Research Paper

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Assessing the Economic Impacts of Al-Haouz Earthquake: Damages and Recovery Strategy

By Eduardo A. Haddad, Karim El Aynaoui, Abdelaaziz Ait Ali, Mahmoud Arbouch, Hamza Saoudi, Inacio F. Araujo

This paper aims to quantify the economic loss from the earthquake that hit Morocco on September 8, 2023, and to evaluate the impact of the five-year reconstruction plan, that will account for roughly 8.5% of GDP. Given the geographically concentrated location of the earthquake, which hit some provinces in the central part of Morocco, the methodology used relies on an inter-province inter-industry Input-Output (IIO) table for Morocco. Assuming that the resources to be spent on infrastructure reconstruction efforts equal the actual loss of capital stock suffered in the provinces, a partial hypothetical extraction is operated on the Moroccan IIO system to simulate the damages suffered by each sector. The reconstruction plan's impact on the economy is simulated for the period 2023-2028, using official information on households' transfers and residential reconstruction aid, in addition to the investment efforts to rehabilitate the affected areas. Our findings suggest that the earthquake will lead to a growth loss of 0.24% of Morocco's GDP in 2023. The reconstruction plan's impact on Morocco's overall economic growth is expected to be mild. However, it is likely to significantly affect the gross regional product (GRP) of the affected provinces, with the magnitude of the effect depending heavily on whether the allocated funds represent new injections into the economy, or merely reallocations of investments across regions.

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I.   INTRODUCTION

The earthquake with a magnitude of 7.0 on the Richter scale, striking Al Haouz on September 8, 2023, resulted in a profound tragedy for Morocco. Nearly 3000 lives were lost, and 4661 individuals were injured, with 1139 identified as severe. The impact extended beyond human casualties to include substantial material damage, with 59,674 buildings collapsed, of which 32% were destroyed completely, and 68% partially damaged.

In response to this crisis, Moroccan authorities have launched an ambitious five-year reconstruction plan, The Program for Reconstruction and Rehabilitation of Affected Areas, allocating a projected budget of 120 billion Moroccan dirhams (MAD), equivalent to $11.7 billion. This comprehensive initiative has of two pivotal components. The first pillar, totaling 22 billion MAD, encompasses emergency aid to families and financial assistance for housing (8 billion MAD), as well as infrastructure rebuilding and upgrading (14 billion MAD), from 2023 to 2027. This pillar aims to uplift affected areas and restore them to their initial state. The second component, endowed with 98 billion MAD, may take the form of credits or more general support policies and will be channeled to upgrading the overall infrastructure networks and improving living conditions in the High Atlas provinces, thus benefiting a population of 4.1 million Moroccans. The program seeks to enhance infrastructure, promote agricultural and tourist activities, rehabilitate urban areas and ancient cities, and improve the quality of public services.

At the heart of this policy analysis lies an initial assessment of the earthquake's impact, with a specific focus on the most affected provinces: Al Haouz, Taroudant, Chichaoua, and Ouarzazate. Two questions guide our analysis: to what extent can we estimate direct and indirect production losses by province, and how effective is the recovery program expected to be in mitigating the impact, particularly in terms of household income support and government aid measures? We start by assessing the earthquake's impact on economic growth in Morocco and the most affected provinces. We then delve into a comprehensive examination of the two fundamental pillars that make up the government's announced 120 billion MAD reconstruction plan.

In light of the uncertainty surrounding the funding sources of the 98 billion MAD second pillar budget envelope, it's unclear whether these funds are newly allocated or reallocated, and in what proportions. We proceeded by considering three different hypothetical scenarios.

A first scenario considers that the whole 98 billion MAD will be financed through new money (ex: debt), the second scenario considers a splitting of the 98 billion MAD equally between new money (1/2), and reallocation of investment (1/2), while the last scenario assumes full investment reallocation funding.

The structure of this study unfolds as follows. Section II briefly outlines the socio-economic profile of the regions most affected by the earthquake—Al Haouz, Taroudant, Chichaoua, and Ouarzazate. Section III presents a literature review on the economic impacts of earthquakes and delves into the channels through which the seismic shock affects economic activity. Section IV provides a detailed methodology for estimating and assessing the earthquake's impact, as well as the impact of the reconstruction plan. The results of our analysis, evaluating macroeconomic, regional, and provincial implications, will be presented in Section V. Section VI offers some insights on the resilience of the Moroccan economy after the earthquake in the light of some daily financial indicators. Finally, Section VII offers a concise conclusion, summarizing the main findings of this study and suggesting strategic directions for the future.

## II. THE SOCIOECONOMIC PROFILE OF THE REGIONS MOST AFFECTED BY THE EARTHQUAKE

The devastating earthquake that hit Morocco on September 8, 2023, affected mainly rural and poor areas in the High Atlas Mountains. The human toll was terrible, causing nearly 3000 deaths. The earthquake significantly impacted a population of 2,608,115 individuals, spread across 578,280 households, with an average household size of 4.5 individuals, just before the seismic event.

The epicenter of the seismic activity, situated in Al Haouz province, saw extensive casualties, impacting a population of 669,028 individuals in 2023. Additional provinces affected by the seismic event include Chichaoua (357,720 inhabitants), Marrakech (553,134 inhabitants), Ouarzazate (317,669 inhabitants), and Taroudannt (556,991 inhabitants).

Regarding households, the affected area in Al Haouz comprised 145,818 households immediately preceding the disaster. Chichaoua had 78,686 households, Marrakech had 137,735 households, Ouarzazate had 65,922 households, and Taroudannt had 124,226 households (Figure 1).

Figure 1

Populations and Household Distributions in the Municipalities Affected by Disasters in 2023, Prior to the Earthquake (in Thousands)
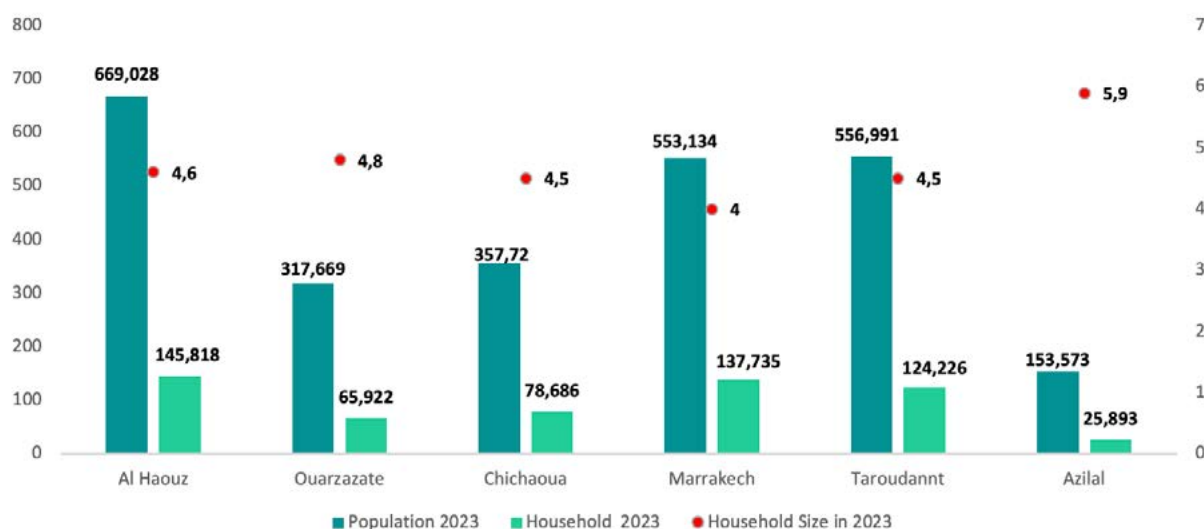
Source: HCP, 2023.

The death distribution by province resulting from the earthquake highlights a significant disparity in the impact of the natural disaster across Morocco. Al-Haouz, the most affected province, recorded 1684 deaths, emphasizing the tragic scale of the catastrophe. Taroudant followed with 980 deaths, indicating a substantial impact, and Chichaoua recorded 202 deaths, raising additional concerns. Ouarzazate, Marrakech, and Azilal reported 38, 18, and 11 deaths, respectively, showcasing varying extents of devastating effects, contributing to a total death toll of 2943. This underscores the need for a differentiated approach in emergency intervention and reconstruction efforts, tailored to each province's specific realities. In this paper, the ratio of deaths by province serves as a weighting factor in the allocation of government reconstruction efforts, including household transfers, reconstruction support for affected buildings, and infrastructure development. This aligns with the government's

reconstruction programs, which we explore further in the simulation.

Population Densities by Province in 2023

The 2023 population densities in the disaster-stricken areas showed marked disparities in demographic concentration. According to data from the High Commission for Planning, Marrakech has the highest density, reaching 364 inhabitants per square kilometer, followed by Al Haouz with 111 inhabitants per square kilometer. Taroudannt, Azilal, and Chichaoua exhibit moderate densities of 52, 58, and 59 inhabitants per square kilometer, respectively. Chichaoua stands out with significant density variations, ranging up to 1,890 inhabitants per square kilometer in urban areas and approximately 154 inhabitants per square kilometer in rural areas. In the Souss-Massa region, Taroudannt reveals marked disparities, with moderate rural densities not exceeding 55 inhabitants per square kilometer, but significant urban concentrations ranging from 870 to 1286 inhabitants per square kilometer. Azilal maintains a moderate density, not exceeding 132 inhabitants per square kilometer. Al Haouz demonstrates urban concentrations varying between 664 and 1180 inhabitants per square kilometer, while rural areas exhibit variations from 20 to 269 inhabitants per square kilometer.

Earthquake Magnitude: Variations Across Moroccan Provinces

The area affected by the earthquake on September 8, 2023, in Morocco is characterized by a predominantly mountainous topography, located in the High Atlas region, covering a total area of 53,135 square kilometers. It encompasses five provinces and one prefecture, distributed across four adjacent regions: the provinces of Al Haouz and Chichaoua, along with the prefecture of Marrakech in the Marrakech-Safi region; the province of Ouarzazate in the Drâa-Tafilalet region; the province of Taroudannt in the Souss-Massa region; and finally, the province of Azilal in the Béni Mellal-Khénifra region.

According to the High Commission for Planning, the repercussions of the September 8, 2023, earthquake vary considerably from one region to another. Al Haouz, in the Marrakech-Safi region, was heavily affected, with 40 affected municipalities, reaching a proportion of 100%. Chichaoua and Marrakech also suffered damage, with 32 and 13 affected municipalities, with disaster rates of 91% and 68%, respectively. In the Drâa-Tafilalet region, the province of Ouarzazate was heavily impacted, with 17 affected municipalities, and a proportion of 100%, while in Souss-Massa, the earthquake affected all 57 municipalities of Taroudant, presenting a disaster proportion of 64%. Finally, in the Béni Mellal-Khénifra region, the earthquake affected all 10 municipalities of the Azilal province, with a disaster proportion of 23%, suggesting a relatively less-critical situation. These disparities underscore the importance of adapting reconstruction and risk prevention strategies to the specific circumstances of each province to mitigate the consequences of the earthquake (Figure 2).

Figure 2

Number and Proportion (in %) of Disaster-Affected Municipalities by Province
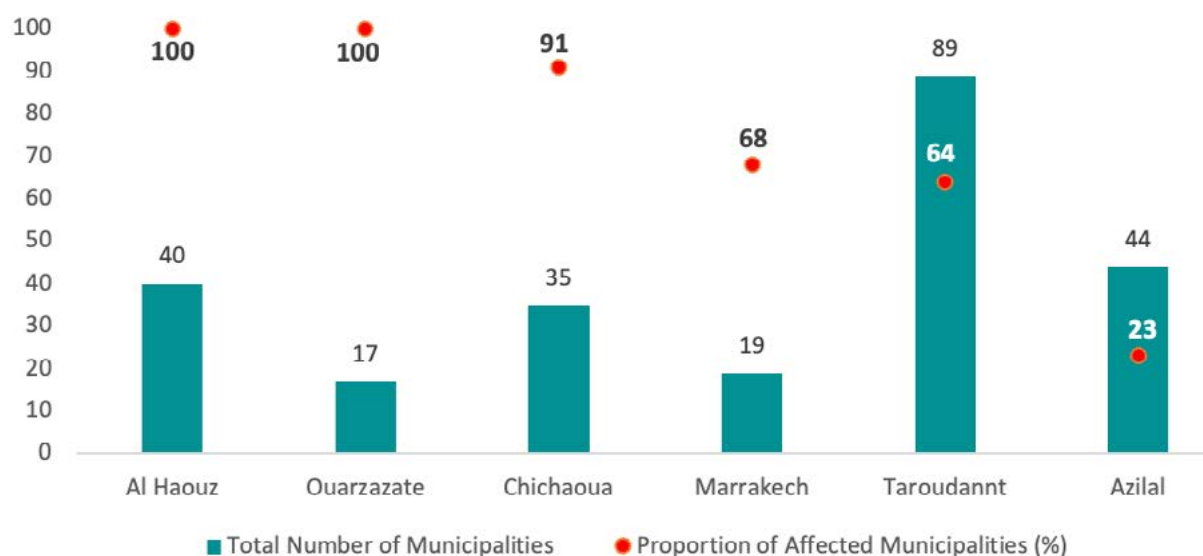
Source: High Commission for Planning.

Residential Characteristics of Affected Provinces

The data from the 2014 RGPH showed distinctive residential characteristics of the affected provinces. Azilal, in the Béni Mellal-Khénifra region, is characterized by a pronounced predominance of rural housing, with 67.9% of households classified as such, while 32.1% reside in Moroccan-style houses. In the Marrakech-Safi region, the province of Al Haouz has a majority of 58.9% of households in rural housing, compared to 41.1% in Moroccan-style houses. Chichaoua, also in the same region, stands out with a clear preference for rural housing, reaching 73.5%, as opposed to 26.5% in Moroccan-style houses. Marrakech, as the prefecture of the region, presents a balanced distribution, with 59.8% of households in rural housing and 40.2% in Moroccan-style houses. In the Drâa-Tafilalet region, the province of Ouarzazate shows a slight inclination towards Moroccan-style houses, with 53.1%, compared to 46.9% in rural housing. Finally, in the Souss-Massa region, the province of Taroudannt exhibits a relatively balanced distribution, with 47.1% of households in rural housing, and 52.9% in Moroccan-style houses.

Living Standards and Poverty-Affected Provinces Before the Earthquake

Analyzing the socio-economic conditions in the Moroccan provinces affected by the recent earthquake unveils distinct economic realities. When examining monetary poverty, the province of Azilal stands out with a particular poverty high rate, reaching 20.7%, surpassing by more than four times the national Moroccan rate of 4.8%. Similarly, Taroudannt records a notable rate of 9.6%, closely followed by Ouarzazate at 8.6%, while Chichaoua, Al Haouz, and Marrakech display respective rates of 7.1%, 5.5%, and 1%. Aggregating this data for the entire zone exposed to the earthquake, the average monetary poverty rate stands at 8%, approximately twice the national rate (Figure 3).

Regarding the multidimensional poverty rate, which encompasses various aspects of deprivation

beyond the monetary dimension; including health, education, standard of living, and social exclusion; significant variations emerge among the affected provinces. Azilal stands out with the highest multidimensional poverty rate, reaching 28.8%, while Marrakech records the lowest rate at only 2.8%. These data highlight notable diversity in terms of deprivation across different regions of the zone.

Considering the entire affected zone, the average multidimensional poverty rate reaches 18.5%, significantly surpassing the national Moroccan rate set at 8.2%. Similarly, the average vulnerability rate for the affected zone is 21.5%, also exceeding the national rate of 12.6% (Figure 4).

Figure 3	Figure 4
Monetary Poverty by Province in 2014	Multidimensional Poverty by Province in 2014
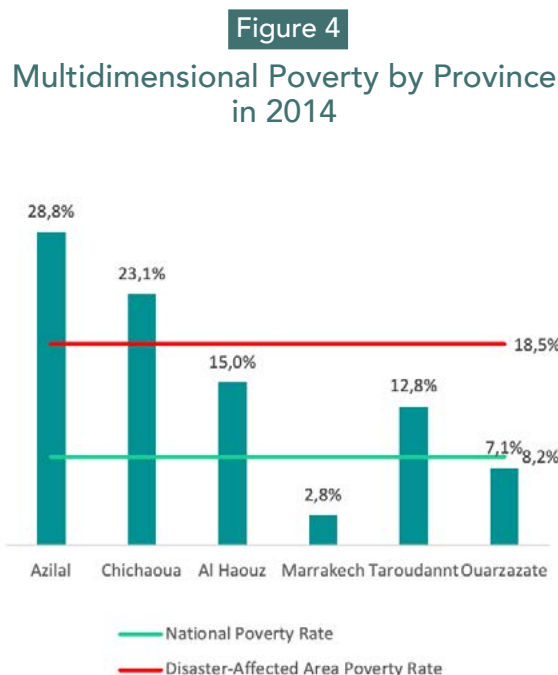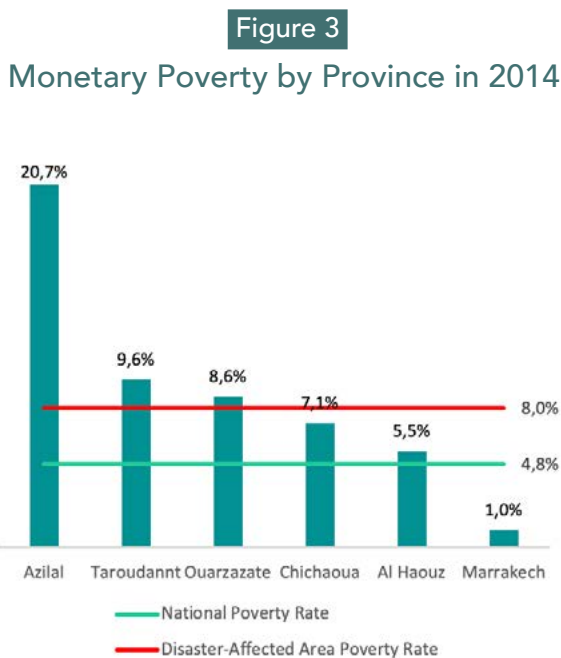
Source: High Commission for Planning.

Concerning the economic vulnerability rate, which measures individuals' propensity to fall into poverty in the event of a socio-economic shock, disaster, or crisis, significant differences among the affected provinces are observed. Azilal has the highest vulnerability rate at 25%, closely followed by Chichaoua at 22.9%. Conversely, Marrakech has the lowest vulnerability rate at only 5% (Figure 5).

These results suggest that, overall, the provinces in this geographical area face more pronounced monetary poverty, multidimensional deprivation, and an increased risk of vulnerability compared to the national average. These disparities show the need to prioritize economic resilience, particularly in provinces with heightened vulnerability. Implementing targeted interventions, including social safety nets and economic protection policies, is crucial for effectively mitigating the associated risks.

Figure 5

Vulnerability Rate by Province in 2014
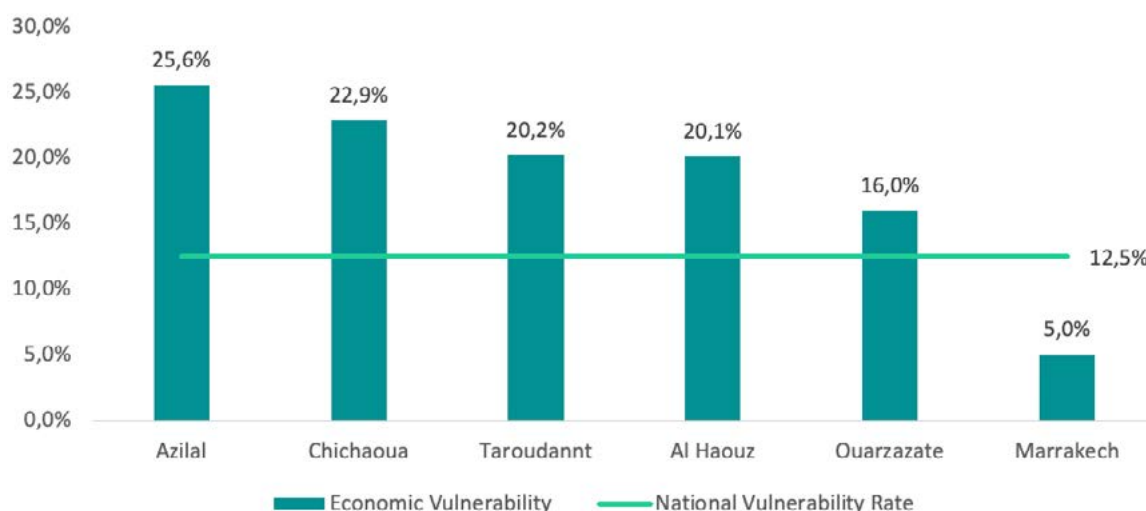
Source: High Commission for Planning.

III. ECONOMIC IMPACTS OF EARTHQUAKES: MECHANISM CHANNELS AND POST-DISASTER RECONSTRUCTION ASSESSMENT

1. A Literature Review

According to economic growth theory, there exists no consensus on how natural disasters affect growth and development (Richard, 1996). Traditional neoclassical economic theory views natural disasters as breakpoints in economic development trends, and significant barriers to economic growth, because of the resulting losses in capital and labor stocks (Cavallo *et al*, 2013). Conversely, endogenous growth theory provides more nuanced perspectives on whether natural disasters have positive or negative impacts on economic growth and development. For instance, the concept of Schumpeterian creative destruction suggests that damages caused by natural disasters can act as catalysts for reinvestment in capital and processes, potentially generating higher economic growth returns, particularly in the medium to long terms (Gignoux and Marta, 2016).

Empirical studies indicate that categorizing the impact of natural disasters on economic growth as positive or negative largely depends on the time horizon under consideration. In the short run, natural disasters can have negative impacts on economic growth because of reduced production factors and momentary interruptions in economic activity (Noy, 2009). However, in the long run, these impacts on growth may differ, with post-disaster reconstruction efforts acting as a stimulus for the economy (Hochrainer, 2009).

Natural disasters can have a significant impact on economic development, while also leading to an influx of capital and new technologies, as well as financial support, during periods of post-disaster reconstruction, which may facilitate economic growth. These contrasting effects may cause vastly different outcomes for affected areas. Studies have reported that government expenses, human

resources, technological progress, and the disaster-affected population are all likely to influence the economic growth outcome (Melecky and Raddatz, 2011). Furthermore, all such factors are related to the initial situation of affected areas and the amounts dedicated to reconstruction. In some cases, a natural disaster can focus political attention on historically disadvantaged areas, and alert policymakers to the need for targeted efforts to enable the affected regions to catch up.

2. Earthquake Economic Impact Mechanism Channels

Natural disasters, in the form of an earthquake, have always presented a significant risk to economies, including the most developed, posing a threat to human lives and economic development. Unlike other adverse shocks (such as a pandemic), which may lead to activity interruptions primarily affecting economic flows, an earthquake can impact stocks beyond that scope. These stocks include productive capital for firms, infrastructure, and the labor force.

Earthquake disasters result in damages that are transmitted to the economy in different and interconnected ways, affecting both the economic functioning mechanisms of the economy and its initial endowments, mainly in terms of capital stock, and labor stock in the case of relatively high death tolls arising from an earthquake. In this regard, the mechanisms through which the physical damage is translated into external shocks to the economy can be divided into three types: building damages, water and electricity outages, and transportation network damages (Hu, *et al*, 2023). At the regional or provincial level, building damages and water and electricity outages compromise the functionality of buildings, both residential and non-residential, resulting in capital stock losses. Similarly, transportation network damages increase commuting and transportation costs, for people and merchandise respectively.

The resulting reductions in capital stock and increases in travel costs affect firms through increases in production costs and through productivity and output losses, mainly because of production interruption, input adjustment, and shipping delays. In the same way, households experience reductions in their labor supply because of evacuation or outmigration, and losses to their real incomes, resulting from job relocation and consumption adjustments.

Within the economic system, these separate disturbances, and the resulting responses from firms and households, lead to reductions in regional aggregate supply and aggregate demand, which are accompanied by losses in terms of output, income, and employment (Figure 6).

Figure 6

## Earthquake Economic Impact Mechanism Channels
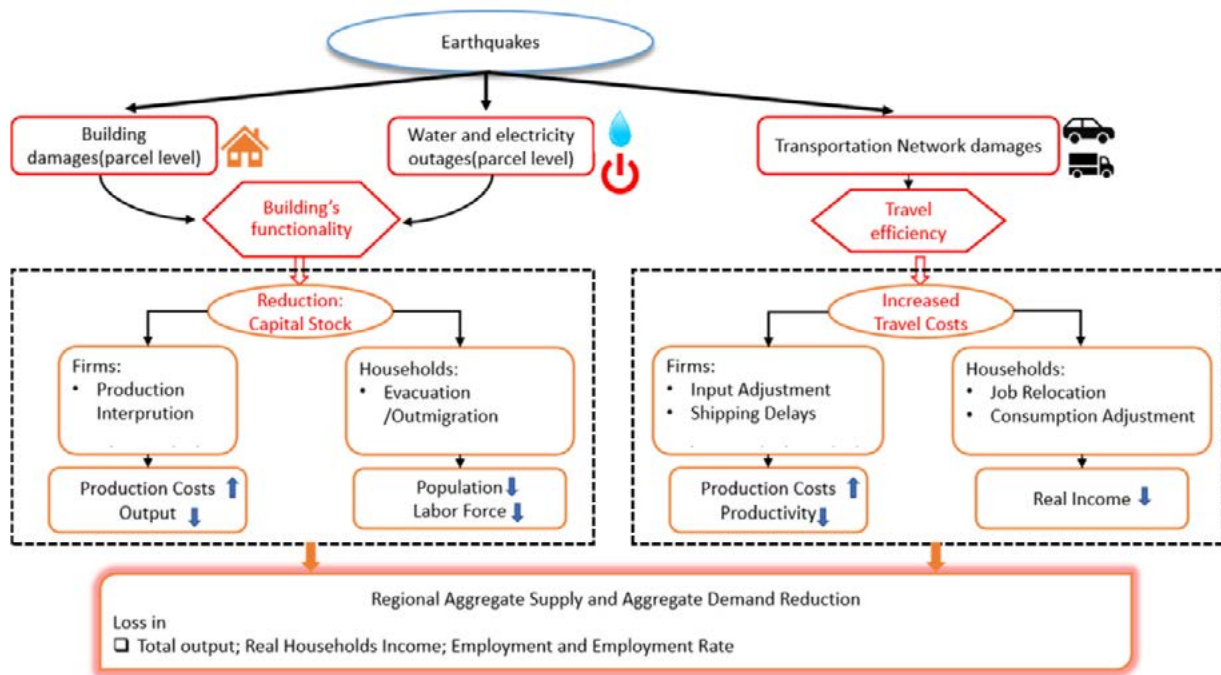
Source: Adapted from Hu *et al.*, 2023.

Post-disaster restoration and reconstruction assessment relies first on comparing the 'GDP post-disaster trajectory' with a 'counterfactual GDP', i.e. the business-as-usual trajectory, or the GDP that would have been realized if the disaster had not happened. This allows the accumulated loss resulting from the earthquake to be assessed, while providing insights into the recovery path. In a scenario in which the GDP post-disaster trajectory and counterfactual GDP tend to be two straight lines, the recovery is harder (Figure 7, left panel). Second, once the recovery process is estimated to have reached its end, three different situations emerge: first, a situation in which the system's functionality (i.e. ability to generate value or GDP) remains below the pre-disaster level, implying an adaptation to a 'new-normal' situation; second, a less likely situation in which things return to exactly how they were before; and finally, a 'build back better' outcome situation, in which the system's functionality exceeds its pre-disaster level (Figure 7, right panel). Regarding the geographical location of the Al Haouz earthquake and all the financing means that are/will be put in place for reconstruction, one can be almost certain that a 'build back better' scenario will be realized (Figure 7, right panel).

Post-Disaster Restoration and Reconstruction Assessment
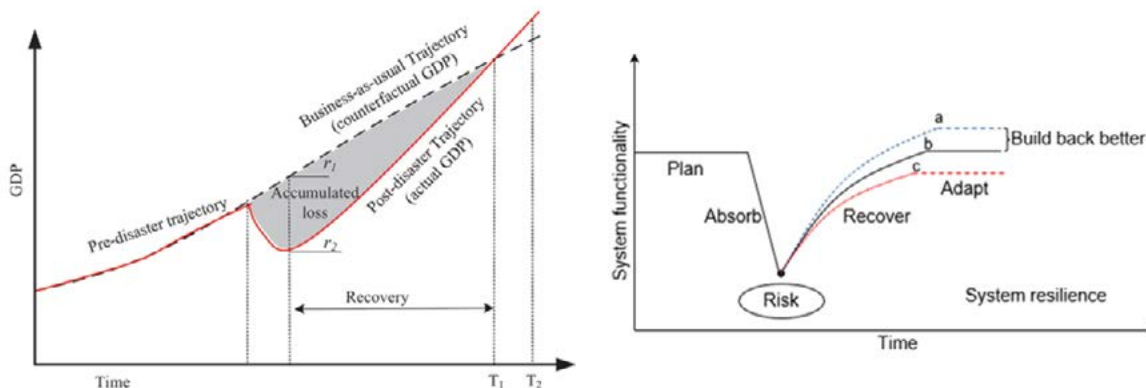
Source : Chen *et al* (2023) and Zhao *et al* (2023).

IV. METHODOLOGY FOR THE EARTHQUAKE ECONOMIC IMPACT ASSESSMENT:

As mentioned previously, the Moroccan government determined that 22 billion MAD will be spent on relief efforts linked to the 2023 earthquake. This amount includes 8 billion MAD that corresponds to emergency aid, while 14 billion MAD will be dedicated to rebuilding infrastructure.

Out of that emergency aid envelop, 1.8 billion will be transferred to households, in form of 2500 MAD per month per household, for one year. We used the 59,674 number of destroyed buildings as a proxy for the number of households that will receive emergency aid. Thus, we consider in our simulations that 60,000 households will receive an amount of 30,000 MAD during a year, which indeed corresponds to the 1.8 billion MAD for transfers. The remaining 6.2 billion MAD will be used to aid residential reconstruction, while the 14 billion MAD will be destined for rebuilding and upgrading infrastructure. The distribution of resources among affected provinces is assumed to be proportional to their share in the countrywide death toll.

A proper simulation of the earthquake's impacts on the economy requires a precise estimation of the economic toll incurred. Without extensive investigation *in loco*, it would be hard, if not impossible, to determine the extent of the damages. We fill this gap by assuming the resources to be spent on infrastructure reconstruction efforts represent the actual loss of capital stock suffered in the provinces. That is, we trust the Government's number to be more informed than any outside spectator, and thus the most precise estimate of the negative economic shock.

Since our model has information down to the regional level, we need to further breakdown our data to analyze the impacts on a province-by-province basis. We use each province's share of its regional sectoral output to allocate the estimated regional capital stock losses.

An estimate of regional capital stocks is available for 2013. We update those estimates for 2023 using the most recent IIO matrices available.

We apply a separate 1% shock to the capital stock of each affected region in our Interregional Computable General Equilibrium (ICGE) model for the Moroccan economy, using a short-run closure.

This is appropriate not only because we are looking for the short-term effects of the earthquake but also because government demand is exogenous in this closure—which better represents our context. We then collect the resulting changes in sectoral output for each simulation, to calculate the intraregional elasticity of sectoral output to regional capital stocks.

Using these elasticities coupled with the estimated capital stock losses, we can calculate the regional output loss caused by the earthquake. This information is used to obtain the sector-level F factors representing the unaffected local output. With these factors, we can operate a partial hypothetical extraction on a Moroccan IIO system to simulate the damages suffered by each sector. We also estimate the impact of the proposed aid throughout the recovery period. In accordance with governmental communications, we assume that household transfers and residential reconstruction will be concentrated in 2024/2025, while investment in infrastructure will be evenly distributed throughout the five-year recovery period spanning 2024-2028. We then calculate the final demand shocks linked to these efforts. This is how we build the alternative scenario—first, we compute the numbers for 2023 using the previously estimated capital stock losses, and then the following years with the cumulative demand shocks caused by the relief efforts.

To create a baseline scenario, i.e. an artificial counterfactual had the earthquake not happened, we use the International Monetary Fund macroeconomic scenario from 2022 to 2028 as a reference to construct time series for GDP, household demand, investments, government demand, and exports (Table 1). These series can be used with the IIO model to downscale estimates and obtain counterfactual province-level GRP trajectories.

<div style="background:#3d6b6b; color:white; display:inline-block; padding:2px 8px;">Table 1</div>

IMF Macroeconomic Forecasts, Used for the Counterfactual Scenario

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Real GDP % change	1.2	2.8	3.0	3.5	3.6	3.6	3.6
Investment	29.8	30.3	30.9	31.5	31.9	32.3	33.1
Exports	36.6	37.0	38.7	41.4	44.7	48.8	53.6
Imports	-63.0	-63.3	-67.4	-72.2	-77.6	-82.3	-86.4
Government spending	32.1	31.5	32.0	32.0	31.7	31.3	31.3
Exchange rate, yearly average (MAD/$)	10.2	11.0	11.1	11.3	11.1	10.6	10.3

Finally, we prepare a summary comparing the two alternative paths.

Figure 8

Methodology for Assessing the Economic Impacts of the 2023 Earthquake
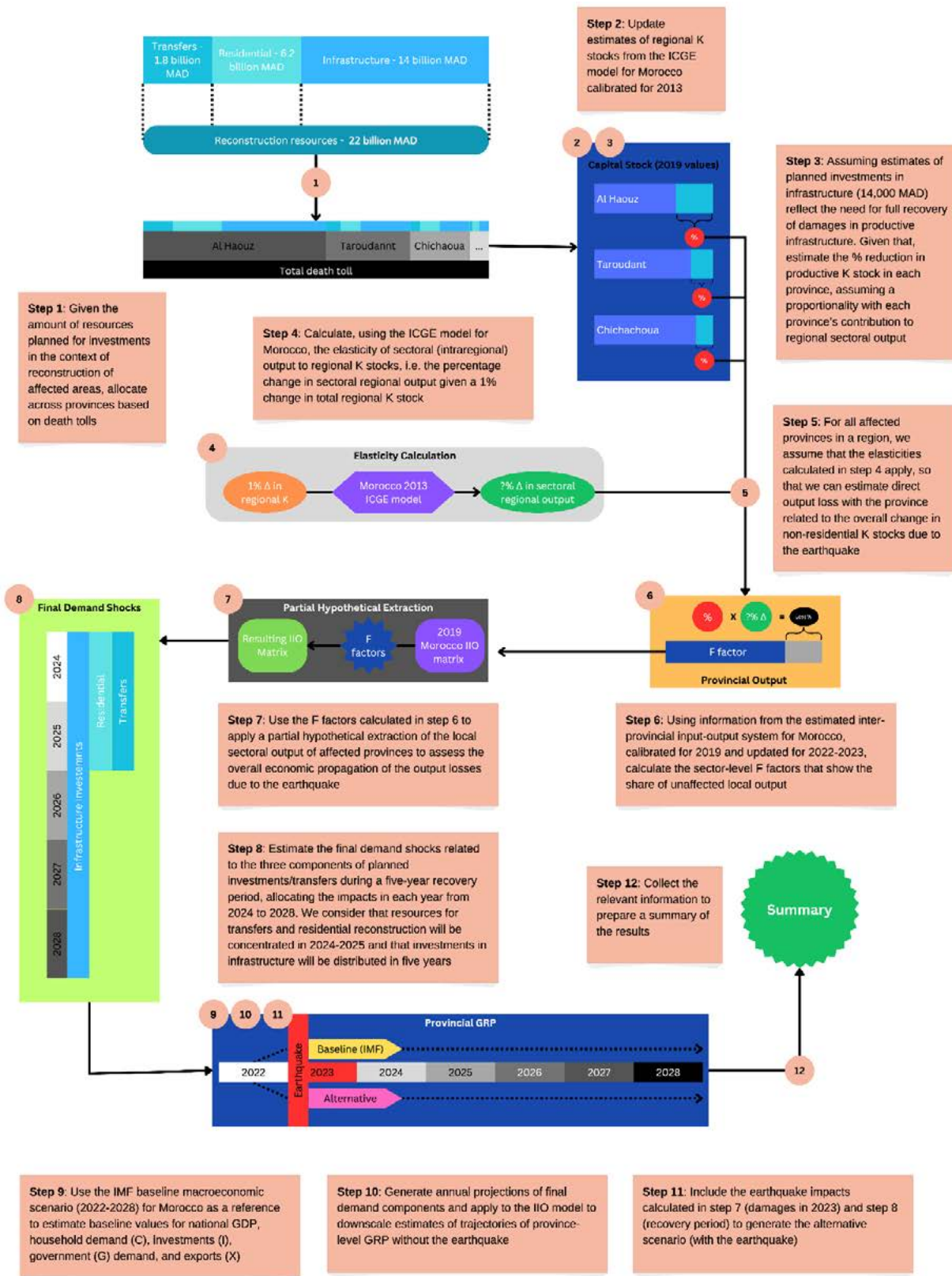
Source: Authors' elaboration.

V.   RESULTS

1.   The Earthquake's Impact on Growth

To begin, we present the cost of the earthquake for the affected provinces. This cost, as explained in the methodology, represents the estimation of the required infrastructure costs needed to restore the capital stock to its pre-earthquake level. In this regard, the direct cost in terms of economic infrastructure loss was concentrated around the earthquake's epicenter in Al-Haouz, followed by neighboring provinces, mainly Taroudant and Chichaoua (Figure 9).

Figure 9

Damage (Direct) Cost, Economic Infrastructure, in %
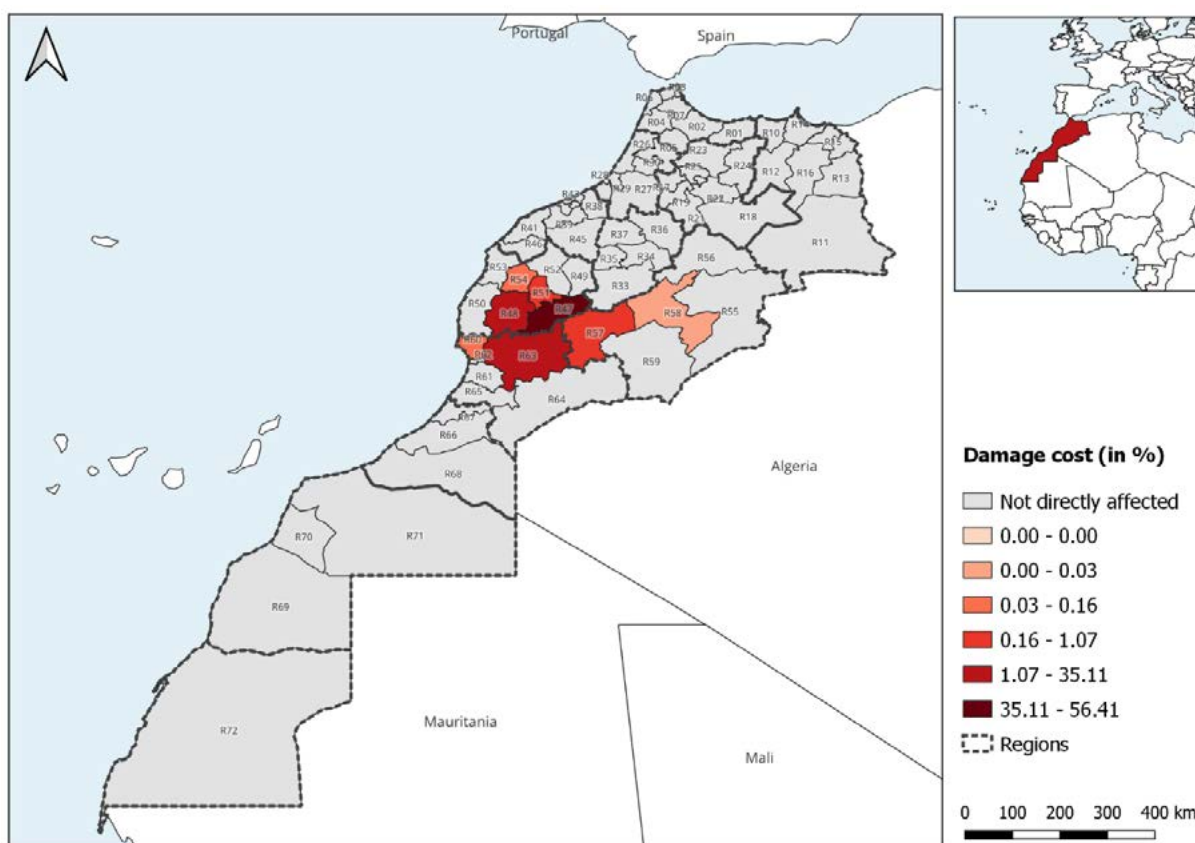
In terms of the indirect cost of the earthquake, and while comparing the baseline scenario—a counterfactual one in which the earthquake did not happen— to the alternative scenario, which represents the factual occurrence, the simulation results suggest that the September 8 earthquake resulted in a GDP loss of 0.24%, or approximately 3 billion MAD in 2023. Consequently, economic activity in Marrakesh region dropped by 1.3%, while Al-Haouz province lost roughly 10.2% of its GRP. The remaining provinces of the Moroccan territory, recorded losses that are lower in magnitude, proportional to their respective linkages with the affected provinces (Figure 10).

Figure 10

Damage (Indirect) Cost, Output Loss (GRP), in %
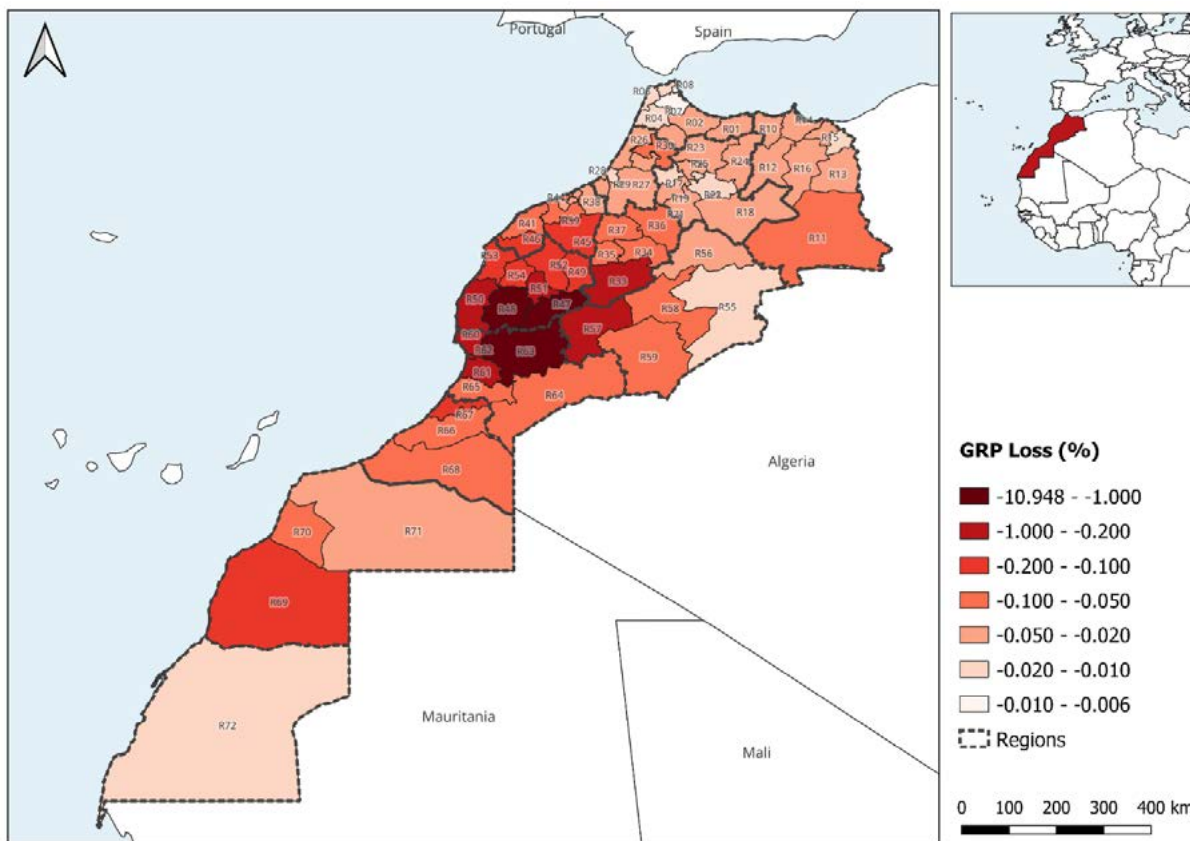
Overall, Al Haouz province registered 53% of the total GRP loss, among the six most affected regions, totaling roughly 1.2 billion MAD. Following closely is the Taroudant province, with a GRP loss of 739 million MAD. The remaining affected provinces—Chichaoua, Marrakech, Ouarzazate, and Azilal—collectively experienced a GRP loss of around 305 million MAD (Figure 11).

Figure 11

GRP Losses Due to the Earthquake in the Affected Provinces, MAD millions
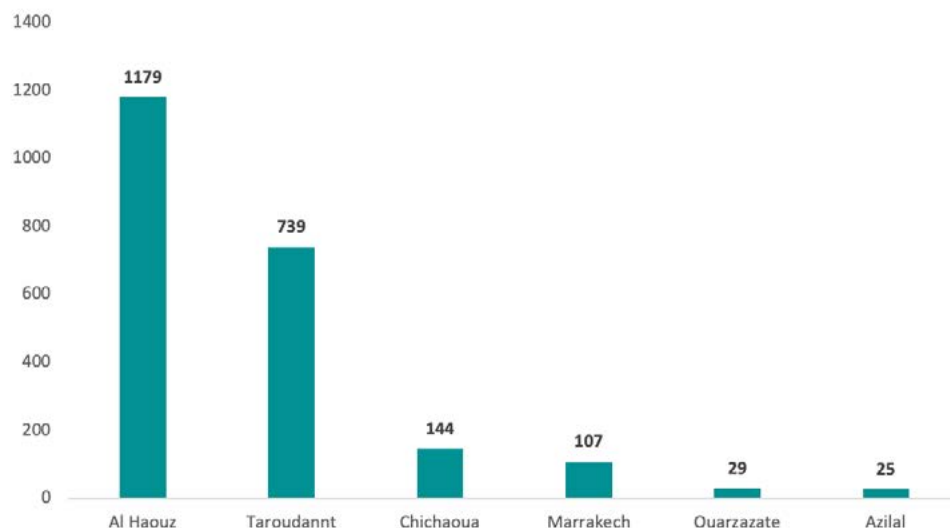
From 2024 to 2028, we calculate the GDP impact of the earthquake and the subsequent recovery efforts as the difference between the alternative and baseline scenarios. This impact is expected to amount to 0.3% and 0.2% in 2024 and 2025, respectively. These two years will concentrate on household transfers, residential reconstruction, and investment efforts in infrastructure. The latter will extend until 2028, resulting in a 0.1% increase in overall GDP compared to the baseline growth path (Figure 12).

Figure 12

Morocco's GDP Growth Simulations (Baseline vs Alternative), and the Earthquake Economic Impact, 2023-2028, in %
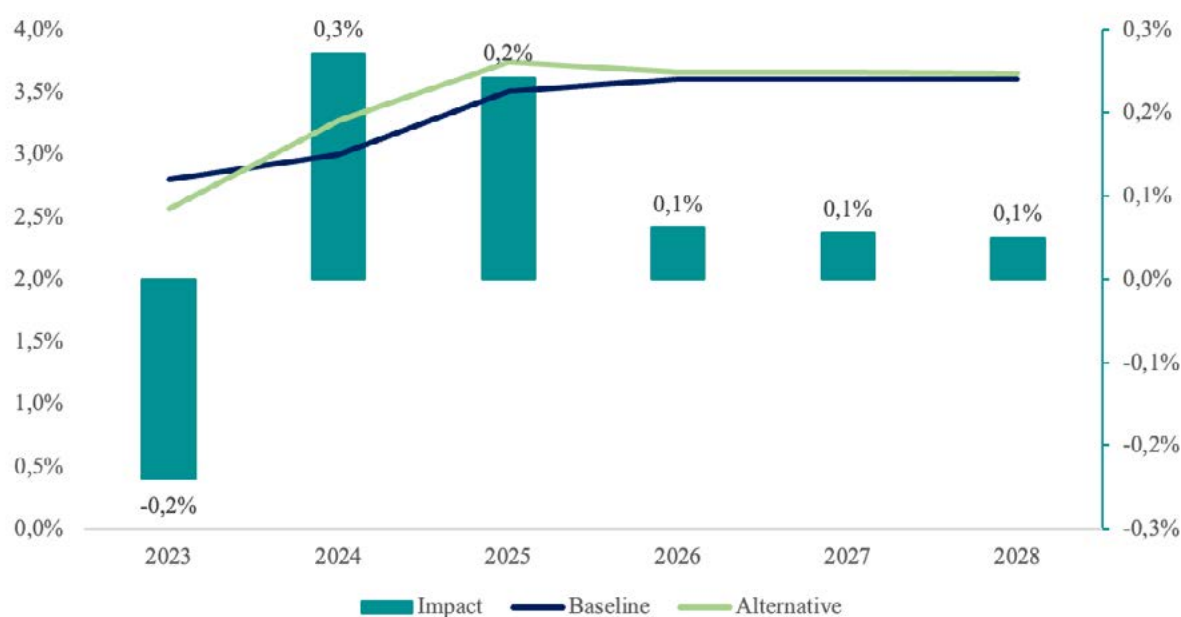
## 2.   Assessing the Impact of the Recovery Plan

In response to the earthquake crisis, Moroccan authorities have launched a five-year reconstruction effort, to which 120 billion Moroccan dirhams (MAD) has been allocated. The budgetary envelope will be split into two pillars: A 22 billion MAD for emergency assistance to households and infrastructure rebuilding, and 98 billion MAD for upgrading the High-Atlas region (Figure 13).

The first pillar includes emergency aid to households and financial assistance for housing over the period 2023-2023, amounting to 8 billion MAD, and 14 billion MAD for infrastructure rebuilding and upgrading over the period 2023-2028.

The second pillar that comprises the remaining 98 billion MAD, will target opening and promoting economic activity in the whole High Atlas regions.

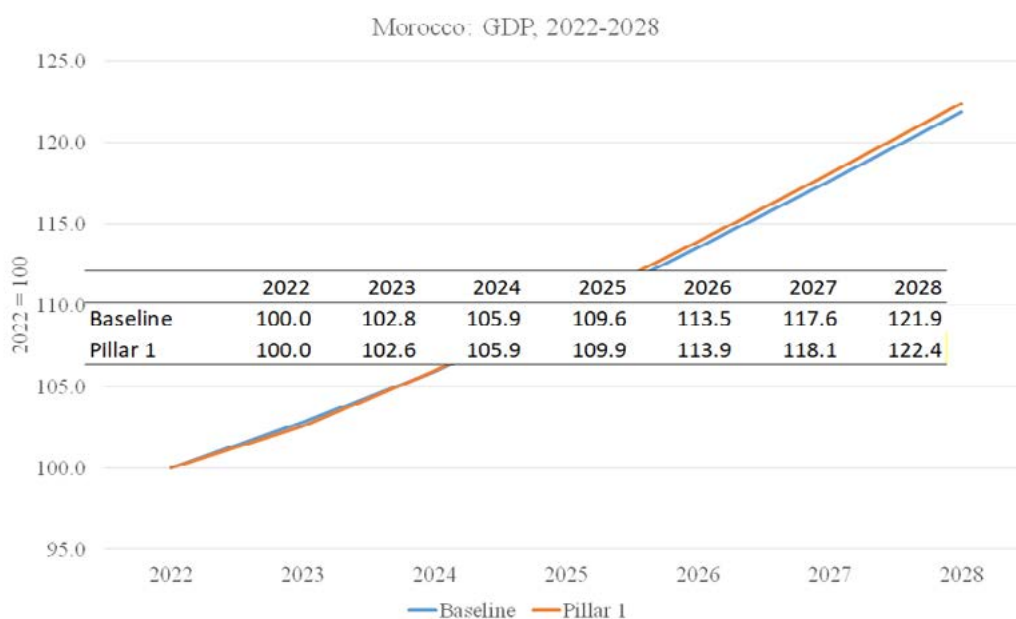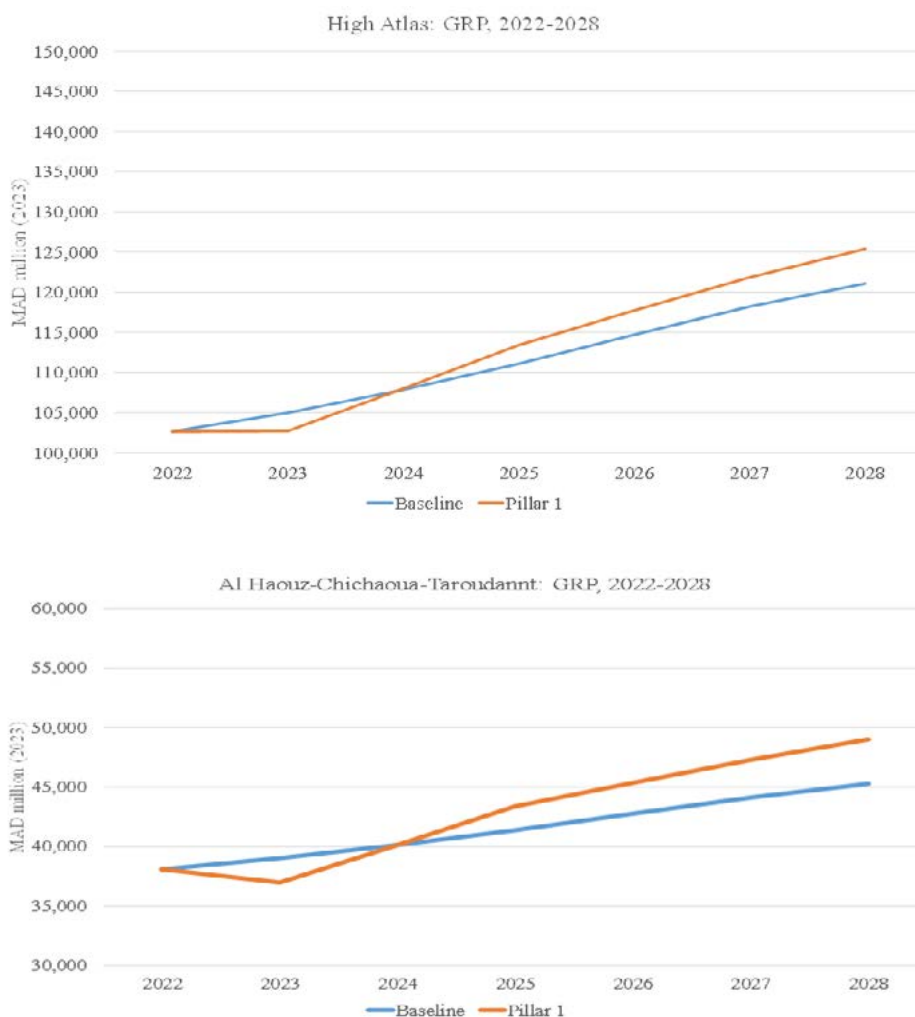## The Recovery Plan Financing Strategy
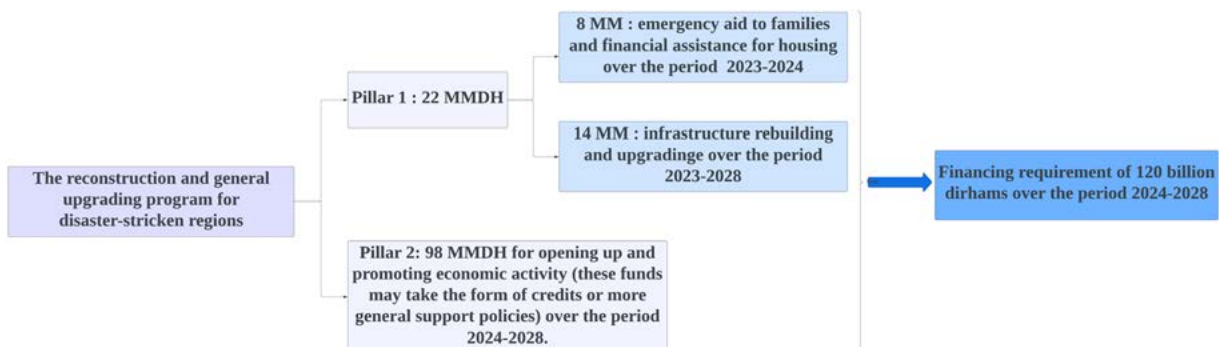
a. First Pillar

Growth simulations for the first pillar indicate that overall, the injection of 22 billion MAD into the Moroccan economy will result in a 0.1 percentage point increase in growth at the national level, and a 1.2 percentage point increase in growth for the High Atlas provinces, on average between 2024 and 2028. We can observe that, transitioning from the national level to a provincial level, the difference between the new growth trajectory (pillar 1) and the baseline scenario (IMF pre-disaster growth projections) increases in magnitude. This can be explained by the fact that the most affected provinces—Al Haouz, Chichaoua, and Taroudant—will be allocated the bulk of the 22 billion MAD recovery plan, considering the relative concentration of deaths in these provinces (Figure 14).

Figure 14

Morocco – High Atlas – and Al Haouz, Chichaoua, Taroudant GDP/GRP Growth Simulations (Baseline vs Pillar 1), 2022-2028, in %

	2022	2023	2024	2025	2026	2027	2028
Baseline	100.0	102.8	105.9	109.6	113.5	117.6	121.9
Pillar 1	100.0	102.6	105.9	109.9	113.9	118.1	122.4

b. Second Pillar

In this section, we include in the simulation results the impact of the recovery plan's second pillar, consisting of 98 billion MAD for developing and promoting economic activity in the High Atlas region.

Since the allocation status of the 98 billion MAD remains uncertain—whether it is newly allocated or reallocated, and in what proportions—we will proceed by considering three different hypothetical scenarios: Haut du formulaire a first scenario ('new money') in which the 98 billion MAD will be financed through new money (ex: debt), a second scenario ('50 – 50') consisting of splitting the 98 billion MAD equally between new money (50%) and investment reallocation (50%), and finally a third scenario ('reallocation') in which the funding will be met through a full investment reallocation. In what follows, we present the simulation results for Morocco and the High Atlas regions for the three scenarios.

- **Morocco**

Growth simulations at national level, taking into account the impacts of both pillars (1 and 2), produce results indicating that the overall impact remains highly dependent on the financing scenario. This ranges from a 0.4 percentage point increase on average for 'new money' to a 0.03 percentage point increase on average for 'Reallocation' over the period 2024-2028 (Figure 15).

The significant contrast in magnitude between the two extreme scenarios—new money and a complete investment reallocation—stems from the fact that the former depicts a hypothetical situation in which the government injects approximately 10% of GDP into the economy in the form of new money (e.g. debt), while the latter involves a straightforward reallocation of investment funds from unaffected to affected areas, potentially resulting in negative repercussions for regions losing funding, and expected to generate only modest positive impacts on growth.

Figure 15

Morocco's GDP Growth Simulations (Baseline vs Pillar 1 vs Pillar 1&2), 2022 – 2028, in % (3 different scenarios)
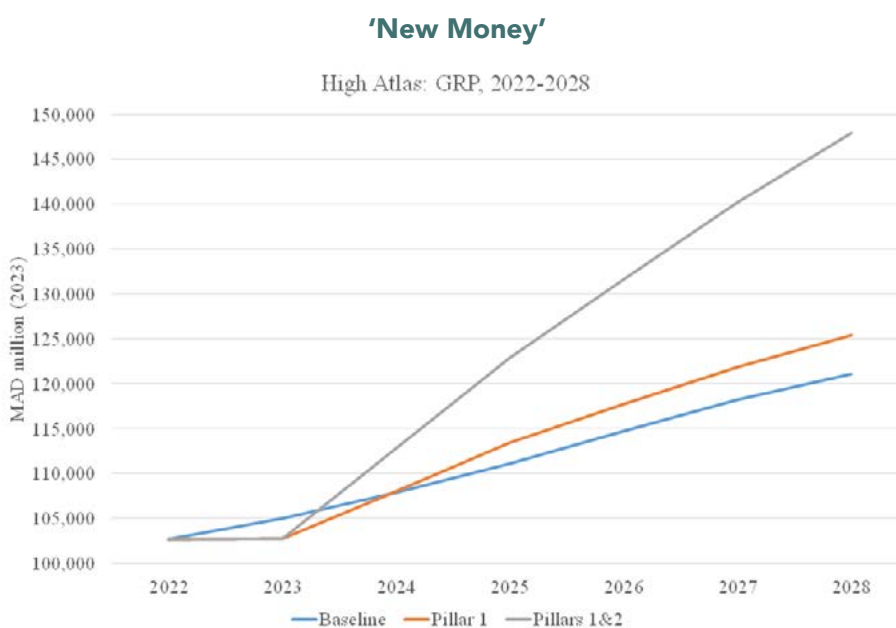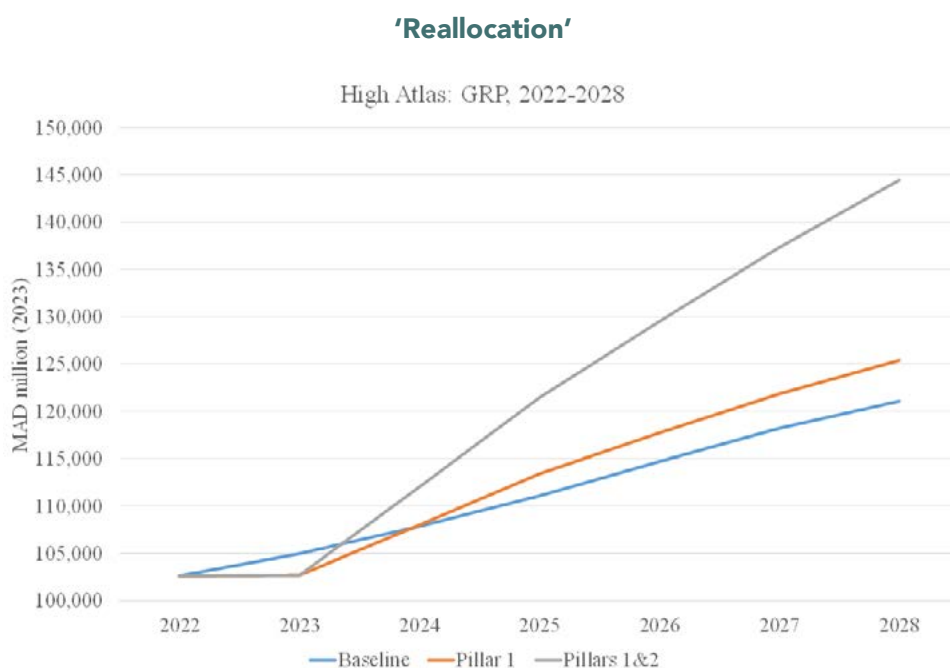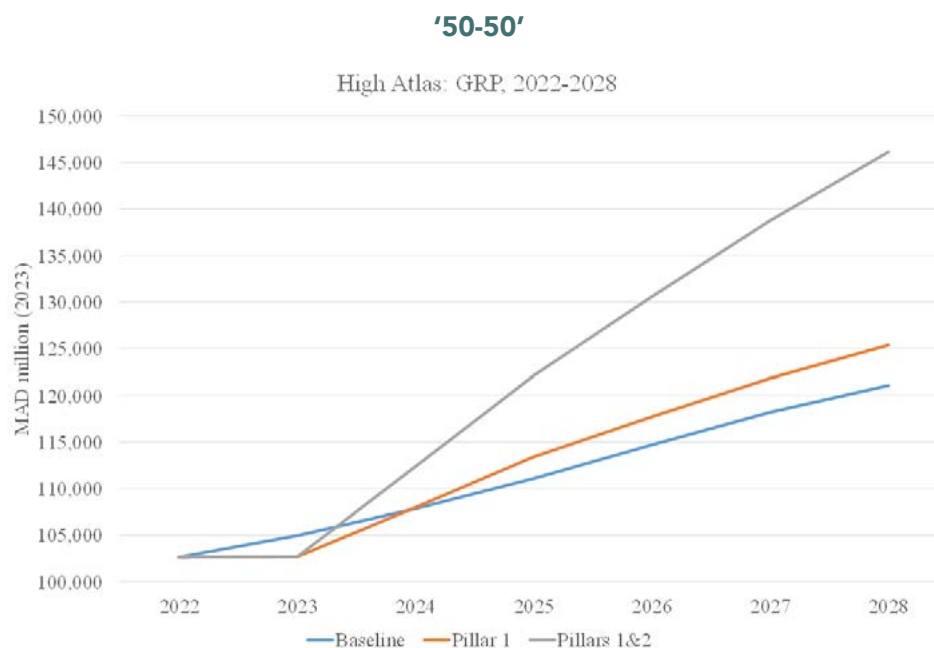
'Reallocation'

Morocco: GDP, 2022-2028
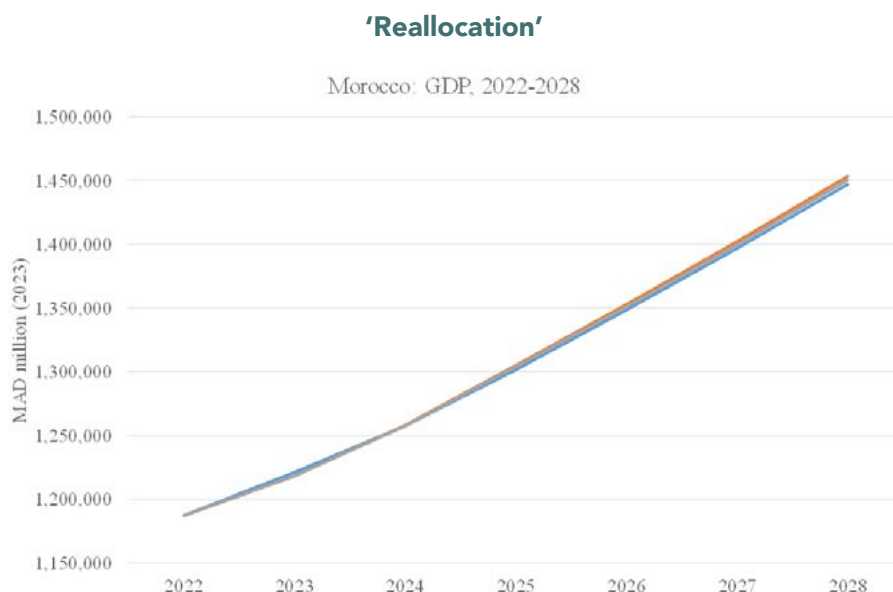
- **High Atlas**

For the High Atlas provinces, growth simulations, taking into account the impacts of both Pillars (1 and 2), result in positive effects on growth regardless of the financing scenario. This can be attributed to the High Atlas provinces being in a situation in which they are funding receivers, regardless of the origin of the funding, hence the minor discrepancies between the various financing scenarios (Figure 16).

Figure 16

High Atlas Regions' GRP Growth Simulations (Baseline vs Pillar 1 vs Pillar 1&2), 2022 – 2028, in % (3 different scenarios)

'New Money'

High Atlas: GRP, 2022-2028

'50-50'

High Atlas: GRP, 2022-2028

'Reallocation'

High Atlas: GRP, 2022-2028

VI. IMPACT OF THE EARTHQUAKE ON HIGH-FREQUENCY INDICATORS: FINANCIAL INDICATORS CONFIRMING THE RESILIENCE OF THE MOROCCAN ECONOMY

In this section, we assess the macro impact of the earthquake on financial markets indicators, available at a daily frequency. It came out of the analysis that although the human cost was terrible—but could have been worse if located in more populated areas—the economic negative implications were limited and not systemic. This confirms the previous section simulation's results, suggesting that the earthquake had only a mild negative impact on Moroccan growth for 2023.

The Impact on the Stock Exchange: One Effect in the Hotels and Leisure Sector, Swiftly Smoothed Subsequently

The Casablanca stock exchange did not display any abnormal trend following the earthquake, except a punctual drop in the market pricing of hotels and leisure companies. In the two days following the earthquake, the MASI—Moroccan All Share Index—did not seem to react to the catastrophe. The volume exchanged during the following days was almost aligned with the annual average. However, digging deeper, the values related more to the central role of Marrakesh in the tourism sector have been affected, and saw a depreciation of around 10% between September 8—a Friday—and September 12, 2023. The market depreciation was the most severe recorded over two days for the whole year. This could have reflected the gloomy outlook regarding the impact of the catastrophe on tourism prospects. Economic stakeholders feared the earthquake would negatively impact foreign tourists' perceptions of Morocco, and the attractiveness of Marrakesh also for local tourists. It is well documented how tourism is naturally vulnerable to such shocks, and negative implications can last for some time (Zhang, 2021). However, in the Moroccan case, the effect was contained within a short period (Figure 17). Ten days later, the hotels and leisure sector regained the value it had prior to the catastrophe and kept evolving in the same level. Later, the financial market, including the tourism values, reacted well to the official announcement of the organization of the 2030 World Cup, which will be part-hosted by Morocco. On October 6, two days after the announcement, the MASI reached the highest level in the year (as of December 8).

Figure 17

Daily Stock Market Indices, December 8, 2022, to December 8, 2023
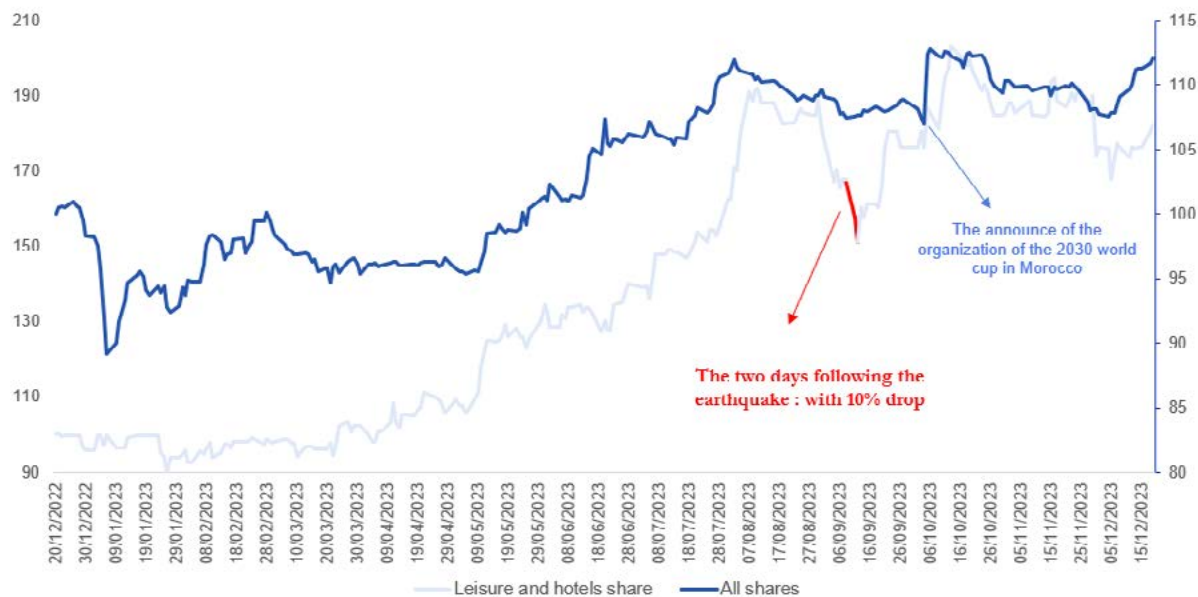
Source : Stock exchange of Casablanca.

These analyses are consistent with evaluations from other institutions regarding the limited impact of the disaster on the tourism sector. Fitch Ratings, quoting local operators, reported more a postponement in the sector rather than cancellation. Local authorities also managed well the post-earthquake period. The decision to go forward with the organization of the IMF-World Bank annual meeting in Marrakesh demonstrated how resilient the country is, and sent the right signal to quash the uncertainties surrounding the implications of the earthquake on tourism, and thereby economic

activity. As a result, September recorded a significant increase in tourists visits to Morocco—7% up compared to the same month in 2022.

The Impact on the Local T-bills Market: The Market Seemed Insensitive to the Natural Disaster

The earthquake did not lead to a holding on of local investors subscribing to treasury bonds, and therefore financing costs remained unchanged. Natural disasters, such as earthquakes, can have detrimental impacts on the capacity of the state to respond, through the sovereign risk channel. High social costs of the damages can imply a greater sovereign risk aversion among investors (Cebotari and Youssef, 2015). Indeed, earthquakes can compromise fiscal trajectories, as investors perceive natural disasters as a negative shock that can put debt on an unsustainable path, and eventually trigger a sovereign default. A manifestation of such a trend can be the spread over sovereign debt. In the T-Bills sector, unlike the stock market, where fluctuation of hotels and leisure sector indices can be driven by idiosyncratic factors distinct from the earthquake impact, or not representative of the common trend in the sector, the market is the most liquid section of the capital markets. Following the earthquake, the interest rates did not exhibit any abnormal volatility along the different maturities and continued evolving in the same level (Figure 18). The same market, for instance, recorded a rise in volatility in the wake of the confinement measures during the COVID-19 period, showing how sensitive it is to adverse shocks stemming also from non-economic catastrophes.

Figure 18

Daily Interest Rates Over T-bills by Maturity, July 2023 to September 2023, in %
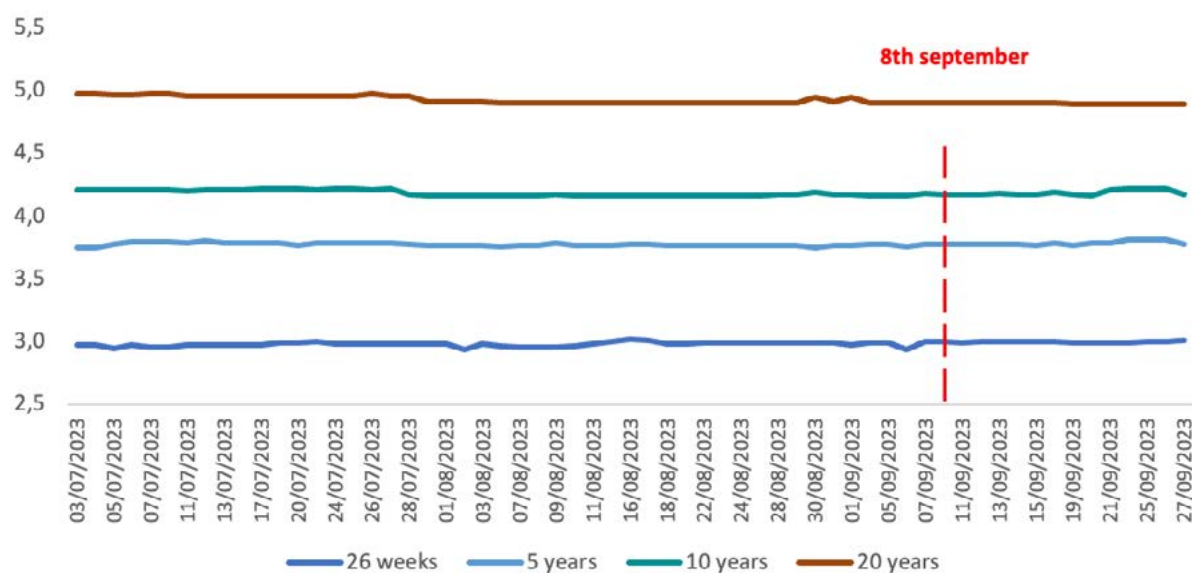
Source: Central Bank of Morocco.

## Impact on the Exchange Market: A Muted Effect on the Exchange Rate

The earthquake did not result in disordered volatility in the Moroccan exchange market. Since Morocco has moved a step forward into the flexibility of the local currency, the exchange rate has

seen, as expected, increased volatility, exacerbated by the multiple shocks affecting the Moroccan economy. In March 2020, the central bank widened the fluctuation bands of the dirham to +/- 5%. The exchange regime was thus considered to be a pegged regime with horizontal bands (IMF *de-facto* classification). In the first week following the COVID-19 lockdown, the dirham depreciated compared to the basket (60% euro, 40% $). Since then, the exchange market has seen an improvement in liquidity, and has started to be a reliable indicator of financial stakeholders' assessments and expectations of the economic situation.

International experience has shown how exchange markets have been sensitive to supply shocks, including natural disasters (Hatasey *et al*, 2013). In the wake of the Japan earthquake in 2011, the yen displayed "*disordered volatility*". The evidence also shows that earthquakes generally result in increased volatility in the exchange market elsewhere. But this depends on the magnitude in terms of the economic damage caused by the earthquake. In the Moroccan case, it appears clear that economic fundamentals have not been seriously affected, and therefore, market volatility did not go through any substantial increase following the earthquake. Indeed, the potential impact through the fall in tourism receipts was muted, as shown earlier, and therefore the exchange rate remained insensitive (Figure 19). Furthermore, in the weeks after the earthquake, Morocco received funds by global doners to fund the reconstruction plan and bring the needed resources to support the recovery plan. This might also offset any uncertainties in the exchange market around the future of the dirham, and the pressure on international reserves.

Figure 19

MAD Daily Exchange Rate Per the Official Basket ($ & E) Index, Base 100, 2015, 2020-2023.
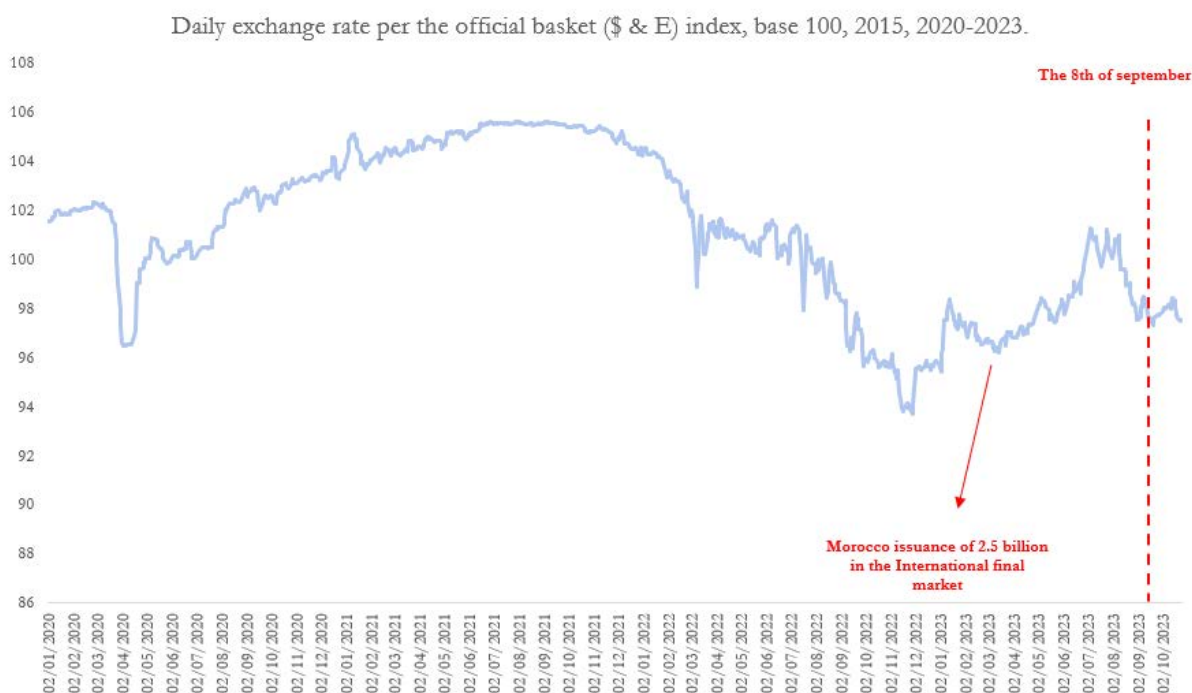
Source: Central Bank of Morocco.

Impact on Foreign Investors's Perceptoins of Morocco: Spreads Have Increased Slightly, Remaining Below the 2023 Average

Premiums increased slightly in the week following the earthquake, without signaling a real threat in terms of perception of the fiscal trajectory. Unlike the local T-Bills Market, the international Eurobonds market reacted little to the natural disaster. After a drop, spreads increased slightly (Figure 20). However, the spread has remained well below the 2023 average. Credit Default Swaps—CDS[1]—followed a similar path, confirming a slight deterioration in the perception of sovereign risk. Indeed, in the following days, CDS increased for all maturities, especially for the five-year CDSs. The increase reached 13.4% for the latter, and 9% and 8% for 10 years and 20 years, respectively. This deterioration seems also temporary, as the second half of November witnessed a downward adjustment (Figure 21).

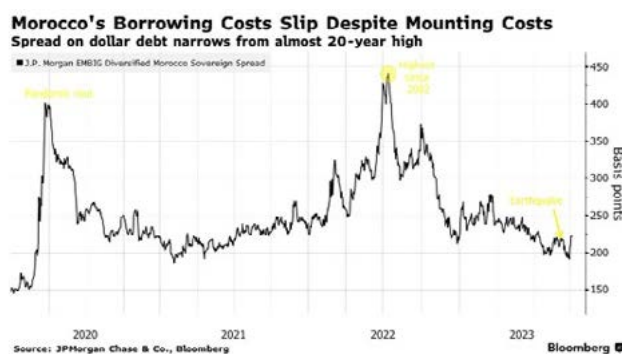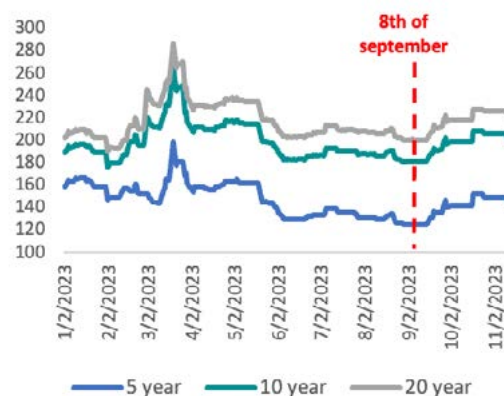| Figure 20	Figure 21
Morocco's Eurobonds Spread	Moroccan CDS Premium, by Maturity

Source : Bloomberg & refinitiv Eikon.

These developments confirm how resilient the Moroccan economy is, following successive domestic and global shocks. However, the favorable perception on the part of international investors stands out. To cushion the impact of further shocks, Morocco requested access to a Flexible Credit Line provided by the IMF, at affordable cost, amounting to $5 Billion. This mechanism sends the right signal over the capacity of the Moroccan economy to absorb shocks affecting its balance of payments and ensures that the IMF trusts the trajectory of the macroeconomic policies deployed. Concerns could have stemmed from the reconstruction plan announced by the authorities, reaching $11.7 billion for the reconstruction and the recovery plan, representing 8.5% of GDP over the period 2024-2028, which could propel treasury debt to even higher, and perhaps unsustainable, levels.

That said, the three-year budgetary plan for 2024-2026 shows a clear commitment by the authorities to bring the fiscal deficit to 3% by 2026, and to start the deleveraging process earlier to bring treasury debt below 70% of GDP (Ministry of Finance, 2023). The 2024 Finance Act comes also to stress how important it is for fiscal policy to strike the right balance between funding strategic reconstruction projects and the broadening of the social safety net, as well as ensuring the sustainability of fiscal policy. One of the novelties of this Act, is a fiscal rule fixed on treasury debt

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1. An agreement between parties to swap the risk of potential losses if a debtor fails to make a timely payment. Higher CDS implies greater risk of default.

that will give investors the right anchor for the orientation of fiscal policy, and contribute to easing financial conditions (IMF, 2023).

Overall, it seems that the financial market did not signal any worrying trends relating to the economic losses connected with the earthquake. This confirms the resilience of the economy, in line with the results obtained through the simulation strategy.

VII. CONCLUSION

In this paper, we first attempted to assess the economic impact of the Al-Haouz earthquake in terms of indirect and direct production losses, at national, regional, and provincial levels, using an Inter-province Input-Output table for Morocco. Our results indicate that this natural disaster will cost 0.24% of Morocco's GDP in 2023, resulting in a 1.3% drop in Marrakesh-Safi GRP, and a 10.2% drop in economic activity in the Al-Haouz province. From these estimations, we can infer that the earthquake on September 8, 2023, was more of a human tragedy with moderate economic losses, especially at the macroeconomic level. This conclusion is generally supported by the analysis of some high-frequency financial indicators, showing the resilient nature of the Moroccan economy following the natural disaster.

Second, we have shed light on The Program for Reconstruction and Rehabilitation of Affected Areas, which allocates 120 billion MAD for short-term emergency aid to households, financial assistance for housing reconstruction, and medium to long-term infrastructure rebuilding and upgrading of the affected areas, as well as the promotion of economic activity in the other High Atlas provinces. We assessed the economic impact of the recovery program through its two main pillars, while considering different hypotheses for the financing scheme of the second pillar, ranging from a new injection of money into the economy (debt), to a complete reallocation of investments from non-affected to affected areas.

Given Morocco's commitment to maintaining macroeconomic stability, especially debt sustainability, and aligned with the Ministry of Finance's assessment that treasury debt is projected to decelerate starting from 2023, and to return to 2021 levels by 2025, the scenario that appears most probable for financing the second pillar (98 billion MAD) suggests a primary reliance on investment reallocation, rather than an increase in indebtedness.

Focusing on this scenario, our results indicate that the 120 billion MAD recovery plan will only have a mild positive impact on growth at the national level, with an average increase of 0.03 percentage points over the period 2024-2028. For the High Atlas provinces, significant growth increases are expected due to the recovery plan, regardless of the financing scenario.

Finally, policymakers will have to confront a trade-off between efficiency and equity when allocating resources from non-affected (and highly productive) areas to affected (and less-productive) areas. Considering the policy intention to reduce regional disparities, and the necessity of assisting underdeveloped regions in catching up with the rest of the country's development stage, we might consider the need to prioritize equity over efficiency in such circumstances.

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About Policy Center for the New South

The Policy Center for the New South (PCNS) is a Moroccan think tank aiming to contribute to the improvement of economic and social public policies that challenge Morocco and the rest of Africa as integral parts of the global South.

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As such, the PCNS brings together researchers, publishes their work and capitalizes on a network of renowned partners, representative of different regions of the world. The PCNS hosts a series of gatherings of different formats and scales throughout the year, the most important being the annual international conferences "The Atlantic Dialogues" and "African Peace and Security Annual Conference" (APSACO).

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