources to countries heavily burdened by malaria, empowering them to enhance healthcare infrastructure, distribute insecticide-treated mosquito nets, and ensure wider access to antimalarial treatments according to the (WHO (2021)) report. Insights from the Global Fund (2024) report on malaria show that the Fund provided 62% of all international financing for malaria programs and invested more than US$19.1 billion in malaria control programs as of June 2024. Furthermore according to Atun, Silva, and Knaul (2017), Global Fund's investment correlates with notable reductions in malaria incidence across different regions, as countries rely on its funds to sustain long-term malaria control programs. Additionally, Global Fund (2024), report show that global fund investments are making an impact. In countries where the Global Fund invests, malaria deaths have dropped by 28% between 2002 and 2022. Without these interventions, malaria deaths would have increased by 90% over the same period. The Global

Fund further supports local health systems by fostering partnerships with governments, non-governmental organizationss, and community organizations, strengthening national capacity to respond to health crises. While effective, the Global Fund's impact has been constrained by factors such as political instability, weak local health systems, and inconsistent donor support, which affect fund disbursement and the efficacy of malaria interventions.

The incidence of malaria is another constructs examined by the study. According to WHO (2022) report, the incidence of malaria reflects the number of new cases in a population over a specific period and is a primary indicator of malaria control effectiveness. It has been reported that sub-Saharan Africa bears the highest malaria burden, accounting for about 95% of cases globally, largely due to favorable climatic conditions for malaria-carrying Anopheles mosquitoes and widespread poverty (WHO, 2022). Within the context of Southeast Asia, it has been reported that malaria transmission persists, though at lower levels, due to improved health interventions and differing transmission dynamics (WHO, 2019). In addition, in the study by (Snow et al. (2012)), the authors report that factors influencing malaria incidence include socioeconomic conditions, availability of health infrastructure, and public health efforts, such as vector control and early treatment. The report further states that interventions funded by the Global Fund have proven effective in reducing malaria incidence by increasing access to preventive measures and treatments. Despite this, Global Fund (2024) report, and previous study by Ashley and Poespoprodjo (2020) suggest that obstacles such as drug-resistant malaria strains in Southeast Asia and logistical challenges in remote Sub-Saharan areas complicate these efforts, necessitating region-specific strategies.

Education is one of the critical variables examined within the context of this study. Gamble, Ekwaru, and Kuile (2006) show that education is a vital factor in malaria control as it raises public awareness and influences health behaviors. Mackenbach and Kunst (1997) suggest that educated individuals are more likely to use preventive measures, such as mosquito nets and repellents, and to seek treatment promptly, reducing malaria transmission within communities. The authors emphasize that post-secondary education is especially important in affecting newborn mortality, life expectancy and child vaccination. Education allow people to cultivate an extensive variety of skills and characteristics (such as intellectual and problem-solving abilities, learning effectiveness, and personal control) that incline them to better health conditions (WHO, 2019)). Within the context of sub-Saharan Africa, it has been reported that educational programs integrated with malaria interventions have shown promising results in improving prevention practices and treatment adherence. In WHO (2019), report it was indicated that education propels community engagement and supports

policy initiatives that aim to control malaria, as a well-informed public advocates for effective healthcare services. Moreover, in Southeast Asia, where literacy rates are generally higher than in sub-Saharan Africa, education have been indicated to play a critical role in overcoming malaria issues and preventive practices (Chongsuvivatwong et al. (2011)).

The Country Policy and Institutional Assessment (CPIA) is also another critical variable examined by the study. According to World Bank (2022) report, CPIA is considered as an index used by the World Bank to assess policy and institutional quality, which strongly influences a country's health program effectiveness. It is important to establish that CPIA scores are essential for comprehending how well policies, governance, and institutional frameworks support malaria control efforts. In addition, Grépin and Dionne (2013) show that higher CPIA scores are associated with effective public health policies, transparent governance, and robust healthcare systems, factors crucial when it comes to incidence of malaria. In sub-Saharan Africa and Southeast Asia, countries with stronger institutional assessments and well-regulated health sectors have demonstrated better capacity for implementing Global Fund-supported malaria interventions. On the contrary, weak institutional environments, characterized by corruption, lack of accountability, and poor policy implementation, hinder malaria control efforts. For instance, countries with lower CPIA scores often face challenges in fund allocation, resource management, and policy execution, limiting the Global Fund's impact.

According to Gyimah-Brempong (2015), good governance and the prevention of corruption are necessary for efficient utilization of national and international funds for healthcare hence this issue deserves a lot of attention. The significance of Global Fund financing in disease control and prevention can only be grasped by placing this stance in its proper context. It should be noted that the Global Fund does not expressly indicate in its official policy documents that it is attempting to promote or assure good governance in management of its money.

Gross Domestic Product is another important construct examined by the study. Within the WHO (2022) report, it indicate that GDP reflects a country's economic performance and is a key determinant of healthcare financing, including malaria control. Similarly, Hogan et al. (2018) suggest that higher GDP enables countries to allocate more resources toward health infrastructure, including the purchase of antimalarial drugs, distribution of mosquito nets, and training of healthcare workers. Within the context of Sub-Saharan Africa, where GDP levels are generally low, external funding from the Global Fund has been revealed as critical and essential for malaria interventions. On the contrary, as countries experience economic

growth, they can invest more in healthcare, potentially reducing dependence on external funds and enhancing program sustainability (Ataguba (2021)). In Southeast Asia, where some countries have higher GDP levels, malaria control efforts benefit from better-funded health systems, although disparities exist across regions. According to Hogan et al. (2018) the relationship between GDP and malaria control effectiveness is complex; while higher GDP has the capacity to improve healthcare access and quality, it requires efficient resource allocation and supportive policies to impact malaria incidence positively.

Chronic diseases and the possibility of death prematurely threaten billions of lives in developing economies. Acemoglu and Johnson (2007) suggest that alleviating these difficulties are essential for economic growth. Relatively inexpensive policy reforms, driven by governments or major charitable organizations, can lead to considerable health gains . According to the scholars, there is also universal agreement that enhancing the health of individuals in underdeveloped countries will result in substantial economic benefits. The authors conclude that the possibility of such economic rewards is frequently highlighted as a key secondary motivation for healthcare interventions. For example, the Commission on Macroeconomics and Health (2001), headed by Jeffrey Sachs, discovered indications that medical care is one of the most significant indicators of a country's economic prosperity.

The Commission report that in a comparable manner, the Abuja Declaration of 2000, ratified by 53 presidents of African countries, states that "malaria has slowed economic growth in African countries by 1.3% per year, as a consequence of which GDP for African economies is currently 37% less than what it could have been without the spread of malaria" According to Conly (1972) substantial advancements in health eventually translate to moderate boosts in GDP per capita. The author further states that substantial rises in GDP per capita need several years to occur. Controlling ailments with a large burden in developing nations might also have limited effects.

Diseases such as malaria are significant public health concern in Sub-Saharan Africa and Southeast Asia, and the Global Fund has supported many malaria control initiatives in these regions in many ways allude Coker et al. (2011). The Global Fund has worked closely with countries in Southeast Asia to strengthen their health systems and improve the prevention, diagnosis, and treatment of malaria.

There is little agreement on the political economy of international aid. Some scholars such as Sarpong and Bein (2021) contend that, under favorable conditions, a country may be able to utilize donor funds to increase economic growth, reduce poverty, and enhance the supply of essential services such as distribution of insecticide treated nets to reduce the spread of malaria. Other scholars including Boateng, Agbola, and Mahmood (2021), also argue

that aid can actually promote reliance whereas hurting progress in economic development especially in the African economic context. Majority of Global Fund-supported countries that saw revenue increases between 2005 and 2010 also saw decreases in malaria Annual Parasite Index (API) and overall Gross National Income (GNI) per capita average yearly growth during that time period. Improvements on worldwide funding on plasmodium have assisted malaria-eliminating countries reduce their total malaria burden since 2005.

On the political front, Kosack (2003) observe that a country's ability to put foreign aid for medical or training to good use under an authoritarian style of leadership is severely limited unless the country practices democratic system of governance. The author suggest that, countries with authoritarian system of governance will not be able to apply foreign aid to positively impact on its social and human capital. In a similar fashion, Asongu and Nwachukwu (2016) show that aid may have unintended consequences, particularly in ethnically and culturally divided African countries. The authors conclude that contributors' support is predicated on assumptions that could promote misconduct, which in turn could lead to weak institutions, an absence of the rule of law, weak regulations, and ineffective authorities, all of which would have a detrimental effect on human development. But they are not completely set in their ways. Democracy was found to have a beneficial effect on donor aid for health care delivery when the model was expanded to include multiple types of government. This notion is corroborated by Kosack (2003) who suggest that donors could channel aid to corrupt governments via non-state organizations with little power or influence due to political and economic self-interest among development partners. The authors showed that some donors choose to work with poorly managed countries due to the donors own selfish political interest, even though many donors place more emphasis on institutional quality when allocating health or health care delivery subsidies. Donors who take excellent governance and quality institutions into account do so because they want donate to economies where resources are used effectively and positively affect people's development.

Kavanagh and Chen (2019) examine the effects of international funding and management on preventing and treating diseases. The authors found that there is a positive correlation between Global Fund and the fight against HIV/AIDS, TB, and malaria. They explain that there is a significant impact that the Global Fund has on promoting key governmental health programmes and achieving health targets whiles reducing cost of health care in the area of HIV/AIDS, TB and malaria. The impact of donor financing on health is also influenced by the broader health system strengthening efforts that are supported by Global Fund financing. By investing in health system infrastructure and capacity, donor funds can support the development of robust malaria control programs and improve the delivery of malaria con-

trol interventions. Stergachis et al. (2010) show that these investments can have important implications for malaria incidence, as they can help to ensure that malaria control efforts are implemented effectively and efficiently. According to Walgate (2002) another important factor that influences the relationship between donor funding and health is the level of funding that is available. While Global Fund financing has supported significant improvements in malaria control efforts in sub-Saharan Africa and Southeast Asia, funding shortfalls can limit the impact of these efforts. As such, sustained and predictable funding for malaria control efforts is critical to ensuring that progress is sustained over the long term.

Goal 6.3 of the Millennium Development Goals (MDG) calls for preventing and eliminating the malaria disease by 2030. This goal, along with others, has seen significant success (United Nations, 2018, 2019). Leach-Kemon et al. (2012) found that massive increases in funding for malaria control have driven these successes, and in the recent decade, international donors have become increasingly important in aiding national governments in malaria control initiatives. However, the aid from international donors is now at a crucial juncture. According to Leach-Kemon et al. (2012) international financing has been on the rise, but the trend has recently shown symptoms of slowing. This is likely due to the ongoing global financial crisis and austerity programs supported by many governments. Smith et al. (2011), observe that the global fund's intervention known as the malaria control programme has made great strides in recent years, but if funding continues to dwindle, the disease could easily make a comeback and threaten lives. Furthermore, when national governmental contributions towards fighting malaria are minimal, even seemingly considerable international help to a country may still be insufficient.

Global fund malaria disbursement to Southeast Asia and Sub-Sahara Africa

Available evidence in Figure 1 shows that for the period 2005 to 2020 a total of approximately (US$7.2 billion) was disbursed to the region under study in this thesis (Global Fund, 2023). This is made up of approximately (US$1.2 billion) and (US$6.0 billion) to Southeast Asia (SEA) and sub-Sahara Africa (SSA) respectively. The details from Figure 1 clearly show that SSA received the highest disbursement in 2020 while SEA received the highest disbursements from the fund in 2010 It could further be seen from Figure 1 that in the year 2006, SEA received the lowest fund whereas SSA received the lowest fund in 2006 for malaria interventions from the Global Fund. Information obtained for this study as presented in Table 1 show that for the period 2005 to 2020 the SEA region received approximately (US$117 million), the highest funding for malaria control initiatives in 2010 while in the year 2006 approximately (US$25 million) was received as the lowest funding. In the case of the SSA

territory, the data presented in Table 2 depicts that during the same period out of the total amount received by the region, the year 2020 was when the highest funding of approximately US$736 million was received. However in 2006, approximately US$104 million, the lowest funding was disbursed to the region by the Global Fund.

Incidence of the Malaria disease in Southeast Asia and Sub-Sahara Africa From the evidence in Figure 2, the incidence of malaria disease is prevalent in the SSA region as compared to those in the SEA territory. The Figure shows that in the year 2011 both SSA and SEA regions recorded highest incidences of malaria. The data obtained indicates, on average 178 and 97 per 1000 incidence of malaria were recorded for SSA and SEA regions respectively. It could be seen from Figure 2 that malaria incidence was low for the SEA region in 2017 and for SSA region in 2009. This could be attributed to many factors such as favorable weather condition, good governance systems in place in applying the funds during those periods, effective health monitoring and supervision over the use of the funds, enhanced human development in the regions as indicated Morrisey (2001).

3 Methodology

3.1 Research Design

In relation to the topic understudy, the research was underscored by non-experimental descriptive research design. In the words of Weyant (2022), this type of design aids in examining and providing insightful description into conditions and phenomenon that exist without applying the principle of variable manipulation. This design aids researchers to collect and analyze existing data with the aim of identifying trends and patterns, relationship or associations among study variables. Most research works that employs secondary data such as reports, databases, and archival data utilizes this design according. In light of the above, this design is considered as suitable and appropriate for describing characteristics or how variables exert influence or impact on each other. Therefore, assessing how global fund financing influences malaria incidence in Sub-Saharan Africa and Southeast Asia Economies makes this design appropriate and relevant. It is also regarded as important for studies establishing associations or correlations among study indicators. It also provided the basis for conducting regional analysis to establish if differences exist between Sub-Saharan Africa and Southeast Asia Economies in relation to global fund and malaria incidence issues.

Research Method The study was carried out within the quantitative research method orientation. According to Creswell and Hirose (2019) the method involves collecting and analyzing numerical data in order to provide objective data driven insights asserts . The method was appropriate for this study because, it allowed the us to quantify the associations and patterns existing in the data. It also provided the basis to objectively examine the linkage between global fund and malaria incidence in sub-Saharan Africa and Southeast Asia Economies. Through the application of rigorous statistical analytical method such as multiple regression, the method provided the basis for conducting comparative regional analysis.

3.2 Study population and justification of the sample selection

The study defined the research population by identifying Africa as the greatest disadvantaged continent in the world, and records higher levels of malaria incidence even though they receive high sums of donor support to combat malaria. A region is eligible to participate in the present research provided it is situated in the sub-Sahara Africa (SSA) and Southeast Asian (SEA) regions and is a recipient of Global Fund to support the fight against the malaria disease from 2005 to 2020. The review of the available literature indicates that sub-Sahara Africa and Southeast Asian countries are appropriate territories for this study.The research sample was appropriate because malaria is a major worldwide health problem in several SSA and SEA countries. The condition has long been prevalent in these parts of the world, with different nations recording a significant number of incidences. Also, many of the reasons for the increased the incidence of malaria in these regions are favorable temperatures for the malaria parasites, the availability of appropriate vectors (mostly mosquitoes of the Anopheles species), and challenges with healthcare systems and accessibility. These regions are also the highest recipients of Global fund support for the combat of malaria disease.

3.3 Data Source

Quantitative data on global fund disbursements was collected from secondary sources, thus the global fund website (https://data.theglobalfund.org/) which provides information on the global fund's grants to the selected countries on annual basis. The funds released by the global fund from 2005 to 2020 to the selected countries in respect of malaria control is the proxy for global fund. Data regarding the rest of the variables were obtained from the World Bank's World Development Indicators (WDI) website which is an annu-

ally updated compilation of data and statistical analysis that assesses a country's economic situation. The database includes 1,400 time-varying indicators for 217 countries in more than 40 country classifications. Easy access to data, dependability, and connectivity can be affected by multiple variables, including methodological issues (World Bank, 2018). The data could be accessed by the public and can be obtained online from https://databank.worldbank.org/source/world- development-indicators.

3.4 Key Variables and Definitions

The study was underpinned by five (5) important variables namely:

- **Independent Variable:** Global fund (GFM)
- **Dependent Variable:** Malaria incidence (MI)
- **Other factors or Controls:** Education (EDU), Country policy and institution assessment (CPIA), and Gross domestic product (GDP)

Global Fund is the donor funds released to the countries towards the fight and control of malaria disease in the regions under study. The funds are measured in United States dollars. Incidence of malaria is measured as the number of newly identified instances of malaria for 1000 people at risk annually. The population at risk is deemed as those living in locations where malaria transmission prevails. To determine the impact of Global Fund on malaria in the regions under study, we hypothesize that three control variables namely GDP per capita, education attainment and country policy and institutional assessment could influence the impact of Global Fund on malaria incidence. GDP per capita is measured as the gross domestic product of a country divided by its total population. The education variable is defined as the proportion of the population in a country who are above twenty-five and have gone through secondary education and have completed. The country policy and institution assessment variable is the governance indicator that measures the overall quality of a country's institutional and policy frameworks from a scale of 0 to 6 with 0 being the least and 6 being the highest. This is a tool used by the World Bank to assess the total effectiveness of a country's institutional and policy frameworks. This variable stands for the quality of governance systems applied by a particular country.

3.5 Specification of the Model

Considering the defined objectives of the study, we employ a model to examine the key factors that lead to effectively applying the Global Fund in these regions. The equations below show the specifications applied for the econometric framework employed for analysis:

Initial Model

$$MI_{it} = \beta_o + \beta_1 GF_{it} + \beta_2 GDP_{it} + \beta_3 EDU_{it} + \beta_4 CPIA + \phi_i + \mu_{it} \tag{1}$$

The regression model above would assist in analyzing the relationship between malaria incidence and the Global Fund, GDP, education, and country policy and institutional assessment while accounting for unobserved heterogeneity ϕ_i and random errors μ_{it}. This model would be transformed using logarithmic transformations as seen below.

Main Models:

$$logMI_{it} = \beta_o + \beta_1 logGFM_{it} + \phi_i + \mu_{it} \tag{2}$$

$$logMI_{it} = \beta_o + \beta_1 logGFM_{it} + \beta_2 logGDP_{it} + \beta_3 logEDU_{it} + \beta_4 logCPIA + \phi_i + \mu_{it} \tag{3}$$

The simple linear regression model above and the multiple regression were used to obtain both correlation results and linear regression results and to analyze the relationship between malaria incidence and Global Fund, GDP, education, and country policy and institutional assessment respectively. This was carried out by examining the relationship between the Global Fund and malaria incidence using the logged transformational data. The natural logarithm basically transforms the data to linearized relationships and interpret the coefficients as elasticities. The log transformation helps in dealing with skewed data by normalizing distributions. Additionally, it reduces heteroscedasticity and helps interpret relationships in proportional terms rather than in absolute terms.

MI_{it} stand for malaria incidence of region i in period t, GFM_{it} is Global Fund malaria aid, GDP_{it} is the gross domestic product per capita, EDU_{it} is education attainment of the population twenty five years and above, $CPIA_{it}$ is country policy and institutional

assessment in each region μ_{it} is the error term in the fixed effect, ϕ_i is the country-specific effects and the specific time characteristics associated with the factors employed for this study, i equals 1,2 and t equals the number of years to be studied, β is the parameters to be estimated. Log is the logarithm of transformed data of the variables.

In the regression model:

$$logMI_{it} = \beta_o + \beta_1 logGFM_{it} + \phi_i + \mu_{it}$$

where MI represent the incidence rate of malaria in a specific region, GFM represents the financial support provided by the Global Fund for malaria control and β_1 is the coefficient that shows the impact of the Global Fund support on malaria incidence, the assumption is that increased funding from the Global Fund (GFM) leads to a reduction in malaria incidence (MI). However the reverse may also be true. Areas with higher malaria incidence may receive more funding from the Global Fund as a priority. In that case, it will be malaria incidence that causes changes in the level of Global Fund support, and not as per the assumption. This would imply that the estimated β_1 (the impact of Global Fund on malaria incidence) would be biased because the causal relationship is reversed. If the funding allocation is systematically higher for regions with severe malaria problems, the regression could falsely attribute the relationship to causation from funding to incidence.

In addressing the issue of reverse causality we used lagged variables in the regression model. The below regression models were used:

$$logMI_{it} = \beta_o + \beta_1 lagGFM_{it} + \phi_i + \mu_{it} \tag{4}$$

$$logMI_{it} = \beta_o + \beta_1 lagGFMnew_{it} + \beta_2 lagGDPnew_{it} + \beta_3 lagEDUnew_{it} + \beta_4 lagCPIAnew_{it} + \phi_i + \mu_{it} \tag{5}$$

to capture the delayed effects of Global Fund on malaria incidence. These would help ensure that funding decisions are not influenced by current malaria incidence rates. Using lagged values of Global Fund, GDP, education, and country policy and institutional assessment would help capture the temporal dynamics in their relationship to malaria incidence. It must be noted that the lag rule employed is Xt-1. The study used the lagged values of the independent variable as predictors to ensure that changes in the independent variable precede changes in the dependent variable. The LagVariable = LogVariable – 1. Such as:

- LagGFMnew = LogGFM – 1

As this method is not a perfect method to tackle the issue of reverse causality, future research into this approach will be necessary. According to Bellemare, Masaki, and Pepinsky (2017) the use of lagged explanatory variables to solve endogeneity problems is an illusion. The authors show that lagging independent variables merely moves the channel through which endogeneity biases causal estimates, replacing a selection on observables assumption with an equally untestable no dynamics among unobservables assumption. The authors however concluded by emphasizing that this does not imply that lagged explanatory variables are always and everywhere inappropriate. In the context of no unobserved confounding, it must be assumed there is no reverse causality and the causal effect operates with a one period lag only.

This methodology differ from the literature in two ways: 1) The simple linear regression employed would help determine the direct effect of the Global Fund on the incidence of malaria. This was not captured in the literature. 2) The other variables, GDP, education, and country policy and institutional assessment, were potent contributors to the effectiveness of the Global Fund on malaria incidence. Based on the objectives of this study, these variable were chosen which were more than those used in the literature. The use of lagged values as explained above is unique to this study.

3.6 Data Analysis Technique

The analysis of the study was carried out using diverse data techniques. These includes Stationarity Test using Augmented Dickey-Fuller (ADF) test, Normality Test using Kolmogorove-Smirnove test, Multicollinearity Check using Variance Inflation Factor (VIF), Autocorrelation Check using Durbin-Watson test, Model Fit and Selection using R^2 or Adjusted R^2, descriptive statistics, simple regression and multiple regression. Besides the preliminary test, the study conducted simple regression analysis to examine the relationship between global fund and malaria incidence and the multiple regression was used to examine the relationship between all study indicators thus dependent, independent and controls or other factors.

4 Results

4.1 Data Preparation and Transformation

Data obtained through the secondary source was carried based on three critical analytical areas. In order to overcome or mitigate spurious relations in the data analysis, especially when it comes to the data obtained for the purpose of this study which is time series data,

log transformation (data log) of the data set was done. This was done to enhance linearity of the data, addressing the issue of heteroscedasticity, making the adopted variables and the relationship additive and enhance the stationarity of the data set. Further, although log transformation has the capacity to address all these issues, the researcher also took into account the need to examine whether the log transformation was suitable for some specific dataset of some of the variables (especially those with negative or zero scores) which may not require log transformation or adjustment. In addition, all the variables was also lagged at -1 to conduct critical analysis of the data and reveal delayed impact of the independent variable on the dependent variable.This was done in order to solve the issue of reverse causality.It is worth noting that the thesis studied sub-Sahara and Southeast Asian territories.

4.1.1 Description of the data

A total of 22 countries were employed for this study based on available data for a period of sixteen years (16), from 2005 to 2020. It includes eleven (11) countries each from Southeast Asia and sub-Sahara African countries. Data was sourced from World Development Indicators and on the Global Fund Website. It is vital to indicates that the key test carried out include preliminary data tests (such as stationarity test, normality test, and Multicollinearity test), test model assumptions and diagnostics analysis (Residual analysis, autocorrelation check, and model fit and selection) and main analytical test (including descriptive statistics, correlation, simple regression, multiple regression and regional comparative analysis using multiple regression).

4.2 Preliminary Data Tests

4.2.1 Descriptive Statistics

The descriptive statistics was carried out on the data set. Means, standard deviations, ranges and many others for each of the study indicators was carried out. However, major focus was on malaria incidence and Global fund disbursements indicators which were the two independent and the dependent variables for the study. The result as presented in Table 3 show LogMI (Malaria Incidence) to have a mean 2.1897, and the standard deviation of 0.34577, indicating consistent malaria incidence levels. LogGFM (Global Fund) have a mean of 6.8244 with a moderate spread 0.90393, suggesting variability in funding levels across observations. LogCPIA (Institutional Assessment) have a standard deviation of 1.93676 which is high relative to its mean 2.3246, implying that institutional scores vary significantly between regions. LogGDP (GDP) have high mean 6.1148 and large standard deviation

4.28295 indicate substantial variation in economic output among the observations. LogEDU (Education) have a mean of 0.8190 with a standard deviation of 0.48936, reflecting moderate variability in education levels.

4.2.2 Stationarity Test

In relation to this test, Augmented Dickey-Fuller test was carried out to check if the time series data obtained for the study is stationary. This was highly essential for spurious regression results since the data set is time series. The result is shown in Table 4. The result shows that all the variables were lagged and the lagged differences was established. The logMI was employed as the dependent variable and original transformed variables and their corresponding lagged differences were considered as the independent variables. Observing the t-values and its corresponding values of the original log-transformed variables such as (logGFM, logEDU, logCPIA, and logGDP) indicates that all the scores were significant at $p < 0.05$. That is [logGFM: t = 2.520, sig = 0.012 < 0.05; logCPIA = -5.875, sig = 0.000 < 0.05; logGDP: t = -4.519, sig = 0.000 < 0.05, logEDU: t = 2.581, sig = 0.010 < 0.05]. The result suggests that all variables tested had statistically significant values, implying that the data is stationary. This means that the null hypothesis of the unit root test which states that the dataset is not stationary can be rejected.

4.2.3 Normality Test

The study carried out normality test using Kolmogorov-Smirnov test, with the aim of ensuring that the data obtained for the purpose of this study follows a normal distribution. Within a data set if the issue of normality is violated, the log transformation has the capacity in helping achieve normality. The result from the analysis is shown in Table 5 shows that the entire log transformed variables obtained K-S p-value > 0.05. This is indicated as [logCPIA = .063 > 0.05; logGDP = .201, logEDU = .220; logGFM = .140, logMI = .210]. This shows that the log transformed data for the study does not significantly deviate from normality, meaning the data set is approximately normal.

4.2.4 Multicollinearity Check

Multicollinearity check was executed among the independent variable and control indicators namely Global Fund disbursements, GDP per capita, EDU, CPIA by estimating the Variance Inflation Factor (VIF). In the expression of Creswell and Hirose (2019), the VIF score of

above 10 is an indicative of an issue of multicollinearity which might requires the removal of combining variables, however, score of 10 or less depict no issue of multicollinearity. In light of this, the result from the data analysis shown in Table 6 depict that VIF scores for all the study variables was less than 10 indicating as [logCPIA = 9.560, logGDP = 6.131, logEDU = 5.094, logGFM = 1.638, logMI = 1.518]. This suggests no issue of multicollinearity among the study variables.

4.3 Test Model Assumptions and Diagnostics Analysis

At this phase of the study two critical tests were carried out namely autocorrelation check and model fit and selection.

4.3.1 Autocorrelation Check

The study employed the Durbin-Watson test to check the autocorrelation in the residuals since the data set included time series elements. The result from the analysis in Table 7 is shown in summary model from the regression analysis. The result shows that Durbin-Watson score is 1.972 indicating no autocorrelation thus the residuals are independent. This finding suggests no autocorrelation presents. This shows an ideal data for analysis.

4.3.2 Model Fit and Selection

The model posited in the methodology section of the thesis was assessed by checking its goodness of fit with R-Square (R^2) and Adjusted R-Squre (AR^2). From the summary on Table 7, it is clear that $R^2 = .292$ and Adjusted $R^2 = .275$. The result suggests that the model explains 29.2% of the variance in the dependent variable (logMI) which is moderate. In addition, in relation to adjusted R square the value is highly closer to the R square value indicating any added variables do not significantly enhance the explanatory power of the study model.

Relationship between Global Fund and Malaria Incidence In view of the first study objective, the simple linear regression analysis was carried to obtain both correlation results and linear regression results. This was carried out by examining the relationship between the Global Fund and malaria incidence using the lagged transformational data. The result as

presented in Table 8 show that Global Fund disbursement is a significant negative predictor of malaria incidence in sub-Saharan Africa and Southeast Asia countries. This show that Global Fund exert significant negative impact on malaria incidence within sub-Saharan Africa and Southeast Asia countries. For every one-unit increase in Global Fund, malaria incidence decreases by 0.127 units, holding other factors constant. The standardized coefficient which measures the relative importance of predictors in standardized terms indicates the strength of the relationship between Global Fund and the incidence of malaria, measured in standard deviations. A β of -0.331 suggests a moderately strong negative relationship between Global Fund and malaria incidence.

Relationship between, Global Fund, Control Variables and Malaria Incidence

The log transformational data regarding log MI as the dependent variable and lagged scores of lag (Global Fund), lag (GDP per capita), lag (EDU), and lag (CPIA) as independent and control variables were carried out using multiple regression analysis. The multiple regression result from Table 9 show that all the study variables namely Global Fund, country policy and institutional assessment, GDP and education are important predictors of malaria incidence in sub-Saharan Africa and Southeast Asia countries. A one-unit increase in lagged funding results in a decrease of 0.047 units in malaria incidence. A standardized coefficient (β= -0.124) indicates a small negative relationship. This effect is statistically significant (p=0.017 $<$ 0.05). Furthermore, a one-unit increase in lagged institutional assessment results in a decrease of 0.210 units in malaria incidence with a standardized coefficient of β = -1.174 suggesting a strong negative relationship. Additionally, a one-unit increase in lagged GDP decreases the incidence of malaria by 0.080 units with a standardized coefficient of β= -0.992 which suggest a strong negative relationship. Finally, a one-unit increase in lagged education results in a decrease of 0.177 units in malaria incidence. The standardized coefficient of β= -0.251 indicate a moderate negative relationship. All these effects are statistically significant. This suggests that increases in funding, institutional strength, economic performance, and education are associated with reduced malaria incidence in the subsequent period.

Differences in the Effects of Global Funds on Malaria Incidence

The third study objective was to examine the differences in the effects of the Global Funds on malaria incidence in sub-Sahara Africa and Southeast Asia comparatively. Table 10 show the sub-Saharan Africa multiple regression results. The result show that all the study variables namely lagged Global Fund, lagged CPIA, lagged GDP and lagged Education are important predictors of malaria incidence (logMI) in sub-Saharan Africa. This shows that all predictors have a negative effect on logMI, suggesting that increases in institutional

strength, GDP, education, and funding are associated with reductions in malaria incidence (log-transformed). By implication, policies improving institutional quality, economic performance, education, and funding allocation may effectively reduce malaria incidence. On the contrary, in relation to Southeast Asia, the result presented in Table 11 show that all the factors failed to predict malaria incidence (logMI2) with the exception of lagCPIAnew which was statistically significant. This show that lagged CPIA is the only predictor with a significant effect on LogMI2 (p=0.001). A higher lagged CPIA score is associated with a decrease in malaria incidence, indicating that stronger institutional performance effectively reduces malaria. As a practical implication, policies focused on improving institutional quality (CPIA) may have a meaningful impact on reducing malaria incidence in Southeast Asia. The insignificant results for GDP, education, and funding might suggest delayed effects, measurement issues, or other confounding factors not captured in this model.

5 Discussion of Findings

This study was carried out to mainly examine the effects of Global Funds on malaria incidence in the SSA and SEA regions. The study was underscored by three critical research questions namely:

1. What is the relationship between the global fund and the incidence of malaria in sub-Sahara Africa and Southeast Asia?

2. What are the key factors that influences the effectiveness of the global fund financing for malaria control?

3. What are the differences in the effects of the global funds on malaria incidence in sub-Sahara Africa and Southeast Asia comparatively?.

First and foremost, the study found that Global Fund exerts significant negative impact on incidence of malaria in sub-Sahara Africa and Southeast Asia. The finding stresses that Global Fund interventions have been effective in reducing the burden of the disease in these regions. The Global Fund's strategic approach combines substantial financial investments with the deployment of evidence-based programs targeting malaria prevention, treatment, and control. Key measures include the distribution of insecticide-treated mosquito nets, access to artemisinin-based combination therapies, and the promotion of indoor residual spraying. Moreover, the study underscores the importance of robust partnerships between

governments, healthcare organizations, and local communities to achieve sustainable outcomes. The Global Fund's ability to channel resources into vulnerable areas has not only improved access to healthcare services but also enhanced the capacity of local health systems to combat malaria effectively. The finding also suggest that these interventions through the Global Fund have led to significant decline in malaria incidence in these two regions underscoring the effectiveness of collaborative global health initiatives for malaria high-record regions of the world. It is worthy to note that within the sb-Saharan Africa, where the issue of malaria incidence is endemic, the efforts of Global Fund have been highly and significantly impactful, resulting in mortality rates reduction and stronger contribution to health responses within the sub-region.

In similar vein, countries in the Southeast Asia have also benefited from resources from the Global Fund, contributing to the prevention and treatment of malaria in one of the highly risked areas of the world. The finding succinctly indicates that sustained support from the Global Fund is critical and important in maintaining and advancing these gains within these two regions, thereby accentuating its role as a vital partner in the global fights against malaria. The finding aligns with some scholarly work by Atun, Silva, and Knaul (2017) which show that Global Fund's investment correlates with notable reductions in malaria incidence across different regions, as countries rely on its funds to sustain long-term malaria control programs. Additionally, Global Fund (2024), report show that the Global Fund's investments are making an impact. In countries where the Global Fund invests, malaria deaths have dropped by 28% between 2002 and 2022. Without these interventions, malaria deaths would have increased by 90% over the same period. Further, despite direct funding, the Global Fund supports local health systems by fostering partnerships with governments, NGOs, and community organizations, strengthening national capacity to respond to health crises.

Secondly, the study examined key factors that influence the effectiveness of the Global Fund financing for malaria control within sub-Sahara Africa and Southeast Asia regions. The study discovered that Global Fund, education, country policy and institution assessment, and gross domestic product exert significant negative impact on malaria incidence in sub-Saharan Africa and Southeast Asia economies. This show that Global fund, education, country policy and institution assessment, and gross domestic product are key factors influencing the effectiveness of the Global Fund financing for malaria control or malaria incidence reduction within sub-Sahara Africa and Southeast Asia regions. All the factors showed negative impact on malaria incidence. By implication, the finding show multiple factors sig-

nificantly influencing effectiveness of the Global Fund financing for malaria control within sub-Sahara Africa and Southeast Asia regions. The negative impact of Global Fund and education on reducing malaria incidence can be attributable to an improved healthcare support, rise in awareness, prevention and access to treatment by people living within these two regions. In addition, GDP and CPIA's negative impact can be argued that higher economic growth and stronger institutional policies have the capacity to be providing more resources for public health and better implementation of health programs.

The findings suggest that an integrated approach strengthening educational initiatives, securing continuous Global Fund support, enhancing economic growth, and improving institutional policies is important in creating a more sustainable reduction in malaria incidence. The finding also stresses on the need for coordinated efforts across these factors to further control and prevent malaria in these high-burden regions of the world. The findings is in agreement with many previous studies like Fofack and Sarpong (2019), who allude to the fact that good governance and education are preconditions of attaining favorable health outcomes in the cases of recipient countries applying donor funds for health interventions. The authors argue that the level of education and good governance system assist fund recipients to use international funding in a positive way devoid of issues like corruption and nepotism for positive heath outcomes and improved quality of life. The GDP factor contributed to improving the situation of malaria diseases in the region consistent with.

Thirdly, the study investigated the differences in the effects of the Global Funds on malaria incidence in sub-Sahara Africa and Southeast Asia comparatively. In relation to sub-Sahara Africa, the study found that Global Fund, education, country policy and institution assessment, and gross domestic product, exert significant negative impact on malaria incidence. However, in relation to Southeast Asia economies, Global Fund, education, and gross domestic product, failed to exert significant statistical impact on malaria incidence with the exception of country policy and institution assessment which showed negative impact on malaria incidence. By implication, the finding suggests that factors influencing malaria incidence differ significantly between sub-Saharan Africa and Southeast Asia. Within the context of sub-Saharan Africa, Global Fund, education, country policy and institutional assessment, and gross domestic product all play important roles in reducing malaria incidence. This indicates that the region benefit from a combination of financial support, educational initiatives, economic growth, and policy effectiveness in combating malaria.

However, in Southeast Asia, only country policy and institution assessment was found

to have a statistically significant impact, implying that robust policy frameworks and institutional quality are more effective in influencing malaria outcomes than external funding, education, or GDP growth. This suggests that tailored approaches, focusing on strong institutional and policy support in Southeast Asia and a broader range of interventions in sub-Saharan Africa, may be necessary to address the unique challenges of malaria control in each region. This aligns with the WHO 2019 report, that the sub-Saharan Africa region is the leading region in the World with malaria cases (WHO (2019)). Again, the regression results is consistent with the data obtained for this study which show that the highest incidence of malaria is reported from the sub-Saharan Africa region with Nigeria and Democratic Republic of Congo recording the highest for the period under study.

6 Conclusion

Essentially, the study found that Global Fund exerts significant negative impact on incidence of malaria in sub-Sahara Africa and Southeast Asia. In addition, it was discovered that Global Fund, education, country policy and institution assessment, and gross domestic product exert significant impact on malaria incidence in sub-Saharan Africa and Southeast Asia countries. This show that Global Fund, education, country policy and institution assessment, and gross domestic product are key factors influencing the effectiveness of the Global Fund financing for malaria control within sub-Sahara Africa and Southeast Asia regions. In relation to sub-Sahara Africa the study found that Global Fund, education, country policy and institution assessment, and gross domestic product exert significant negative impact on malaria incidence. However, in relation to Southeast Asia economies, Global Fund, education, and gross domestic product failed to exert significant statistical impact on malaria incidence with the exception of country policy and institution assessment which showed negative impact on malaria incidence.

From these discoveries, it is succinct to expound that the factors influencing malaria incidence through Global Fund financing in sub-Saharan Africa and Southeast Asia are both diverse and context-dependent. The study provides insights on how Global Fund, along with education, country policy and institution assessment, and gross domestic product, play significant roles in shaping malaria outcomes, particularly in sub-Saharan Africa, where all four variables impact malaria incidence. However, the factors operate differently in Southeast Asia, where only country policy and institution assessment was found to have a statistically significant effect. It is vital to note that the Global Fund has made a substantial impact in

reducing malaria incidence in sub-Saharan Africa and Southeast Asia. By providing financial resources, the Global Fund enables these regions to improve healthcare delivery, increase access to Insecticide Treated Nets, and expand the reach of malaria treatment. This funding empowers countries to implement and sustain critical health interventions, which directly correlates with lower malaria incidence. However, the significance of the Global Fund's impact is much more pronounced in sub-Saharan Africa, suggesting that financial support may be more effective in regions with limited resources and higher malaria prevalence.

Further, in view of education, it is clear that education plays a vital role in malaria control efforts, particularly in sub-Saharan Africa, where higher educational attainment is associated with lower malaria incidence. It is clear that education promotes greater awareness of malaria prevention methods, supports adherence to treatment protocols, and fosters understanding of personal and community health practices that prevent disease spread across these regions. This finding underscores the value of education in public health initiatives and indicates that integrating educational programs into malaria control strategies can improve their effectiveness. In Southeast Asia, however, education did not exert a statistically significant effect, potentially due to varying levels of baseline education or existing awareness and prevention measures that reduce malaria risk. Country policy and institution assessment emerged as a significant factor in both sub-Saharan Africa and Southeast Asia, although it has a differing impact between the regions. Country policy and institution assessment reflects the strength of institutional frameworks, policy quality, and governance, all of which are critical for effective implementation and sustainability of malaria programs.

In Sub-Saharan Africa, a robust country policy and institution assessment score correlates with reduced malaria incidence, suggesting that policies and institutions that prioritize health contribute to malaria control. Interestingly, in Southeast Asia, country policy and institution assessment was the only variable with a statistically significant negative impact, indicating that policy and governance structures play a pivotal role in malaria reduction. This may be due to Southeast Asia's relatively better healthcare infrastructure, making effective policies more impactful than external funding. Moreover, in relation to economic growth measured by GDP, the finding revealed its significant negative influence on malaria incidence in sub-Saharan Africa, while its effect was not statistically significant in Southeast Asia. This discrepancy may be attributed to varying economic conditions and healthcare infrastructure between the regions. In sub-Saharan Africa, where GDP growth translates to more funds for health sector improvements, GDP negatively impacts malaria incidence. In contrast, Southeast Asian economies may already have relatively well-funded health systems, rendering GDP growth less impactful on malaria incidence. The findings suggest that, for poorer

regions, economic growth can significantly bolster malaria prevention by enabling larger health budgets and better infrastructure.

Generally, the study underscores the critical role of the Global Fund, education, policy quality, and economic growth in influencing malaria outcomes in sub-Saharan Africa and Southeast Asia. While financial assistance from the Global Fund and educational programs show significant negative effects on malaria reduction in sub-Saharan Africa, effective policies and institutional frameworks prove most impactful in Southeast Asia. These insights highlight the need for region-specific approaches that consider local socio-economic and political contexts, suggesting that a "one-size-fits-all" model is less effective in global malaria control. In light of this, by embracing tailored based interventions that address the unique needs of each region, stakeholders would have the capacity to make significant strides toward reducing malaria incidence worldwide.

6.1 Policy implications and recommendations

Notably, the findings of the study suggest that the Global Fund, education, country policy and institution assessment, and GDP are essential factors in malaria control, though their influence varies by region. In sub-Saharan Africa, all these factors significantly impact malaria incidence negatively, indicating that comprehensive support such as financial, educational, economic, and institutional are vital for effective malaria reduction. The negative impact of the Global Fund and education in this region highlights the importance of sustained financial assistance and health education to increase awareness, prevention, and treatment efforts. In addition, the negative influence of GDP and country policy and institution assessment on malaria suggests that economic growth and strong institutional frameworks can help reduce malaria by improving healthcare infrastructure and access. In Southeast Asia, however, only country policy and institution assessment had a significant impact, suggesting that policy and governance play a larger role in malaria outcomes than external funding or education alone. This implies that malaria control strategies in Southeast Asia might be more effective if focused on strengthening institutional frameworks rather than solely increasing financial or educational interventions.

Further, the thesis provides policy implications for donor agencies in the international and local levels, healthcare policy decision making agents such as the WHO as well as governments in the Southeast Asia and sub-Saharan Africa regions. In a large extent, the Global Fund people will take a cue from this study. The objective of establishing the fund is to

combat the malaria disease in endemic territories like those employed for this study. This therefore imply that countries are expected to receive the funds, apply them to positively improve on the malaria disease in their economy. While a large percentage of the Global Fund malaria budget is expected to be given to the greater burden, less wealthy economies, financing should concentrate a greater emphasis on malaria recurrence possibility. The Global Fund's New Funding Model (NFM), established income thresholds and illness burden-based on national categories. According to Kumar et al. (2012) this is especially significant for nations that have increasing levels of the disease burden.

Fresh, improved methods and ingenious resource harnessing will be required in order to bridge possible funding shortages, notably expanding financial pledges from the business community donors, national governments, novel financing arrangements, or cooperative regional finance systems. Kumar et al. (2012) documents several finance approaches in their finance for eradicating malaria paper. Regional actions can promote accountability and manage cross-border spread as well as importation hazards. With the launch of the NFM, the global fund has made optimistic initial moves towards leveraging finances by requiring larger domestic donations and catalyzing additional geographic regions malaria eradication efforts. As a policy consequence, recipient nations must conduct periodic evaluations of the Global Fund impact on malaria statistics using preliminary survey findings. This will enable policymakers to scale up initiatives in regions that require extra expenditure and consideration depending on outcomes. According to Sarpong and Bein (2021), policymakers ought to be conscious in order to develop a sustained economy, it is necessary to define the type of governance structure that must be in place. Overall, the study emphasizes the need for region-specific malaria strategies that consider local socio-economic and policy environments, maximizing the impact of the Global Fund and other interventions through tailored approaches.

Further studies could concentrate on the SEA and SSA territories in their entirety and study the dynamics of the factors in a regional-wide perspective. This will assist scholars appreciate the global SEA and SSA picture for an informed decision with respect to the impact of Global Fund on the combat of malaria in these areas. As has been already mentioned in the introductory part of this paper, the Global Fund is aimed at the combat of three different diseases. However, this paper only considered malaria, it is therefore prudent that future studies could pay attention to the impact of the fund on HIV/AIDS or Tuberculosis in the SEA and SSA regions

7 Use of Generative AI and AI-assisted tools

During the preparation of my thesis, I used ChatGPT4o to properly typeset my latex tables. After using this tool/service, I reviewed and edited the content as needed and take full responsibility for the content of my thesis.

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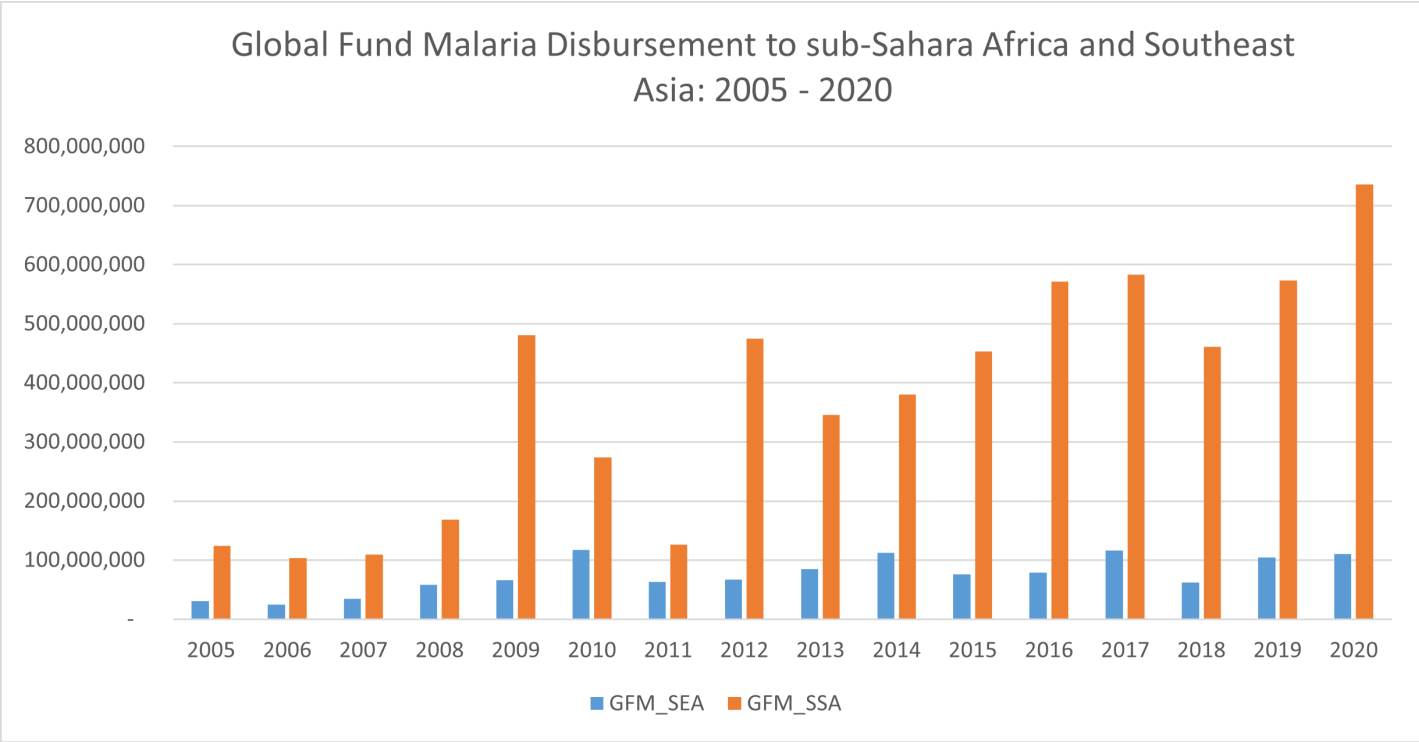
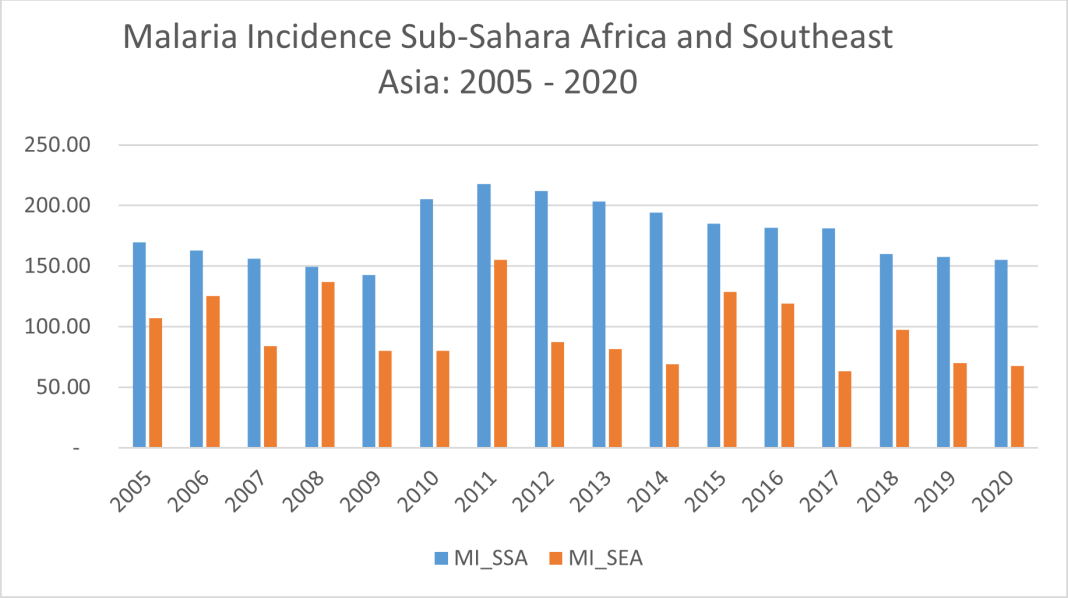
Appendix

Figure 1: Global Fund Malaria Disbursement to SSA and SEA: 2005-2020



Source: The Global Fund People, 2023.

Figure 2: Aggregate incidence of the Malaria disease (per 1000) in SSA and SEA: 2005-2020



Source: World Bank 2018

Table 1: Global Fund Malaria Disbursements to SEA Countries: 2005 - 2020

Year	**Disbursement (USD$ 'Million')**
2005	31.077
2006	24.667
2007	34.515
2008	58.564
2009	66.371
2010	117.144
2011	63.501
2012	66.889
2013	84.431
2014	112.273
2015	75.469
2016	79.273
2017	116.532
2018	62.237
2019	104.939
2020	110.273
TOTAL	**1208.162**

Source: The Global Fund People, 2023

Table 2: Global Fund Malaria Disbursements to SSA Countries: 2005 - 2020

Year	**Disbursement (USD$ 'Million')**
2005	124.46
2006	103.681
2007	109.477
2008	168.778
2009	480.441
2010	273.861
2011	126.026
2012	474.398
2013	345.862
2014	380.308
2015	453.041
2016	571.049
2017	583.405
2018	460.684
2019	573.056
2020	735.63
TOTAL	**5964.161**

Source: The Global Fund Website, 2023

Table 3: Descriptive Statistics

	Mean	**Std. Deviation**	**N**
LogMI	2.1897	0.34577	352
LogGFM	6.8244	0.90393	352
LogCPIA	2.3246	1.93676	352
LogGDP	6.1148	4.28295	352
LogEDU	0.8190	0.48936	352

Table 4: Augmented Dickey-Fuller Test

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*Sig.*	Collinearity Statistics	
	B	Std. Error	*Beta*			Tolerance	VIF
(Constant)	2.673	0.252		10.597	0.000		
LogCPIA	-0.216	0.037	-1.212	-5.875	0.000	0.049	20.560
LogGDP	-0.085	0.019	-1.051	-4.519	0.000	0.038	26.131
LogEDU	0.187	0.073	0.265	2.581	0.010	0.196	5.094
LogGFM	0.056	0.022	0.147	2.520	0.012	0.610	1.638
Lagdiff2	-0.026	0.024	-0.054	-1.057	0.291	0.798	1.253
Lagdiff3Edu	0.007	0.106	0.003	0.068	0.946	0.862	1.161
Lagdiff4CPIA	0.116	0.090	0.080	1.296	0.196	0.541	1.849
Lagdiff5GDP	0.024	0.043	0.035	0.559	0.576	0.540	1.852

a. Dependent Variable: LogMI

Table 5: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	*df*	*Sig.*	Statistic	*df*	*Sig.*
LogCPIA	0.313	352	0.063	0.771	352	0.061
LogGDP	0.329	352	0.201	0.712	352	0.110
LogEDU	0.222	352	0.220	0.893	352	0.200
LogGFM	0.100	352	0.140	0.817	352	0.057
LogMI	0.103	352	0.210	0.856	352	0.061

a. Lilliefors Significance Correction

Table 6: Collinearity Statistics

Model	Tolerance	VIF
(Constant)		
LogCPIA	0.049	9.560
LogGDP	0.038	6.131
LogEDU	0.196	5.094
LogGFM	0.610	1.638
LogMI	0.510	1.518
Lagdiff2	0.798	1.253
Lagdiff3Edu	0.862	1.161
Lagdiff4CPIA	0.541	1.849
Lagdiff5GDP	0.540	1.852

Table 7: Autocorrelation Check

Model	**R**	**R Sq**	**Adjusted R Sq**	**Std. Error**	**Sig. F Change**	**Durbin-Watson**
1	0.540[a]	0.292	0.275	0.29428	0.000	1.972

Table 8: Relationship between Global Fund and Malaria Incidence

Model	**Unstandardized Coeff**		**Standardized Coeff**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
1 (Constant)	.453	.114		3.981	.000
LagGFMnew	-.127	-.019	-.331	-6.557	.000

a. Dependent Variable: LogMI

Table 9: Relationship between, Global Fund, Control Variables and Malaria Incidence

Model	Unstandardized Coeff		Standardized Coeff	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.633	.198		8.235	.000
LagGFMnew	-.047	.020	-.124	-2.405	.017
LagCPIAnew	-.210	.036	-1.174	-5.897	.000
LagGDPnew	-.080	.018	-.992	-4.475	.000
LagEDUnew	-.177	.067	-.251	-2.663	.008

a. Dependent Variable: LogMI

Table 10: Differences in the Effects of Global Funds on Malaria Incidence: sub-Sahara Africa

Coeff	Model	Unstandardized Coeff		Standard Coeff	t	Sig.
		B	Std. Error	Beta		
(Constant)		4.667	.352		13.244	.000
LagCPIAnew		-1.218	.130	-.490	-9.339	.000
LagGDPnew		-.348	.036	-.623	-9.639	.000
LagEDUnew		-.415	.062	-.443	-6.727	.000
LagGFMnew		-.036	.017	-.113	-2.084	.039

a. Dependent Variable: LogMI

Table 11: Differences in the Effects of Global Funds on Malaria Incidence: Southeast Asia

Model	Unstandardized Coeff		Standardized Coeff	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.615	0.359		7.285	0.000
LagCPIA2new	-0.218	0.063	-0.356	-3.449	0.001
LagGDP2new	0.013	0.150	0.008	0.086	0.932
LagEDU2new	0.022	0.125	0.013	0.178	0.859
LagGFM2new	0.055	0.038	0.119	1.439	0.152

a. Dependent Variable: LogMI2

Table 12: List of Countries

Number	**Countries**	**Territory**
1	Indonesia	Southeast Asia
2	Singapore	
3	Philippines	
4	Malaysia	
5	Cambodia	
6	Myanmar	
7	Vietnam	
8	Thailand	
9	Brunei Darussalam	
10	Timor-Leste	
11	Laos	
12	Nigeria	Sub-Saharan Africa
13	Niger	
14	Sudan	
15	Tanzania	
16	Uganda	
17	Burkina Faso	
18	Burundi	
19	Congo DR	
20	Mali	
21	Ghana	
22	Mozambique	