Multidimensional poverty in Lebanon

A proposed measurement framework, and an assessment of the socioeconomic crisis

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Introduction

The deteriorating economic activity and domestic political instability witnessed in Lebanon since 2019 have increased pressure on the fixed exchange rate, and caused a devaluation of the country's currency, higher inflation, a decline in purchasing power, and stalled international remittances. These multiple shocks have significantly increased poverty, especially among the Lebanese population.

The ongoing crises, including the energy and utilities crisis, have resulted in business shutdowns, layoffs and unemployment. Layoffs owing to lockdown measures alone have led to an estimated 43 per cent reduction in earnings, and a 52 per cent reduction in working hours.[1] Moreover, even before these adverse impacts caused by the COVID-19 pandemic, the large influx of Syrian refugees had stretched the State's capacity, which was already obstructed by inadequate spending on safety nets and low health insurance coverage.

Coping strategies to tackle these overlapping crises have varied. Many, especially middle and lower-middle income households, have resorted to selling domestic assets such as land, cars, gold, and other basic livelihood assets, which also increases their vulnerability to future shocks. A significant drop in school and university enrolment rates was also recorded along with rising drop-out rates.

In sum, few in Lebanon have been spared the consequences of these multiple and overlapping shocks. Nearly all population groups have been exposed to one shock or another via different channels. ESCWA (2020) estimated that more than half of the population in Lebanon is now trapped in poverty.

Given this context, and based on a request from Lebanon in 2019, ESCWA contacted the Lebanese Central Administration of Statistics (CAS) and embarked on a multidimensional poverty assessment using a proposed technical multidimensional poverty index (MPI). The aim is to encourage and contribute to a national discussion on the impact of socioeconomic crises on multidimensional poverty in Lebanon, and thus on remedial policy actions. Accordingly, the present paper has two objectives. Firstly, it explains the conceptual framework used to design the technical MPI. Secondly, the paper fleshes out a methodology used to nowcast data from the 2019 labour force and household living conditions survey (LFHLCS), by simulating the impact of these overlapping shocks between mid-2019 and mid-2021, and reporting a comparative of general results and baseline results at the national and subnational levels.

[1] Kebede, Stave and Kattaa, 2020.

1. Framework

Using the latest 2019 LFHLCS for Lebanon,[2] population-representative at the governorate level, the present paper proposes a framework to measure MPI at both the national and subnational levels. The choice of indicators and their definitions are constrained by the available instruments and their quality, and must be fine-tuned through the following procedures:

- Technical assessment of questions and data structure in LFHLCS.
- Normative assessment of the intrinsic and instrumental value of all components.[3]
- Consultative process, including an expert dialogue.
- Consideration of other MPIs (notably the regional MPI) and the Sustainable Development Goals (SDGs).
- Statistical and mathematical validation procedures, such as redundancy and robustness tests (annex 1).

The proposed MPI follows the Alkire-Foster methodology, which identifies the percentage of individuals living in households experiencing multiple deprivations. It shows the aspects in which people are deprived, and reveals the intensity of such deprivations. LFHLCS collects individual-level data for various indicators, while other data are collected at the household level. In all cases, indicators define deprivations at the household level. The MPI unit of analysis is therefore the household. Where applicable, deprivations are computed at the individual level, and then expanded to the household level. In other instances, deprivations are computed at the household level directly. The overlapping deprivation scores are common to all members within a household, but differ between households. The final headcount is computed at the individual level.

The proposed framework is composed of six dimensions sorted by three pillars:

1. The human capabilities pillar, including the 'education' and 'health' dimensions.
2. The housing and access to services pillar, including the 'housing' and 'general services' dimensions.
3. The livelihood and assets pillar, including the 'assets' and 'employment and income' dimensions.

To measure households' capabilities under these pillars, proxies are used to incorporate information on different aspects of moderate deprivations. A total of 20 such proxies are used and referred to as indicators. Each dimension encompasses 3 to 4 indicators (table 1). The specified dimensions and indicators cover various life domains, allowing the detection of a range of deprivation facets. Although conditioned by data availability,[4] the chosen indicators make the best use of data to fulfil the objective of the proposed MPI.

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[2] www.cas.gov.lb/index.php/demographic-and-social-en/laborforce-en.

[3] Sen, 1992; 1999.

[4] For example, the data does not allow proxies for food security.

Table 1. Proposed framework for the Lebanon MPI based on the 2019 LFHLCS

Dimension (weight)	Indicator (weight)	Indicator Weight	Deprived if
Education (weight=16.67%)	**LF01 Access to Education** (weight=33.33%)	5.56%	HH is deprived if there is no school public, private, elementary, complementary and secondary) within a 10 minutes walk distance
	LF02 - Educational Attainment (weight=33.33%)	5.56%	HH is deprived if all members aged 20+ are either: Not enrolled, Illiterate, Read and write, Pre-school, Elementary, Intermediary
	LF03 - School Attendance (weight=33.33%)	5.56%	HH is deprived if any member aged 5-19 is not attending school (excluding members who completed secondary)
Health (weight=16.67%)	**LF04 - Health Insurance** (weight=33.33%)	5.56%	HH deprived if any HH member has no health insurance coverage (excluding domestic workers - no data)
	LF05 - Access to Medicines (weight=33.33%)	5.56%	HH deprived if any HH member needs regular medication and can't afford it (excluding domestic workers - no data)
	LF06 - Access to Medical Services (weight=33.33%)	5.56%	HH deprived if any HH member needs medical services and can't afford it (excluding domestic workers - no data)
General Services (weight=16.67%)	**LF07 - Electricity** (weight=25%)	4.17%	Deprived if HH has no access to electricity or a generator
	LF08 - Drinking Water (weight=25%)	4.17%	Deprived if HH uses non-improved drinking water or HH uses bottled water and not improved service water
	LF09- Sanitation (weight=25%)	4.17%	HH is deprived if there is no access to improved drainage technique
	LF10 - Waste Collection (weight=25%)	4.17%	HH is deprived if garbage is not disposed in containers or disposed of in containers inside the building which are emptied once a week or less
Housing (weight=16.67%)	**LF11 - Overcrowding rate** (weight=33.33%)	5.56%	HH is deprived if there are more than 2 persons aged 10+ per room
	LF12 - Housing type (weight=33.33%)	5.56%	Deprived if the housing situation fits at least one of the following conditions: (i) home is a place other than a stand-alone house or apartment ; (ii) area is less than 30m2 ; (iii) it has a non-permanent floor
	LF13 - Having a toilet (weight=33.33%)	5.56%	HH is deprived if HH has no toilet in dwelling
Assets and Property (weight=16.67%)	**LF14 - Internet Access and ICT** (weight=25%)	4.17%	HH is deprived if it has no internet access and has neither a phone (fixed phone or cell phone), computer, iPad, TV, DVD, satellite dish
	LF15 - Means of transport (weight=25%)	4.17%	HH is deprived if it has neither a car nor a motorcycle and do not have access to public transportation (<10min)
	LF16 - Household electrical devices (reduced list) (weight=25%)	4.17%	HH is deprived if it has neither a fridge, washing machine, air conditioner nor any water heater
	LF17 - Heating devices (weight=25%)	4.17%	HH deprived if it has no heating other than charcoal
Employment and Income (weight=16.67%)	**LF18- Unemployment (ANY)** (weight=33.33%)	5.56%	HH deprived if all HH members, aged 20+, are unemployed or underutilized or discouraged
	LF19 Employment Informality (ALL) (weight=33.33%)	5.56%	HH deprived if all HH member, aged 20+, are informally employed
	LF20 - Income (2019) (weight=33.33%)	5.56%	HH is deprived if adjusted income for children and economies of scale is less than 386,000 LBP

Associated with each indicator is a threshold, or deprivation cut-off, that distinguishes deprived from non-deprived individuals. An individual is considered deprived in a specific indicator if their household achievement meets the deprivation definition for that indicator. Our deprivation cut-offs are grounded in a rights-based approach and international standards, and in expert opinions regarding the country's context, relevant circumstances, current policy priorities and cultural norms.

Another component of a summary measure of multidimensional poverty is the weighting structure assigning the relative importance of each indicator to national priorities. Different weighting schemes have been used in previous works; in many studies, equal weighting for items is applied.[5] We choose this weighting scheme as a starting point. The three pillars and six dimensions of the proposed MPI are assigned equal weights, with each dimension receiving one sixth of the total weight (16.67 per cent). Similarly, indicators nested within each dimension are also assigned equal weights. Final weights are the multiplication of both assigned fractions, and in the current framework, the weights of the indicators range between 4.2 and 5.5 per cent depending on the count of indicators in each dimension (or 1/24 and 1/18 of the total weight, respectively).

Given these weighted indicators, a deprivation score is assigned for each individual in the survey according to the proposed multidimensional poverty framework. Hence, if a person is deprived in at least one sixth of all the utilized indicators, they are considered multidimensionally poor. All individuals with a deprivation score between 11 per cent (rounding of 1/9) and 17 per cent (rounding of 1/6) are classified as very vulnerable to multidimensional poverty.[6] Lastly, individuals deprived in more than two dimensions, with a score greater than 33 per cent, are regarded as living in extreme multidimensional poverty and form a subset of the poor.

A. Education dimension

The world has nearly reached the yardstick of universal primary education. Lebanon, however, is known to have achieved significantly higher levels of education when compared with the world and the Arab region, while certain disparities remain striking at the secondary education level, considered as a threshold for productive opportunities. The education dimension includes three indicators – access to education, education attainment, and school attendance – equally weighted within the dimension. The nested weight of 33.33 per cent equates to a final weight of 5.56 per cent in the framework.[7]

B. Health dimension

Lebanon is known as an excellence centre for medical services in the Levant. However, significant disparities arise when measuring access to health care and medical services, as well as the capability of covering the cost of such services when accessible. The three indicators within the health dimension – health insurance coverage, access to medication, and access to medical services– receive a weight of 1/3 each. Their final weight in the framework is 1/18 (around 5.56 per cent).

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[5] Ashaal and Bakri, 2019.

[6] To define vulnerability, we consider people who would fall into poverty owing to one additional deprivation in the framework's indicators. To compute the vulnerability threshold, we subtract the highest weight of an indicator from the poverty cut-off value, e.g., poverty cut-off = 1/6, highest indicator weight = 1/18, vulnerability cut-off=1/6-1/18 = 1/9.

[7] Final Indicator Weight= Dimension Weight*Indicator Nested Weight=1/6 * 1/3=1/18≅5.56%.

C. General services dimension

Life in Lebanon is characterized by poor access to public services. Notoriously unreliable access to electricity significantly impedes quality living or doing business. The country's inefficient and fragile electricity system does not meet local electricity demand due to poor infrastructure and limited capacity to generate, transmit or distribute additional electric energy. The Lebanese Ministry of Energy and Water and UNDP point to the shortage in generation capacity by Electricity du Liban's (EDL) grid.[8] Garbage collection and waste management services have also proved to be unsustainable in recent years, in addition to other 'hidden' shortages in services such as improved drinking water and drainage. Such poor services breach the rights to adequate living standards. Within the general services dimension, each of the four indicators in the proposed MPI – electricity, drinking water, drainage and waste collection – has a nested equal weight of 25 per cent, with a final weight in the framework of 4.2 per cent.

D. Housing dimension

Decent housing is a basic human right. The three indicators within the housing dimension – inadequate toilet facility, overcrowding, and inadequate dwelling – are equally weighted at 33.33 per cent each, with a final weight in the framework of 5.56 per cent.

E. Assets and property dimension

Household assets and property serve two purposes: as indicators for enhanced individual capabilities to deliver particular functions and thus enhanced achievement of particular capabilities; and as proxies for material scarcity affecting households' ability to acquire and maintain basic assets. Assets are intrinsically related to households' capacity togenerate incomes and allow adequate livelihoods.

The livelihood and assets pillar has undoubtedly been affected by the current economic crisis in Lebanon, since about one in five Lebanese households have resorted to severe crisis or emergency livelihood coping strategies, including spending less on health and education, selling productive assets, and begging.[9]

The assets dimension includes four asset classes as separate indicators – ICT assets, mobility assets, livelihood assets and heating assets – receiving a nested weight of 25 per cent each. In each of these asset groups, households are classified as deprived if they have no communication devices, no vehicles, no home appliances, and only use charcoal as the sole source of heating. This definition recognizes households' choice to dismiss any one particular asset while retaining others.

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[8] Ministry of Energy and Water and UNDP, 2017.

[9] Based on WFP assessment on the impact of the economic and COVID-19 crises in Lebanon, June 2020. Available at https://docs.wfp.org/api/documents/WFP-0000116784/downloa/.

F. Employment and income dimension

Beside the stock of property and assets held by household members, their employment and income are critical to households' ability to meet their basic needs. Lebanese households have seen their employment conditions and incomes deteriorate since the beginning of the financial crisis of 2019, if not before. Amid the COVID-19 pandemic, more than a third of residents in Lebanon have lost their jobs, and around 60 per cent have seen their income fall, while less than 10 per cent have experienced a salary raise.

Knowing that employment is the main source of income for individuals, as revealed by the data, the framework presents employment and income under a single dimension. Indicators within the employment and income dimension are employment deprivation, informality, and income. They are equally weighted at 33.33 per cent within the dimension, and at 5.56 per cent in the framework.

Several facts are worth mentioning here:

1. Household income from all sources over the past month is extracted from categorical data with six categories, ranging from less than LBP 650,000 to more than LBP 5,000,000. Since literature shows that income is under reported when compared with registry records,[10] we adjust this original variable in two ways. To account for the number of individuals relying on household income, we divide the upper bound of each household-income category by the household size. This is a conservative correction. Since the monetary value of basic needs normally varies depending on whether the individual is a child or an adult, and since some goods and services can be shared among family members and have a public good aspect, we account for both of these considerations, adult-equivalence scale and household-economies of scale, by resorting to previous work on poverty in Lebanon by CAS and the World Bank.[11] We assume that children's consumption needs are one half those of adults, and we introduce small economies of scale with a factor of 0.92.
2. The updated annual national poverty line is computed using a consumer price index (CPI) provided by CAS, as retrieved in July 2021 (table 2).[12]

Table 2. Inflation multiplier

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CPI	104.97	111.88	117.27	119.45	114.97	114.07	119.00	126.23	130.03	240.37	346.41
Inflation multiplier		1.066	1.048	1.019	0.963	0.992	1.043	1.061	1.030	1.849	1.441

[10] Angel, Heuberger and Lamei, 2018.

[11] Central Administration of Statistics and the World Bank, 2015.

[12] Central Administration of Statistics, Consumer Price Index page, 2021.

The updated monetary poverty line is computed based on CAS estimates and the following facts:

1. The 2011 national poverty line per capita was reported at LBP 4,729,000 annually.
2. The poverty line is updated to 2019, the date of the survey, using the compounded inflation rate from 2012 to 2019: the new annual poverty line per capita is LBP 5,857,652 annually (or LBP 488,000 monthly). This cut-off coincides with a 40 per cent monetary poverty rate based on the adjusted income variable.
3. For the purpose of simulations, estimates by ESCWA experts and recent publications are adopted to validate the poverty rate in 2019 of approximately 28 per cent. This rate coincides with a poverty line of LBP 386,000 per month per capita based on the survey data.
4. Due to data limitations, the income distribution was not adjusted for remittance fluctuations or demographic shifts, such as brain drain, which would have significant impact on income if data are to be nowcasted.

2. Shock simulation

A. Background

The purpose of shock simulations is to examine the effect of certain social or economic shocks on poverty figures (MPI, poverty headcount). The simulation process we present can be used to predict the impact of social policies. This may constitute a positive shock, such as an increase in overall secondary school completion rates, or a negative shock, such as the COVID-19 pandemic. The simulation exercise is based on the Monte Carlo method. The reasoning behind using this method is that shocks are (generally) not deterministic: although we can estimate the total intensity of the shock (percentage of people attained), we cannot pinpoint the exact people concerned. This may be even more problematic when working on survey data where only a sample of the population is studied. For that reason, we resort to assuming randomness, to study the 'average' behaviour of a shock. We present two models. The first is simple, offering only a random uniform shock on the set of concerned households. The second model may be more realistic, generalizing the first model as it targets a shock according to deprivation scores. It is worth mentioning that the MPI Assist Tool[13] (MAT), developed by ESCWA, allows similar simulation rational, but at the household level. It also offers flexibility to the randomization process based on the beta family distributions; a family that provides more sophistication and flexibility when compared with the uniform distribution.

1. MPI computation

The proposed MPI applies the Alkire-Foster method using survey data. We build the pre-defined binary indicators based on deprivation cut-offs. Once the binary data is ready at the individual level, we expand it to the household level, meaning that all individuals in a household have the same deprivation score for each indicator (0 for non-deprived, 1 for deprived), depending on the definition. The shock simulation operates at the level of the expanded data, i.e. at the individual level. The household deprivation is then re-assessed after every shock, to conclude if the household changes its deprivation status or not, for every indicator. We then use the weights assigned to indicators to compute the total deprivation level/score (between 0 and 1) and classify a household as multidimensionally poor if the score exceeds the poverty cut-off (k). To compute the desired poverty figures, we derive the headcount ratio H, poverty intensity A and MPI.

2. Random shock model: uniform distribution

In this study, we present the simple form of negative shocks on the non-deprived households in a given indicator. These households can be labelled originally as poor, vulnerable or non-poor, depending on their accumulated total score at the beginning of the shock exercise. The designed negative shock presents only the

[13] The tool is available at https:\\mpi.unescwa.org. Users can request a username and password by sending an email to askmat@un.org.

uniform shock otherwise known as random shocks. This will be based on a Monte Carlo simulation; a basic statistical and probabilistic technique mainly used for simulation purposes. To loosen the effect of inaccuracy, we use the random simulations approach, since the number of simulations (iterations) can be repeated several times and the stability option that the method offers helps reduce the uncertainty in the measure and the mentioned shocks. We acknowledge that positive and negative shocks are in essence driven by the intensity of deprivation for each household, depending on the extent and efficiency of policy measures (such as cash transfer, for positive shock) or economic crisis (such as currency devaluation, for negative shock) that aim to change the deprivation status of households.

The aim is to randomly shock a part of the population according to the target of each poverty indicator and repeat the experiment n times. The shock magnitude for each indicator needs to be pre-defined. For instance, suppose an economic crisis has led to a decrease in the access to medication by 30 per cent. Thus, at each iteration of the simulation process, the algorithm randomly chooses 30 per cent of non-deprived households (random sampling with respect to the indicator 'access to medication'), turns them into deprived households and then scores and computes the relevant poverty figures. At the last step, the collected figures are then averaged to minimize the stochastic margin of error. We can also construct relevant confidence intervals (annex 2). As the number of iterations increases, the figures eventually stabilize at around 500 iterations (figure 1), and we can thus assess the impact of the shock on poverty levels. In general, the shocks are split into two categories: positive shocks (targets the set of deprived households for this indicator and turns their status to non-deprived); and negative shocks (targets the set of non-deprived households for this indicator and turns their status to deprived). In the case of Lebanon, the shock will be solely negative. The algorithm takes into consideration survey variables that indicate the eligibility of the household, for each indicator, when applicable. For example, when the indicator 'access to education' in negatively shocked by increasing the number of deprived units, the algorithm selects the households to be shocked among the non-deprived households with children aged 6 to 18 years as the eligibility criteria for this indicator. To this end, we indicate the eligibility criteria and target population for each indicator, and shock the eligible individuals or households depending on the nature of the indicator (annex 4).

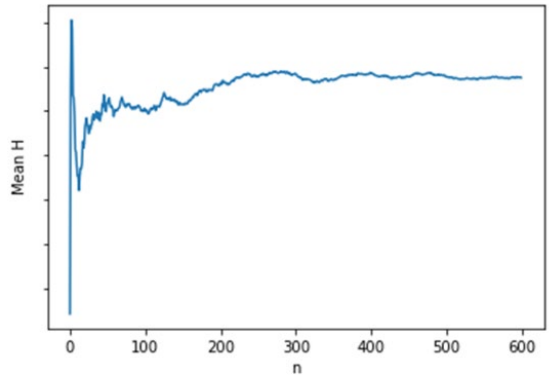
The results are interpreted as the mean expected poverty figures for a random shock with the given magnitude. We can involve multiple shock indicators within the same model. The model is relatively simple, as it deploys the shock based on a uniform distribution. Yet this presents some limitations, where in real times of crises often poor and vulnerable households are the first to be affected, meaning that households with higher deprivation levels will often be more vulnerable to the negative shock. In the case of Lebanon, most of the experienced negative shocks do not distinguish between poor or non-poor, unless otherwise stated (annex 4).

3. Stabilization

The general guideline is to run 1,000 iterations for a significant simulation. This number is data driven and changes depending on the data at hand and on the nature of the problem to be solved. To this end, we ran several tests on the Lebanon data, and reported the stabilization graph to assess the range of iterations beyond the point to which estimates dwell around the

stable state. This means that the estimates do not significantly vary after a certain number *n* of iterations. Figure 1 depicts the stabilization of the poverty headcount H for a shocking protocol of three indicators and 600 iterations. We can see that the percentage stabilizes around *n*=200 at a scale of three digits. Further tests (annex 3) lead to the conclusion that the more indicators we shock, the higher the number of simulations are needed for reaching stability. In other words, the more indicators are shocked simultaneously, the more we find variability within the figures. We thus set the number of iterations at $n = 500$. The run time is about three hours.

Figure 1. Stabilization of poverty headcount ratio as the number of iterations increases

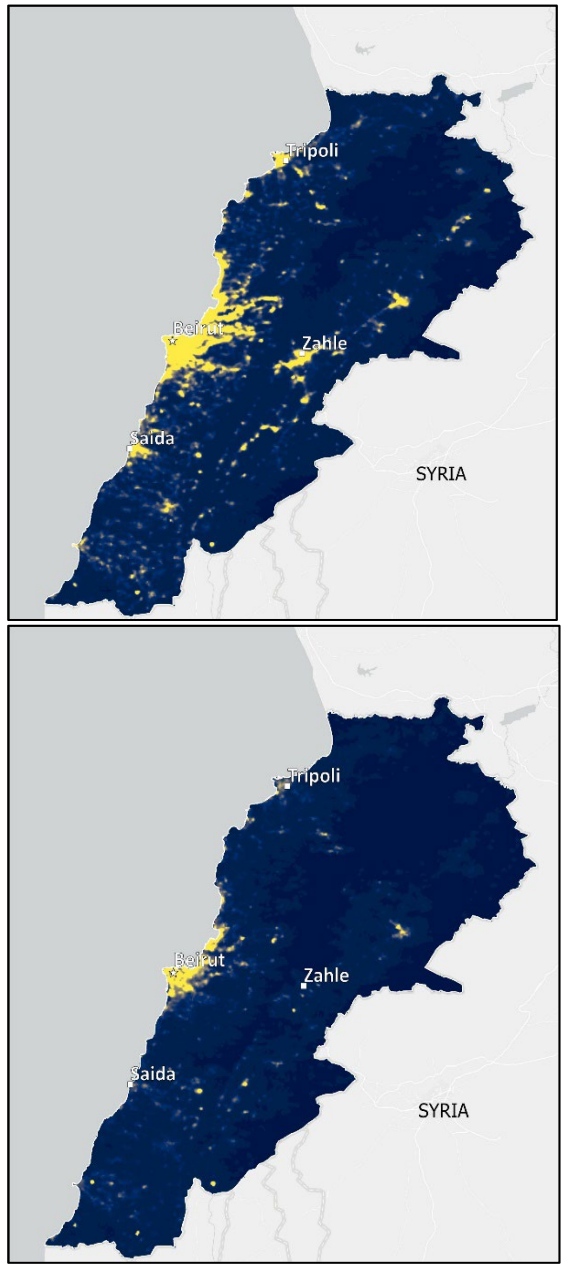


Source: Compiled by ESCWA.

B. Shock assumptions and target populations

Now that the shock distribution is defined as uniform, we focus on the magnitude of each shock, in other words the percentage of the non-deprived household that will change status to deprived, at each iteration. ESCWA has conducted an extensive literature review on shock assumptions, summarized in table 3.

Luminosity decrease between 2019 and 2021



Source: Visible Infrared Imaging Radiometer Suite/Suomi National Polar-orbiting Partnership Lunar BRDF-Adjusted Nighttime Lights Monthly L3 (VNP46A3). Analysis and production: United Nations Satellite Centre (UNITAR-UNOSAT).

Table 3 shows that not all indicators were shocked. A detailed explanation on how the figures are treated for the shock simulation is provided in annex 4. We based our shock assumptions on different sources. Eight shocks were based on quick surveys published by international organizations, one on hard imagery and one on local news information. The 10 shocks are estimated over different time intervals, which are subject to the latest availability of reliable insights. Some of these insights can have momentary impact while others will have a longer-term impact. The eleventh indicator, income, has a deterministic shock model.

Table 3. Summary of shock assumptions, including references

Indicator	Negative shock magnitude (*Additional increase*)		Source and date of latest estimation
	Lebanese (*Percentage*)	Non-lebanese (*Percentage*)	
School attendance (among vulnerable households)	15	35	UNICEF, June 2021
Access to medication	47	57	WFP Report June 2020
Access to medical services	27	32	WFP Report June 2020
ICT assets	8.39	9.155	2021 (WFP Report June 2020 + 1SD)
Mobility assets	5.7	6.375	2021 (WFP Report June 2020 + 1SD)
Domestic livelihood assets	6.83	10.08	2021 (WFP Report June 2020 + 1SD)
Heating assets	8.72	11.97	2021 (WFP Report June 2020 + 1SD)
Employment	1.1		ILO, May 2020
Electricity	45		Imagery analysis, August 2021
Waste collection	33		L'Orient Today, August 2021

Source: Compiled by ESCWA.

3. Main results

A. Comparative results

The proposed MPI comprises overlapping information that is used to locate the most prevalent deprivations. The MPI (M0) is the product of two key pieces of information: the multidimensional headcount ratio (H), this is the incidence or the proportion of people within the population experiencing multiple deprivations;[14] and the intensity of deprivation (A), this is the average deprivation score experienced by multidimensionally poor people.[15] As indicated in table 4, the multidimensional poverty rate in Lebanon doubled from 39 per cent in 2019 to 81 per cent of the total population in 2021, leaving nearly 3.9 million people living in multidimensional poverty. A household is classified as multidimensionally poor if it is deprived in one or more out of the six dimensions. For the purposes of the present paper and the use of the MPI Assist Tool (MAT), this cut-off is rounded up to 17 per cent. However, for the policy brief reporting, results of the exact cut-off were reported. Extreme multidimensional poverty represents 34 per cent of the overall population in 2021, a significant increase from 8 per cent in 2019. Extreme poverty has increased to 1,650,000 people, equivalent to about 400,000 households. A household is classified as extremely multidimensionally poor if it is deprived in two or more of the six dimensions.

We also note that the average intensity of poverty increased from 27 per cent in 2019 to 31.7 per cent in 2021, indicating that the poor in Lebanon are currently deprived in around 32 per cent of all weighted indicators. The MPI increased from 0.106 in 2019 to 0.255 in 2021. The MPI (H x A) adjusts the multidimensional headcount ratio by the intensity of the deprivation experienced, since not all the poor are deprived equally in the same indicators. Moreover, our results reveal that in 2019 around 23 per cent of people in Lebanon were prone to fall below the poverty line. Those are considered to be vulnerable to poverty i.e. they are close to the MPI poverty line and have certain overlapping deprivations but do not live in poverty. This implies that an additional deprivation in one indicator will largely increase the headcount of the poor to up to 62 per cent of the total population. However, the simulation results showed that the multiple shocks suffered by people in Lebanon pulled more than the vulnerable into poverty. In other words, the 81 per cent poor in 2021 were beyond the expected 62 per cent in 2019 (39 per cent poor and 23 per cent vulnerable). The new proportion of vulnerability in 2021 is around 12 per cent.

[14] It is calculated by dividing the number of people who are multidimensionally poor by the total population.

[15] It is calculated by dividing the censored deprivation score of a certain individual by the number of multidimensionally poor people.

Table 4. Main findings at the national level

Year	Cut-off (k)[a]	Multidimensional poverty index (M0)	Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Proportion of vulnerability[b] (*Percentage*)	Proportion of severe poverty[c] (*Percentage*)
2019	17%	0.106	39	27	23	8
	1/6	0.111	42	26		
2021	17%	0.255	81	32	12	34
	1/6	0.258	82	31		

Source: ESCWA calculations.
[a] Results in the policy brief were based on the exact cut-off point.
[b] A household is considered to be vulnerable to falling into poverty if its deprivation score is greater than or equal to 11.11 per cent and less than 17 per cent.
[c] A household is considered to be in severe poverty if the deprivation level of the household is beyond two dimensions or has a score >2/6. This is a subset of the poor category.

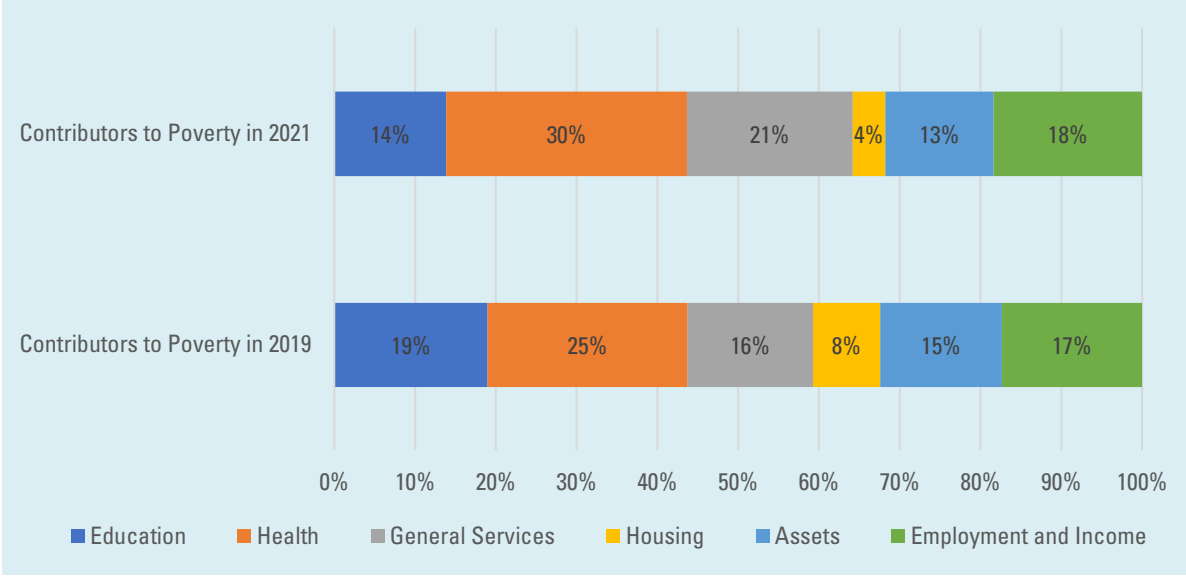
As for the dimensions' contribution to multidimensional poverty in Lebanon, we observe from figure 2 (A) that the health dimension contributed most to poverty by 25 per cent, followed by the education dimension at 19 per cent in 2019. Similar results are reflected by the indicators' contribution to multidimensional poverty, presented in figure 2 (B), where the largest contributor to poverty is health insurance (16 per cent). This implies that there remain some challenges when it comes to access to essential health coverage, while access to medical services and medication contributes to poverty with a magnitude of 9 per cent, combined. Depriving people of the opportunity to remain healthy will negatively impact other indicators, most importantly the education attainment and employment indicators.

Table 5 presents the uncensored (raw) headcount ratios, and the censored headcounts for the 21 indicators used. The former displays the proportion of the entire population deprived in each indicator by aggregating the deprivation of both multidimensionally poor and non-poor, while the latter conveys the proportion of the population in Lebanon that is multidimensionally poor and deprived in each indicator. Because uncensored headcount ratios might comprise those who voluntarily choose to be deprived in a certain indicator, censored headcount ratios are more accurate for measuring an indicator's magnitude of deprivation. Our results establish that 55 per cent of the population in Lebanon are deprived in health insurance, whereas 31 per cent are multidimensionally poor and deprived in health insurance.

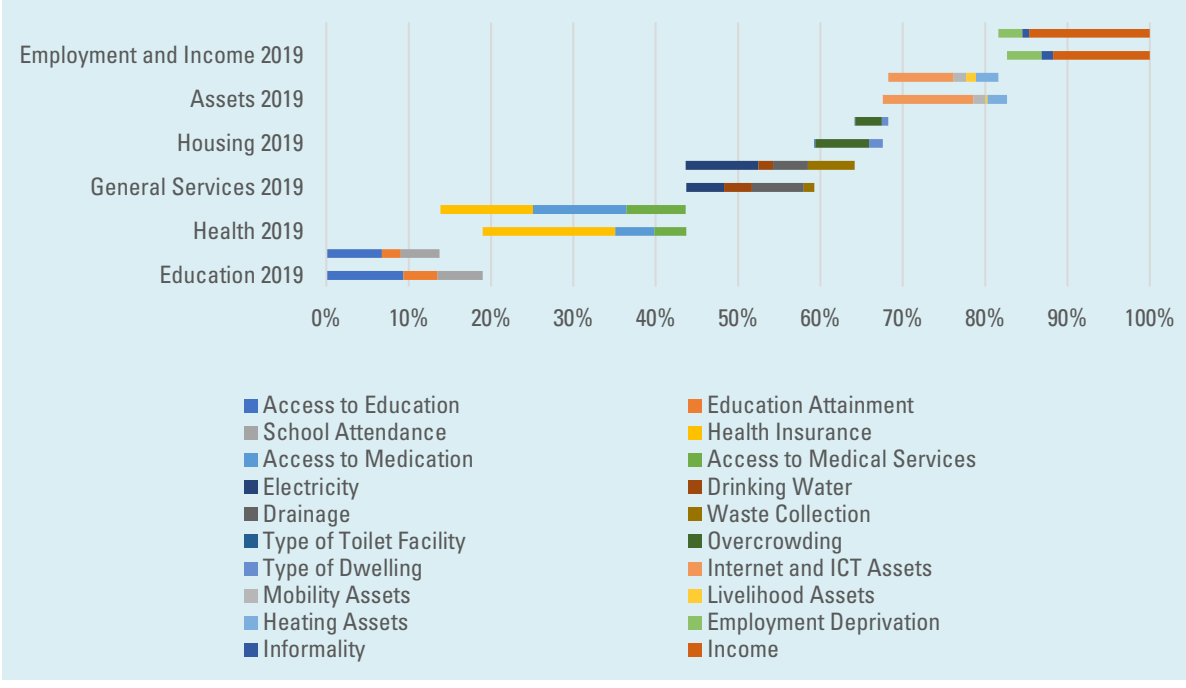
Table 6, table 7 and table 8 show a comparative of the distribution of poverty headcount ratio and dimensions contributions in the eight governorates of Lebanon. It is worth mentioning that some governorates with high population densities may exhibit lower poverty rates, yet accumulate a large count of deprived households and individuals. In contrast, some governorates exhibit almost total deprivation rates across the population, especially Akkar, Baalbek-Hermel, Nabatieh and Bekaa.

Figure 2. Contribution of dimensions and indicators to multidimensional poverty at the national level over time

A. Dimensions



B. Indicators



Source: Compiled by ESCWA.

Table 5. Uncensored and censored headcount ratio (*Percentage*)

Indicator	2019 headcount		2021 headcount	
	Uncensored	Censored	Uncensored	Censored
Access to education	35	18	35	31
Education attainment	11	8	11	11
School attendance	13	10	22	22
Health insurance	55	31	55	52
Access to medication	11	9	59	52
Access to medical services	9	7	36	33
Electricity	16	12	62	54
Drinking water	11	9	11	11
Drainage	28	16	28	26
Waste collection	7	3	40	35
Type of toilet facility	0.3	0.3	0.3	0.3
Overcrowding	15	12	15	15
Type of dwelling	4	3	4	3
Internet and ICT assets	42	28	52	49
Mobility assets	4	4	10	9
Livelihood assets	1	1	8	7
Heating assets	9	6	18	17
Employment deprivation	13	8	14	13
Informality	4	3	4	4
Income	28	22	74	67

Source: ESCWA calculations.

Table 6. Poverty headcount ratio by area of residence, 2019-2021

Governorate	2019				2021		
	Frequency	H (*Percentage*)	Individuals	Households	H (*Percentage*)	Individuals	Households
Beirut	341,725	35	119,604	29,901	71	243,836	60,959
Mount Lebanon	2,032,573	29	589,446	147,362	74	1,495,370	373,842
North Lebanon	637,909	40	255,163	63,791	84	532,778	133,195
Akkar	323,967	63	204,099	51,025	92	298,679	74,670
Bekaa	297,659	53	157,759	39,440	90	267,326	66,831
Baalbek-Hermel	245,082	57	139,697	34,924	91	223,618	55,904
South Lebanon	584,371	38	222,061	55,515	85	493,847	123,462
Nabatieh	379,183	52	197,175	49,294	91	346,080	86,520
Lebanon	4,842,467	39	1,888,562	472,141	80	3,873,974	968,493

Table 7. Percentage contribution of dimensions to multidimensional poverty by area of residence, 2019

Dimension	Beirut	Mount Lebanon	North Lebanon	Akkar	Bekaa	Baalbek-Hermel	South Lebanon	Nabatieh
Education	11	19	17	15	20	19	25	24
Health	33	25	29	22	24	21	23	23
Services	13	13	14	19	19	24	13	17
Housing	13	11	7	8	7	6	6	4
Assets	13	16	15	17	13	16	14	13
Employment and income	15	17	18	19	17	15	19	18

Table 8. Percentage contribution of dimensions to multidimensional poverty by area of residence, 2021

Dimension	Beirut	Mount Lebanon	North Lebanon	Akkar	Bekaa	Baalbek-Hermel	South Lebanon	Nabatieh
Education	8	13	12	13	16	15	18	17
Health	35	30	32	27	29	26	29	28
Services	18	20	20	23	21	24	19	22
Housing	7	5	3	5	4	3	3	2
Assets	14	14	13	15	12	14	12	12
Employment and income	18	18	19	18	18	17	19	19

The simulation revealed the following results:

- Compared to the 2019 Lebanon MPI results, in 2021 we observe a significant increase in both, H and A and thus MPI. In 2021, the multidimensional headcount ratio (H) is 82 per cent, which indicates the proportion of multidimensionally poor people in Lebanon. Moreover, the poor in Lebanon are deprived in 31 per cent of the weighted indicators on average. Since not all the poor are deprived in all the considered deprivations, MPI adjusts the multidimensional headcount ratio by the intensity of the deprivation suffered. MPI is therefore the product of H and A. In our proposed framework for the 2021 Lebanon MPI, the MPI is 0.25. In addition to the deteriorating economic activity, the political instability and the COVID-19 pandemic, the increase in poverty in Lebanon was most likely triggered by the 2020 Beirut Port explosion.
- Decomposing the Lebanon 2021 MPI by nationality shows an expected yet significant increase in multidimensional poverty between 2019 and 2021 for both Lebanese and non-Lebanese. Similar to the 2019 Lebanon MPI results, the 2021 findings reveal that the portion of non-Lebanese residing in Lebanon still seem to be more deprived than the Lebanese.

- To uncover the composition of poverty within the country, we decomposed MPI by subnational regions. This allowed us to make comparisons across governorates. The substantial increase in the magnitudes of all three indicators – *A*, *H* and *MPI* – for eight Lebanese governorates from 2019 to 2021 is noticeable. Our national poverty results in 2021 indicate a geographic divide that is somehow similar to the one detected in 2019. Specifically, in 2021, we remark that the highest *H* and *MPI* values are recorded in Akkar governorate (*H*=92 per cent; *MPI*=0.32), whereas the lowest poverty levels are recorded in Mount Lebanon (*H*=73 per cent; *M0*=0.23) and Beirut (*H*=71 per cent; *M0*=0.22). Therefore, multidimensional poverty is geographically concentrated in governorates that are lagging behind in development.
- Results reflected by the 2021 indicators' contribution to multidimensional poverty are consistent with the findings above**.** They indicate a negative relationship between household size and multidimensional poverty for households comprising one to four members, and a positive relationship between household size and multidimensional poverty for households comprising above five members.
- Our analysis of the 2021 MPI in Lebanon reveals that, similar to the 2019 Lebanon MPI results, female-headed households are slightly poorer than their male-headed counterparts (M0 is 0.26).
- Our analysis of the 2021 MPI in Lebanon indicates that, among all four age groups, adolescents seem to be the most affected by poverty across Lebanon (H=86 per cent; MPI=0.28).
- In 2021, MPI results also point to a decreasing MPI trend alongside an increase in education attainment**,** where 30 per cent of residents that have no education attainment actually live in multidimensionally poor households compared with only 18 per cent among those who obtained a university degree.
- Similar to the 2019 Lebanon MPI results, we observe that in 2021, both men and women are almost equally poor. We also observe a significant increase in both, H and A, and thus MPI for both men and women in 2021 compared with 2019.

Results reflected by the 2021 indicators' contribution to multidimensional poverty imply that small and medium enterprises (SMEs) play a key role in poverty reduction, given their contribution to job creation. In other words these firms are hosting the most in need and offer them employment opportunities. While 83 per cent of those outside the labour force in Lebanon are multidimensionally poor in 2021, 72 per cent of those working in SMEs live in multidimensionally poor households. B. Detailed analysis of the 2019 results.

We further disaggregate MPI by subnational regions and by population subgroups to disclose the composition of poverty within the country. Decomposing national poverty results allows us to make comparisons across governorates and across different demographic characteristics, such household size, gender of the head of household, and at the individual level by age, gender and education. Revealing subnational poverty variations ensures more targeted government responses to local needs.

B. Disparities by nationality

For the past few decades, Lebanon has been home to people of various nationalities, including a foreign labour force, refugees and

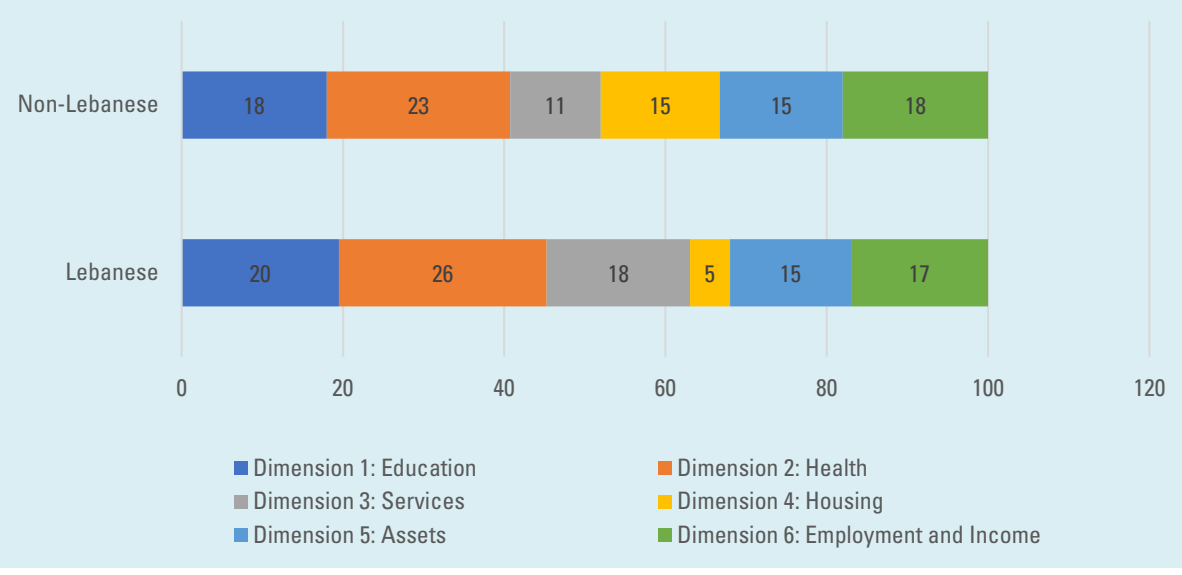
migrants. Our analysis of the 2021 Lebanon MPI by nationality, presented in table 9, indicates that 61 per cent of non-Lebanese residents in Lebanon are multidimensionally poor. However, only 33 per cent of Lebanese citizens are multidimensionally poor. Thus, the non-Lebanese population in Lebanon seems to be more deprived than the Lebanese residing in Lebanon. Figure 3 further deciphers the contribution of dimensions to multidimensional poverty by nationality. It reveals that both Lebanese and non-Lebanese are mostly deprived in health. While Lebanese suffer from deprivations in education, health and services that are larger than those being suffered by non-Lebanese, the opposite is true when it comes to deprivations in housing, assets, and employment and income indicators.

Table 9. Multidimensional poverty headcount by nationality

	Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Multidimensional poverty index (M0)
Lebanese	33	26	0.09
Non-lebanese	61	29	0.18

Source: ESCWA calculations.

Figure 3. Percentage contribution of dimensions to multidimensional poverty by nationality



Source: ESCWA calculations.

C. Disparities between governorates

Table 10 reveals very low discrepancies in the intensities of deprivation (A) among the eight Lebanese governorates, where all the intensities range between 27 and 29 per cent. However, this is not the case for the multidimensional headcount ratios (H) and thereby MPIs (M0) for which our results indicate a clear geographic divide. Particularly, multidimensional poverty is still more prevalent and concentrated in Akkar and Baalbek-Hermel, with the highest *H* and *M0* values recorded by Akkar (*H*=63 per cent; *M0*=0.17) followed by Baalbek-Hermel (*H*=57 per cent; *M0*=0.16). Whereas the lowest poverty levels are recorded in Mount Lebanon (*H*=29 per cent; *M0*=0.08) and Beirut (*H*=35 per cent; *M0*=0.10). Thus, poverty in Lebanon is not equally spread across the country's different governorates. Instead, it varies among different areas of residence and is geographically concentrated in governorates that are historically lagging behind in terms of development.

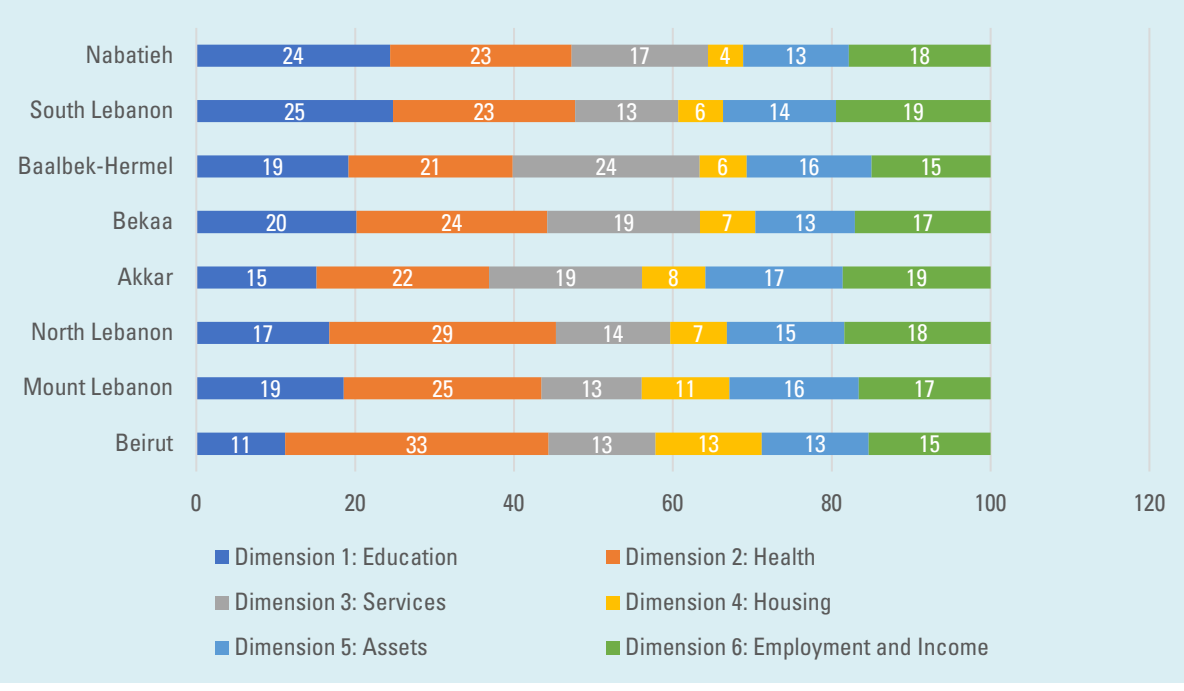
By further analysing the percentage contribution of dimensions to MPI in Lebanese governorates, demonstrated in figure 4, we notice that deprivation in the health dimension is a main driver of poverty across most governorates: Beirut, Mount Lebanon, North Lebanon, Akkar, and Bekaa. In contrast, in South Lebanon and Nabatieh, the education dimension mostly contributes to poverty, following the deprivation in health. While in Baalbek-Hermel the services dimension is the highest contributor to poverty, followed by the health dimension. This detailed evaluation provides important insights that will enable designing relevant and meaningful policy measures that fit the profile of each governorate, with the aim of reducing overall poverty in Lebanon.

Table 10. Multidimensional poverty headcount, intensity and M0 index by governorate

	Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Multidimensional poverty index (M0)
Beirut	35	28	0.10
Mount Lebanon	29	27	0.08
North Lebanon	40	27	0.11
Akkar	63	27	0.17
Bekaa	53	28	0.15
Baalbek-Hermel	57	29	0.16
South Lebanon	38	27	0.10
Nabatieh	52	27	0.14

Source: ESCWA calculations.

Figure 4. Percentage contribution of dimensions to multidimensional poverty by area of residence, 2019



Source: ESCWA calculations.

D. Household characteristics

Before disaggregating MPI by demographic characteristics, we analysed the relationship between household characteristics and various socioeconomic factors and dimensions. Our results may have major implications in regards to poverty reduction efforts.

1. Household size

We start by exploring the impact of household size in Lebanon on several family welfare aspects. Table 11 shows a negative relationship between household size and multidimensional poverty for households comprising one to four members. This trend is however reversed for households comprising five members and above, indicating that multidimensional poverty increases with household size. Besides reducing household savings, having additional children may hinder a mothers' employment and prevent some children from attending school or university. For instance, table 11 shows that, among the different household sizes, households that consist of more than eight members are the most deprived in housing (14 per cent). While large households record the highest poverty levels with 21 per cent of those being multidimensionally poor, households that record the second highest poverty level in Lebanon are single-person households (M0 is 18 per cent). Those households are evidently struggling to achieve acceptable standards of living.

2. Gender of household head

We then move to examine the impact of gender of the head of household on multidimensional poverty. Based on MPI, we notice that female-headed households are poorer (*M0* is 0.13 per cent) than their male-headed counterparts (M0 is 0.10 per cent) (table 11).

Table 12 demonstrates that female-headed households are more deprived in four of the six dimensions: education, health, assets, and employment and income. Our results imply that female-headed households are at higher risk of poverty.

Table 11. Multidimensional poverty headcount, intensity and M0 index, by size of household and gender of household head

		Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Multidimensional poverty index (M0)
Size of household	1	65	27	0.18
	2	47	28	0.13
	3	28	26	0.07
	4	27	26	0.07
	5	30	26	0.08
	6	42	27	0.11
	7	54	28	0.15
	8+	71	26	0.21
Gender of household head	Male-headed	38	27	0.10
	Female-headed	45	28	0.13

Source: ESCWA calculations.

Table 12. Contribution of dimensions to multidimensional poverty, by size of household and gender of household head (*Percentage*)

		Education	Health	Services	Housing	Assets	Employment and income
Size of Household	1	26	19	13	3	20	19
	2	25	20	13	3	17	22
	3	21	26	16	4	16	17
	4	17	16	18	8	16	16
	5	17	27	17	7	15	16
	6	17	25	17	9	15	17
	7	18	25	16	12	14	16
	8+	18	25	14	14	14	16
Gender of Household head	Male-headed	19	25	16	9	15	17
	Female-headed	20	26	13	5	16	20

Source: ESCWA calculations.

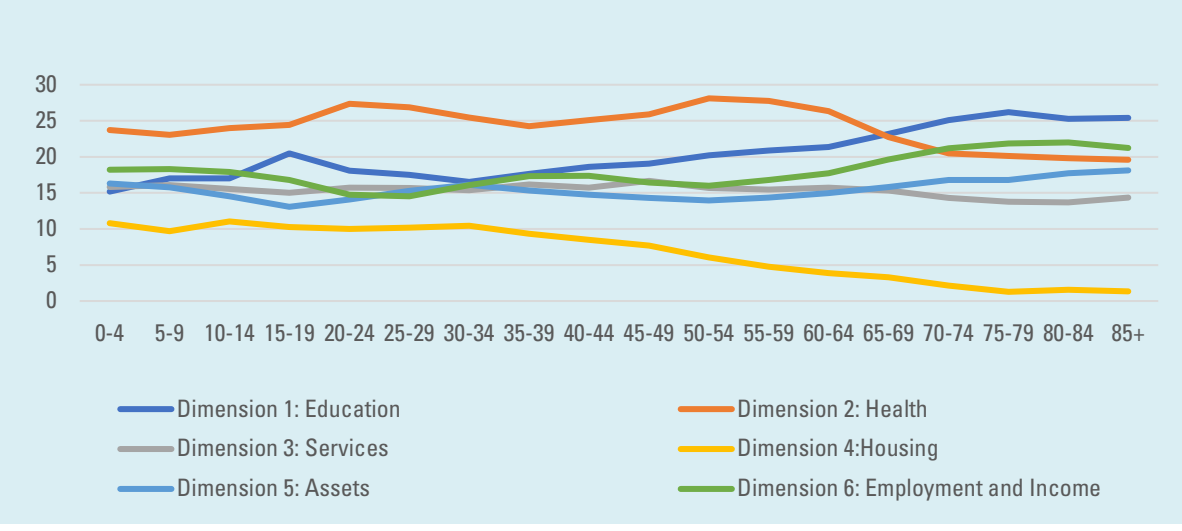
E. Disparities by age, education and gender

1. Age groups

Breaking down MPI by four age groups – children, adolescents, adults, and older persons[16] – conveys an intensity of deprivation (A) that is almost equal among all age groups and a multidimensional headcount ratio (H) and MPI (M0) that are lowest for adults (H=35 per cent; M0=0.09) and highest for adolescents and elderlies (H=44 per cent; M0=0.12 for both groups) (table 13). Therefore, among all four age groups, older persons and adolescents seem to be the most affected by poverty across Lebanon. We notice from table 13 that for adults, adolescents and children, the health dimension remains the lead contributor to poverty. Deprivation in education is remarkable for older persons, mostly showing that they live mostly in households deprived of education.

[16] Grouping of the four stages of life as categorized based on the original five years categorical grouping of the age variable in the survey. The groups are as follows: children [0-14] years; adolescents [14-19] years; adults [19-64] years; older persons [65+ years].

Figure 5. Percentage contribution of dimensions to multidimensional poverty by age groups



Source: ESCWA calculations.

Another interesting observation concerns deprivation in the housing dimension, which seems to considerably decrease with age, recording a pronounced gap of 8 per cent between childhood (10 per cent) and old age (2 per cent) where more children live in multidimensionally poor households than older persons. It is also noteworthy that although the contribution of heath deprivation to poverty increases from childhood to adulthood, it then decreases to reach its lowest recorded levels in old age. These findings are displayed in table 13 and are reiterated in figure 5, which clearly manifest a decreasing trend for housing deprivation with age, and a trend for health deprivation that begins to decrease after the age of 70.

2. Education attainment

To further assess poverty in Lebanon, we disaggregate MPI by education attainment. The importance of education lies in its ability to directly impact most other dimensions, principally health and employment and income. We find that, in Lebanon, university graduates have the lowest intensity (A), poverty headcount (H), and thus MPI (M0) compared with uneducated people who record the highest values for all three measures (table 13). Results point to a decreasing MPI trend with an increase in education attainment, where 54 per cent of residents that have no education attainment actually live in multidimensionally poor households, compared with only 15 per cent among those who obtained a university degree. While the level of education attainment does not capture the quality of education, individuals who attained high levels of education are expected to better lift their families and themselves out of poverty.

Table 13. Multidimensional poverty headcount, intensity and M0 index by age group, education attainment and gender

		Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Multidimensional poverty index (M0)
Age group	Elderly	44	27	0.12
	Adults	35	27	0.09
	Adolescents	44	28	0.12
	Children	43	28	0.11
Education	None	54	29	0.15
	Lower secondary	47	27	0.13
	Upper secondary	26	24	0.07
	University	15	24	0.04
Gender	Women	39	27	0.10
	Men	39	27	0.11

Source: ESCWA calculations.

In contrast, not only is a lack of education expected to increase poverty, but also poor individuals are expected to be largely disadvantaged when it comes to access to education, causing a vicious cycle for the poor. It is also worth mentioning that while we infer from table 14 that deprivations in housing, assets, and employment and income decrease for high levels of education attainment, we notice that deprivations in the health and services dimensions have higher contributions to poverty for people with higher levels of education attainment.

3. Gender distribution

We finally decompose MPI by one last demographic characteristic: gender. Results for intensity (A), poverty headcount (H), and thus MPI (M0) assure the absence of gender disparities in Lebanon when it comes to multidimensional poverty, indicating that both men and women are equally poor. While both sexes live in households experiencing large deprivations in most dimensions, we observe that more women than men live in households deprived in the employment and income dimension. The opposite is true as far as the housing dimension is concerned. More men live in poor households deprived in housing. Overall, results indicate the balanced gender distribution with regard to deprivations in the chosen dimension. The above findings are reported in table 13 and table 14, respectively.

F. Small and medium enterprises

To decipher the role of SMEs in alleviating poverty, we disaggregated MPI by classifying people in Lebanon based on the size of enterprises in which they work in: micro, SMEs, large firms, or outside the labour force. The results, presented in table 15, reveal that while 40 per cent of those outside the labour force in Lebanon were multidimensionally poor in 2019, 26 per cent of

those working in SMEs live in multidimensionally poor households. This slight yet significant difference between multidimensional poverty among those employed in SMEs and those outside the labour force indicated that SMEs play a key role in poverty reduction, given their role in job creation. SMEs absorb a large proportion of employees living in multidimensionally poor households, providing them with stable income. Moreover, when employment is formal, SMEs other benefits such as social protection, health coverage and education subsidies for dependents.

We next explore the contribution of dimensions to poverty by the size of enterprises (table 16). We realize that the contribution of health and employment and income are higher for those working in SMEs, when compared with the poor working in large firms. Nevertheless, the deprivation of the latter is greater when it comes to services and education. Lastly, those working in either type of establishment, MSMEs or large firms, are equally deprived in housing and assets.

Table 14. Contribution of dimensions to multidimensional poverty by age group, education attainment and gender (*Percentage*)

		Education	Health	Services	Housing	Assets	Employment and income
Age groups	Elderly	25	21	14	2	17	21
	Adults	19	26	16	8	15	16
	Adolescents	20	24	15	10	13	17
	Children	16	24	16	10	16	18
Education	None	19	23	14	9	16	18
	Lower secondary	20	25	15	9	15	17
	Upper secondary	15	28	19	7	15	17
	University	16	28	20	6	14	16
Gender	Women	19	25	16	8	15	18
	Men	19	25	16	9	15	17

Source: ESCWA calculations.

Table 15. Multidimensional poverty headcount, intensity and M0 index by the size of enterprises

		Poverty headcount (H) (*Percentage*)	Intensity (A) (*Percentage*)	Multidimensional poverty index (M0)
Size of enterprise	Micro	44	27	0.12
	SME	26	26	0.07
	Large firm	14	25	0.04
	Outside the labour force	40	27	0.11

Source: ESCWA calculations.

Table 16. Contribution of dimensions to multidimensional poverty by the size of enterprises (*Percentage*)

		Education	Health	Services	Housing	Assets	Employment and income
Size of enterprise	Micro	20	26	15	9	15	15
	SME	19	27	15	11	16	12
	Large firm	20	26	19	11	16	8
	Outside the labour force	19	24	16	8	15	18

Source: ESCWA calculations.

4. Conclusion

The multiple overlapping crises witnessed in Lebanon have had severe repercussions for the poor and the vulnerable over the past two years. In 2019, according to the estimates set out in the present study, as many as 42 per cent of households were classified as multidimensionally poor. Since 2019, poverty has dramatically increased owing to a decline in economic activity and widespread political instability. Our projections show that multidimensional poverty doubled to 82 per cent of the population in 2021, with nearly 4 million people living in multidimensional poverty, while extreme multidimensional poverty affected 40 per cent of the poor, equivalent to 34 per cent of the entire population.

Our analysis has shown that shocks in selected dimensions of living conditions were responsible for the bulk of the overall deterioration. The share of households deprived in health care increased from 9 per cent in 2019 to 33 per cent in 2021. The population shares unable to obtain medicines, or those without electricity, have increased to over 50 per cent. Meanwhile, the shocks have not been distributed equally across the population, and some social groups have borne the brunt of the crises. Older persons in particular have been critically affected by scarcities in the spheres of household budget, medication and health services, and public utility provision in the country, and the share of older persons living in multidimensional poverty rose sharply from 44 per cent in 2019 to 78 per cent in 2021. Limiting these impacts requires stabilization of the political environment, collaboration between all spheres of Lebanese society, and support from the international community.

Annex 1
Internal robustness and redundancy coefficients

Cramer's V

	S01	S02	S04	S07	S08	S09	S11	S12	S13	S14	S16	S17	S18	S22	S23	S24	S25	S03	S05	S20
S01 - Education Attainment	1.00																			
S02- School Attendance	-0.14	1.00																		
S04- Access to Education	0.02	-0.03	1.00																	
S07- Health Insurance	0.06	0.12	-0.03	1.00																
S08- Access to Medication	0.04	0.14	-0.03	0.15	1.00															
S09- Access to Medical Services	0.01	0.14	-0.04	0.15	0.57	1.00														
S11- Electricity	0.04	0.06	0.02	0.11	0.11	0.11	1.00													
S12- Drinking Water	0.01	0.03	0.11	0.06	0.02	0.01	0.08	1.00												
S13- Drainage	0.02	-0.02	0.30	0.01	-0.03	-0.05	0.04	0.15	1.00											
S14- Waste Collection	-0.01	0.01	-0.01	-0.03	0.00	-0.01	0.01	0.02	0.00	1.00										
S16- Type of Toilet Facility	0.02	0.04	0.01	0.02	0.01	0.01	0.03	0.02	0.02	0.01	1.00									
S17- Overcrowding	-0.08	0.34	-0.04	0.14	0.14	0.14	0.09	0.05	-0.03	0.02	0.08	1.00								
S18- Type of Dwelling	0.01	0.09	-0.04	0.05	0.03	0.03	0.03	-0.02	-0.05	0.04	0.18	0.30	1.00							
S22- Internet and ICT Assets	0.21	0.08	0.07	0.14	0.11	0.09	0.17	0.17	0.11	-0.01	0.05	0.11	0.05	1.00						
S23- Mobility Assets	0.13	0.03	0.16	0.05	0.04	0.03	0.10	0.10	0.16	0.01	0.03	0.04	0.02	0.17	1.00					
S24- Livelihood Assets	0.01	0.01	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.05	0.02	0.06	0.02	0.02	1.00				
S25 - Heating Assets	0.01	0.14	-0.11	0.07	0.07	0.09	0.05	-0.03	-0.12	0.02	0.01	0.14	0.09	0.06	-0.03	0.03	1.00			
S03 - Employment Deprivation	0.32	-0.08	0.04	0.00	0.03	0.02	0.02	0.03	0.03	-0.01	0.00	-0.07	-0.03	0.13	0.11	0.01	-0.01	1.00		
S05- Informality	0.05	0.03	-0.01	0.08	-0.01	0.00	0.02	-0.01	0.00	0.01	0.04	0.02	0.12	0.03	0.01	0.02	0.05	-0.07	1.00	
S20 - Income	0.06	0.23	0.01	0.34	0.20	0.19	0.14	0.12	0.05	-0.01	0.03	0.25	0.09	0.27	0.12	0.01	0.11	0.07	-0.02	1.00

Redundancy Coefficient R0

	S01	S02	S04	S07	S08	S09	S11	S12	S13	S14	S16	S17	S18	S22	S23	S24	S25	S03	S05	S20
S01 - Education Attainment	1.00																			
S02- School Attendance	0.00	1.00																		
S04- Access to Education	0.36	0.31	1.00																	
S07- Health Insurance	0.64	0.74	0.52	1.00																
S08- Access to Medication	0.15	0.27	0.31	0.78	1.00															
S09- Access to Medical Services	0.13	0.28	0.28	0.80	0.62	1.00														
S11- Electricity	0.21	0.22	0.34	0.67	0.30	0.31	1.00													
S12- Drinking Water	0.12	0.17	0.46	0.64	0.15	0.13	0.23	1.00												
S13- Drainage	0.31	0.27	0.58	0.56	0.24	0.21	0.29	0.46	1.00											
S14- Waste Collection	0.09	0.13	0.31	0.47	0.08	0.06	0.14	0.11	0.25	1.00										
S16- Type of Toilet Facility	0.19	0.34	0.38	0.64	0.13	0.10	0.37	0.23	0.40	0.14	1.00									
S17- Overcrowding	0.09	0.48	0.28	0.74	0.32	0.30	0.25	0.21	0.25	0.14	0.60	1.00								
S18- Type of Dwelling	0.13	0.31	0.22	0.72	0.17	0.13	0.25	0.10	0.15	0.11	0.51	0.80	1.00							
S22- Internet and ICT Assets	0.72	0.55	0.45	0.64	0.60	0.55	0.60	0.65	0.50	0.38	0.71	0.58	0.61	1.00						
S23- Mobility Assets	0.28	0.19	0.68	0.66	0.16	0.13	0.30	0.23	0.56	0.07	0.13	0.22	0.06	0.81	1.00					
S24- Livelihood Assets	0.38	0.27	0.30	0.91	0.23	0.23	0.36	0.18	0.30	0.02	0.15	0.58	0.47	0.85	0.20	1.00				
S25 - Heating Assets	0.13	0.27	0.19	0.67	0.17	0.17	0.24	0.09	0.12	0.08	0.15	0.31	0.22	0.54	0.07	0.35	1.00			
S03 - Employment Deprivation	0.41	0.06	0.39	0.56	0.17	0.14	0.19	0.14	0.31	0.10	0.10	0.09	0.06	0.58	0.28	0.27	0.12	1.00		
S05- Informality	0.20	0.19	0.30	0.78	0.08	0.08	0.20	0.10	0.25	0.09	0.15	0.22	0.16	0.53	0.05	0.20	0.18	0.00	1.00	
S20 - Income	0.68	0.91	0.60	0.76	0.91	0.89	0.76	0.77	0.65	0.54	0.78	0.91	0.89	0.76	0.87	0.91	0.79	0.67	0.58	1.00

Annex 2
MPI simulation confidence intervals

We derive the confidence intervals for the MPI, the poverty headcount ratio (H) and the poverty average intensity (A).

We want this interval to take into account two sources of variability:[17]

- The variability from the shocking procedure (simulation randomness).
- The sampling variability from the data (sampling randomness).

Using the law of total variance: $Var\ (Y) = E[Var(Y|X)] + Var(E[Y|X])$, we compute the total variance of the resulting figure.

Let Y be the poverty figure we are interested in (either MPI, H, or A) and let X be the matrix of binary data.

To account for sampling randomness:

$S_2 = E[Var(Y|X)]$: This is the expected value (Sample mean) of the variances that are computed and retained at each of the n iterations.

First, following each shock, we compute the variance of the MPI value for the shocked data set. These variances are gotten using the formulae:

$$\hat{\sigma}^2_{MPI} = \frac{1}{n-1}\sum_{i=1}^{n}[c_i(k) - \widehat{\mathrm{MPI}}]^2$$

$$\hat{\sigma}^2_H = \widehat{\mathrm{H}}(1-\widehat{\mathrm{H}})$$

$$\hat{\sigma}^2_A = \frac{1}{q-1}\sum_{i=1}^{q}[c_i(k) - \widehat{\mathrm{A}}]^2$$

where q represents the total number of poor individuals, n represents the total number of individuals in the survey, and c_i represent the deprivation scores. Then, all the values of $\hat{\sigma}^2_Y$ are stored in a vector and the vector's sample mean is computed to get S_2.

To account for the simulation's randomness

$S_1 = Var(E[Y|X])$: Following all the shocks, we gather the resulting Y values and compute their sample variance.

[17] The derivations in this section are based on discussions with OPHI (Oxford Poverty and Human Development Initiative) as well as comments from the ECLAC social statistics team.

This is simulation variance of the resulting vector of MPIs (similarly of Hs or As) in which the variance is computed based on the Y estimates resulting from n iterations already calculated in the Monte Carlo algorithm.

The **Total Variance** will be $V_{tot} = S_1 + S_2$.

Confidence Interval

Let $\bar{Y}$ be the mean of the resulting y-values at each iteration (this is the end result of the simulation around which we want to build a confidence interval), and let m be the number of iterations. An $(1 - \alpha)$% confidence interval for $\bar{Y}$ is:

$$(\bar{Y} - z_{\alpha/2}\frac{\sqrt{V_{tot}}}{\sqrt{m}}, \bar{Y} + z_{\alpha/2}\frac{\sqrt{V_{tot}}}{\sqrt{m}})$$

Examples of 95% CIs

	2019	95% confidence interval		2021	95% confidence interval	
Figure	Estimate	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound
MPI	0.106	0.105	0.107	0.255	0.238	0.273
H	0.389	0.387	0.392	0.81	0.761	0.851
A	0.272	0.272	0.273	0.32	0.307	0.328

	2019	95% confidence interval		2021	95% confidence interval	
Figure	Estimate	Lower bound	Upper bound	Estimate	Lower bound	Upper bound
Beirut						
MPI	0.099443	0.098724	0.100162	0.221864	0.203729	0.24
H	0.353767	0.351336	0.356198	0.713546	0.662386	0.764707
A	0.281097	0.280467	0.281728	0.310941	0.30063	0.321251
Mount Lebanon						
MPI	0.078264	0.077611	0.078916	0.223401	0.205829	0.240973
H	0.290872	0.288562	0.293181	0.735703	0.685804	0.785602
A	0.269066	0.268379	0.269753	0.303658	0.293283	0.314034
North Lebanon						
MPI	0.106799	0.106085	0.107513	0.260574	0.244618	0.27653
H	0.395444	0.392958	0.39793	0.835196	0.793213	0.877179
A	0.270074	0.269458	0.270689	0.311995	0.302024	0.321966

	2019	95% confidence interval		2021	95% confidence interval	
Figure	Estimate	Lower bound	Upper bound	Estimate	Lower bound	Upper bound
Akkar						
MPI	0.170011	0.169281	0.17074	0.316031	0.301602	0.330461
H	0.626967	0.624508	0.629426	0.921943	0.891587	0.9523
A	0.271164	0.270691	0.271636	0.342793	0.332382	0.353204
Bekaa						
MPI	0.148984	0.148212	0.149757	0.297405	0.282164	0.312647
H	0.534416	0.53188	0.536952	0.898094	0.86386	0.932328
A	0.27878	0.278199	0.279361	0.331155	0.320405	0.341905
Baalbek-Hermel						
MPI	0.162595	0.161803	0.163387	0.312756	0.297474	0.328039
H	0.568659	0.566141	0.571177	0.91242	0.880432	0.944409
A	0.285926	0.285346	0.286506	0.342781	0.331636	0.353926
South Lebanon						
MPI	0.102796	0.10209	0.103501	0.268967	0.252901	0.285033
H	0.380423	0.377954	0.382891	0.845093	0.80415	0.886036
A	0.270215	0.269611	0.270819	0.318276	0.308053	0.328498
Nabatieh						
MPI	0.140079	0.139346	0.140813	0.30582	0.291247	0.320393
H	0.520022	0.517482	0.522562	0.912699	0.880756	0.944641
A	0.269372	0.268864	0.26988	0.335075	0.324723	0.345427

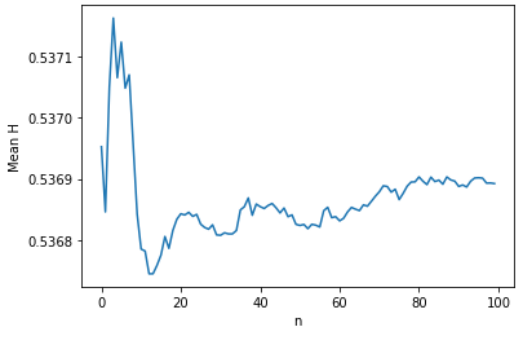
Annex 3
Stabilization of Monte Carlo iterations

We present some tests conducted following the Uniform distribution shock model. We use the Lebanese (LFHLCS) 2019 data and National 2019 MPI framework. We vary the number of shocked indicators and the shock magnitudes randomly. Note that in the presented graphs, the goal is to assess the number of iterations needed irrespective of the shock magnitude. We used different shocks of different magnitudes instead of replicating the assumptions of the indicators shock magnitude in table 3 [for illustration, the y-axis shows results that are not centred at the reported MPI nor H.

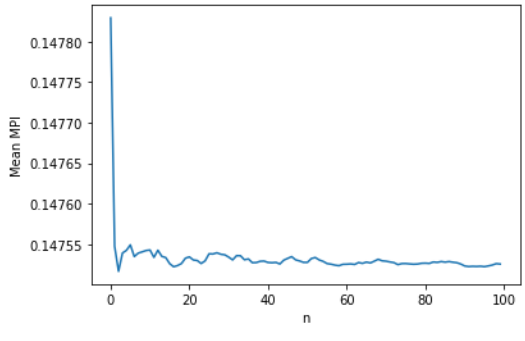
1. Case of shocking one indicator

Positive Shock, LF04 – Employment Deprivation, magnitude = 0.7. We run 100 simulations.

The two graphs below come from different simulations.

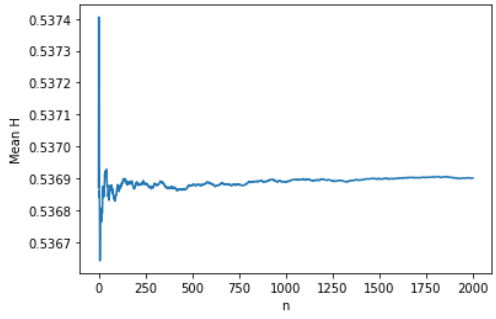


Mean MPI for n=100



Mean H for n=100

We can see that the mean MPI stabilizes faster than the mean H. To see more details about H, we repeat the mean H experiment for n=2000.

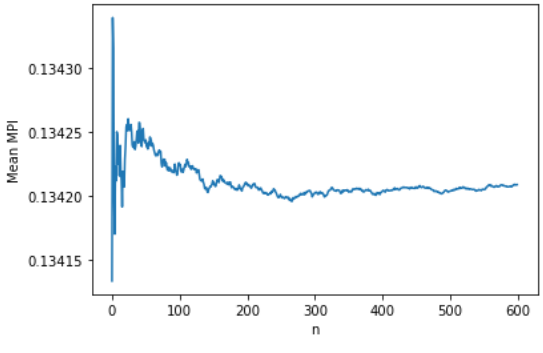


Mean H for n=2000

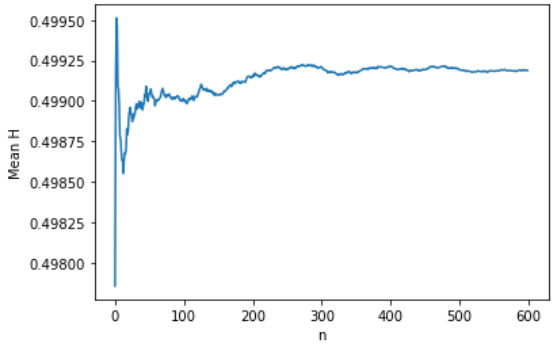
2. Case of shocking three indicators

We run 300 simulations. Note that we only shock positively in order to visualize the maximum extent of variability. If we shock positively and negatively, some shocks will cancel out.

- Positive Shock, LF04 – Employment Deprivation, magnitude= 0.5.
- Positive Shock, LF18 – Internet and ICT access, magnitude = 0.6.
- Positive Shock, LF20 – Livelihood Assets, magnitude = 0.7.



Mean MPI for n=600



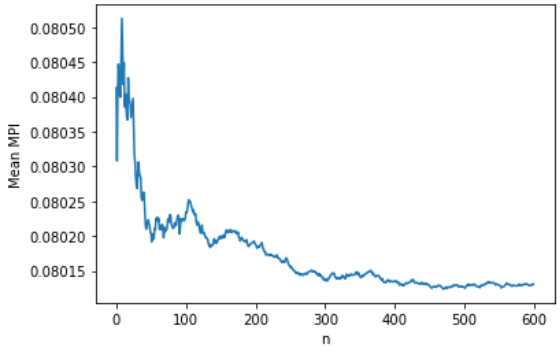
Mean H for n=600

Observation As the number of indicators increases to 3, the simulations take longer to stabilize for both the mean H and the mean MPI. Also, note that the purpose of presenting the trends from different experiments is to show that the general trend may differ, but the result will not. (If the graphs came from the same experiment, they would be similar, as in the case below).

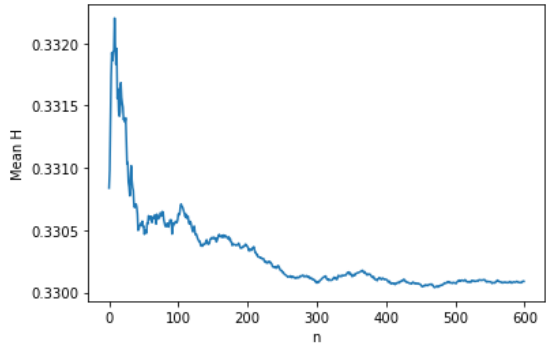
3. Case of a small shock on all indicators

We negatively shock all 20 indicators of the Lebanon framework at a relatively small magnitude of 0.3.

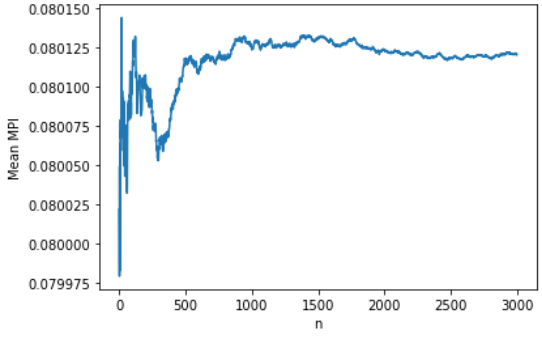
We take n=600 and n=3000. The two graphs below come from **the same** simulation.



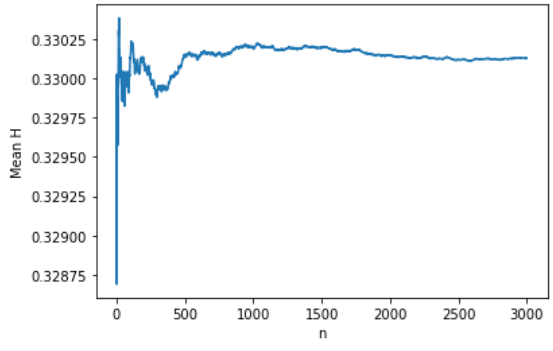
Mean MPI for n=600



Mean H for n=600



Mean MPI for n=3000



Mean H for n=3000

Observation: as noted earlier, the MPI achieves a three digits stability quite early. As for the headcount ratio (H), the three digits stability is reached around 600 simulations, and keeps on improving with an increase of n.

Annex 4
Technical details for the choice of shocks for each indicator

Indicator 1	School attendance
Definition as per the FW	Household (HH) is deprived if any child 5-19 is not going to school
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	Individual level: $\frac{\#deprived\ children}{total\ \#\ of\ individuals\ 5<=Age<=19} = \frac{5{,}245}{37{,}155} = 13.23\%$ Expanded at HH level: $\frac{\#\ of\ individuals\ living\ in\ deprived\ HH}{total\ number\ of\ individulas\ in\ teh\ survey} = \frac{19{,}689}{149{,}233} = 13.19\%$
Shock Insight	"Nine per cent of families sent their child to work, 15 per cent stopped their children's education and 60 per cent had to buy food on credit or borrow money. The situation is even worse for Syrian households, at 22 per cent, 35 per cent and 100 per cent respectively". Sample of vulnerable HHs (beneficiaries of UNICEF assistance programmes)
Target Population and Eligibility (x%)	Target population: the shock definition can be generalized to a target population composed of HHs that are vulnerable/poor and have individuals aged 5 to 19. x% additional HHs out of the target population of the UNICEF survey. Condition for shock: We need to apply the shock on the vulnerable HHs that have individuals aged 5-19, who did not finish secondary, and are currently attending school: $5 <= Age <= 19 \& EDU2 < 6 \& EDU3\_adj = 1 \& DL >= 11\%$
Shock Magnitude	x_{leb}=15% out of eligible (target) Lebanese HHs 1. get the share in absolute numbers 2. shock that many HHs using the condition above (among eligible HHs). x_{non_leb}=35% out of eligible (target) non-Lebanese HHs (same logic)
Year	2021
Source	UNICEF, June 2021 https://www.unicef.org/lebanon/media/6541/file
Pre-shock uncensored HC	13.23%
After shock uncensored HC	22%

Indicator 2	Access to medication
Definition as per the FW	HH is deprived if any HH member needs regular medication and can't afford it
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	Individual level: 10.84% Expanded at HH level: $16{,}159/(133{,}079 + 16{,}159) = 10.82\%$
Shock Definition	Out of respondents who had to buy medicine in the last month, 56 per cent of Lebanese respondents reported facing challenges in accessing medicine, while 71 per cent of Palestinians and 73 per cent of Syrians reported encountering challenges. Average non-Lebanese 72 per cent.
Target Population and Eligibility (x%)	Target population: HH that bought medicine in the past month. We know that most residents tried to buy a medicine during 2020> expand shock to the general population. x% HH who were not deprived in this indicator, out of total HHs.
Shock Magnitude	Take the difference between the current rate of deprivation by nationality and the new one. x_{leb}= 56% - 8.955% = 47.045% $x_{non\text{-}leb}$ = 72% - 15.23% = 56.77% we need to hard code the difference
Year	2020
Source	WFP Report June 2020 (p17) https://docs.wfp.org/api/documents/WFP-0000116784/download/
Pre-shock uncensored HC	11%
After shock uncensored HC	59%

Indicator 3	Access to medical services
Definition as per the FW	HH deprived if any HH member needs medical services and can't afford it
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	Individual level: 9.39% Expanded at HH level: $13{,}971/(135{,}260 + 13{,}971) = 9.36\%$
Shock Definition	Out of Lebanese respondents who are aware of or had to seek medical care, nearly half reported health services functioning as usual, however 34 per cent reported facing barriers to accessing health care due to recent non-functional facilities or other inaccessibility reasons. non-Lebanese: Syrians: 51% (12% no longer functioning + 39% no access), Palest:41%. Average non-Lebanese 46 per cent
Target Population and Eligibility (x%)	Target population: HHs that are aware of the situation of medical care services in Lebanon. We know that most Lebanese residents are aware of medical care situation> expand shock to general population. x% HH who were not deprived in this indicator, out of total HHs.
Shock Magnitude	x_{leb} = 34% - 7.38% = 26.62% Take the difference between the current rate of deprivation by nationality and the new one. $x_{non\text{-}leb}$ = 46% - 14.21% = 31.79% we need to hard code the difference (cross tab binary indicator)
Year	2020
Source	WFP Report June 2020 (p. 17) https://docs.wfp.org/api/documents/WFP-0000116784/download/
Pre-shock uncensored HC	9%
After shock uncensored HC	36.24%

Indicators 4 and 5	ICT assets	Mobility assets
Definition as per the FW	HH is deprived if it has no internet access or has none of the following: a phone (fixed phone or cell phone), computer, iPad, TV, DVD, satellite dish	HH is deprived if it has neither a car nor a motorcycle and do not have access to public transportation (<10min)
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	45.92%	5.1%
Shock Definition	Selling productive assets is equivalent to additional shock magnitude: Leb 3.5%, non-Leb 4.175% (Pal 2.5%, Syr 4%). Leb: ICT+1SD: 3.5%+4.98%=8.39% mobility+1SD: 3.5%+2.2%=5.7% non-Leb: ICT+1SD: 4.175%+4.98%=9.155% mobility+1SD: 4.175%+2.2%=6.375%	

Indicators 4 and 5	ICT assets	Mobility assets
Target Population and Eligibility (x%)	Target population: all households x% HH not deprived in this indicator, out of total HHs.	Target population: all households x% HH not deprived in this indicator, out of total HHs.
Shock Magnitude	x_leb=8.39% x_non_leb=9.155%	x_leb=5.7% x_non_leb=6.375%
Year	2020	
Source	WFP Report June 2020 (p11) https://docs.wfp.org/api/documents/WFP-0000116784/download/	
Pre-shock uncensored HC	46%	5%
After shock uncensored HC	52.08%	10%

Indicators 6 and 7	Domestic livelihood assets	Heating assets
Definition as per the FW	HH is deprived if it has neither a fridge, washing machine, burner (with or without an electrically operated oven), microwave, dishwasher, vacuum cleaner, air conditioner nor any water heater	HH deprived if it has no heating other than charcoal
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	0.66%	8.06%
Shock Definition	selling domestic assets is equivalent to additional shock magnitude: Leb 6%, non-Leb 9.25% (Pal 6.5%, Syr 12%). Leb: livelihood+1SD: 6% +0.83%=6.83% Heating+1SD= 6%+2.72%=8.72% non-Leb: livelihood+1SD: 9.25% +0.83=10.08% Heating+1SD=9.25% +2.72%=11.97%	
Target Population and Eligibility (x%)	Target population: all households x% HH not deprived in this indicator, out of total HHs.	Target population: all households x% HH not deprived in this indicator, out of total HHs.
Shock Magnitude	x_leb=6.83% x_non_leb=10.08%	x_leb=8.72% x_non_leb=11.97%
Year	2020	
Source	WFP Report June 2020 (p11) https://docs.wfp.org/api/documents/WFP-0000116784/download/	
Pre-shock uncensored HC	1%	8%
After shock uncensored HC	8.01%	18%

Indicator 8	Employment deprivation
Definition as per the FW	A household is deprived if none of its labour force members are employed, or all of its members are outside the labour force
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	Individual level: $\#unemployed/Labor\_force = 6276/54067 = 11.6\%$ Expanded at HH level: 19,866/(129,397+19,866) =13.31%
Shock Definition	2020 ILO modeller estimate>>(6.04 in 2019 to 6.61% in 2020) >> 9.44% increase in unemployment rate (not absolute increase in pp). An increase of 9.44% is equal to an increase of around 1.1% in the total labour force. The new rate of unemployment for 2020 is 12.7% (= 11.6*1.0944) Note: we think this shock is unrealistic, yet we decided to be conservative, awaiting the survey updates and ILO figures. The logic of targeting remains the same if we get a better insight on the latest unemployment rates, unless the demographic shift and brain drain are to be taken into consideration.
Target Population and Eligibility (x%)	Target population: labour force x% employed individuals (LB1_adj=1) out of total labour force (LB1_adj=1 + LB1_adj=2), should become unemployed. Denominator (total target population): LB1_adj=1&LB1_adj=2 Shock from eligible non-deprived: LB1_adj = 1 *LB1_adj codebook: 1 "Employed" 2 "Unemployed" 3 "Outside labour force" 4 "Under 15"* We need to shock at the Individual level, then expand at HH level. then change the status of the 2019 HHs, only if they were ND then became D
Shock Magnitude	x% = 1.1%
Year	2020
Source	ILO Modelled Estimates https://www.ilo.org/shinyapps/bulkexplorer16/?lang=en&segment=indicator&id=UNE_2EAP_SEX_AGE_RT_A
Pre-shock uncensored HC	12.57%
After shock uncensored HC	14.39%

Indicator 9	Electricity
Definition as per the FW	Deprived if HH has no access to electricity or a generator
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	17.82%
Shock Definition	Electricity supply was a challenging indicator since we have no official data to estimate the shortage. As a proxy we analyse satellite night imagery and compute the luminosity across Lebanon or 2019 and 2021. The change in luminosity should reflect the change in electricity deprivation, be it public network or private generator. Other sources of energy such as solar panels, are assumed to have a minimal share of the luminosity. Satellite images were downloaded from July 1st, 2nd and 3rd, for both years 2019 and 2021. For 2021, it characterized the latest imagery we could reach, and it characterizes the beginning of the electricity crisis. A median image for each day was produced, while filtering out values equal to 65535, as per NASA's methodology. Then the average is computed for the median images and the results are as follow: $2019\ average\ =\ 48.555\ nanoWatts/cm^2/sr$ $2021\ average\ =\ 28.290\ nanoWatts/cm^2/sr$ Change in luminosity (July 2019 – July 2021)= $\frac{28.290-48.555}{48.555}\cdot 100 = -41.74\%$ We assume a minimal (conservative) reduction in luminosity of 3% for blackouts during July and August 2021. Summary: 45% of non-deprived HHs lost their access to electricity since 2019. Technical definition: We used VIIRS VNP46A2 daily nighttime product. A quote from their manual explains that "The daily moonlight and atmosphere corrected NTL (VNP46A2) is available at 500 m resolution from January 2012-present. The VNP46A2 product has 7 layers containing information on BRDF-corrected NTL", where BRDF is the Bidirectional Reflectance Distribution Function and the NTL is the Nighttime Light.
Target Population and Eligibility (x%)	Target population: all households x% HH not deprived in this indicator, out of total HHs.
Shock Magnitude	x%=45%
Year	2021
Source	NASA Earth Data Catalog https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/products/VNP46A2/#overview
Pre-shock uncensored HC	18%
After shock uncensored HC	62%

Indicator 10	Waste collection
Definition as per the FW	HH is deprived if garbage is not disposed in containers or disposed of in containers inside the building and not emptied at least once a week
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	6.52%
Shock Definition	Ramco had suspended waste collection intermittently during 2020 and 2021. Several other regions in Lebanon had witnesses repeated delays in waste collection services due to different reasons, such as dumps' full capacity and fuel shortage among others.
Target Population and Eligibility (x%)	Target population: all households x% HH not deprived in this indicator, out of total HHs.
Shock Magnitude	x%=33%
Year	2021
Source	Local news https://today.lorientlejour.com/article/1270461/ramco-suspends-trash-collection-in-metn-and-kesrouan.html?utm_source=rss&utm_medium=rss&utm_campaign=ramco-suspends-trash-collection-in-metn-and-kesrouan
Pre-shock uncensored HC	7%
After shock uncensored HC	39.80%

Indicator 11	Income
Definition as per the FW	HH is deprived if adjusted income for children and economies of scale is less than LBP 386,000
Deprivation Dashboard 2019 Uncensored headcount, expanded at HH level (out of total population, unless otherwise stated)	28%
Shock Definition	This is a deterministic shock. So it will not be subject to the simulation, deprivations will rather be computed pre-simulation based on the following definition. The LBP 386,000 poverty line is adopted and updated by the compounded inflation rate up to 2021: the new annual poverty line per capita is LBP 12,340,616 annually or LBP 1,028,385. Based on data gaps between the two figures, we simplify the cut-off to LBP 1,020,000 monthly, and the results do not change.
Target Population and Eligibility (x%)	The adjusted cut-off affects all HHs whose individual income is below LBP 1,020,000 per month (done statically)
Shock Magnitude	

Year	2021
Source	CAS
Pre-shock uncensored HC	29%
After shock uncensored HC	73.77%

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