Estimating the Crowding-Out Effect of Public Health Spending on Out-of-Pocket Expenditures: A Comparative Econometric Analysis between Morocco and South Korea

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Abstract. Background: The achievement of Universal Health Coverage (UHC) often confronts the paradox of persistently high out-of-pocket (OOP) expenditures despite increased public investment. This study compares this phenomenon between Morocco, whose system is undergoing major reform, and South Korea, which has a mature system.

Objective: This article aims to quantify and compare the crowding-out effect of public spending on OOP in these two countries to measure the effectiveness of public financial transfers.

Method: An econometric analysis was conducted on panel data (2000-2022) from the World Bank/WHO. A "Pooled OLS" regression model with an interaction term was estimated, using robust and clustered standard errors to ensure the validity of the inferences.

Results: The marginal effect of public spending on OOP is -0.71 in Morocco (95% CI [-0.84, -0.57]) and -1.40 in South Korea. This difference, which is highly statistically significant ($p < 0.001$), indicates that the effectiveness of public financing is twice as high in South Korea. Hypothesis tests confirm that the transfer is imperfect in Morocco, whereas it exceeds a perfect transfer in South Korea.

Conclusion: The effectiveness of public investment in health is strongly conditioned by the system's maturity and regulation. For Morocco, budget increases are insufficient without deep structural reforms aimed at improving spending efficiency.

Keywords: Health financing; Crowding-out effect; Out-of-pocket expenditures (OOP); Universal Health Coverage (UHC); Morocco; South Korea

1 INTRODUCTION:

Achieving Universal Health Coverage (UHC) is a central goal for global health systems, aiming to ensure equitable access to care without exposing populations to financial hardship [1]. However, the expansion of de jure insurance coverage does not systematically translate into effective de facto financial protection. A high level of out-of-pocket (OOP) expenditures persists in many countries, constituting a major barrier to care access and a significant cause of impoverishment [2]. This phenomenon highlights a central paradox in health financing: a substantial portion of public

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effort does not result in an equivalent reduction of the financial burden on citizens, suggesting a partial "crowding-out effect" where public investment does not fully replace private spending.

Morocco perfectly illustrates this structural challenge. Engaged in an ambitious reform to generalize Compulsory Health Insurance (AMO) by 2025, the country has made remarkable quantitative progress in coverage. Nevertheless, the Moroccan health system remains characterized by high fragmentation and a critical dependence on out-of-pocket expenditures, which still account for nearly half of total health spending [3]. This situation raises crucial questions about the efficiency of the transmission of public financing policy into effective financial protection for households.

At the other end of the development spectrum, South Korea offers a particularly relevant point of comparison. Having achieved UHC in record time by the late 1980s [4], its system, organized around a single-payer insurer (National Health Insurance Service), is often cited as a model of success. Yet, despite its maturity and high-income status, the South Korean system also faces an OOP level higher than the OECD average, mainly due to a limited benefit package and a predominant private sector [5, 6]. The comparison between a developing model (Morocco) and a mature yet structurally complex system (South Korea) provides a unique opportunity to analyze the heterogeneity of the crowding-out effect.

While recent studies have initiated descriptive comparisons of the Moroccan and South Korean health systems [7] or analyzed their financing practices in isolation [1, 5], a rigorous and comparative econometric quantification of the elasticity of OOP in response to increased public spending is currently lacking. To what extent does public health spending reduce out-of-pocket expenditures, and why does its effectiveness differ between Morocco and South Korea?

This article aims to fill this gap by conducting the first comparative econometric analysis of the crowding-out effect for these two countries. Using time-series data from the World Bank and WHO for the period 2000-2022, we estimate a "pooled" regression model with an interaction term to quantify and compare the marginal impact of public health spending on out-of-pocket expenditures. The objective is to move beyond simple trend observation to provide a robust measure of the effectiveness of public financial transfers and to identify the structural factors that could explain the performance differences between the two systems. The results aim to inform debates on the priority reforms needed for the promise of UHC to become a concrete financial security for all.

2 LITERATURE REVIEW:

The literature on health financing has extensively demonstrated the complexity of the transition to Universal Health Coverage (UHC). The central challenge lies not only in expanding insurance coverage but also in the ability of health systems to provide effective financial protection, primarily measured by the reduction of out-of-pocket (OOP) expenditures [1, 2]. This literature review is structured around three

axes: the health financing paradox as a global challenge, an analysis of Morocco's specific context, and a perspective on the South Korean reference model.

2.1 The Crowding-Out Effect and the Health Financing Paradox

The concept of the "crowding-out effect" is central to understanding health financing dynamics. Ideally, each monetary unit invested by the public sector should replace one monetary unit of private spending, creating a "perfect transfer." However, OECD studies show that this transfer is often imperfect [2]. The persistence of high OOP levels despite increased public budgets indicates deep structural inefficiencies. These frictions may include weak regulation of private sector tariffs, an insufficient benefit package, or poorly designed co-payment mechanisms, forcing households to continue paying out-of-pocket even when covered [3]. The quantification of this crowding-out effect is therefore a key indicator of a health financing system's performance.

2.2 The Moroccan Context: Between Ambition and Structural Vulnerability

The Moroccan health system has been the subject of in-depth analyses that confirm its structural vulnerability. Recent works, such as those by Boughaleb and Jerry, emphasize that despite major advances in generalizing AMO, the system remains characterized by a fragmentation of financing sources and an excessive dependence on OOP [1]. These direct expenditures, representing nearly half of total health spending, limit equity and access to care. Another study by the same authors identifies persistent weaknesses in financial governance, including insufficient coordination, an inadequate regulatory framework, and fragmented information systems [3]. Cost analyses conducted by Akhnif et al. provide microeconomic evidence for this macroeconomic observation, showing significant cost variations for identical services across different public hospitals, suggesting significant inefficiencies and a lack of standardization [8, 9]. These structural weaknesses largely explain why additional public effort struggles to translate into a proportional reduction of the household burden.

2.3 The South Korean Model: Maturity, Efficiency, and Persistent Challenges

South Korea is often presented as a model of successful transition to UHC. Historical reforms, particularly the merger of multiple insurance societies into a single payer (National Health Insurance Service - NHIS) in 2000, were crucial for improving the system's equity and efficiency [4, 6]. The South Korean system is now characterized by centralized governance, strong investment in information technologies for management and regulation, and a robust legal framework that clearly defines financing mechanisms and the benefit package [5, 10, 11].

However, the model is not without its challenges. Studies like that of Lee et al. show, through a longitudinal econometric analysis (1990-2016), that while the equity of health insurance contributions has improved, OOP remains weakly regressive [5]. Analyses by the OECD and the World Bank confirm that the OOP level in South Korea remains high for a high-income country, mainly due to significant co-payments and a benefit package that excludes certain services, leaving an important role for complementary private insurance [12, 13]. Nevertheless, South Korea's trajectory demonstrates an ability to contain the growth of OOP while increasing the share of public financing, suggesting greater efficiency in the financial transfer mechanism.

This study provides the first comparative econometric quantification of the crowding-out effect between Morocco and South Korea.

3 METHODOLOGY AND DATA:

To quantify the crowding-out effect and compare its magnitude between Morocco and South Korea, this study adopts an econometric approach using macroeconomic panel data. This section details the data source, variable definitions, model specification, and the chosen estimation strategy.

3.1 Data Source and Sample:

The data used are from the World Bank's World Development Indicators (WDI) database, which aggregates statistics from the World Health Organization's (WHO) Global Health Expenditure Database. The use of this source, which relies on the standardized System of Health Accounts (SHA) methodology, ensures a high level of comparability of indicators between countries [2].

Our sample is a balanced panel covering the period from 2000 to 2022 for Morocco and South Korea. This period was chosen as it encompasses major reforms in both countries, notably the launch of AMO in Morocco and the consolidation of the single-payer system in South Korea [4]. The final sample includes N=2 countries and T=23 annual periods, for a total of 46 observations.

3.2 Variable Definitions:

In line with the health financing literature [1, 5], the following variables were selected for the model:

- → **Dependent Variable (Y):** Out-of-Pocket Expenditures (OOP). Measured as a percentage of current health expenditure (% CHE), this variable is the main indicator of effective financial protection. Its level reflects the share of care costs not covered by prepayment and risk-pooling mechanisms.
- → **Main Independent Variable (X_1):** Public Health Expenditure (Gov_Exp). Also measured as a percentage of current health expenditure, this variable represents the financial effort made by the state and social security schemes. It is the main public policy lever for reducing dependence on OOP.
- → **Control Variable (X_2):** Total Health Expenditure (% of GDP). Expressed as a percentage of Gross Domestic Product, this variable is included to control for the effect of the overall macroeconomic importance of the health sector, which could influence the financing structure independently of coverage policies.

Due to degrees-of-freedom constraints and the focus on financial structure, the model includes a limited set of controls.

3.3 Econometric Model Specification:

To test the hypothesis of a difference in the effectiveness of public effort between the two countries, we use a "pooled" multiple linear regression model with an interaction term. This specification allows us to capture both the average effect of public spend-

ing and how this effect is modulated by the national context. The model is formulated as follows:

$$OOP_{it} = \beta_0 + \beta_1 GovExp_{it} + \beta_2 Korea_i + \beta_3 (GovExp_{it} * Korea_i) + \beta_4 TotalExp_{it} + \varepsilon_{it}$$

Where:

- i denotes the country and t the year;
- OOP_{it} is the share of out-of-pocket expenditures;
- $GovExp_{it}$ is the share of public health expenditure;
- $Korea_i$ is a dummy variable equal to 1 for South Korea and 0 for Morocco, which serves as the reference group;
- $GovExp_{it} * Coree_i$ is the interaction term that captures the difference in effect;
- ε_{it} is the error term.

The interpretation of the coefficients is central to our analysis:

- β_1 represents the marginal effect of public spending on OOP for Morocco. A coefficient of -1 would signify a perfect transfer.
- β_3 is our main coefficient of interest. It measures the difference in the crowding-out effect between South Korea and Morocco. A negative and significant β_3 would indicate superior efficiency in the South Korean system. The total effect for South Korea is the sum $(\beta_1 + \beta_3)$.

3.4 Estimation Strategy:

Estimating the model using Ordinary Least Squares (OLS) on panel data can be subject to biases related to heteroskedasticity (different error variance between countries) and serial autocorrelation (errors correlated over time for the same country), problems frequently raised in longitudinal analyses of health financing [4, 5].

Given the small cross-sectional dimension (N=2), pooled OLS with clustered errors is preferred over fixed-effects estimators. To ensure the robustness of our statistical inferences, we use robust standard errors clustered at the country level. This technique adjusts the standard errors to account for the intra-group correlation of observations, thereby producing more reliable confidence intervals and p-values. All econometric results and hypothesis tests presented in the next section are based on this robust estimation method.

4 RESULTS:

This section presents the results of our empirical analysis. It is organized into three parts: a descriptive analysis of the data to set the context, followed by the results of the econometric model that quantifies the relationship of interest, and finally, a presentation of formal hypothesis tests that validate our conclusions.

4.1 Descriptive Statistics and Evolving Trends

Table 1 displays the descriptive statistics for the key variables for Morocco, South Korea, and the overall sample for the period 2000-2022. It reveals fundamental structural differences between the two financing systems. The average share of out-of-

pocket expenditures (OOP) in Morocco is 51.7%, a level significantly higher than the 38.1% average in South Korea. This trend is reversed for public financing, which represents an average of 55.2% of current health expenditure in South Korea, compared to only 33.6% in Morocco. These figures confirm that Morocco is structurally much more dependent on direct household payments, while the South Korean system relies on a predominantly public financing model.

Table 1 : Descriptive Statistics of Key Variables (2000-2022)

		Out-of-Pocket Expenditure (OOP) (% CHE)				Public Expenditure (% CHE)				Total Health Expenditure (% GDP)			
Group	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Morocco	23	51.74	5.32	41.29	59.66	33.55	6.42	23.89	44.10	4.89	0.59	3.69	5.68
South Korea	23	38.11	4.75	28.79	45.27	55.17	3.06	50.26	62.75	3.46	1.34	1.82	6.23
Overall (Pooled)	46	44.93	8.50	28.79	59.66	44.36	12.01	23.89	62.75	4.18	1.25	1.82	6.23

Source: Authors' calculations using R Studio

Figure 1 illustrates the temporal evolution of the share of public spending and OOP in both countries. The graph highlights distinct trajectories. In South Korea (left panel), the share of public financing (blue line) has consistently remained above that of OOP (red line), with a gap that tends to widen, indicating strengthening financial protection. In Morocco (right panel), the historical situation is reversed, with OOP largely dominating public financing. However, a transition is clearly visible from the mid-2000s, showing a steady increase in public effort and a corresponding decrease in the household burden, with the two curves eventually crossing at the end of the study period.

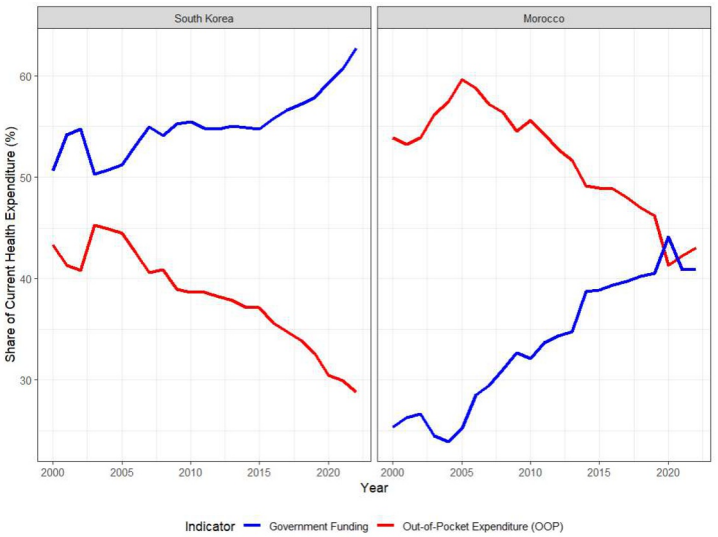

Figure 1: Comparative Evolution of Public Health Spending and Out-of-Pocket Expenditures

Source: Authors' calculations using R Studio

4.2 Econometric Modeling Results

To quantify the relationship between public effort and the household burden, we estimated the "Pooled OLS" model with interaction. Figure 2 graphically presents the model's predictions, illustrating the relationship between the share of public spending and the predicted share of OOP. The graph visually confirms a strong negative correlation for both countries. More importantly, it reveals a notable difference in slope: the regression line for South Korea (in blue) is visibly steeper than that for Morocco (in red), suggesting a superior marginal effectiveness of public spending in the South Korean system.

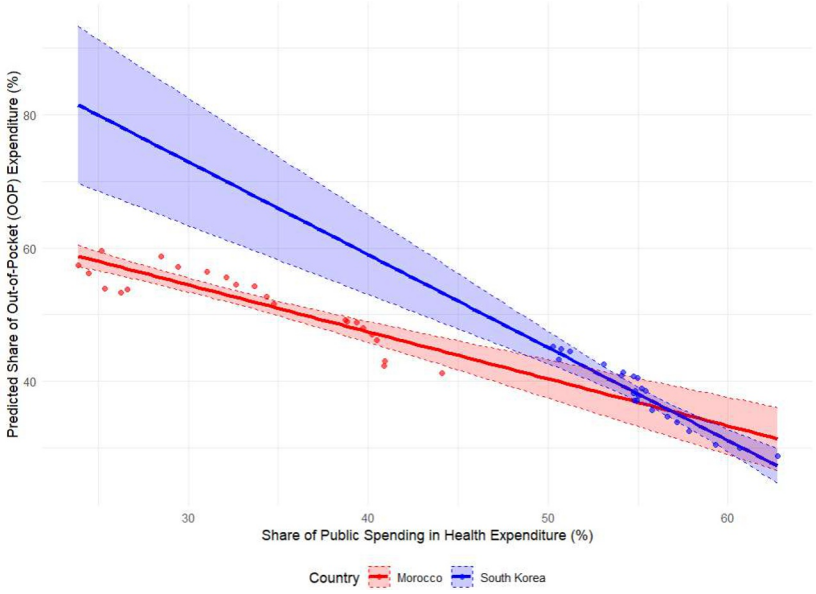

Figure 2: Predicted Share of Out-of-Pocket (OOP) Expenditure

Source: Authors' calculations using R Studio

Table 2 details the estimated coefficients of the model. The statistical inferences (confidence intervals and p-values) are based on robust and clustered standard errors to ensure their validity.

Table 2: Modeling the Share of Out-of-Pocket (OOP) Expenditure

Characteristic	Pooled OLS Model with Interaction
Public Spending (% CHE) [Morocco]	
South Korea Dummy	
Total Health Expenditure (% GDP)	

Source: Authors' calculations using R Studio

The interpretation of the results is as follows:

→ For Morocco (the reference group), the coefficient for the "Public Spending" variable is -0.71 (95% CI [-0.84, -0.57]; $p < 0.001$). This means that a one-percentage-point increase in the share of public financing is associated with a 0.71-point reduction in the share of OOP. The effect is therefore significant but incomplete, characterizing a partial crowding-out effect.

→ The interaction coefficient ("Public Spending * South Korea Dummy") is -0.69 (95% CI [-1.0, -0.33]; $p < 0.001$). This result, at the core of our analysis, is negative and highly significant. It indicates that the effect of public spending is 0.69 points stronger in South Korea than in Morocco.

→ The total marginal effect for South Korea is therefore the sum of the two coefficients: (-0.71) + (-0.69) = -1.40. In the South Korean context, each additional point of public financing is associated with a 1.40-point reduction in OOP. This effect, greater than 1, suggests a particularly powerful "crowd-in" mechanism.

→ The control variable "Total Health Expenditure (% GDP)" is not statistically significant ($p = 0.7$), indicating that the macroeconomic importance of the health sector does not have a distinct effect on the share of OOP once the financing structure (public vs. private) is taken into account.

However, it is important to note that these results indicate strong associations rather than definitive causal effects.

4.3 Hypothesis Tests

Table 3 summarizes the results of the hypothesis tests conducted to statistically validate our main conclusions.

Table 3: Summary of Key Hypothesis Tests

Based on Pooled OLS Model with Robust Standard Errors

Hypothesis Tested	Null Hypothesis (H_0)	F-Statistic	p-value	Conclusion (α = 5%)
Overall Model Significance	$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$	222.991	<0.001	Reject H_0
Perfect Transfer in Morocco	β(Gov_Exp) = -1	11.068	0.002	Reject H_0
Difference in Effect (Morocco vs. South Korea)	β(Interaction) = 0	21.841	<0.001	Reject H_0
Perfect Transfer in South Korea	β(Gov_Exp) + β(Interaction) = -1	11.327	0.002	Reject H_0

Source: Authors' calculations using R Studio

The tests confirm the following points:

→ **Overall Significance:** The model as a whole is highly significant (F = 222.99, p < 0.001), which validates its relevance in explaining the variation in OOP.

→ **Perfect Transfer Hypothesis in Morocco:** The null hypothesis that the effect of public spending in Morocco is equal to -1 is rejected (F = 11.07, p = 0.002). The crowding-out effect, although strong, is statistically different from a perfect transfer.

→ **Difference in Effect between Countries:** The null hypothesis of no difference in effect (i.e., a zero interaction coefficient) is strongly rejected (F = 21.84, p < 0.001). This confirms that the marginal effectiveness of public financing is statistically superior in South Korea.

→ **Perfect Transfer Hypothesis in South Korea:** The hypothesis that the total effect in South Korea is -1 is also rejected (F = 11.33, p = 0.002). The estimated effect of -1.40 is statistically different from a simple one-for-one substitution.

The descriptive, graphical, and econometric results converge to paint a coherent picture: while both countries have succeeded in reducing the household burden by increasing public financing, the efficiency of this mechanism is structurally and significantly higher in South Korea than in Morocco.

5 DISCUSSION:

The results of our econometric analysis provide a rigorous and comparative quantification of the crowding-out effect of public health spending in Morocco and South Korea. While the general trajectory in both countries shows a progressive rebalancing in favor of public financing, our modeling reveals fundamental differences in the effectiveness of this process. This discussion aims to interpret these results in light of the respective institutional contexts, draw policy implications, and highlight the limitations of our approach.

5.1 Interpreting the Results: Why Such a Difference in Effectiveness?

Our main finding is the significant heterogeneity of the crowding-out effect: the marginal impact of public spending is twice as powerful in South Korea (-1.40) as in Morocco (-0.71). This difference is not a statistical artifact but a symptom of pro-

found structural divergences in the governance and regulation of the two health systems.

→ *The Quantified "Moroccan Paradox": A Financial Transfer Hampered by Structural Weaknesses*

The coefficient of -0.71 for Morocco means that nearly 30% of each additional public dirham does not translate into a direct reduction of the household burden. This "shortfall" can be interpreted through the lens of the structural weaknesses documented in the literature. Studies like those by Boughaleb and Jerry [1, 3] highlight the system's fragmentation, an inadequate regulatory framework, and insufficient coordination among actors. The absence of a strong regulatory authority for the private sector, the uncontrolled practice of balance billing, and a benefit package that remains limited compel households, including the insured, to resort to direct payments.

Furthermore, hospital cost analyses by Akhnif et al. [8, 9] reveal internal inefficiencies within the public sector itself, with highly variable costs for similar services. In this context, public money injected into the system only partially manages to "replace" private spending; a significant portion is absorbed by system inefficiencies or captured by a poorly regulated private supply. The partial crowding-out effect we have measured is thus the macroeconomic consequence of these microeconomic frictions.

→ *South Korean Efficiency: The Impact of a Mature and Regulated System*

The coefficient of -1.40 for South Korea is particularly remarkable. It suggests not only a more-than-perfect transfer but also a "crowd-in" effect, where public investment might stimulate a reallocation of household spending or increased trust in the public system, leading to an even greater reduction in private spending. This particularly strong result must be interpreted with caution. The coefficient above unity should be interpreted cautiously and may reflect behavioral responses and system efficiency rather than pure financial substitution. It undoubtedly reflects the effectiveness of a mature and highly regulated system.

The literature on South Korea offers several explanations. The 2000 reform, which consolidated multiple insurance funds into a single payer, the National Health Insurance Service (NHIS), was a decisive step [4, 6]. This single payer has considerable negotiating power over tariffs, a capacity to regulate services, and a centralized data infrastructure to manage the system [10, 11]. Although the system is not perfect and OOP remains a challenge [5, 12], cost-control mechanisms, service standardization, and health technology assessments are far more developed than in Morocco. Massive investment in information technologies allows for precise monitoring of expenditures and more rational resource management [13]. Thus, when the South Korean government increases public funding, this money is injected into a system where "leaks" are better controlled, which explains a much more direct and amplified impact on reducing the household burden.

5.2 Implications for public policy in morocco

Our results have direct implications for the health system reform strategy in Morocco.

First, they econometrically demonstrate that increasing public budgets, while absolutely necessary, is not a sufficient condition to achieve financial protection objectives. Without deep structural reforms, a significant portion of the financial effort will continue to dissipate. The priority should therefore not only be to "find more money" but also to "spend the money better."

Second, the South Korean experience suggests that the most urgent reform projects for Morocco could significantly enhance governance and regulation. This includes:

→ The concretization of the project to create a High Authority of Health (HAS) to make it a true regulator of the system, with tariff negotiation power and control over services extending to the private sector.

→ The implementation of mechanisms to control balance billing and a revision of national conventions to better align reimbursed tariffs with real costs.

→ The acceleration of the digitalization of the health system, drawing inspiration from the Korean model, to create a unified information system that allows for data-driven management, better care coordination, and control of fraud and abuse.

Our study confirms that Morocco should not only compare itself to countries at a similar level of development but also draw lessons from more mature models like South Korea's. While descriptive comparison with other studies [7] is useful, our econometric analysis shows that the real challenge lies in adopting the institutional mechanisms that have proven their effectiveness elsewhere. However, institutional transferability requires contextual adaptation.

5.3 Limitations of the study and avenues for future research

This study has certain limitations inherent in its macroeconomic approach. First, aggregate national-level data mask intra-country inequalities in access and financial burden, whether between income quintiles or between urban and rural areas. Second, our model, while robust, does not allow for a precise decomposition of the respective weight of each structural friction (regulation, organization, etc.) in the observed crowding-out effect. Finally, the coefficient greater than 1 for South Korea, while interesting, deserves to be explored in greater detail with more complex models to understand its underlying mechanisms.

These limitations open up fertile avenues for future research. Econometric analyses on regional panel data or, ideally, on household survey micro-data would refine the understanding of the determinants of catastrophic spending and identify the most vulnerable populations. Furthermore, qualitative case studies on regulatory mechanisms in South Korea could provide lessons more directly transposable to the Moroccan context. By providing the first comparative quantification of the crowding-out effect, this article hopes to lay the groundwork for more targeted future research aimed at transforming the promise of UHC into a tangible reality for every Moroccan citizen.

6 CONCLUSION:

This study aimed to quantify and compare the crowding-out effect of public health spending on the household burden in Morocco and South Korea. By analyzing the

2000-2022 period using a panel data econometric model, we were able to move beyond descriptive analysis to provide a robust measure of the effectiveness of public financial transfers in two distinct Universal Health Coverage (UHC) contexts: a system in development and a mature system.

The main result of our modeling is unequivocal: the marginal effectiveness of public financing in reducing out-of-pocket expenditures (OOP) is structurally and significantly higher in South Korea than in Morocco. Our estimation reveals that an additional percentage point of public financing reduces the OOP share by 0.71 points in Morocco, compared to 1.40 points in South Korea. This substantial difference, validated by formal hypothesis tests, demonstrates that while increasing public budgets is a universal lever, its impact is strongly conditioned by the maturity and robustness of the health system's governance and regulation mechanisms.

For Morocco, this study quantifies the "financing paradox": nearly 30% of the additional public effort does not translate into a direct reduction of the household burden, a "leak" that can be attributed to documented structural weaknesses, such as system fragmentation and weak regulation of the private sector [1, 3]. For South Korea, the remarkable effectiveness of its system, a legacy of profound reforms like the unification of the payer [4, 6], offers a powerful counter-example and highlights the importance of centralized management and strong regulation.

The implications of these results for public policy in Morocco are major. While the country has succeeded in the quantitative expansion of insurance coverage, the transition to effective financial protection remains incomplete. Our analysis suggests that future levers for action lie not only in a continued increase in budgets but primarily in structural reforms aimed at improving spending efficiency. This includes strengthening tariff regulation, better integrating the private sector into a controlled framework, and making a massive investment in information systems to enable data-driven management.

By providing the first comparative econometric quantification of this phenomenon, this article hopes to enlighten decision-makers on the political trade-offs to come. The path to a sustainable UHC involves not just more resources, but a system capable of transforming those resources into tangible financial protection for every citizen. These findings reinforce the importance of efficiency-oriented reforms to translate coverage expansion into real financial protection.

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