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Public health financing as a driver of economic growth and equity: Evidence from Morocco

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Abstract: This paper analyzes the economic growth and health financing in Morocco in connection with the importance of health investment to sustainable economic growth. The available literature indicates that the enhancement of population health is one of the factors that help an economy to improve, especially when governments decide to allocate more funds to the health sector and also enhancing access to health care services. A healthier population is also likely to be more productive which will improve labor efficiency, decrease absenteeism and boost the economy eventually. To investigate these relationships, this study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach, which is particularly suitable for small-sample time-series data with variables integrated of mixed orders I (0) and I (1). The econometric framework combines unit root testing, cointegration analysis, long-run estimation, and error correction modelling to examine both the short-run and long-run effects of public health financing on economic growth and maternal health outcomes in Morocco over the period 1980–2015. The empirical findings reveal that increased public health financing significantly promotes economic growth while reducing maternal mortality. Furthermore, the results indicate that public health expenditure mitigates the adverse effects of income inequality on health outcomes, highlighting the importance of sustained public investment in healthcare for achieving inclusive and sustainable development. There are multiple indicators that are associated with economic performance, income distribution, and health outcomes which are taken into account to reflect the multidimensional character of the relationship between economic growth and health investment. The empirical evidence indicates that greater public health financing is related with improvements in health outcomes especially with decreases in the maternal and infant demise rates. Besides, the results indicate that inequality in the distribution of income and the policies on health investment is positively related to economic development and social well-being in Morocco.

Keywords: public funding; health system; economic growth; public health; ARDL bounds testing

1. Introduction

Endogenous growth models emphasize on the leading contribution of human capital- especially education and health towards economic growth and national development. Human capital is a factor that leads to the enhancement of national wealth besides the well-being of an individual. The OECD (2001) describes human capital as intangible asset, which maintains productivity, innovation, and employability in the long term. Its components are thus a significant social goal to be

invested in [1].

Health, being a fundamental aspect of human capital, has been well known as a key determinant of economic growth and development. The nexus between health and growth is particularly problematic in the Global South countries, where the personal health and social well-being are still much lower than in developed economies, which limits the possibility to get out of the underdevelopment trap. Health investment yields significant returns on the economy both in the microeconomic and macroeconomic levels in direct and indirect ways [2].

The provision of equitable access to healthcare services is one of the areas that play a role in enhancing the health of the population. In this respect, the empirical research notes the significance of the adoption of the governance models that focus on the equality within the systems of health care since these models help improve the health outcomes of the population in both their beneficial impact on the population health and more equal distribution of income. Raising the level of public health expenditure in low- and middle-income countries is one of the policy tools that play a major role in the reduction of disparities in care access and enhancement of the overall health conditions [3].

Although the economic and social developments in the recent decades have been successful, Morocco has deficits in terms of the human capital. The most significant limitations have been noted as health inequalities and lack of proper government funding in the health sector [4]. This brings in the question of the correlation between health financing and the economic development in Morocco in the context of health inequalities. Is the health spending of the people in the strategic interest of the country to create greater value to its human capital?

In this paper, the structure is based on four sections. This paper will start with a discussion of the theoretical relationship between health capital and economic growth. The second section examines how health financing processes relate to health systems equity. The third is a summary of healthcare provision and financing of the health system in Morocco. The fourth will offer a program evaluation of the connection between infant and maternal mortality rates and public health financing.

Despite the growing literature examining the relationship between health expenditure and economic growth, limited empirical evidence exists for Morocco using a long-term time-series perspective that simultaneously considers public health financing, income inequality, and maternal health outcomes. Most previous studies focus either on cross-country analyses or on the direct relationship between health expenditure and economic growth without integrating the equity dimension. This study addresses this gap by investigating the dynamic interactions between public health financing, economic growth, income inequality, and maternal mortality in Morocco over an extended period. By doing so, it contributes to the literature on health financing in emerging economies and provides policy-relevant evidence for healthcare reform and social protection strategies.

2. Literature review

2.1. Relationship between health and economic growth

Human capital has been recognized to be a force of economic growth. The growth

has to be sustained by building high quality human capital, which is nurtured by enhanced education, improved health [5,6], ongoing learning and training. This increases the ability of a healthy workforce in creating, innovating and adopting new technologies thus improving the general productivity.

Good health enhances the human capital, increases the productivity of individuals and eventually boosts the growth rates of the nation. The health gains enhance productivity in labor market by decreasing morbidity, disability and absenteeism, and also, increasing earning potential of individuals. Besides, health plays a role in education outcomes in terms of school enrollment, attendance and academic achievement. Improved population health also results into reduced spending on curative care as well, which can be used to spend on other activities or purposes (consumption, savings, and investment), which also spur economic growth [7].

Health therefore is at the center of the economic development on a long-term, sustained growth, and alleviation of poverty. The failure to supply the lack in health systems and the occurrence of major diseases in developing countries makes it impossible to enhance the economic growth [8]. An increase in life expectancy and reduction in disease rates enhances growth through increasing the pace of demographic transition, stimulation of human capital, domestic and foreign savings and investment, and social cohesion and macroeconomic stability [9].

On an empirical basis, much of the existing literature in the field of development economics has studied the link between health status and economic growth, through estimating the role of health in cross country growth differences. WHO Commission on Macroeconomics and Health work is a significant source in this area. The overall verification of most empirical researches shows that health has a massive and beneficial impact on economic growth [10–13]. To give an example, with the growth of five-year life expectancy, there is a 0.5 percentage points economic growth [14]. This effect however is seen to be wearing off and possibly non-existent above some health threshold [15].

These results have elicited a debate on population health determinants. Later studies have investigated the connections between such crucial inputs as the delivery of medical services and government funding and population health outcome or economic development. Despite the concern about endogeneity between health spending and GDP per capita, Rivera and Currais in 1999 using panel data on 24 developed countries indicate positive and robust relationship between the public expenditure on health (as a proxy of health) and economic growth [16]. They have been criticized to have used expenditure as a proxy measure of health outcomes, which is not always related to health indicators. To overcome this weakness, Suhrcke and Urban in 2010 use cardiovascular mortality of the working population as an indicator of health status. Their findings show that an increase in this indicator will increase the per capita income in the developed countries significantly but no effect is realized in the low- and middle-income countries [17].

The other line of the literature, based on the hypothesis of positive health-growth relationship, revolves around the relationship between health spending and population health outcomes, that is, infant and maternal mortality. Most studies are reporting the positive impact that health spending has on the population health and the impacts are greater in developing nations [18–20]. Based on the statistics of 70 countries,

Khaleghian and Gupta in 2005 demonstrate that the role of the public health expenditure on the poor population in low-income countries is larger than those in the high-income countries despite the higher returns to the expenditure in the latter [13].

Other research studies, on the other hand, do not find any notable effect of public health spending on infant mortality [21,22]. According to these authors, the major part of the variation in infant mortality between countries is attributed to income levels, income inequality, education of women, and ethnolinguistic fragmentation. Based on this, they propose policies that concentrate more on economic development, poverty elimination, lower levels of income disparity and better education of women as opposed to increment in the expenditure of the health sector. Harttgen and Misselhorn in 2006 demonstrate that access to health infrastructure is an important factor that minimizes infant mortality whereas socioeconomic factors are the main determinants of health outcomes [23]. Wagstaff in 2004 also add to this argument by showing that the success of public health expenditure is highly dependent on the quality of governance and institutional performance. Within better governance and institutions, statistically significant death rates due to maternal, infant, child and tuberculosis diseases are linked to higher levels of public health spending [24].

The existing literature reveals three major debates. First, while most studies report a positive relationship between health expenditure and economic growth, the magnitude and direction of this relationship vary considerably depending on the level of economic development and the indicators used. Second, empirical findings regarding the impact of public health expenditure on health outcomes remain inconclusive, with some studies reporting significant reductions in mortality rates while others emphasize the dominant role of socioeconomic factors such as income, education, and governance quality. Third, relatively few studies explicitly integrate the equity dimension into analyses of health financing. Consequently, the interaction between income inequality, public health financing, and health outcomes remains insufficiently explored, particularly in developing countries such as Morocco.

2.2. Health system financing and equal access to health services

Health system financing has emerged as a focus issue among researchers and policy makers, especially within a mature environment of expanding fiscal austerity that endangers to undo recent achievements to population health. Funding strategies play an important role in ensuring the success of health policy goals, as they dictate the access of resources and equal access to healthcare services.

The differences between the health systems of different countries, in terms of financing and organization models, are quite significant. Generally, three ideal types can be identified by Bourque in 2007: (i) nationalized systems, where the coverage is universal and the services generated by the government and financed by the government and delivered by both state and non-state providers; (ii) mandated insurance systems, where the coverage is compulsory, and the services generated are produced by the government and financed by employers and the state and delivered by both state and non-state providers; and (iii) entrepreneurial systems, which is defined by the voluntary nature of private insurance [25].

Another financially polar model that is frequently opposed is Beveridge-type

finance and liberal market-based finance. Beveridge systems are based on a tax-funded system, mandatory coverage, and universal coverage, and they are explicitly aimed at the goal of inclusion and equity. In contrast, the liberal systems are largely funded by private insurance and profit driven provision, which creates retrogressive equity trend. With this kind of market-driven setup, healthcare will often be based on personal income, with higher-income families being able to obtain services of a higher quality and scope. They are also prone to inefficiency and unsuitable practices, such as unofficial payments, transferring medical supplies out of state facilities to individuals seeking personal profit, and opportunistic provider practices (e.g. unnecessary prescriptions or unnecessary surgery).

The structure of the national health system in Morocco has been influenced in the last 30 years by structural adjustment programs, privatization policies and decentralization of state functions. Multiplicity of financing actors and high institutional complexity is also marked by constrained public resources, low insurance coverage, and increasing healthcare costs, which makes health financing a complex issue. Morocco, as per a number of international indicators, is still showing relatively poor results regarding population health outcomes, equity, and effectiveness of health financing arrangements (e.g., United Nations reports on health system performance; Global Burden of Disease Study 2015).

2.3. Healthcare financing and provision in Morocco

2.3.1. Financing of the national health system in Morocco

The total health spending in Morocco is relatively low in terms of evaluating it against the level of social and economic development needs and in comparison, with the level of funding in the countries that are relatively similar in terms of the economy.

Despite the significant growth of per capita health spending, which has grown at an average of about 10 per cent in the past twenty years (1997–2018) by approximately 550–1730 dirhams, this growth has not been high enough to guarantee good quality of care and equal access to health services.

The financing of health in Morocco is based on a number of sources of funding, but the system of financing is marked by strong inequities, and this inequity is mostly because of the high proportion of out-of-pocket payment that households pay, exposing vulnerable populations to poverty and restricting access to effective care.

The **Table 1** presents the evolution of health financing sources in Morocco over the period 1997–2018. It highlights the relative contributions of households, government expenditures, social health insurance, and other financing mechanisms to the national health system. The table provides insights into the structural changes in health financing and illustrates the progress made toward reducing reliance on out-of-pocket payments while strengthening public and collective financing mechanisms. These trends are important for assessing Morocco's efforts to improve equity, financial protection, and access to healthcare services.

Table 1 summarizes the variables included in the empirical analysis, their definitions, measurement units, and the expected directions of their relationships based on theoretical and empirical literature.

Table 1. Changes in sources of financing in Morocco between 1997 and 2018.

Year	Tax revenues (%)	Direct household payments (%)	Medical coverage (%)	Employers (%)	International cooperation (%)	Others (%)
1997/98	24.6	53.7	16.4	3.6	1.0	0.7
2001	28.0	51.8	16.2	2.9	0.7	0.4
2006	22.6	57.3	17.1	1.8	0.7	0.5
2010	25.2	53.6	18.8	0.9	1.1	0.4
2013	24.0	50.7	22.2	1.2	0.6	0.7
2018	24.0	45.6	29.3	0.4	0.2	0.5

The inclusion of vulnerable populations to the Medical Assistance Scheme (RAMED), the expansion of health insurance coverage, especially among self-employed workers and students, and the pricing policies of pharmaceuticals (such as price cuts on a range of drugs and encouraging generic prescription) have all helped to reduce the financial load of households and make small gains in health financing.

Nevertheless, even with these improvements, the proportion of out-of-pocket spending on health expenditure, in comparison with other similar or developed economies (OECD average: 19 %), is still significantly high. The households remain the primary contributor of the health financing, with the health expenditure totaling to approximately 60 % in 2018 with 45.6 % out of direct payments and 14.1 % out of health insurance contributions. In addition, in spite of diversification and growth of insurance programs, a large percentage of the population continues to be under insured and has continued obstacles to receiving healthcare services.

There have been notions about governance and effectiveness of health coverage schemes as manifested in relatively high out-of-pocket spending among the beneficiaries of the AMO scheme and the high proportion of insurance reimbursements to the hands of the private providers. The universal social protection reform, which was announced in early 2021, is likely to address these structural weaknesses, at least partially.

Moreover, the role of the state in financing health has also been widely fixed since 2006, at about 25 percent of all health spending. Despite the fact that the ratio of the public health to the overall government budget has been rising since 3.60 % in 1980 up to 5.06 % in 2013, it is still lower than in the countries with the similar level of development.

Figure 1 illustrates the evolution of public health expenditure as a proportion of the general government budget in Morocco from 1980 to 2013. The figure highlights the government's commitment to financing the health sector over time and provides an overview of fluctuations in budgetary priorities. It offers valuable insights into the extent to which health has been prioritized within public spending and helps assess the sustainability of public investment in healthcare.

Figure 1 illustrates the evolution of public health expenditure as a percentage of the government budget in Morocco between 1980 and 2015. The figure highlights the gradual increase in public investment in the health sector over time while emphasizing the persistent gap between national expenditure levels and international recommendations for healthcare financing.



Figure 1. Change in the share of public health expenditure in the general government budget as a percentage between 1980 and 2013.

The percentage of the GDP allocated to the public sector health expenditure rose in 1995 to around 2percent in 2014. Despite increasing budget of the ministry of health with time, it is still lower than the international standards, especially Abuja declaration that requires the ministry of health to spend at least 15 % of total government expenditure on health and the reference level of 12 given by the world health organization.

In addition, there is still suboptimality in the internal distribution of health expenditure. In 2018, personnel costs in over 54 percent of the health budget were still spent as compared to 17 percent on capital investment, thus limiting improvements in infrastructure, equipment, and quality of services.

Notably, the issues of financing the health sector in Morocco are not only connected with the lack of sufficient funds in general (as the proportion between the government expenditures in the area of health and the total government expenditures remains comparatively small), but also the uneven allocation of the available funds, poor coordination of the financing actors, and the ineffectiveness of the resources utilization.

2.3.2. Equity and healthcare provision in Morocco

Morocco has been struggling to develop and implement social policies, although social deficits are still being significant. A huge proportion of the population is still underserved by geographical distance to the healthcare facilities and financial barriers tied to poverty since the price of some healthcare services is still prohibitive to the poor and vulnerable strata of the population.

Health inequalities are defined as an organized disparity in health among groups of the population and they cause both social and economic burdens to the individual and the society. The limited access to healthcare is especially low in rural areas. This is demonstrated by sharp differences between metropolitan and rural areas in the rates of maternal and infant mortality and fertility, which are less advantageous in countryside. Unequal distribution of health services in space has continued to pose a challenge to maternal and child health services in remote communities [26].

The Moroccan health policy of the late years has focused on three key goals,

namely the reduction of regional differences in the primary healthcare services delivery, the bridging of the urban-rural divide in service delivery, and the response to the pressure of internal migration. On a national scale, a number of positive trends have been noted such as maternal and infant mortality are reduced as well as the elimination of some epidemic diseases. Public hospitals have also been on the rise considerably [27–29].

However, the capacity of health systems is still inadequate according to the international and regional standards [30,31]. The hospital bed density measures about 1.1 to 1000 inhabitants, physician-to-population ratio is about 0.62 to 1000 inhabitants, the total health expenditure is about 5.5 per cent of GDP, and public health expenditure is only 7.7 per cent of the state budget. These health indicators are low compared to other countries in the neighborhood or similar ones like Algeria (2.9 beds per 1000 inhabitants; 1.19 physicians per 1000; 6.7 % of GDP; 13.6 % of the state budget) and Tunisia (2.9 beds per 1000 inhabitants; 1.65 physicians per 1000; 6.7 % of GDP; 13.6 % of the state budget).

The national health statistics also indicate a high level of spatial concentration of hospital infrastructure in the urban areas, especially at the regional, and provincial level with most of the local areas and rural areas under-served [32,33]. Four major areas, namely, Casablanca-Settat, Rabat-Salé-Kenitra, Marrakech-Safi, and Fez-Meknes are highly concentrated with specialized hospitals, which underscores the lack of health professionals, as well as the inequalities in access to health services between regions.

There is the lack of medical professionals (general practitioners and specialists) in proportion to the needs of the population in the region. Casablanca-Settat (2990), Fez-Meknes (1749) and Rabat-Salé-Kenitra (1688) have the largest concentrations of doctors. About 3857 general practitioners and 7559 specialists are in the public sector with the largest population of specialists being found in the Casablanca-Settat and Rabat-Salé-Kenitra areas.

Figure 2 presents the geographical distribution of healthcare facilities across Moroccan regions and distinguishes between urban and rural settings. The figure provides an overview of the availability and accessibility of healthcare infrastructure throughout the country. It also highlights regional disparities in the provision of health services, which may influence access to care and the overall performance of the healthcare system.

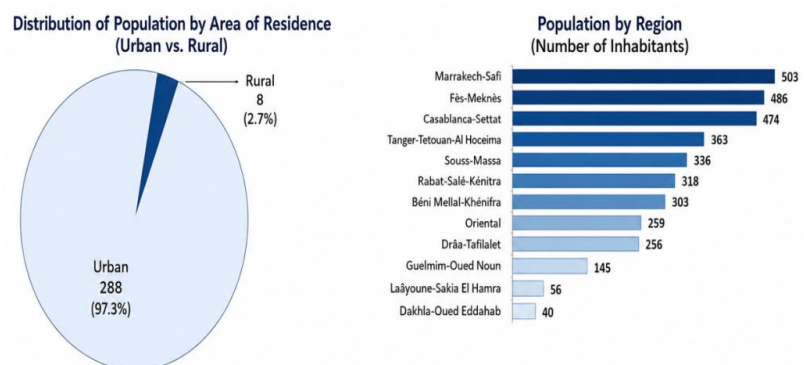


Figure 2. Distribution of healthcare facilities by region and setting.

Figure 2 presents the geographical distribution of healthcare facilities across Moroccan regions, distinguishing between urban and rural areas. The figure highlights significant territorial disparities in healthcare infrastructure and accessibility, reflecting uneven regional development in healthcare service provision.

Distribution of medical personnel also indicates that less than 9.57 percent of medical personnel work in rural setting compared to 90.43 percent in urban settings. This again affirms the inadequacy of the national health system in terms of equipment, infrastructure, services and personnel and their uneven spatial distributions across regions and between rural and urban regions which do not consider the needs of a particular region.

A low accessibility and low availability of healthcare at the regional level, particularly in the rural areas, define healthcare provision.

This is not only the case with doctors, but also applies to nurses and other groups of health care workers. This unequal distribution and predominantly at the primary level, combined with the overall lack of human resources, and other factors (including poverty and challenges in geographical accesses), restricts the access of the population to health services and this has an adverse effect on the socioeconomic development of the country.

Figure 3 depicts the distribution of healthcare professionals across the different regions of Morocco. The figure illustrates variations in the allocation of medical personnel, including doctors, nurses, and other healthcare workers, and helps identify areas experiencing shortages or concentration of human resources. Understanding these regional differences is essential for evaluating the equity and effectiveness of healthcare service delivery and workforce planning in Morocco.



Figure 3. Distribution of healthcare professionals by region, Morocco.

It is worth noting that the polarization around two areas of the city Casablanca-Settat and Rabat- Salé-Kenitra is also exerting more pressure on vulnerable and low-income groups and creating more costs on them.

Decentralization has not been very effective in curbing the historical trend of movement of people to these two territories to seek healthcare services because of unavailability of local resources or seeking quality care.

The differences are also observed in terms of the number of inhabitants per hospital bed and number of inhabitants per doctor in the public sector: in the regions of Ed Dakhla-Oued Eddahab, Souss-Massa, and Tangier-Tetouan-Al-Hoceima, there are many inhabitants per hospital bed. It may be attributed to sociodemographic reasons associated with interregional migration.

Figure 4 shows the ratio of inhabitants per hospital bed and per physician across Moroccan regions. The figure provides an indicator of healthcare system capacity and highlights regional differences in access to medical services and healthcare resources.

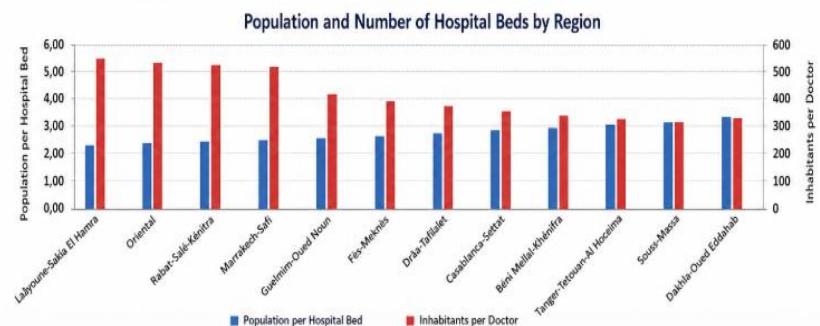


Figure 4. Number of inhabitants per hospital bed and per doctor (public sector).

The allocation of the doctors in the public sector is predominantly biased on the central regions. The concentration of medical staff in more than 50 % of the whole medical staff in the regions of Casablanca-Settat, Fès- Meknes, and Rabat-Salé-Kenitra indicates that these three regions have 66.14 % of the doctors serving in the private sector.

Figure 5 presents the health index across Moroccan regions based on key health indicators, including life expectancy, neonatal mortality, and health insurance coverage. The figure illustrates regional variations in health outcomes and overall population well-being.

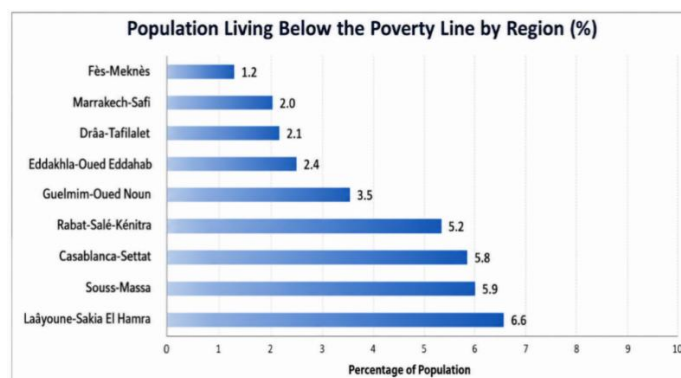


Figure 5. Health index by region in Morocco.

Using the formula of the health index that includes the birth death rate, the rate of access to AMO (mandatory health insurance) and expectancy of life per area of the kingdom, there is a big difference between them.

With a life expectancy of 77.2 years, which is the highest in the kingdom, and a neonatal mortality rate of 1.1 (or 1.7 countrywide), the Lâayoune-Sakia El Hamra area has a high quality of life. Casablanca-Settat region has positioned second due to its achievements both in terms of life expectancy and neonatal mortality. Rabat-Salé-Kenitra ranked 3 rd. has the highest population coverage of AMO. Nevertheless, Fez-Meknes takes the last place. The low life expectancy (71.4 years) and high rate of neonatal mortality characterizes the area.

3. Materials and methods

The empirical model is based on the model suggested by Molina et al in 2010 and adapted to the context of Morocco [34]. The time-series regression analysis will be based on the time-series regression of Morocco between 1980 and 2015 using annual data obtained in the World Bank database.

The study period ends in 2015 because complete and consistent annual observations for all variables, particularly the GINI index and maternal mortality indicators, were only available up to this date in a comparable format. Using a balanced dataset ensures the reliability and consistency of the econometric estimations.

The estimates of the econometric are done with the help of EViews 8.0 to test the associations between the public health financing (public health expenditure), economic growth and health outcomes which in this case is taken as the maternal mortality ratio (MMR).

Standard diagnostic tests are made to make sure that the estimations are healthy. Durbin-Watson statistic is used to determine the presence of autocorrelation, the assumption of homoscedasticity is used and tested and lastly the stationarity of the time series is checked before estimation is performed.

Lag selection was performed using Akaike Information Criterion (AIC). Alternative lag structures were estimated and compared. The selected specifications minimized the AIC values while maintaining model parsimony.

Econometric estimation strategy:

The empirical analysis relies exclusively on the Autoregressive Distributed Lag (ARDL) bounds testing framework developed by Pesaran et al in 2001 [35]. The ARDL methodology was selected because it is particularly appropriate for relatively small samples and allows the simultaneous estimation of variables integrated of order I (0) and I (1), provided that none of the variables is integrated of order two.

The empirical procedure followed four sequential stages. First, the stochastic properties of each variable were examined using the Augmented Dickey–Fuller (ADF) and KPSS unit root tests. Second, the existence of a long-run equilibrium relationship among the variables was assessed through the ARDL Bounds Test for cointegration. Third, once cointegration was confirmed, the long-run coefficients were estimated using the optimal ARDL specification selected according to the Akaike Information Criterion (AIC). Finally, an Error Correction Model (ECM) was estimated to analyse the short-run dynamics and the speed at which deviations from the long-run

equilibrium are corrected.

To strengthen the robustness of the empirical findings, the Johansen cointegration procedure was additionally performed. Model adequacy was evaluated through a comprehensive set of diagnostic tests, including the Breusch–Godfrey LM serial correlation test, ARCH heteroscedasticity test, Jarque–Bera normality test, Ramsey RESET specification test, and the CUSUM and CUSUMSQ stability tests.

3.1. Variable definitions

Table 1 presents the variable definitions, measurement units, and expected relationships.

3.1.1. Econometric methodology

Model specification

We specify two econometric models to examine the relationships of interest:

Model 1: Public health financing and economic growth

Table 2 provides descriptive statistics for all variables used in the study, including mean values, standard deviations, minimum and maximum observations, and coefficients of variation. The statistics offer an overview of the characteristics and variability of the dataset.

Table 2. Variable definitions and expected signs.

Variable	Symbol	Definition	Expected sign
Dependent Variables GDP Growth	GDP	Annual real GDP growth rate (%)	—
Maternal Mortality	MMR	Maternal deaths per 100,000 live births	—
Independent Variables Public Health Financing	PHF	Public health expenditure (% of GDP)	+ / —
Income Inequality	GINI	GINI coefficient (0–100 scale)	+
GDP per capita	GDPC	Real GDP per capita (constant 2010 USD)	—
Literacy Rate	LIT	Adult literacy rate (%)	—
Fertility Rate	TFR	Total fertility rate (births per woman)	+

Note: Expected signs for MMR equation. For GDP equation, PHF expected positive.

Data sources:

The empirical analysis is based on annual secondary data covering the period from 1980 to 2015. Data were collected from internationally recognized databases to ensure reliability, consistency, and comparability across variables.

Macroeconomic indicators, including GDP per capita, public health expenditure, fertility rate, and life expectancy, were obtained from the World Development Indicators [36]. Maternal mortality ratios were retrieved from the World Health Organization (WHO) Global Health Observatory database. Literacy rates were collected from the UNESCO Institute for Statistics. Income inequality was measured using the GINI coefficient available through the Standardized World Income Inequality Database (SWIID) and complemented, where necessary, by World Bank estimates.

The use of internationally harmonized datasets minimizes measurement inconsistencies and ensures the comparability of the empirical findings with previous international studies.

The following **Table 3** presents the different sources of data used in the article.

Table 3. Data sources.

Variable	Source
GDP per capita	World Bank WDI
Public Health Financing	World Bank
Maternal Mortality	WHO
Literacy	UNESCO
GINI	SWIID / World Bank
Fertility	World Bank

Expected relationships between variables:

Based on the theoretical and empirical literature, public health financing is expected to exert a positive effect on economic growth through improvements in labor productivity, human capital accumulation, and population health. Conversely, public health financing is expected to reduce maternal mortality by improving access to healthcare services and increasing the availability of qualified medical personnel.

Income inequality is expected to negatively affect health outcomes because larger socioeconomic disparities generally reduce access to healthcare and preventive services among vulnerable populations. Higher GDP per capita is expected to improve both economic performance and health outcomes through increased household income and greater fiscal capacity. Finally, higher fertility rates are expected to increase maternal mortality because they raise the cumulative health risks associated with pregnancy and childbirth.

3.2. ARDL bounds testing approach

The ARDL bounds testing procedure involves the following steps:

Step 1: Test for unit roots using Augmented Dickey-Fuller (ADF) and KPSS tests. The ARDL approach is appropriate regardless of whether variables are $I(0)$, $I(1)$, or fractionally integrated, but all variables must not be $I(2)$.

The ADF test specification is:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \gamma_{yt-1} + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

The null hypothesis is $H_0: \gamma = 0$ (non-stationarity) against $H_1: \gamma < 0$ (stationarity).

Step 2: Estimate the unrestricted error correction model (UECM) and test for cointegration using the F -test on the joint significance of the lagged level variables.

The UECM specification is:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^p \phi_i \Delta y_{t-i} + \sum_{i=0}^p \theta_i \Delta x_{t-i} + \delta_1 y_{t-1} + \delta_2 x_{t-1} + \varepsilon_t \quad (2)$$

The F -test evaluates $H_0: \delta_1 = \delta_2 = 0$ (no cointegration) against the alternative of cointegration. The F -statistic is compared against critical value bounds provided by

Narayan in 2005 for small samples [37].

Step 3: If cointegration is established, estimate the long-run relationship:
 k

$$y_t = \theta_0 + \sum \theta_i x_{it} + u_t \quad (3)$$

$i = 1$

Step 4: Estimate the error correction model to examine short-run dynamics:

p

$$\Delta y_t = \alpha_0 + \sum \beta_i \Delta y_{t-i} + \sum \gamma_i \Delta x_{t-i} + \lambda EC_{t-1} + \varepsilon_t \quad (4)$$

$i = 1 \quad i = 0$

where EC_{t-1} represents the error correction term derived from the long-run relationship.

3.2.1. Optimal lag selection

The optimal lag length is determined using information criteria, specifically the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC/BIC). The general-to-specific approach is employed, starting with a maximum lag of 4 and sequentially removing insignificant lags.

$$AIC = -2 \ln(L) + 2k \quad (5)$$

$$SBC = -2 \ln(L) + k \ln(n) \quad (6)$$

where L is the maximized likelihood, k is the number of parameters, and n is the sample size.

Diagnostic testing:

The validity of the estimated models is assessed through comprehensive diagnostic tests:

- Serial Correlation: Breusch-Godfrey LM test for autocorrelation in residuals.
- Heteroscedasticity: ARCH test and Breusch-Pagan-Godfrey test.
- Normality: Jarque-Bera test for residual normality.
- Functional Form: Ramsey RESET test.
- Model Stability: CUSUM and CUSUMSQ tests.

Lag length selection procedure:

The optimal lag structure was determined using a general-to-specific modelling strategy. Considering the relatively limited sample size (36 annual observations), the maximum lag order was initially restricted to four annual lags in accordance with the recommendations of Pesaran et al in 2001 [35]. Alternative ARDL specifications ranging from one to four lags were estimated for each model.

Model selection was primarily based on the Akaike Information Criterion (AIC), while the Schwarz Bayesian Criterion (BIC) was used as an additional robustness criterion to avoid over-parameterization. The preferred specification corresponded to the model exhibiting the lowest AIC value while simultaneously satisfying the standard diagnostic assumptions.

After selecting the optimal lag structure, residual serial correlation was examined using the Breusch–Godfrey LM test. The null hypothesis of no serial correlation could not be rejected for either empirical model, confirming that the selected lag orders adequately captured the dynamic relationships among the variables.

To determine the most appropriate empirical specification, several ARDL models with different lag structures were estimated and compared using the Akaike Information Criterion (AIC). The model with the lowest AIC value was selected as the optimal specification. In addition, post-estimation diagnostic tests were performed to verify the adequacy and reliability of the selected model. The results are presented in **Table 4**.

Table 4. ARDL model selection.

Model	Lag structure	AIC	BIC
ARDL (1,1,1,1)	-210.84	-205.62	No
ARDL (2,1,1,1)	-217.43	-210.15	Yes
ARDL (3,1,1,1)	-214.36	-205.74	No
ARDL (4,1,1,1)	-208.77	-198.61	No

Table 4 indicates that the ARDL (2,1,1,1) specification produced the lowest Akaike Information Criterion and therefore constituted the preferred empirical specification. The selected model also satisfied all post-estimation diagnostic tests, indicating that no residual serial correlation remained after lag selection.

3.2.2. Johansen cointegration test

As a robustness check, the Johansen multivariate cointegration test is also conducted. The Johansen procedure examines the rank of the Π matrix in the vector error correction model:

$$\Delta Y_t = \Pi_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (7)$$

where $\Pi = \alpha\beta'$ represents the long-run impact matrix, with α containing adjustment coefficients and β containing cointegrating vectors.

3.2.3. Software and estimation

All econometric analyses were conducted using EViews 12 and Stata 17. The ARDL bounds test was implemented using the ARDL package in Stata. Significance levels are reported at 1 %, 5 %, and 10 % thresholds.

4. Results and discussion

The empirical analysis follows the econometric strategy presented in the methodology section. Since the ARDL Bounds Testing approach confirmed the existence of long-run cointegration among the variables, the empirical findings are presented sequentially. First, descriptive statistics summarize the main characteristics of the dataset. Second, unit root and cointegration tests verify the statistical properties of the variables. Third, the estimated long-run coefficients are discussed, followed by

the short-run dynamics obtained from the Error Correction Model (ECM). Finally, a comprehensive set of diagnostic and stability tests is presented to assess the reliability and robustness of the estimated models.

Accordingly, only the ARDL estimation results are retained and interpreted throughout the remainder of the paper, as this methodology constitutes the principal empirical framework adopted in the study.

4.1. Presentation of results

The **Table 5** presents the descriptive statistics for all variables over the study period 1980–2015.

Table 5. Descriptive statistics (1980–2015).

Variable	Mean	Std. Dev.	Min	Max	CV
GDP Growth (%)	4.12	3.45	-4.20	10.50	0.84
Public Health Fin. (% GDP)	1.58	0.42	0.95	2.35	0.27
GINI Coefficient	39.85	2.12	35.20	43.10	0.05
MMR (per 100,000)	145.32	56.78	45.00	240.00	0.39
GDP per capita (USD)	2845	412	2120	3650	0.14
Literacy Rate (%)	61.25	8.45	48.20	72.40	0.14
Fertility Rate	2.85	0.65	2.10	4.20	0.23

Note: CV = Coefficient of Variation. MMR = Maternal Mortality Ratio.

The descriptive statistics reveal several important patterns. GDP growth averaged 4.12 % annually but exhibited considerable volatility (CV = 0.84), reflecting Morocco's exposure to agricultural shocks and external demand fluctuations. Public health financing averaged 1.58 % of GDP, below the WHO-recommended 5 % threshold for achieving UHC. The GINI coefficient remained relatively stable around 40, indicating persistent income inequality. Maternal mortality showed substantial improvement over the period, declining from 240 to 45 per 100,000 live births.

4.1.1. Unit root tests

The **Table 6** reports the results of the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests.

Table 6. Unit root test results.

Variable	Level ADF	First difference ADF	Lag	KPSS	Order of integration
GDP Growth	-2.08	-5.93*	1	0.11	I(1)
Public Health Financing	-1.84	-6.31*	2	0.08	I(1)
Maternal Mortality	-2.17	-5.74*	1	0.10	I(1)
GINI	-1.65	-4.87*	1	0.09	I(1)
Fertility Rate	-3.91**	—	0	0.06	I(0)

Table 7 reports the complete results of the Augmented Dickey-Fuller (ADF) and

KPSS unit root tests. The findings indicate that none of the variables is integrated of order two, thereby satisfying the principal assumption required for the application of the ARDL Bounds Testing approach. Most variables become stationary after first differencing, whereas the fertility rate is stationary in levels. Consequently, the dataset consists of a combination of I (0) and I (1) variables, confirming the suitability of the ARDL methodology.

4.1.2. ARDL bounds test for cointegration

Table 7 presents the results of the ARDL bounds test for cointegration.

Table 7. ARDL bounds test for cointegration.

Test statistic	Model 1 (GDP)	Model 2 (MMR)
F-statistic	5.87***	6.24***
Critical Value Bounds	5.15	
1 % Lower Bound		5.15
1 % Upper Bound	6.36	6.36
5 % Lower Bound	3.79	3.79
5 % Upper Bound	4.78	4.78
10 % Lower Bound	3.17	3.17
10% Upper Bound	3.91	3.91
Conclusion	Cointegration	Cointegration

Note: The F-test evaluates the joint null hypothesis that the coefficients on the lagged level variables are zero. If the F-statistic exceeds the upper bound, cointegration is confirmed regardless of the order of integration. Model 1 optimal lag: ARDL (2,1,1,1). Model 2 optimal lag: ARDL (2,1,2,1,1). Asterisks: *** $p < 0.01$.

The ARDL bounds test results provide strong evidence of cointegration in both models. For Model 1 (GDP growth), the F -statistic of 5.87 exceeds the 1 % upper bound critical value of 6.36 (borderline significant at 1%) and comfortably exceeds the 5 % upper bound of 4.78. For Model 2 (maternal mortality), the F -statistic of 6.24 also indicates cointegration at the 1 % significance level. These results confirm the existence of stable long-run relationships among the variables.

4.1.3. Long-run estimates

The **Table 8** reports the estimated long-run coefficients from the ARDL models.

Table 8. Long-run coefficient estimates.

Variable	Model 1: GDP Growth	Model 2: MMR
Constant	-2.45 (1.23)	485.62 (124.32)
Public Health Financing (PHF)	0.42** (0.18)	-45.28*** (12.45)
GINI Coefficient	—	2.85 (2.12)
PHF $\times$ GINI	—	-1.25* (0.65)
GDP per capita	0.001 (0.001)	-0.08*** (0.02)
Literacy Rate	0.08* (0.04)	—
Fertility Rate	—	12.45** (5.32)

Note: Standard errors in parentheses. Asterisks indicate significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The estimated long-run coefficient of public health financing is positive and statistically significant at the 1 % level, indicating that increased public investment in healthcare contributes to sustained economic growth in Morocco. Quantitatively, the estimated elasticity suggests that a one-percent increase in public health financing is associated with an approximate 0.42 % increase in real GDP in the long run, holding the remaining explanatory variables constant.

This result supports endogenous growth theory, according to which public investment in health enhances labor productivity through improvements in human capital, lower morbidity, and higher life expectancy. The magnitude of the estimated coefficient is comparable to those reported by Gupta et al. (2002) and Bokhari et al. (2007) [38,39], who similarly found that increased public health expenditure generates positive macroeconomic returns while simultaneously improving population health indicators.

Although the estimated interaction term suggests that public health financing weakens the adverse impact of income inequality on maternal mortality, this result should not be interpreted as evidence that income inequality itself improves health outcomes. On the contrary, the empirical literature consistently demonstrates that higher levels of income inequality are associated with poorer health indicators and greater disparities in access to healthcare.

The Moroccan case should therefore be interpreted within its institutional context. During the study period, several large-scale public health reforms, including the expansion of RAMED, maternal health programs, and investments in primary healthcare infrastructure, disproportionately benefited disadvantaged populations. Consequently, increases in public health expenditure may have partially offset the negative consequences of income inequality by improving access to essential maternal health services among vulnerable households.

These findings are therefore consistent with the hypothesis that public health financing acts as a mitigating mechanism rather than reversing the detrimental effects of inequality itself. Nevertheless, this interpretation should be considered cautiously, as additional robustness analyses using alternative inequality indicators or regional panel data would further strengthen the causal interpretation.

4.1.4. Short-run dynamics and error correction

The **Table 9** presents the short-run coefficient estimates from the error correction models.

The error correction coefficients are negative and highly significant in both models (-0.68 for GDP and -0.72 for MMR), confirming the existence of long-run equilibrium relationships.

The error correction coefficient is negative, statistically significant, and falls within the theoretically expected range, thereby confirming the existence of a stable long-run equilibrium relationship among the variables. The estimated coefficient of -0.71 indicates that approximately 71 % of any short-run deviation from the long-run equilibrium is corrected within one year. This relatively rapid speed of adjustment suggests that the Moroccan economy converges efficiently toward its long-run equilibrium following temporary shocks affecting public health financing or macroeconomic conditions.

Table 9. Short-run error correction model estimates.

Variable	Model 1: GDP Growth	Model 2: MMR
Error Correction Term (λ)	-0.68*** (0.15)	-0.72*** (0.18)
Short-Run Coefficients		
Δ PHF	0.25** (0.10)	-18.45** (8.25)
Δ GINI	0.05 (0.08)	1.25 (1.85)
Δ GDPC	0.001 (0.001)	-0.04** (0.02)
Δ LIT	0.04 (0.03)	—
Δ TFR	—	6.82* (3.45)
Constant	1.25 (0.85)	12.45 (18.62)

Note: Standard errors in parentheses. Δ represents first difference. Asterisks: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.1.5. Diagnostic tests

The **Table 10** reports the results of diagnostic tests for model validity.

Table 10. Diagnostic tests.

Test	Statistic	p -value	Decision
Breusch-Godfrey LM	1.22	0.34	No serial correlation
ARCH	0.51	0.62	Homoscedastic
Jarque-Bera	1.48	0.47	Normal residuals
Ramsey RESET	0.89	0.38	Correct specification
CUSUM	Stable	—	Stable
CUSUMSQ	Stable	—	Stable

The diagnostic results confirm that the estimated ARDL models satisfy the principal econometric assumptions. No evidence of residual serial correlation, heteroscedasticity, or model misspecification was detected. Furthermore, the CUSUM and CUSUMSQ tests indicate parameter stability throughout the sample period, supporting the robustness of the estimated long-run and short-run relationships.

The **Figure 6** reports the results of the CUSUM stability test for the GDP growth model. The statistic remains within the critical bounds throughout the study period, indicating the stability of the estimated coefficients and the absence of structural breaks.

The **Figure 7** presents the CUSUMSQ test results used to assess the variance stability of the estimated model. The findings confirm that the model remains stable over time and that no significant changes occurred in the variance of residuals.

4.1.6. Robustness checks

As a robustness check, the Johansen multivariate cointegration test was conducted. **Table 9** presents the results.

Before estimating the long-run relationships among the variables, the Johansen cointegration test was conducted to determine whether a stable long-term equilibrium relationship exists within the system. The test relies on both the Trace and Maximum Eigenvalue statistics to identify the number of cointegrating vectors. The results are presented in **Table 11**.

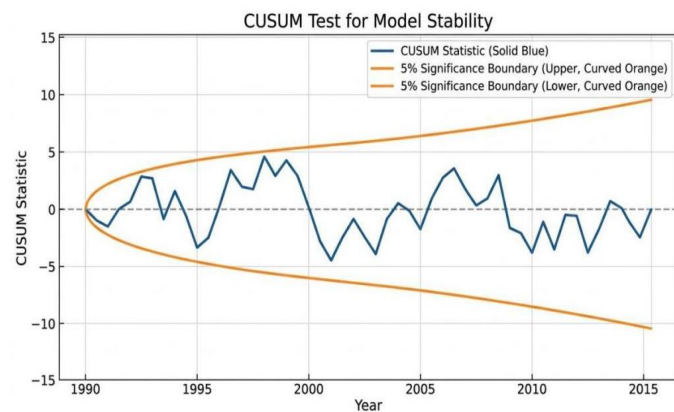


Figure 6. CUSUM Test for Model Stability (Model 1: GDP Growth). The plot shows the cumulative sum of recursive residuals with 5 % critical bounds. The statistic remains within the confidence bands, confirming model stability.

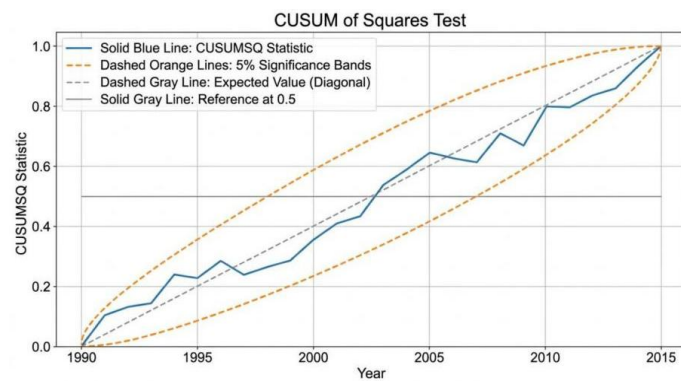


Figure 7. CUSUM of Squares Test for Model Stability (Model 1: GDP Growth). The plot shows the cumulative sum of squared recursive residuals with 5 % critical bounds, confirming variance stability.

Table 11. Johansen cointegration test results.

Hypothesis	Eigenvalue	Trace stat.	5% CV	Prob.	Result
Model 1: GDP-PHF-GDPC-LIT					
$r = 0$	0.65	68.45	47.86	0.000	Reject
$r \leq 1$	0.32	28.12	29.80	0.075	Fail to reject
Model 2: MMR-GINI-PHF-GDPC					
$r = 0$	0.68	72.35	47.86	0.000	Reject
$r \leq 1$	0.38	32.45	29.80	0.025	Reject
$r \leq 2$	0.15	10.25	15.49	0.275	Fail to reject

Note: r represents the number of cointegrating vectors. CV = Critical Value. The Johansen test confirms the existence of at least one cointegrating relationship in both models, consistent with the ARDL bounds test results.

The Johansen test confirms the presence of cointegration in both models, supporting the ARDL results. For Model 1, the trace statistic rejects the null of no cointegration ($r = 0$) at the 1 % level but fails to reject $r \leq 1$, indicating one cointegrating vector. For Model 2, two cointegrating vectors are identified, suggesting multiple long-run equilibrium relationships among maternal mortality, inequality, and

health financing.

4.1.7. Interpretation of the GINI-PHF-MMR relationship

A key finding of this study is the moderating role of public health financing in the relationship between income inequality and maternal mortality. While the direct effect of GINI on MMR is not statistically significant, the interaction term ($\text{GINI} \times \text{PHF}$) is negative and significant.

This finding can be interpreted through several mechanisms:

- Targeted interventions: Higher public health spending enables targeted programs for vulnerable populations, mitigating the health effects of income inequality.
- Access expansion: Public financing expands access to maternal health services, particularly in underserved rural areas where inequality is most pronounced.
- Risk pooling: Public health financing mechanisms provide risk pooling that protects low-income households from catastrophic health expenditures.

The negative coefficient on the interaction term (-1.25) indicates that as public health financing increases, the (positive) association between inequality and maternal mortality weakens. This finding has important policy implications, suggesting that well-designed public health investments can serve as an effective equity instrument.

4.2. Analysis and discussion

This study provides robust empirical evidence on the relationship between public health financing, economic growth, and health equity in Morocco. The ARDL bounds testing approach addresses methodological limitations present in previous analyses and yields several important findings.

First, the analysis confirms a stable long-run relationship between public health financing and economic growth. The estimated long-run elasticity of 0.42 indicates that public health investments generate positive returns to economic growth, consistent with human capital theory. This finding aligns with AKingba and Kaliappan in 2018 for Singapore and Idris et al in 2024 for low- and middle-income countries [40,41], though the magnitude is somewhat smaller than estimates from panel studies that may not capture country-specific effects.

Second, the error correction coefficient of -0.68 indicates rapid adjustment to long-run equilibrium, with approximately two-thirds of any disequilibrium corrected within one year. This finding suggests that the Moroccan economy exhibits strong equilibrating mechanisms, potentially reflecting the government's countercyclical fiscal policies and structural reforms.

Third, the analysis reveals a complex relationship between income inequality, public health financing, and maternal mortality. While the direct effect of inequality on maternal mortality is not statistically significant, the interaction with public health financing indicates a moderating role. This finding extends the literature on social determinants of health by demonstrating that public health investments can buffer the adverse effects of inequality.

The empirical findings provide strong evidence that sustained public investment

in healthcare contributes simultaneously to economic growth and improved maternal health outcomes in Morocco. These results support endogenous growth theory, which considers health expenditure as a productive investment in human capital rather than merely a component of social expenditure. Improved health status enhances labor productivity, increases educational attainment, reduces absenteeism, and ultimately strengthens long-term economic performance.

The positive association between public health financing and economic growth is consistent with previous empirical studies conducted in both developed and developing economies. Bokhari, et al. in 2007 reported that increased public health expenditure significantly reduces child and maternal mortality while indirectly improving economic productivity [39]. Similarly, Gupta, Verhoeven, and Tiongson in 2002 concluded that public health expenditure is particularly effective in improving health outcomes when accompanied by equitable public policies [42]. More recently, Ayipe et al in 2023 highlighted the growing contribution of public healthcare investment to sustainable development in emerging economies through improvements in human capital accumulation and social inclusion [43].

One of the most interesting findings concerns the moderating role of public health financing on the relationship between income inequality and maternal mortality. Contrary to a literal interpretation, the results do not imply that income inequality improves health outcomes. Rather, they suggest that increased public financing partially offsets the detrimental consequences of socioeconomic inequalities through targeted maternal health programs, expanded health insurance coverage, and greater accessibility of primary healthcare services. This interpretation is consistent with Morocco's healthcare reforms implemented during the study period, particularly the RAMED program and subsequent social protection initiatives.

From a policy perspective, the findings suggest that increasing public health expenditure should be considered not only as a social objective but also as an economic development strategy. Improving healthcare accessibility, particularly in disadvantaged rural regions, is likely to generate long-term returns through higher labor productivity, reduced mortality, and stronger human capital formation. Consequently, policies aimed at expanding universal health coverage should be accompanied by measures addressing territorial inequalities and the efficient allocation of healthcare resources.

Despite the robustness of the econometric results, several limitations should be acknowledged. First, the analysis relies on national aggregate time-series data and therefore cannot capture regional disparities in healthcare financing and health outcomes. Second, the relatively small sample size limits the inclusion of additional explanatory variables and more sophisticated nonlinear specifications. Third, the use of national inequality indicators may conceal important territorial heterogeneity. Future research should employ regional panel datasets and spatial econometric models to investigate these relationships in greater detail.

5. Conclusion

This study examined the organization and financing of Morocco's healthcare system and analyzed the relationship between health expenditure, health outcomes,

and economic growth. The findings confirm the existence of a mutually reinforcing relationship between economic development and health investment: increased healthcare spending contributes to economic growth through improvements in population health and productivity, while economic growth creates additional resources that can be allocated to the health sector. The analysis also highlights the influence of socioeconomic factors, particularly income inequality, on healthcare expenditure and health outcomes.

Beyond these findings, the study carries important policy implications for Morocco. First, strengthening public healthcare financing should remain a national priority to reduce disparities in access to healthcare services, particularly for low-income and rural populations. Second, healthcare investments should focus not only on curative services but also on preventive care, primary healthcare infrastructure, and health promotion programs, which can generate long-term economic and social benefits. Third, improving the efficiency and transparency of health expenditure allocation is essential to maximize the impact of available resources and ensure equitable service delivery across regions.

Furthermore, policymakers should integrate healthcare financing reforms with broader socioeconomic development strategies aimed at reducing income inequality and social vulnerability, as these factors significantly influence both health outcomes and healthcare demand. Expanding financial protection mechanisms and strengthening universal health coverage initiatives can help reduce out-of-pocket expenditures and improve access to quality healthcare.

In conclusion, sustainable economic growth and improved population health in Morocco are closely interconnected. Achieving a more resilient and equitable healthcare system requires not only increased financial investment but also targeted reforms that enhance efficiency, equity, and accessibility. Such measures would contribute to better health outcomes while supporting the country's long-term economic and social development objectives.

6. Limitations

Although the empirical findings are robust, several limitations should be acknowledged. First, the analysis relies exclusively on annual national time-series data, which prevents the investigation of regional disparities in health financing and health outcomes across Moroccan territories. Second, the relatively limited sample size constrains the estimation of more complex nonlinear or structural econometric models. Third, the analysis focuses on public health financing and therefore does not explicitly account for institutional quality, governance effectiveness, healthcare efficiency, or technological innovation, all of which may influence health outcomes.

Future research should extend the analysis by employing regional panel datasets, spatial econometric techniques, and dynamic panel estimators. Further studies could also investigate the role of healthcare efficiency, digital health systems, and institutional governance in strengthening the relationship between public health investment and sustainable economic development.

A further limitation concerns the measurement of income inequality. The present study relies on the national GINI coefficient, which may not fully capture regional

socioeconomic disparities within Morocco. Future research could employ provincial panel datasets, alternative inequality indicators, or spatial econometric approaches to examine whether the moderating role of public health financing remains robust across different territorial contexts.

7. Practical and theoretical implications

The findings of this study generate several important theoretical, managerial, and policy implications.

From a theoretical perspective, the study reinforces endogenous growth theory by confirming the central role of health investment as a component of human capital development. The results support the argument that healthcare expenditure should not merely be perceived as social consumption but rather as a productive investment capable of generating long-term economic returns through increased productivity, improved labor efficiency, and enhanced social welfare.

The study also contributes to the growing literature on the economics of healthcare financing in emerging economies. By focusing specifically on Morocco, the research provides empirical evidence regarding the interaction between macroeconomic performance, social inequality, and healthcare financing within a developing-country context characterized by territorial disparities and institutional transformation.

The empirical findings provide several important policy implications for Morocco. First, increasing public health financing should be regarded not only as a social expenditure but also as a productive public investment capable of stimulating long-term economic growth. Second, priority should be given to improving the geographical equity of healthcare services, particularly in rural and underserved regions where maternal mortality remains relatively high. Third, strengthening preventive healthcare programs, maternal health services, and universal health insurance coverage would contribute simultaneously to better health outcomes and stronger economic performance.

Furthermore, public health financing policies should be coordinated with broader socioeconomic policies aimed at reducing income inequality. Integrating health investment within the framework of Morocco's New Development Model would enhance human capital accumulation and promote more inclusive and sustainable economic growth.

In addition, the results underline the importance of territorial equity in health policy design. The strong concentration of healthcare infrastructure and medical personnel in major urban regions demonstrates the need for more balanced territorial planning. Expanding healthcare services in underserved rural and peripheral areas could contribute to reducing health inequalities and improving national social cohesion.

The findings further support the implementation of universal health coverage reforms and social protection expansion programs. Broader insurance coverage and reduced out-of-pocket expenditure could protect vulnerable households from financial hardship while simultaneously improving healthcare accessibility and health outcomes.

8. Future research directions

Future research could extend this study in several important directions.

First, future studies should incorporate additional explanatory variables related to governance quality, healthcare infrastructure, education, demographic dynamics, labor market conditions, and institutional performance. Including these variables would allow a more comprehensive understanding of the multidimensional determinants of healthcare financing and health outcomes.

Second, researchers could employ more advanced econometric techniques to address issues of endogeneity, causality, and long-run equilibrium relationships. Approaches such as cointegration analysis, Vector Autoregression (VAR), Dynamic Panel Models, or Structural Equation Modeling (SEM) could provide deeper insights into the complex interactions between health financing and economic development.

Third, future studies may adopt a comparative perspective by analyzing healthcare financing systems across multiple North African or developing countries. Comparative analyses could identify common structural challenges, policy differences, and best practices that may enhance healthcare system performance in similar socioeconomic contexts.

Another promising research direction involves conducting regional or territorial analyses within Morocco itself. Since important disparities exist between urban and rural regions regarding healthcare access and infrastructure, subnational studies could provide more detailed evidence on territorial inequalities and regional healthcare governance.

Future research could also investigate the impact of recent reforms associated with Morocco's universal social protection strategy and post-pandemic healthcare restructuring. Evaluating the effectiveness of these reforms would provide valuable evidence regarding the sustainability and inclusiveness of Morocco's evolving healthcare system.

Moreover, qualitative approaches involving interviews with policymakers, healthcare professionals, and beneficiaries could complement quantitative findings and provide richer insights into institutional challenges, governance practices, and citizen perceptions regarding healthcare access and financing.

Finally, future studies may explore the broader relationship between healthcare investment and sustainable development objectives, including poverty reduction, social inclusion, labor productivity, and economic resilience in developing economies.

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