RevistaEconomică
Journal of economic-financial theory and practice
Vol. 76, issue 4 Year 2024
DOI: 10.56043/reveco-2024-0038

ANALYSIS OF THE IMPACT OF COVID-19 ON KEY DEMOGRAPHIC INDICATORS IN ROMANIA AND MOLDOVA USING ECONOMETRIC MODELING

Ion PÂRȚACHI [1], Simion MIJA [2], Claudiu HERȚELIU [3]

[1]Academy of Economic Studies of Moldova (University), 0000-0002-8042-983X
[2]Academy of Economic Studies of Moldova (University), 0009-0000-0814-5982
[3] Bucharest University of Economic Studies, 0000-0001-8860-9547

Abstract: *The complexity of the impact of the COVID-19 pandemic crisis remains a challenging subject to define and estimate. In this paper, we will reflect on the impact from the perspective of demographic indicators, considering how the crisis has affected family well-being, especially in relation to dependence on remittances. We will also address the problematic aspects caused by the crisis on social and economic mobility, as well as the perception of state responses to the pandemic, from a comparative perspective. This includes examining the support interventions provided to families, the public policy measures adopted, and the responses of public health systems in Moldova and Romania. Econometric analysis of these effects offers a detailed understanding of how COVID-19 has influenced demographic dynamics in both countries, facilitating the development of policies better suited to the post-pandemic context.*

Keywords: *econometric analysis, demographic dynamics, COVID-19*

JEL classification: *C10, C22, C38, C52*

1. Introduction

Global health and the economy face immense problems because of pathogens in history globally. The outbreak of the SARS-CoV-2 pathogen was responsible for the infectious disease of coronavirus (COVID-19). This research tried to assess the trend of COVID-19 cases, COVID-19 deaths, COVID-19 cases per million, and COVID-19 transmission rate in Romania and Republic of Moldova, as of March 1, 2022, and to analyze the impact of covid-19 on key demographic indicators.

In Europe, the first three cases detected, were reported in France on 24 January 2020 and had onset of symptoms on 17, 19 and 23 January respectively. In Romania first case was reported on 1st March 2020, in Republic of Moldova on 8th March 2020. Analyzing the situation in the region, in Europe showed a relatively a higher median of daily COVID-19 cases on 90th day (63.5), 360th day (501.5), in Republic of Moldova 90th day (2.4), 360th day (7.7), and in Romania 90th day (11.1), 360th day (61.6), of the COVID-19 outbreak.

Some possible factors behind the difference may be temperature, precipitation, population density, mobility, health sector, demographic indicators.

[1] *ipartachi@ase.md*
[2] *mija.simion@ase.md*
[3] *hertzi@ase.ro*

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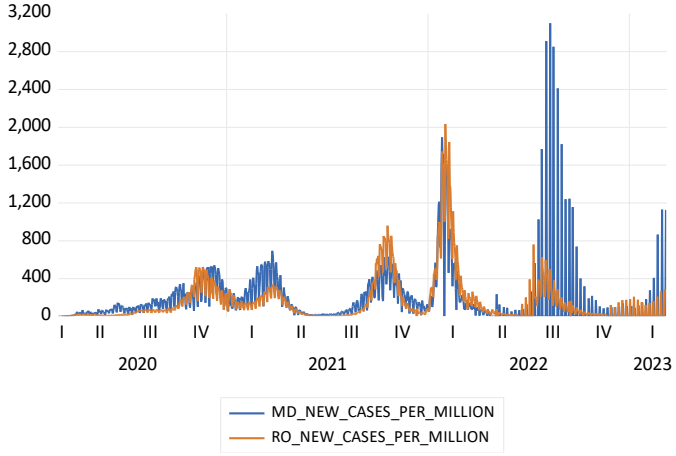
DOI: 10.56043/reveco-2024-0039

Figure 1: COVID-19 new cases per million in Republic of Moldova and Romania



Source: Author, based on Data Catalog (https://ourworldindata.org)

Discussing the COVID-19 cases per million, a similar trend can be observed from the beginning of the COVID-19 period until the first half of 2022 in both countries. After which the new cases of COVID-19 in9 the Republic of Moldova increased significantly compared to Romania.

In this regard, it is important to note that Romania had a significantly higher number of fully vaccinated people, with 8,114,769 in June 2022, compared to 1,063,425 in the Republic of Moldova for the same period.

Although the share of vaccinated individuals is quite similar when compared to the total population of each country.

A distinguishing factor that generated this big difference for the Republic of Moldova was due to the war in Ukraine started on 23 February 2022, which led to a portion of the population entering or transiting through the country.

In the Republic of Moldova and the same in Romania, as well as worldwide, COVID-19 has profoundly affected various demographic indicators. Here are some key areas that were impacted:

Mortality Rates: The pandemic significantly increased mortality rates. According to estimated data from World Mortality Dataset (WMD), in case of Moldova the estimated daily excess deaths, on average, in 2021 was 30.8 and in Romania the estimated daily excess deaths, on average, in 2021 was 208.6. In particularly among older adults and those with preexisting health conditions. This has altered life expectancy calculations and overall population health statistics.

Fertility Rates: Since the early 1990s, the Republic of Moldova has experienced a continual demographic decline. The country has one of the lowest fertility rates in the world, with 1.26 children per woman. This compares with a fertility rate of 1.76 in Romania and a world average of 2.4. Both countries saw a decline in birth rates during the pandemic, influenced by economic uncertainty, lockdown measures, and changing social dynamics. Some families experienced a temporary "baby bust" while others may undergo changes in their family planning approaches.

Migration Patterns: The pandemic affected internal and international migration. Travel restrictions led to decreased immigration, and many expatriates returned to their home countries, impacting labor markets and demographic compositions in both sending and receiving nations.

Population Aging: With higher mortality among older populations, there may be accelerated aging. This affected healthcare demands, social services, and economic productivity.

Economic Inequality: The pandemic exacerbated existing inequalities, with marginalized groups often facing greater health risks and economic hardships. This has implications for income distribution and social mobility.

Health Disparities: COVID-19 highlighted and often worsened health disparities among different demographic groups, particularly affecting racial and ethnic minorities, leading to calls for more equitable healthcare access.

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Mental Health: The pandemic's stressors contributed to a rise in mental health issues, affecting demographics such as youth and healthcare workers disproportionately.

Educational Impact: School closures and shifts to online learning disrupted education for millions, particularly affecting lower-income families and those without access to technology, which may have long-term implications on educational attainment.

These changes may reshape societies in the long term, influencing everything from workforce demographics to social policies.

An important aspect that needs more attention is that the epidemiological studies highlight the connection between meteorological conditions and COVID-19. Many studies indicate that dry or cold weather contributes to the spread of influenza. The transmission of SARS decreased during warmer months and ultimately ceased in July 2023. Meteorological factors—such as humidity, average temperature, and wind speed—had an inverse effect on COVID-19 cases.

2. Data, methods and results

2.1 Data sources

This study is based on some data sources, namely:

- The primary source of confirmed and cured people from COVID-19, as well as deaths due to COVID-19 in Romania and Republic of Moldova.
- Historical data about healthcare facilities available in countries by the National Institute of Statistics (NIS) from Romania (www.insse.ro) and National Bureau of Statistics (NBS) of the Republic of Moldova (statistica.md).
- Fundamental data provided by the World Bank, Official data collated by the Our World in Data team, WHO COVID-19 Data, Household Budget Surveys.

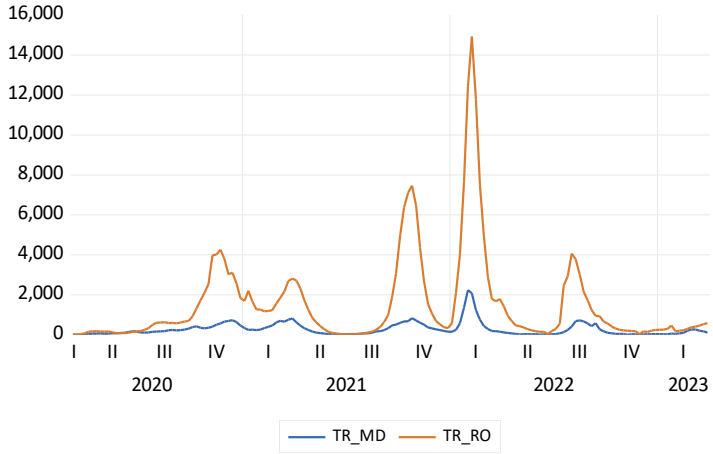
2.2 Methods and results

2.2.1 COVID-19 transmission rate

This study used COVID-19 data from Romania and Republic of Moldova from March 01, 2020, to March 31, 2023 (some analysis up to August 8, 2024). This study used data about daily cases and deaths, collected from the WHO COVID-19 Data. The data about population density and per capita income were obtained from World Development Indicators. The transmission rate describes the speed of COVID-19 transmission in a country and can be calculated using the following formula:

$$Transmition\ rate\ (TR) = \frac{Number\ of\ infected\ Persons}{Days\ of\ Infection\ (Outbreak)} \quad (1)$$

Figure 2: COVID-19 new cases per million in Republic of Moldova and Romania



Source: Author, based on Data Catalog (https://ourworldindata.org)

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In case of Romania, the average transmission rate was higher, and several critical periods can be identified. The first period began in the second half of 2020 and lasted until the second quarter of 2021. The second critical period occurred at the end of the third trimester of 2021, with the most severe period taking place in the first trimester of 2022, followed by another critical phase in the third trimester of that year. In the Republic of Moldova, the transmission rate of COVID-19 was less critical, although periods of increased transmission mirrored those in Romania, albeit with lower magnitude.

2.2.2 COVID-19 related to temperature and precipitation

This study explored the transmission rate based on, average temperature (°C) and average precipitation (mm).

This has been done by using the the following linear regression model:

$$\boldsymbol{log(TC) = \beta_0 + \beta_1 * temp + \beta_2 * dummy(prcp) + \varepsilon_t} \quad (2)$$

where, TC is the total number of COVID-19 new cases in time t, $\boldsymbol{\beta_0}$ is the intercept, $\boldsymbol{\beta_1, \beta_2}$ represent the slope coefficient for $\boldsymbol{temp}$, that is the average daily temperature (C), and for $\boldsymbol{dummy(prcp)}$, that is the dummy variable for precipitation (rain and snow), $\boldsymbol{\varepsilon_t}$ represent the error term.

Table 1: Regression for COVID-19 new cases, Romania case

Dependent Variable: L_RO_NEW_CASES
Method: Least Squares
Sample (adjusted): 3/08/2020 8/04/2024
Included observations: 231 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUMMY_BUC_PR				
CP	288.5321	28.19685	3.023277	0.3108
BUC_TAVG	-81.13862	14.84775	-5.464708	0.0000
C	2164.614	245.1102	8.831189	0.0000

Root MSE	942.3904	R-squared	0.364363
Mean dependent var	1188.999	Adjusted R-squared	0.340376
S.D. dependent var	1192.721	S.E. of regression	968.6948
Akaike info criterion	16.64186	Sum squared resid	4.73E+86
Schwarz criterion	16.75036	Log likelihood	-46.29721
Hannan-Quinn criter.	16.68392	F-statistic	35.19045
Durbin-Watson stat	1.807950	Prob(F-statistic)	0.000006

Source: Author, based on EViews 11, data from WHO, NIS

To test these links and causalities, it was applied in the case of Romania, as well as in the case of the Republic of Moldova.

Table 2. Regression for COVID-19 new cases, Republic of Moldova case

Dependent Variable: L_MD_NEW_CASES
Method: Least Squares
Sample (adjusted): 3/08/2020 8/04/2024
Included observations: 231 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAP_TAVG	-13.35155	3.008611	-4.437777	0.0000
DUMMY_CAP_PR				
CP	32.44003	57.13550	2.567774	0.5726
C	452.9367	49.66687	9.119494	0.0000

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Root MSE	190.9573	R-squared	0.371946
Mean dependent var	287.8316	Adjusted R-squared	0.344472
S.D. dependent var	225.8224	S.E. of regression	196.2874
Akaike info criterion	13.44912	Sum squared resid	2.41E+23
Schwarz criterion	13.55762	Log likelihood	-373.5754
Hannan-Quinn criter.	13.49119	F-statistic	49.89880
Durbin-Watson stat	2.166317	Prob(F-statistic)	0.000223

Source: Author, based on EViews 11, data from WHO, NIS

At first glance, this regression model may appear simplistic, but it underscores several important points: (1) the direct relationship between the precipitation and the new COVID-19 cases, and (2) the inverse relationship between rising air temperatures and the new COVID-19 cases.

In case of Romania the increasing of temperature in Bucharest by 1^{o}C determines the decreasing of the new COVID-19 cases by 81.1 cases.

In case of Republic of Moldova, the increasing of temperature in Chisinau by 1^{o}C determines the decreasing of the new COVID-19 cases by 13.4 cases.

In both cases, in the Republic of Moldova and in Romania case, the effect of precipitation has a direct impact on the new cases of COVID-19. Due to the fact that precipitation is relatively rare in the capital of Republic of Moldova and the same in Romania, in the study was decided to be introduced through a dummy variable. The precipitation in the capital of the countries affects the new COVID-19 cases in Republic of Moldova in proportion of 32.4 and in Romania in proportion of 288.5. According to the (Ammar Zahid R.M., 2023, p. 7) this effect is characteristic countries having precipitation between 1mm and 750 mm.

2.2.3 The impact on household income

The impact of the COVID-19 crisis on household income has been assessed by comparing the average monthly income of households before and after March 2020. Given the ongoing nature of the crisis, income levels recorded since March 2020 represent the new average incomes of households, rather than merely delays in income receipt.

For example, in the Republic of Moldova, households with children have experienced an average income loss of approximately 15 percent due to the COVID-19 crisis. All segments of the population have been affected, with those receiving remittances experiencing a greater impact—averaging a 17 percent income drop compared to 13 percent for those without remittances. However, households receiving remittances still maintain a slightly higher per capita monthly income.

The decline in household income has similarly impacted both urban and rural households, as well as those with single and multiple children. Households headed by women have shown slightly more resilience than those headed by men, with an income drop of 11 percent compared to 15 percent. This difference can be attributed to the significant salary reductions experienced by male-headed households. The poor have also been heavily affected, primarily because many lack full or stable salaries and do not receive remittances—two income sources that have been particularly hard hit by the crisis.

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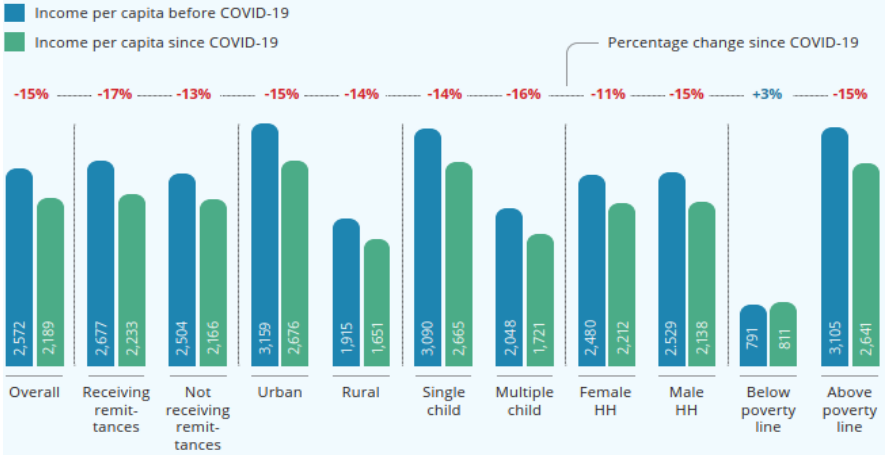
Figure 3: Change in monthly income (MDL) per capita since COVID-19



Source: Unicef Moldova Country report, 2021 (https://worldbank.org)

The data from the figure on changes in monthly per capita income (MDL) since the onset of COVID-19 reveals a range of income situations. Fifty percent of households with children have experienced a decline in income, with 35 percent reporting a loss of over 20 percent. Only 38 percent have managed to maintain their income at pre-crisis levels. Additionally, just 12 percent claim that their income has increased, but this figure often reflects specific cases where families have turned to coping strategies, such as seeking assistance from friends or family or taking on additional jobs, rather than a genuine rise in household income.

The reasons for income declines vary across different households. For those not receiving remittances, income loss primarily stems from salary reductions. In contrast, households that do receive remittances experience income decreases mainly due to a decline in remittance payments. Following this trend, urban households and those headed by men predominantly faced salary losses, while rural households and those headed by women were more affected by reduced remittances. All segments have turned to unofficial income sources to offset their losses, especially in rural areas, where many have been able to sell home-grown farm products informally. Additionally, individuals living below the poverty line have been more successful in accessing social benefits, although these amounts remain modest. Overall, no significant changes in the amount or timing of social benefit payments have been observed, with most households continuing to receive them punctually.

2.2.4 The impact on liquidity of firms and access to the government support

More and better targeted support is needed for a resilient recovery. Both the magnitude and the composition of the Government response can play a critical role for a swift and resilient recovery. Strengthening social assistance is essential to reach the most vulnerable workers and households during this crisis, as more and more households see their sources of income significantly reduced.

According to the 2020 Household Budget Surveys (HBS), in Republic of Moldova 17 percent of households reported a reduction or loss of income from work, 8.3 percent a reduction or loss of remittances from abroad, and 3.6 percent the withholding of salaries, pensions, and social benefits.

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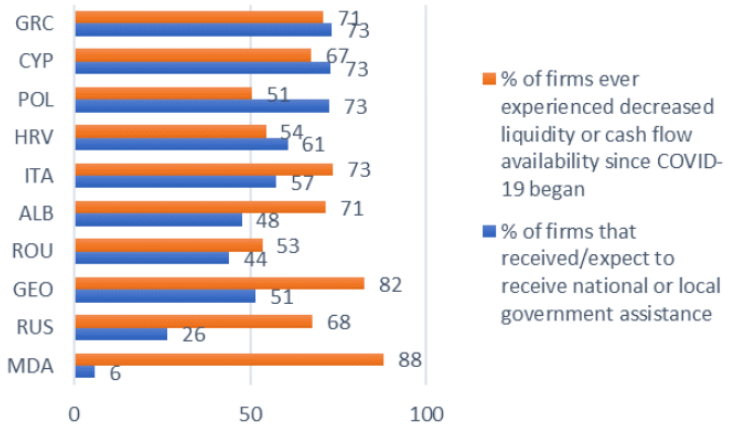
Figure 4: The impact on firms' liquidity and access to government's support



Source: Author, based on Worldbank data (https://worldbank.org)

Support to businesses should also increase and be targeted towards the most affected sectors and firms. The enterprise survey shows that in both cases, case of Republic of Moldova and Romania firms perceive the Government response to be insufficient, considering the severe liquidity constraints they are experiencing. As of November 2020, almost 90 percent of firms in Republic of Moldova and 53 percent of forms in case of Romania report that they have experienced a decrease in liquidity or cash flow since the beginning of COVID-19, and an increasing number of firms had to delay payments.

However, only 6 percent of surveyed firms in case of Republic of Moldova and 44 percent of surveyed firms in case of Romania, mostly medium and large companies, received government support since the pandemic started, or expect to do so. Among the respondents, 31 percent of the firms in Moldova did not know that assistance opportunities existed, while 22 percent did not qualify. Although the percentage of firms receiving assistance has doubled since May 2020, it remains the lowest in Europe and Central Asia.

3. Conclusion

The study highlights the need for targeted interventions and responses based on the specific circumstances and factors affecting each country, including their geographical location, temperature, precipitation levels, population density, and per capita income.

The econometric model indicates for the both countries the negative association between the temperature and COVID-19 cases, that also can be related based on the correlation with deaths, and transmission rate (TR).

In the longer term – and should austerity plans be introduced after the crisis – do not cut support to the most vulnerable households. Necessity to protect the most vulnerable households, many of whom are already struggling to meet their basic needs, notably those with multiple children and living in rural areas, are especially vulnerable.

The findings from this research should continue to be leveraged by the government when planning for the post-crisis era. A fair proportion of households are extremely vulnerable and at risk of not meeting basic survival needs such as food. These most basic needs should be prioritized by the government.

Acknowledgments

Ion Partachi, Simion Mija and Claudiu Herțeliu are partially supported by a project "Analysis of the impact of Covid-19 on the main demographic indicators in Romania and the Republic of Moldova by using econometric modeling" code PN-IV-P8-8.3-ROMD-2023-0208 funded by the Romanian Ministry of Research, Innovation and Digitalization (MCID) through UEFISCDI.

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