Empirical Economics (2024) 66:1683–1707
https://doi.org/10.1007/s00181-023-02504-9

Pandemic, sentiments over COVID-19, and EU convergence

Athanasios Anastasiou[1] · **Nicholas Apergis**[2] · **Athina Zervoyianni**[3]

Received: 27 March 2023 / Accepted: 14 September 2023 / Published online: 13 October 2023

Abstract

This study examines the convergence/divergence of people's sentiments over Covid-19 in European economies and investigates the role of the support policies that were implemented by governments and central banks. The analysis focuses on 26 EU countries plus the UK, using changes in human mobility to essential places as a proxy for pessimistic/optimistic sentiments. Based on a panel-clustering methodology and multinomial logistic regressions, the results suggest heterogeneous effects of Covid-19 on people's behavior in Europe, which were not drastically reduced through fiscal- or monetary-policy interventions. Heterogeneous Covid-19 impacts are a matter of concern in the EU context, where harmonization is a primary target. Thus, given the need for harmonization, additional EU-wide support policies are necessary in the post-Covid-19 era in order to effectively address asymmetries across member economies and restore the convergence process.

Keywords Covid-19 · Sentiments/expectations · Government policy · Panel convergence · Multinomial logit regressions

JEL Classification E60 · E70 · C54

1 Introduction

The pandemic of Covid-19 profoundly affected the global economy. Partial or full lockdowns were implemented in many countries, causing a disruption of financial

We are grateful to two anonymous referees for constructive comments on an earlier version of the paper.

✉ Athanasios Anastasiou
athanastas@uop.gr

[1] Department of Management Science and Technology, University of Peloponnese, Karaiskaki 70, 221 00 Tripoli, Greece

[2] Department of Banking and Financial Management, University of Piraeus, Piraeus, Greece

[3] Department of Economics, University of Patras, Patras, Greece

and commodity markets, international trade, and global supply chains. Within this environment, governments and central banks sought to support households and firms through fiscal stimulus programs and measures aimed to lower the cost of borrowing, although the intensity of such policies varied across countries. In general, there is still considerable uncertainty regarding the longer-term economic consequences of Covid-19 and the extent to which the path to full economic recovery would differ across countries (Arthi and Parman 2021; Jordà et al. 2022; Bianchi et al. 2023).

The quantification of the pandemic's impact has been the subject of a growing literature. Part of this literature examines the effects on the global economy, based on simulations of general equilibrium models that combine epidemic and economic dynamics (Eichenbaum et al. 2020; Acemoglu et al. 2020; McKibbin and Fernando 2021). Other studies use data on stock returns, energy consumption, or manufacturing exports to provide evidence on how economic activity in specific countries has evolved since the pandemic's outbreak (Baker et al. 2020; Alfaro et al. 2020; Deb et al. 2022; Famiglietti and Leibovici 2022).

Despite the growing literature in this area, there is still no systematic empirical evidence on how Covid-19 has affected convergence patterns across economies and whether policy actions by governments and/or central banks have contributed to reducing cross-country asymmetric effects. Given that convergence is an explicit objective in the EU, this study places the focus on the European economies, examining the differential impact of the Covid-19 pandemic on people's behavior and the extent to which support policies led to a more harmonized cross-country pattern. EU convergence has received a lot of attention in the past, but recent studies examining convergence/divergence during Covid-19 are limited and mostly use average, yearly-based, measures of dispersion, such as coefficients of variation, comparing their values for selected macroeconomic aggregates between 2020–2021 and 2019. Our analysis complements this literature by applying a panel-convergence methodology to high-frequency human mobility data to test for convergence, while it uses multinomial logit analysis to identify aspects of the pandemic that may have been responsible for cross-EU asymmetric patterns and the emergence of distinct clubs of convergence.

More specifically, the objective of the study is twofold. First, using the Phillips–Sul (2007, 2009) panel-convergence testing procedure and data from 26 EU countries, plus the UK, spanning over two periods, February-November 2020 and January–September 2021, it seeks to explore to what extent people's beliefs and sentiments across Europe during the Covid-19 outbreak have followed a common or a divergent path and whether the vaccination process contributed to a greater harmonization. Second, based on multinomial logistic regressions, it explores the role in convergence/divergence patterns of the fiscal and monetary policies implemented during the respective periods. The issue is of particular relevance in the European Union, to the extent that divergence in people's beliefs and sentiments can cause respective divergence in spending or labor-supply decisions and thus lead to overall cross-country differentiated patterns, which, in the EU context, where economic harmonization is a primary target, would be a matter of concern. Indeed, a growing empirical literature demonstrates that particularly in periods of high uncertainty, beliefs and sentiments are crucial in shaping economic decisions (Bailey et al. 2019; Coibion et al. 2021; D'Acunto et al. 2022; Hendren 2017; Kuchler and Zafar 2019). Especially during the pandemic crisis, several studies point to the close relationship between sentiments/expectations, or corresponding behavior, and economic outcomes (Andersen et al. 2020; Sheridan et al. 2020; Cox et al. 2020; Coibion et al. 2020a, b; Bounie et al. 2020; Hacıoğlu-Hoke et al. 2021; Chen et al. 2021a, b; Carvalho et al. 2021; Van der Wielen and Bsrios 2021; Kapetanios et al. 2022). Thus, given the relationship between beliefs/sentiments and economic decisions/outcomes, in this study we ask the following questions: how similar/dissimilar has been people's behavior toward Covid-19 in the European economies? To what extent did the initiation of vaccination programs affect convergence/divergence patterns? How effective have been the fiscal support measures, or the lower cost of borrowing through the monetary easing of the central banks, in achieving greater cross-country harmonization and reducing the probability of EU countries belonging to different convergence clubs?

To examine these questions, we focus on changes relative to a pre-Covid-19 baseline in people's visits to essential places (grocery and farmers' markets, food shops, drug stores, and pharmacies), given that, particularly in periods of turbulence caused by extraordinary situations, visits to these places can be taken to reflect pessimistic/optimistic expectations about the future. A negative change would imply a switch toward more pessimistic expectations, while a positive change would imply a switch toward more optimism. We, thus, use this variable as an overall indicator of pessimism/optimism in European economies during the Covid-19 period and examine potential channels through which the pandemic could have affected cross-country convergence/divergence in this indicator, focusing on the role of support policies, and in particular, whether fiscal and/or monetary interventions contributed to more harmonization. Human mobility indicators are used by a number of studies to investigate associations with other Covid-19-related variables, while a growing literature emphasizes the close connection between such indicators and people's beliefs and sentiments (Chan et al. 2020; Rocher and Renault 2021; Feng and Kirkley 2021; Li et al. 2022).

Our findings can be summarized as follows. First, there is evidence of considerable heterogeneity across European economies in responses to Covid-19, with the results suggesting the presence of several distinct clubs of convergence as far as people's sentiments/expectations are concerned in both periods considered. Second, the initiation of vaccination programs was not accompanied by a drastic switch toward greater convergence. Four distinct convergence clubs are detected even during January–September 2021, each with different country memberships compared to February–November 2020. Third, the driving forces behind the club-convergence patterns in the two periods considered are not the same. Unlike during February–November 2020, in the period January–September 2021 heterogeneity in fiscal support policies appears to have played a crucial role in differentiating people's sentiments/expectations across the sample countries.

Overall, as convergence is an explicit objective in the EU, the results suggest the necessity of additional and more coordinated support policies in the post-pandemic era that could enable member states to offset the asymmetric impacts of Covid-19 on their economies and restore the harmonization process.

The rest of the paper are structured as follows. Section 2 provides a discussion of related studies and identifies the contribution of the paper to the literature. Section 3 describes the methodology and the data we use for the analysis. Section 4 presents the empirical findings. Section 5 concludes.

2 Literature review and motivation

There is a large literature on the pandemic's economic consequences. Part of this literature draws on experience from past pandemics or uses simulations of general equilibrium models that emphasize interactions between epidemic and economic-activity dynamics to provide a quantification of the global impact of Covid-19 (Barro et al. 2020; Jordà et al. 2022; Eichenbaum et al. 2020; Acemoglu et al. 2020; Bairoliya & Imrohoroglu 2020; McKibbin & Fernando 2021). Other studies use single-equation structural models or vector autoregression methodology to examine effects on individual countries, or on specific sectors such as the labor market (Coibion et al. 2020a, b; Fana et al. 2020; Costa Dias et al. 2020; Albanesi & Kim 2021), international trade and capital flows (Baldwin and Evenett 2020; Free and Hecimovic 2021; Goldbach and Nitsch 2022), financial and stock markets (Alfaro et al. 2020; Al-Awadhi et al. 2020; Ashraf 2020), or consumption spending (Cox et al. 2020; Bounie et al. 2020; Andersen et al. 2022).

Other studies focus on fiscal- and monetary policy during Covid-19. Heyden and Heyden (2021) and Klose and Tillmann (2021) use data on policy announcements in Europe and the US and find negative effects on stock and bond markets from the announced expansionary fiscal measures and positive effects from the announced expansionary monetary measures. Chen et al. (2021a, b) examine real-time policy reactions to Covid-19 and detect considerable cross-country heterogeneity in fiscal policy interventions, especially with respect to the size of fiscal spending. Chudik et al. (2021) use impulse response functions derived from an estimated global VAR model to assess the macroeconomic effects of fiscal interventions and predict lower short-run output contractions in countries with larger fiscal-support programs. Famiglietti and Leibovici (2022) present similar evidence for the US indicating that fiscal interventions contributed to mitigating the drop in state-level economic activity, while Dergiades et al. (2023) find that these interventions also helped to bring infections cases down through lower workplace hours by individuals. On the other hand, focusing on the EU context, Batini et al. (2020) emphasize that fiscal co-ordination and risk-sharing are the optimal way to deal with situations like Covid-19, in order to lessen the trade-off between supporting member-state economies and minimizing the probability of sovereign debt crises in the post-covid era. In the same spirit, Makin and Layton (2021) point to potential risks to macroeconomic stability in the post-Covid-19 period, due to non-coordinated fiscal responses by EU governments and elevated public debt levels in some member states.

With respect to the EU, while convergence/divergence trends have been studied extensively in the past, few recent papers focus on similarities/dissimilarities in Covid-19 impacts across member states (Gräbner et al. 2020; Muggenthaler et al. 2021; Abrhám & Vošta 2022; Holobiuc and Miron 2022; Fedajev et al. 2022; Alcidi et al. 2023; De Haan et al. 2023). The majority of these studies find heterogenous effects of

Covid-19, mostly based on coefficients of variation, or other similar dispersion measures, for selected macroeconomic variables in 2020–2021 relative to 2019, or relative to other pre-covid periods. For example, using coefficients of variation, Abrhám and Vošta (2022) find that the divergence of GDP per capita among the EU27 increased from 41.1% in 2019 to 45.1% in 2020 and 46.2% in 2021, while among the Eurozone economies increased from 41.6% in 2019 to 45.0% in 2020 and 47.7% in 2021. In the same spirit, based on coefficients of variation, Holobiuc and Miron (2022) find bigger differences among the EU countries in terms of individual consumption and households' consumption expenditures in 2020 compared to the period 2010–2019. Alcidi et al. (2023) present similar evidence examining yearly based standard deviations of incomes and spending levels for 2020–2021. Fedajev et al. (2022) use the Shannon entropy index as a measure of divergence and conclude that the disparities among the EU member states in terms of unemployment, inflation, and budget balance were greater in 2020 than in 2008 when the global financial crisis occurred. De Haan et al. (2023) examine output-gap similarities and detect more pronounced differences among the Eurozone economies in terms of the amplitude of output gaps during the pandemic's first four quarters (2020Q2–2021Q1) than in the previous four quarters (2019Q2–2020Q1).

Our study seeks to complement this literature by examining people's sentiments/expectations and corresponding behavior, which constitute an important transmission channel of shocks to the economy (Bailey et al. 2019; Coibion et al. 2021; D'Acunto et al. 2022; Hendren 2017; Kuchler and Zafar 2019) and by using a convergence methodology that allows for transitional dynamics. In particular, in this study, we place our focus on how similar/dissimilar the pandemic's impact on people's beliefs and perception about the future in Europe and to what extent the initiation of the vaccination process, the fiscal-stimulus programs, and/or the lower cost of borrowing through monetary easing by the central banks contributed to a greater cross-country harmonization. We, thus, focus on 26 EU countries, plus the UK, using high-frequency data on human mobility to essential places as a proxy for pessimistic/optimistic expectations and the Phillips–Sul (2007, 2009) panel-convergence methodology to test for convergence. Unlike coefficients of variation or other similar dispersion measures that provide a yearly-based measure of divergence, the Phillips–Sul methodology allows for heterogeneous transitional dynamics and can be used to identify which countries are drifting over time toward greater or less convergence. Moreover, after having investigated convergence/divergence patterns through the Phillips–Sul procedure, we test, based on multinomial logit regressions, how sensitive have convergence/divergence patterns been to key aspects of the Covid-19 period, i.e., cross-country differences in the intensity of restrictions, mortality risks, and fiscal or monetary interventions. Thus, our study differs from, and contributes to, the existing literature on EU convergence during Covid-19 both in terms of focus and in terms of methodology.

More generally, our study is related to a growing literature investigating behavioral responses to Covid-19 and assessing their consequences. For example, using household bank transaction data in The Netherlands, Kapetanios et al. (2022) find that Covid-19, through generalized uncertainty, had a direct impact on consumers' behavior, which led to lower consumption spending independently of the lockdown measures and the associated drop in incomes. Based on data from Denmark, the UK, China, and Spain, Andersen et al. (2020), Sheridan et al. (2020), Hacıoğlu-Hoke et al. (2021), Chen et al. (2021a, b), and Carvalho et al. (2021) report similar results, indicating that consumers' direct responses to Covid-19, including voluntary stay-at-home behavior due to generalized uncertainty and infection-related risks, were not less important than the lockdowns in causing lower spending levels during the pandemic's early stages. In the same spirit, employing several uncertainty measures, including newspaper-based uncertainty, Baker et al. (2020) find that about half of the output contraction in the US during the pandemic's initial phase could be attributed to behavioral effects, through Covid-19-induced economic uncertainty. Van der Wielen and Bsrios (2021), using Internet search data, and detecting an increase in the intensity of searches on issues related to employment/ unemployment, also point to strong behavioral effects of Covid-19 through income/job anxiety, concluding that the pandemic's overall socio-economic impact could be as negative as the financial crisis of 2007–2009. Cox et al. (2020), Coibion et al. (2020a, b), and Bounie et al. (2020) present results in the same direction, suggesting a robust relationship between consumers'/workers' expectations, spending and/or labor-market decisions, and the cost of Covid-19 crisis for the US and France.

Our study is also related to a growing body of literature emphasizing the connection between people's sentiments/expectations and human mobility during crisis periods, including the Covid-19 pandemic. For example, Huang et al. (2020) use online emotional reactions to Covid-19 as a proxy for human mobility in a sample of 20 developed and developing countries, in order to assess responsiveness to containment measures. Feng and Kirkley (2021) construct different indicators of Covid-19-related sentiments based on online tweets and find that most of these indicators had been consistently highly correlated with human mobility in 49 cities across the US. Based on tweet data from 58 countries, Chan et al. (2020) also find that people's feeling and risk attitudes toward Covid-19 have, to a significant extent, been reflected in human mobility patterns. Similar evidence, suggesting that human mobility patterns are strongly connected with people's beliefs about the future, is documented by Porcher and Renault (2021) for the US and by Li et al. (2022) for China.

3 Methodology and data

3.1 Methodology

The empirical analysis consists of two parts. In the first part, similarities/dissimilarities in people's behavioral responses to Covid-19 are examined by applying a panel-convergence procedure to data on human mobility to essential places in 26 EU countries, plus the UK, over two periods of equal length that correspond to the pandemic's pre- and post-vaccine phases. In the second part, having identified which countries are together drifting over time toward greater convergence and thus constitute distinct convergence clubs, we use multinomial logit regressions to investigate to what extent cross-country differences in key developments during Covid-19 (restrictions and associated expectations of income/job loss, morality risks, fiscal support by governments, and changes in the cost of borrowing through monetary easing by the central banks) can explain the emergence of distinct convergence clubs.

To test similarities/dissimilarities in people's behavior toward Covid-19, we use the Phillips–Sul (2007, 2009) panel-convergence methodology,[1] which is based on a specification of panel-data decomposition of the variable of interest that allows for heterogeneous transitional dynamics. In particular, panel data, X_{it}, can be represented by:

$$X_{it} = g_{it} + \alpha_{it}, \tag{1}$$

where g_{it} is a systematic component, α_{it} is a transitory component, and both g_{it} and α_{it} may consist of common and idiosyncratic elements. To isolate idiosyncratic from common elements, (1) can be modified as follows:

$$X_{it} = \left(\frac{g_{it} + \alpha_{it}}{\mu_t}\right)\mu_t = b_{it}\mu_t, \tag{2}$$

X_{it} now consists of two components, a shared component μ_t, and an idiosyncratic component b_{it}, which includes a transitory element that absorbs α_{it}. In country-panel data, the interpretation is that μ_t could be common among economies, while idiosyncratic dynamics are described by the b_{it}'s. Convergence of all countries to a common long run path implies $\lim_{k\to\infty} b_{it+k} = b$ for $i = 1, 2,\ldots N$. Transitional dynamics may differ, so convergence is investigated via the evolution of the b_{it}'s.

Given the large number of parameters, a relative transition coefficient, h_{it}, can, more conveniently, be used, describing transition paths with respect to panel average:

$$h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}} = \frac{b_{it}}{N^{-1}\sum_{i=1}^{N} b_{it}} \tag{3}$$

where the h_{it}'s measure countries' relative departure from μ_t and thus reflect possible divergence. To formulate a null hypothesis of convergence, the following semiparametric model for the transition coefficients is proposed by Phillips and Sul (2007, 2009):

$$b_{it} = b_t + \sigma_{it}\varepsilon_{it},\ \sigma_{it} = \frac{\sigma_i}{\log(t)t^{\alpha}},\ \sigma_i > 0 \tag{4}$$

where ε^{it} is iid (0,1) over i and weakly dependent over t, and α represents the convergence rate. Based on (4), the hypothesis of convergence can be presented as $H_0 : b_i = b$

[1] As, e.g., Apergis and Cooray (2014) point out, the Phillips-Sul testing procedure has important advantages over other methods of examining cross-country convergence: (1) no assumptions regarding the stationarity of the variable of interest and/or the presence of common factors need to be made; (2) the convergence test can be explained as an asymptotic cointegration test, and thus one need not worry about small-sample considerations that are crucial in unit-root and cointegration testing; and (3) the specification can be interpreted as a general non-linear time-varying model. For a similar convergence method, based on country pairs with interdependencies among the different pairs, see Stengos, et al. (2018) and Beylunioğlu et al. (2020).

for all i with $\alpha \geq 0$, versus $H_\alpha : b_i \neq b$ for all i with $\alpha < 0$. To test for convergence, Phillips and Sul suggest the estimation of (5):

$$\log\left(\frac{H_1}{H_t}\right) - 2\log(logt) = \alpha + \beta logt + u_t \tag{5}$$

$$\text{with } H_t = N^{-1}\sum_{i=1}^{N}(h_{it} - 1)^2,$$

where for $t = [rT], [rT]+1, \ldots, T$ and $r > 0$, $\frac{H_1}{H_t}$ is the cross-country variance-ratio and β is a scaled estimator of the speed-of-convergence parameter since $\beta = 2\alpha$. In the context of (5), the hypothesis of full convergence (convergence of all countries) can be tested through a one-sided test ('logt test'), based on heteroscedastic and autocorrelation-consistent standard errors and is rejected at the 5% significance level if $t_{\hat{\beta}} < -1.65$.

If the 'logt test' is rejected for the whole sample, a clustering procedure can be used to detect possible convergence-subgroups (clubs) in the panel, consisting of the following four steps:

> (i) Sort the N countries in descending order according to the last-period value of the time series. (ii) Combine all possible core groups/clubs C_k, by taking the first k highest countries for $2 \leq k \leq N$ and use the logt_k test within each subgroup of size k to test for convergence. Then, set the core club C^* of size k^* as the club for which the maximum computed logt_k occurs, provided that it complies with the convergence hypothesis. (iii) After the core club C^* is detected, run the logt regression adding one country at a time to the core club C*. If the logt test strongly satisfies the convergence hypothesis, then add the country to group C^*. Countries included initially in the core group C* and those added constitute the first convergence club. (iv) Repeat steps (i)–(iii) in order to determine whether there are other subgroups that constitute convergence clubs. If there are no further convergence clubs, the remaining countries diverge.

Because this club-convergence algorithm may imply more members of clubs than their true number, Phillips and Sul (2009), as a robustness check, propose testing for merging adjacent initial clubs into larger convergence groups model.

Having examined convergence/divergence in this way based on the Phillips-Sul panel-clustering method, the next step is to investigate, through multinomial logit (MNL) analysis, the role of the different channels of Covid-19 impacts in country assignments to distinct convergence clubs. MNL regressions are a useful framework for examining, in a probabilistic way, potential determinants of a categorical variable with more than two outcomes when the various categories have no natural ordering. This is the case here, as the variable to be explained through the MNL regressions is categorical with multiple outcomes (different country-convergence clubs due to Covid-19), while the right-hand-side variables reflect cross-country developments owing to the pandemic. More generally, for a panel dataset consisting of a dependent categorical variable Y with M outcomes (*1, 2,.., m, …, M)* and repeated observations per entity i for Xj explanatory variables (j = *1, 2,…L*), we have the following MNL model:

$$g\left(\boldsymbol{Y}_m\right) = \ln\left[\frac{(Y = m|X)}{(Y = M|X)}\right]$$
$$= \Theta_{m0} + \Theta_{m,1}X_{1,it} + \Theta_{m,2}X_{2,it} + \ldots \Theta_{m,j}X_{j,it} \cdots + \Theta_{m,L}X_{L,it} + u_{it} \quad (6)$$

$g(\boldsymbol{Y}_m)$ can be interpreted as consisting of *M-1* logit equations, each reflecting the likelihood of having response $m = 1, 2, \ldots, M - 1$ relative to a reference case M. The $\Theta_{m,j's}$ capture the effect on the logit of a one-unit increase in the value of the corresponding explanatory variable when the other variables are held constant. Thus, in our case, if full-sample convergence is rejected and club convergence prevails, (6) can be used to assess, in a probabilistic context, how sensitive are convergence clubs to cross-country dissimilarities in key developments during Covid-19, i.e., lockdowns and corresponding income loss, infection-related mortality risks, fiscal support policies, and lower borrowing costs through monetary-policy easing by the central banks. If any of such factors has been important for the assignment of a country to a club other than the reference/base club, this would be reflected in the sign (positive) and statistical significance of the $\Theta_{m,j's}$. The MNL model can more conveniently be expressed in terms of relative risk ratios (RRR), where the coefficients are described by the exponential function:

$$RRR(\boldsymbol{Y}_m) = \frac{\Pr(Y = m|X)}{\Pr(Y = M|X)} = \exp\left(\Theta_{m0} + \sum_{j=1}^{L}\Theta_{m,j}X_{j,it}\right) \quad (7)$$

When the RRR coefficient on a given variable is significantly greater than unity, then, in terms of this variable, the probability of obtaining outcome/grouping m is greater than that of obtaining outcome/grouping M.

3.2 Data

Human mobility data to test for convergence/divergence of people's behavior toward Covid-19 are obtained from Google Mobility Reports.[2] This set of data measures, on a daily basis, the percentage change in people's visits to specific places during the pandemic compared to a pre-Covid-19 baseline, which corresponds to the median value of the 5-week period from January 3 to February 16, 2020. We focus on mobility to essential places (grocery markets, farmer's markets, specialty food shops, and pharmacies) given that, compared to other places, is least likely to have been directly connected to lockdowns (in most countries lockdowns did not apply to essential places), while especially in periods of extreme crisis, it can be taken to reflect people's beliefs and confidence about the future. We use the trend component of this series by applying a Hodrick-Prescott filter to the raw data since daily observations are likely to

[2] https://www.google.com/covid19/mobility/.

contain a large amount of short-run variability that may cause problems of interpretation regarding people's sentiments/expectations.[3] The sample consists of 26 EU economies,[4] plus the UK, for two periods (of equal length), i.e., 17/2/2020-30/11/2020 and 17/12/2020-30//9/2021, which correspond to the pandemic's pre- and post-vaccine phases. Focusing on these two periods allows us to investigate how the initiation of the vaccination process has affected the outcomes.[5]

Regarding the right-hand side variables in the MNL regressions to explain convergence clubs, we use proxies for cross-country dissimilarities in key elements of the Covid-19 period: (1) strictness of controls leading to income risks through worsened macroeconomic conditions and/or mortality risks through a realization of the pandemic's severity (Chan et al. 2020; Coibion et al. 2020a, b; Fetzer et al. 2021; Dergiades et al. 2022), (2) intensity of fiscal measures to support incomes and the unemployed (Chen et al. 2021a, b; Chudik et al. 2021), and (3) magnitude of changes in the cost of borrowing through monetary easing by the central banks (Li et al. 2021). As a proxy for restrictions and controls, we use the Hale et al. (2021) stringency index (OxCGRT Database),[6] which records the overall strictness of government-imposed 'lockdown-type' measures during the pandemic, and takes values between 0 and 100. Although in most countries, 'lockdowns' were not applied directly to essential places, they are expected to have affected people's sentiments/ expectations indirectly, through anticipations of lower incomes due to the slowdown of economic activity and/or infection-induced mortality risks by reflecting the pandemic's contagiousness. To isolate effects resulting from mortality-related risks, the interaction of the restrictions variable with the announced number of new Covid-19 fatalities is included in the set of regressors, with the respective fatality data obtained from ECDC (European Center for Disease Prevention & Control).[7] Fiscal measures to mitigate the pandemic's adverse economic consequences are proxied by the Hale et al. (2021) OxCGRT economic-support index,[8] which records how the intensity of fiscal support by governments has varied across countries and includes income support as well as debt relief. This index also takes values in the range of 0–100, and a higher value indicates greater support. To proxy monetary easing by the central banks, we use data on a set of short-term interest rates (1-, 6- and 12-month money market rates), obtained from Eurostat (*Economy & Finance Database*)[9] and measured as deviations from pre-Covid-19 levels (values in 2019).[10] To allow for cumulative effects on sentiments/expectations of the pandemic's various aspects, right-hand-side variables in

[3] The Phillips-Sul panel-convergence methodology requires no assumptions regarding the stationarity of the variable of interest and/or the presence of common factors.

[4] Cyprus is not included due to data unavailability.

[5] We have avoided examining a later equal-length period given that the initiation of the Ukraine-Russian conflict in February 2022 could introduce bias in the comparability of the results.

[6] Stringency index, https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker.

[7] https://www.ecdc.europa.eu/en/covid-19/data.

[8] Economic support index, https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker.

[9] https://ec.europa.eu/eurostat/data/database, series IRT_ST_M.

[10] Human mobility to essential places is measured relative to a pre-Covid-19 baseline, while the right-hand-side variables in the MNL model either directly reflect developments due to Covid-19 (have zero values in the pre-Covid-19 period), or in the case of interest rates are measured as deviations from 2019 levels.

Table 1 Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
Panel A: Variables in convergence testing					
Changes in human mobility to essential places (relative to a pre-Covid-19 baseline, %)					
1st period	7776	− 5.92	7.78	− 30.12	18.84
2nd period	7776	4.535	11.585	− 32.045	41.274
Panel B: Explanatory variables in MNL regressions					
Restrictions	486	55.887	15.967	18.101	95.436
Announced new Covid-19 fatalities (per 10,000 population)	486	0.391	0.613	0	4.302
Fiscal support	486	68.015	23.326	0	100.00
Interest rates, 1-month (in deviations from 2019 levels)	468	− 0.246	0 .484	− 1.86	1.35
Interest rates, 6-month (in deviations from 2019 levels)	450	− 0.258	0.505	− 1.86	1.61
Interest rates, 12-month (in deviations from 2019 levels)	432	− 0.298	0.481	− 1.80	2.04

The sample covers 26 EU economies (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden) plus the UK. Daily data relative to a pre-Covid-19 baseline are used in panel-convergence testing (first period:17/2/2020–30/11/2020; second period: 17/12/2020–30/9/2021). Monthly averages of explanatory variables are used in MNL regressions (first period: March-November 2020; second period: January–September 2021)

the MNL regressions are measured as monthly averages. Moreover, as the Phillips-Sul convergence testing procedure discards the first 5% of observations, the sample period in MNL regressions is March-November 2020 and January–September 2021.

Descriptive statistics are shown in Table 1. The table suggests considerable cross-country heterogeneity in people's behavior during the period considered (Panel A),[11] as well as diversity in the extent of restrictions and fiscal support, with fiscal support showing greater diversity than restrictions (Panel B). The table also indicates variations

Footnote 10 continued
As a result, given the before-after approach in both the first and the second part of the empirical analysis, structural or other time-invariant characteristics of countries are absorbed.

[11] For a graphical representation, see Fig. 1 (Appendix).

Table 2 Convergence of sentiments/expectations, 17 February-30 November 2020

	Countries	β coefficient	$t_{\hat{\beta}}$
Full sample	26 EU countries plus the UK	− 2.696	− 4.910
First club	Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Latvia, Lithuania, The Netherlands, Sweden	− 1.447	− 1.470
Second club	France, Spain	− 0.479	− 1.565
Third club	Belgium, Italy, Malta, Slovakia	0.473	4.385
Fourth club	Austria, Luxembourg, UK	0.192	1.088
Fifth group–non-converging	Poland, Portugal, Romania, Slovenia	− 2.626	− 19.153

Panel-convergence testing; the first 5% of observations are discarded

Table 3 Club-merging test, 17 February-30 November 2020

Club	β coefficient	$t_{\hat{\beta}}$
Club 1 + 2	− 1.663	− 10.382
Club 2 + 3	− 1.049	− 1.693
Club 3 + 4	− 0.606	− 3.080
Club 4 + non-conv	− 1.995	− 10.979

in interest rates, although overall the data show a decrease in the cost of borrowing relative to pre-covid levels.[12]

4 Results

The results regarding the convergence/divergence of people's behavior during the pandemic's pre- and post-vaccine phases are presented, respectively, in Tables 2, 3, 4, 5 and 6. The tables show that responses to Covid-19 across the European economies have not been uniform. Starting from the pre-vaccine phase, the logt statistic in the first row of Table 2 is − 4.910, implying a violation of the full convergence hypothesis. Applying the Phillips-Sul club-clustering procedure reveals four distinct convergence clubs and one non-converging group (2nd–5th rows). The first club consists of Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Latvia, Lithuania, The Netherlands and Sweden. France and Spain form a separate, second, club. A third club consists of Belgium, Italy, Malta, and Slovakia. Austria, Luxembourg and the UK belong to a fourth club, while Poland, Portugal, Romania and Slovenia do not converge at all. To check the robustness of these results, following

[12] Panel-unit-root tests for the variables are shown in Table 9 (Appendix).

Table 4 Convergence of sentiments/expectations, 17 December 2020—30 September 2021

	Countries	β coefficient	$t_{\hat{\beta}}$
Full sample	26 EU countries plus the UK	– 0.741	– 201.608
First club	Greece, Lithuania, Portugal	0.107	1.105
Second club	Croatia, Poland	0.011	0.130
Third club	Belgium, Bulgaria, Czech Republic, Estonia, France, Germany, Hungary, Ireland, Latvia, Malta, Romania, Slovenia, Slovakia	0.083	1.186
Fourth club	Austria, Finland, Italy, Luxembourg, The Netherlands, Spain, Sweden	0.196	18.516
Fifth club	Denmark, UK	1.593	9.616

Panel-convergence testing; the first 5% of observations are discarded

Table 5 Club-merging test, 17 December 2020–30 September 2021

Club	β coefficient	$t_{\hat{\beta}}$
Club 1 + 2	0.005	0.059
Club 2 + 3	– 0.329	– 18.204
Club 3 + 4	– 0.168	– 33.342
Club 4 + non-conv	– 0.011	– 2.281

Table 6 Final club classification, 17 December 2020–30 September 2021

	Countries	β coefficient	$t_{\hat{\beta}}$
First club	Croatia, Greece, Lithuania, Poland, Portugal	0.005	0.059
Second club	Belgium, Bulgaria, Czech Republic, Estonia, France, Germany, Hungary, Latvia, Malta, Romania, Slovenia, Luxembourg, The Netherlands	0.083	1.186
Third club	Austria, Finland, Italy, Ireland, Slovakia, Spain, Sweden	0.196	18.516
Fourth club	Denmark, UK	1.593	9.616

Phillips and Sul (2009), we consider merging adjacent sub-clubs into larger groups and the club-merging results are shown in Table 3. The null hypothesis is rejected for all initial clubs, indicating that they cannot be merged into larger groups.

Turning to the post-vaccine phase, again full convergence is violated as the logt statistic in the first row of Table 4 is – 201.608. For this period, the Phillips-Sul testing procedure suggests five convergence clubs. The first and second clubs consist, respectively, of Greece, Lithuania and Portugal, and Croatia, Poland. A third club comprises

Belgium, Bulgaria, Czech Republic, Estonia, France, Germany, Hungary, Ireland, Latvia, Malta, Romania, Slovenia and Slovakia. Austria, Finland, Italy, Luxembourg, The Netherlands, Spain and Sweden belong to the fourth club, and Denmark and the UK to a fifth club. Compared to Table 2, several of these clubs consist of different economies. For example, Denmark, Finland, Croatia and Sweden, which previously belonged together to the first club, have now moved to other groups. France and Spain, which, during February-November 2020, constituted a separate convergence group, have also moved to different clubs. At the same time, Denmark and the UK now form a separate club of convergence. Moreover, the Phillips-Sul robustness test in Table 5 suggests merging only the initial first and second clubs into a larger group, and the results for the final club classification are reported in Table 6.

Overall, Table 6 suggests no drastic switch toward greater convergence of sentiments/ expectations across the European economies following the initiation of vaccinations. Indeed, while, compared to Table 2, Poland, Portugal, Romania and Slovenia now do not form a non-converging group, other countries have simply changed groupings. Only Bulgaria, the Czech Republic, Estonia, Germany, Hungary and Latvia belong together to the same club in both periods considered.

Which aspects of the Covid-19 pandemic are responsible for the distinct convergence clubs obtained in Tables 2 and 6? Why have club memberships changed during the pandemic's post-vaccine phase? To what extent have fiscal- and/or monetary-policy interventions contributed to greater harmonization? We proceed to examine these questions in a probabilistic context that allows for nonlinearities, using MLN regressions, with the various club categories as a dependent variable, and the proxies for restrictions, (res), infection-related mortality risks, $(res * mrisk)$, fiscal support, $(fiscal)$, and cost of borrowing, $(interestrates)$, as explanatory variables. The estimation results are presented in Tables 7 and 8. The largest club in each period is treated as the base/reference club. RRR coefficients (and corresponding standard errors) are reported in all columns of the tables.

Starting from Table 7, the results suggest that an important factor behind the distinct country-groups during the pre-vaccine period has been the differentiated effects through the pandemic psychology, i.e., expectations of income loss due to business closures and/or risks of infection-induced mortality. Thus, in the case of Club 2, holding constant the other variables, (res) has, throughout columns (1)-(4), a significant coefficient that exceeds unity, suggesting that, for the countries of this club, economic anxiety and/or the perceived Covid-19 contagiousness mattered more for people's sentiments compared to the base club. The probability of membership in Club 3 rather than in the base club is also significantly related to the (res) variable, whose coefficient in these columns exceeds unity. The same applies to Club 5, where (res) significantly enters into columns (1)-(4) with a coefficient greater than one. At the same time, for the countries of Club 2, both (res) and $(res * mrisk)$ in columns (5)–(7) have significant and greater-than-unity coefficients, implying differentiated responses relative to the base club due both to generalized economic uncertainty and risks of infection-related mortality. Compared to the base club, mortality risks also appear to have played a relatively important role for the countries of Club 3 as the coefficient of $(res * mrisk)$ in columns (7)–(8) is greater than unity and statistically significant.

Table 7 Convergence clubs and the role of cross-country differences in key developments during Covid-19, March-November 2020

Dependent variable	Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CLUB 2	(*res*)	1.042*** (2.93)	1.042*** (2.74)	1.041*** (2.67)	1.038*** (2.51)	1.027*** (2.08)	1.025*** (1.77)	1.024*** (1.66)	1.016 (1.12)
	(*res*mrisk*)					1.008*** (2.05)	1.008*** (2.12)	1.008*** (2.18)	1.011*** (2.51)
	(*fiscal*)	1.017 (1.47)	1.020 (1.59)	1.020 (1.56)	1.019 (1.54)	1.015 (1.27)	1.018 (1.41)	1.019 (1.40)	1.017 (1.31)
	(*interest rates*)		1.416 (0.73)	1.727 (1.09)	2.576*** (1.75)		1.645 (0.98)	1.941 (1.30)	3.460*** (2.20)
CLUB 3	(*res*)	1.027*** (2.29)	1.026*** (2.04)	1.025*** (1.96)	1.022*** (1.75)	1.016 (1.24)	1.014 (0.94)	1.013 (0.86)	1.005 (0.31)
	(*res*mrisk*)					1.007 (1.56)	1.007 (1.58)	1.007*** (1.67)	1.010*** (2.09)
	(*fiscal*)	1.009 (1.00)	1.011 (1.20)	1.011 (1.21)	1.010 (1.14)	1.008 (0.82)	1.010 (1.06)	1.010 (1.07)	1.008 (0.91)
	(*interest rates*)		1.316 (0.63)	1.713 (1.30)	2.594*** (2.11)		1.453 (0.80)	1.855 (1.32)	3.366*** (2.52)
CLUB 4	(*res*)	0.992 (-0.56)	0.984 (-0.98)	0.983 (-0.99)	0.982 (-1.08)	0.985 (-0.84)	0.997 (-1.14)	0.976 (-1.17)	0.973 (-1.37)
	(*res*mrisk*)					1.004 (1.06)	1.004 (0.96)	1.005	1.006 (1.30)
	(*fiscal*)	1.102*** (2.95)	1.108*** (2.87)	1.109*** (2.85)	1.107*** (2.75)	1.102*** (2.95)	1.108*** (2.88)	(1.02) 1.110*** (2.86)	1.106*** (2.77)
	(*interest rates*)		0.485 (-1.16)	0.716 (-0.64)	0.857 (-0.31)		0.497 (-1.15)	0.721 (-0.65)	0.899 (-0.22)

Table 7 (continued)

Dependent variable	Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CLUB 5	(*res*)	1.027***	1.032***	1.035***	1.030***	1.025***	1.036***	1.039***	1.034***
		(2.16)	(2.43)	(2.53)	(2.23)	(1.75)	(2.48)	(2.61)	(2.22)
	(*res*mrisk*)					1.002	0.998	0.997	0.998
						(0.36)	(-0.37)	(-0.44)	(-0.27)
	(*fiscal*)	0.992	0.991	0.990	0.991	0.992	0.992	0.991	0.991
		(-0.96)	(-1.08)	(-1.19)	(-1.11)	(-0.99)	(-0.98)	(-1.10)	(-1.08)
	(*interest rates*)		0.163***	0.178***	0.198***		0.155***	0.170***	0.193***
			(-3.10)	(-3.43)	(-3.41)		(-3.31)	(-3.69)	(-0.27)
	Observations	243	234	225	216	243	234	225	216
	Wald X***	28.74	72.26	57.63	58.01	33.06	82.27	71.56	72.55
	Pseudo-R***	0.092	0.136	0.142	0.140	0.100	0.145	0.152	0.153

MLN estimation. The dependent variable represents the distinct convergence clubs (*CLUB 1* = base/reference club). The explanatory variables are measured as monthly averages, and either directly reflect developments due to Covid-19, or in the case of interest rates are measured as deviations from 2019 levels. Coefficient estimates are relative risk ratios (RRR), thus indicating how likely/unlikely is the emergence of a club other than the base club due to the cross-country similarities/dissimilarity in the key aspects of the Covid-19 period. A significantly greater- than-unity RRR coefficient on an explanatory variable implies that this variable increases the probability of membership in a club other than the base club. Numbers in parentheses are z-scores (single, double, and triple asterisks correspond to statistical significance at 10%, 5%, and 1%, respectively). Robust standard errors are shown in all specifications. Columns (2) and (6), (3), and (7), and (4) and (8), use, respectively, 1-, 6-, and 12-month interest rates

Table 8 Convergence clubs and the role of cross-country differences in key developments during Covid-19, January–September 2021

Dependent variable	Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CLUB 1	(*res*)	1.008	1.023	1.022	1.022	1.009	1.032	1.030	1.029
		(0.63)	(1.52)	(1.47)	(1.43)	(0.59)	(1.53)	(1.50)	(1.39)
	(*res*mrisk*)					0.999	0.994	0.994	0.996
						(-0.19)	(– 0.70)	(– 0.68)	(– 0.53)
	(*fiscal*)	1.028***	1.057***	1.057***	1.067***	1.028***	1.057***	1.056***	1.066***
		(3.47)	(6.06)	(6.03)	(5.74)	(3.47)	(6.06)	(6.03)	(5.71)
	(*interest rates*)		0.889	0.867	0.985		0.864	0.845	0.959
			(– 0.31)	(– 0.37)	(– 0.04)		(– 0.37)	(– 0.42)	(– 0.10)
CLUB 3	(*res*)	1.014	1.017	1.021***	1.033***	1.032***	1.038***	1.040***	1.046***
		(1.32)	(1.41)	(1.80)	(2.19)	(2.34)	(2.46)	(2.61)	(2.56)
	(*res*mrisk*)					0.985***	0.985***	0.987***	0.990
						(– 1.96)	(– 2.13)	(– 1.92)	(– 1.25)
	(*fiscal*)	1.059***	1.088***	1.082***	1.137***	1.058***	1.089***	1.082***	1.136***
		(5.43)	(5.91)	(5.78)	(8.37)	(5.46)	(6.20)	(5.95)	(8.51)
	(*interest rates*)		23.092***	11.521***	28.241***		32.331***	13.408***	29.341***
			(5.15)	(5.19)	(5.67)		(5.36)	(5.24)	(5.71)
CLUB 4	(*res*)	1.008	1.007	1.008	1.009	1.032	1.030	1.031	1.029
		(0.48)	(0.40)	(0.44)	(0.47)	(1.44)	(1.21)	(1.25)	(1.16)
	(*res*mrisk*)					0.978	0.982	0.981	0.983
						(– 1.05)	(– 1.00)	(– 0.99)	(– 0.93)
	(*fiscal*)	1.028***	1.038***	1.036***	1.043***	1.028***	1.038***	1.035***	1.042***
		(1.66)	(2.12)	(2.01)	(2.03)	(1.66)	(2.10)	(1.99)	(1.98)
	(*interest rates*)		2.037***	1.573	2.144***		1.931	1.440	2.007***
			(1.86)	(1.25)	(1.99)		(1.54)	(0.92)	(1.67)

Table 8 (continued)

Dependent variable	Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Observations	243	234	225	216	243	234	225	216
	Wald X***	37.78	81.74	86.95	96.37	46.69	91.76	92.24	114.35
	Pseudo-R***	0.094	0.183	0.173	0.242	0.106	0.193	0.182	0.247

MLN estimation. The dependent variable represents the distinct convergence clubs ($CLUB\ 2 =$ base/reference club). The explanatory variables are measured as monthly averages, and either directly reflect developments due to Covid-19, or in the case of interest rates are measured as deviations from 2019 levels. Coefficient estimates are relative risk ratios (RRR), thus indicating how likely/unlikely is the emergence of a club other than the base club due to the cross-country similarities/dissimilarity in the key aspects of the Covid-19 period. A significantly greater- than-unity RRR coefficient on an explanatory variable implies that this variable increases the probability of membership in a club other than the base club. Numbers in parentheses are z-scores (single, double, and triple asterisks correspond to statistical significance at 10%, 5%, and 1%, respectively). Robust standard errors are shown in all specifications. Columns (2) and (6), (3) and (7), and (4) and (8), use, respectively, 1-, 6- and 12-month interest rates

On the other hand, only in one case in Table 7, i.e., Club 4, is the coefficient estimate of $(fiscal)$ significantly greater than unity, suggesting that, during the pandemic's initial phase, heterogeneities in the extent of fiscal interventions have not been a crucial factor behind the differentiated sentiments/expectations of populations across the entire set of countries considered. Moreover, columns (2)–(4) and columns (6)–(8) suggest a weak differential response of households across the sample countries to the monetary easing by the central banks. Only in the case of Clubs 2 and 3, when the 12-month interest rate is used, does significant divergence from the base club occurs (columns (4) and (8)). For these two clubs, the coefficients of 1- and 6-month interest rates, albeit greater than unity, are statistically insignificant at conventional levels [columns (2)–(3) and (6)–(7)]. In the case of Club 4, all interest rates have statistically insignificant coefficients, while in the case of Club 5 the respective coefficients indicate resemblance with the base club. One explanation for this weak sensitivity of country groupings to the change in borrowing costs is that in both eurozone and non-eurozone economies, interest rates were already quite low just before the pandemic's outbreak in January 2020, so their further drop during March–November 2020 generated no considerable additional optimism and thus did not lead to differentiated cross-country patterns.

The results in Table 8 are different. The table suggests that during January–September 2021, an important factor behind the club-convergence pattern in people's behavior across EU has been the differential intensity of fiscal support policies. Thus, both in columns (1)–(4) and in columns (5)–(8), fiscal support increases the probability of having Club 1 as a distinct country group compared to the base club. The estimates in columns (1)–(4) or columns (5)–(8) also indicate a higher probability of membership in Club 3 rather than in the base club through the fiscal variable. Similarly, in these columns, the likelihood of countries belonging to Club 4 and not to the base club is related to fiscal support. More generally, throughout Table 8, the coefficient of $(fiscal)$ is significantly greater than unity, regardless of the interest rate used, suggesting that, during the pandemic's second phase, fiscal interventions were effective in changing expectations at the country level, but at the same time, differences in the extent or duration of these interventions constituted a source of diversity in people's sentiments across the sample economies. By contrast, compared to March–December 2020, convergence clubs in Table 8 appear to be less sensitive to the interaction term $(res * mrisks)$, probably due to the quite synchronous initiation of vaccinations in Europe, which reduced mortality risks. Indeed, in Table 8, $(res * mrisks)$ is statistically significant only in the case of Club 2, and its coefficient estimate implies resemblance with the base club. For this particular club, the (res) variable in columns (5)-(8) has a greater-than-unity coefficient, indicating divergence from the base club due to differentiated expectations regarding income losses.

With respect to the changes in the cost of borrowing, the differential cross-country impact during January–September 2021 appears to be marginally stronger compared to March-November 2020. We can see, for example, that in the case of Club 3 in Table 8 [columns (2)–(4) and (6)–(8)], divergence from the base club is significantly related to all interest rates (i.e., 1-, 6-, and 12-months). Divergence from the base club also applies to the countries belonging to Club 4, where 12- or 1-month rates in columns (2), (4), and (8) are statistically significant, with coefficients exceeding one.

Overall, the results indicate differentiated impacts of Covid-19 on sentiments/expectations across the sample countries, which were not drastically reduced after the initiation of the vaccination programs or through the implementation of support policies. In the context of the European Union, and given the close connection between sentiments/expectations and economic outcomes, this is a matter of concern as it suggests that the pandemic has disrupted the harmonization process. It also leads to the contention that automatic EU-level fiscal-support mechanisms may need to be designed, so that potential asymmetries across the member-state economies due to future shocks are quickly and effectively dealt with.

5 Conclusions

The pandemic of Covid-19 had adverse effects on many economies, causing a contraction in per capita GDP of 4.7% on average in the OECD countries and 6.1% in the EU (IMF 2022). To support households and firms, governments launched fiscal programs that included tax deferrals, debt relief, and wage subsidies or unemployment benefits. Central banks sought to reinforce these actions by providing access to low-cost short-term borrowing through asset purchase programs and other bank-refinancing operations. But have these interventions contributed to reducing the asymmetric impacts of Covid-19 across economies and achieved greater cross-country convergence?

While a large body of literature assesses the pandemic's consequences, there is a lack of systematic empirical evidence on how Covid-19 has affected the convergence of economies and whether policy interventions have contributed to a greater harmonization. The issue is of particular relevance in the EU where harmonization is an explicit objective.

Although EU convergence has been a subject of extensive analysis in the past, recent studies examining the convergence/divergence of member economies during Covid-19 are limited and are mostly based on a comparison of coefficients of variation for selected macroeconomic variables between 2020–2021 and 2019. On the other hand, the connection between people's behavioral responses to shocks and the economy, particularly through income anxiety or job insecurity, has long been stressed in the literature (Hendren 2017; Kuchler & Zafar 2019; Bailey et al. 2019; Coibion et al. 2021). Especially during the recent pandemic crisis, a number of studies find that individuals' behavior toward Covid-19 played an important role in determining economic-activity outcomes (Andersen et al. 2020; Fana et al 2020; Cox et al. 2020; Hacıoğlu-Hoke et al. 2021; Chen et al. 2021a, b; Carvalho et al. 2021; Fetzer et al. 2021; Kapetanios et al. 2022).

This study has sought to contribute to the literature on the pandemic's impacts by focusing on the convergence/divergence of people's behavior toward Covid-19 and by examining channels through which the pandemic could have increased dissimilarities in households' beliefs and sentiments in the EU economies. While our study is related to the contributions of, e.g., Abrhálm & Vošta, 2022; Fedajev et al. 2022, Holobiuc & Miron (2022), and De Haan et al. (2023), which also assess EU convergence during Covid-19, it differs from this literature both in terms of focus and in terms of methodology. In terms of focus, instead of projected macroeconomic aggregates, we examine convergence in sentiments/expectations, which are important channels of transmission of shocks to the economy through spending and labor-supply decisions. In terms of methodology, instead of examining yearly-based coefficients of variation or other similar dispersion measures, we use high-frequency data and a panel-convergence methodology that allows for heterogenous transitional dynamics and can identify which countries are drifting toward greater or less convergence over time. Moreover, using multinomial logit regressions, we examine aspects of the Covid-19 period that could have increased the probability of dissimilar beliefs/sentiments among households in the EU economies, including differential intensities of fiscal- and monetary support measures. Evidence on the role of fiscal- and monetary support measures in cross-country convergence/divergence during Covid-19 is lacking, and this applies to both non-EU and EU economies.

Our findings indicate a heterogeneous impact of Covid-19 across Europe, with the analysis suggesting a club-convergence pattern as far as people's expectations are concerned both in the pre- and post-vaccine phases. The results also indicate that fiscal-support policies, while effective in changing expectations at the country level, did not help much to offset the cross-country asymmetric impacts of Covid-19. Especially in the EU context, asymmetric Covid-19 impacts are a matter of concern, given the large dissimilarities across member-state economies even before the pandemic's outbreak and the emphasis of European institutions on the objective of EU-wide harmonization. This suggests that EU policymakers should consider establishing automatic crisis-management mechanisms in the field of fiscal interventions that would enable a more coordinated response to future shocks like Covid-19 and increase member states' capacity to overcome them quickly.

Funding Open access funding provided by HEAL-Link Greece.

Appendix

See Fig. 1 and Table 9.

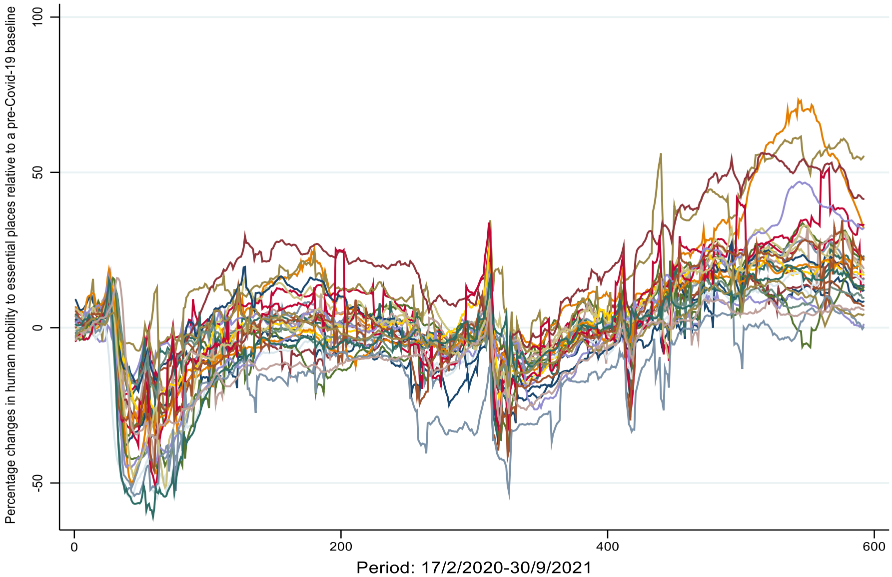

Fig. 1 Changes in human mobility to essential paces relative to a pre-Covid-19 baseline (%), 17/2/2020–30/9/2021

Table 9 Panel unit-root tests results

Variable	(1)	(2)	(3)
Changes in human mobility to essential places, (relative to a pre-Covid-19 baseline, %)	78.91*** (0.015)	213.55*** (0.000)	134.42*** (0.000)
Restrictions	197.68*** (0.000)	253.82*** (0.000)	123.87*** (0.000)
Announced new Covid-19 fatalities (per 10,000 population)	204.95*** (0.000)	231.47*** (0.000)	149.48*** (0.000)
Fiscal support	85.10*** (0.004)	142.37*** (0.000)	69.69*** (0.074)
Interest rates, 1-month (deviations from 2019 levels)	74.75*** (0.021)	172.53*** (0.000)	72.80*** (0.019)
Interest rates, 6-month (deviations from 2019 levels)	353.66*** (0.000)	213.78*** (0.000)	76.33*** (0.015)
Interest rates, 12-month (deviations from 2019 levels)	120.08*** (0.000)	322.65*** (0.000)	74.92*** (0.020)

Fisher-type test based on augmented Dickey–Fuller (ADF) tests (column (1) with cross-sectional means included, column (2) with a drift term included, and column (3) with a time trend). The null hypothesis is that all panels contain unit roots against the alternative that at least one panel is stationary. The test is based on the inverse Chi-squared, which is applicable when the number of panels is finite (Choi 2001). Single, double, and triple asterisks correspond to statistical significance at 10%, 5%, and 1%, respectively (*p* values in parenthesis)

References

Abrhám J, Vošta M (2022) Impact of the COVID-19 pandemic on EU convergence. J Risk Financ Manag 15:384–398

Acemoglu D, Chernozhukov V, Werning I, Whinston MD (2020) A multi-risk SIR model with optimally targeted lockdown, Vol 2020. National Bureau of Economic Research, Cambridge, MA

Al-Awadhi AM, Alsaifi K, Al-Awadhi A, Alhammadi S (2020) Death and contagious infectious diseases: impact of the COVID-19 virus on stock market returns. J Behav Exp Financ 27:100326

Albanesi S, Kim J (2021) The gendered impact of the COVID-19 recession on the US labor market. NBER Working Paper 28505

Alcidi C, Corti F, Postica D, Di Salvo M, Maftei A (2023) Promoting social cohesion and convergence: EU convergence: Geographical dimension, impact of COVID-19 and the role of policy. Research Report, European Foundation for the Improvement of Living & Working Conditions

Alfaro L, Chari A, Greenland AN, Schott PK (2020) Aggregate and firm-level stock returns during pandemics, in real time. NBER Working Paper 26950

Andersen AL, Hansen ET, Johannesen N, Sheridan A (2022) Consumer responses to the COVID-19 crisis: evidence from bank account transaction data. Scand J Econ 124:905–929

Andersen AL, Hansen ET, Johannesen N, Sheridan A (2020) Pandemic, shutdown and consumer spending: Lessons from Scandinavian policy responses to COVID-19. arXiv preprint arXiv:2005.04630, Cornell University

Apergis N, Cooray A (2014) Convergence in sovereign debt ratios across heavily indebted EU countries: evidence from club convergence. Appl Econ Lett 21:786–788

Arthi V, Parman J (2021) Disease, downturns, and wellbeing: economic history and the long-run impacts of COVID-19. Explor Econ Hist 79:101381

Ashraf BN (2020) Stock markets' reaction to COVID-19: cases or fatalities? Res Int Bus Financ 54:101249

Bailey M, Dávila E, Kuchler T, Stroebel J (2019) House price beliefs and mortgage leverage choice. Rev Econ Stud 86:2403–2452

Bairoliya N, Imrohoroglu A (2020) COVID-19: mitigation measures and the aftershock in an overlapping generations model. Available at SSRN 3737173.

Baker SR, Bloom N, Davies SJ, Terry SJ (2020) Covid-induced economic uncertainty. NBER Working Paper 26983

Baldwin E, Evenett S (eds) (2020) COVID-19 and trade policy: Why turning inward won't work? CEPR Press, Boca Raton

Barro RJ, Ursúa JF, Weng J (2020) The coronavirus and the great influenza pandemic: lessons from the "spanish flu" for the coronavirus's potential effects on mortality and economic activity. NBER Working Paper 26866

Batini N, Lamperti F, Roventini A (2020) Reducing risk while sharing it: a fiscal recipe for the EU at the time of COVID-19. IMF Working Paper WP/20/181

Beylunioğlu FC, Yazgan ME, Stengos T (2020) Detecting convergence clubs. Macroecon Dyn 24:629–669

Bianchi F, Bianchi G, Song D (2023) The long-term impact of the COVID-19 unemployment shock on life expectancy and mortality rates. J Econ Dyn Control 146:104581

Bounie D, Camara Y, Fize E, Galbraith J, Landais C, Lavest C, Savatier B (2020) Consumption dynamics in the covid crisis: real time insights from French transaction bank data. Covid Econ 59:1–39

Carvalho VM, Garcia JR, Hansen S, Ortiz Á, Rodrigo T, Rodríguez Mora JV, Ruiz P (2021) Tracking the COVID-19 crisis with high-resolution transaction data. R Soc Open Sci 8:210218

Chan HF, Skali A, Savage DA, Stadelmann D, Torgler B (2020) Risk attitudes and human mobility during the COVID-19 pandemic. Sci Rep 10:1–13

Chen H, Wenlan Q, Qiang W (2021a) The impact of the COVID-19 pandemic on consumption: Learning from high-frequency transaction data. AEA Pap Proc 111:307–311

Chen C, Shi Y, Zhang P, Ding C (2021b) A cross-country comparison of fiscal policy responses to the COVID-19 global pandemic. J Comp Policy Anal Res Pract 23:262–273

Choi I (2001) Unit root tests for panel data. J Int Money Fin 20(2):249–272

Chudik A, Mohaddes K, Raissi M (2021) Covid-19 fiscal support and its effectiveness. Econ Lett 205:109939

Coibion O, Gorodnichenko Y, Weber M (2020) Labor markets during the COVID-19 crisis: a preliminary view. NBER Working Paper 27017

Coibion O, Gorodnichenko Y, Weber M (2020) The cost of the covid-19 crisis: Lockdowns, macroeconomic expectations, and consumer spending. NBER Working Paper No. 27141

Coibion O, Georgarakos D, Gorodnichenko Y, van Rooij M (2021) How does consumption respond to news about inflation. NBER Working Paper No. 26106
Costa Dias M, Joyce R, Postel-Vinay F, Xu X (2020) The challenges for labour market policy during the Covid-19 pandemic. Fisc Stud 41(2):371–382
Cox N, Ganong P, Noel P, Vavra J, Wong A, Farrell D, Greig F, Deadman E (2020) Initial impacts of the pandemic on consumer behavior: evidence from linked income, spending, and savings data. Brook Pap Econ Act 2:35–82
D'Acunto F, Hoang D, Weber M (2022) Managing households' expectations with unconventional policies. Rev Financ Stud 35:1597–1642
Deb P, Furceri D, Ostry JD, Tawk N (2022) The economic effects of COVID-19 containment measures. Open Econ Rev 33:1–32
Dergiades T, Milas C, Mossialos E, Panagiotidis T (2022) Effectiveness of government policies in response to the first COVID-19 outbreak. PLOS Global Public Health 2:1–19
Dergiades T, Milas C, Mossialos E, Panagiotidis T (2023) COVID-19 anti-contagion policies and support measures in the USA. Oxf Econ Pap 75:613–630
Eichenbaum MS, Rebelo S, Trabandt M (2020) The macroeconomics of epidemics. NBER Working Paper 26882
Famiglietti M, Leibovici F (2022) The impact of health and economic policies on the spread of COVID-19 and economic activity. Eur Econ Rev 144:104087
Fana M, Torrejón Pérez S, Fernández-Macías E (2020) Employment impact of Covid-19 crisis: from short term effects to long terms prospects. J Ind Bus Econ 47:391–410
Fedajev A, Radulescu M, Babucea AG, Mihajlovic V, Yousaf Z, Milićević R (2022) Has COVID-19 pandemic crisis changed the EU convergence patterns? Econ Res 35:2112–2141
Feng S, Kirkley A (2021) Integrating online and offline data for crisis management: online geolocalized emotion, policy response, and local mobility during the COVID crisis. Sci Rep 11:1–14
Fetzer T, Hensel L, Hermle J, Roth C (2021) Coronavirus perceptions and economic anxiety. Rev Econ Stat 103:968–978
Free C, Hecimovic A (2021) Global supply chains after COVID-19: The end of the road for neoliberal globalisation? Account Audit Account J 34:58–84
Goldbach S, Nitsch V (2022) Covid-19 and capital flows: The responses of investors to the responses of governments. Open Econ Rev 33:751–774
Gräbner C, Heimberger P, Kapeller J (2020) Pandemic pushes polarisation: the Corona crisis and macroeconomic divergence in the Eurozone. J Ind Bus Econ 47:425–438
De Haan J, Jacobs JP, Zijm R (2023) Coherence of output gaps in the Euro area: The impact of the COVID-19 shock. Eur J Polit Econ 102369 (in press)
Hacıoğlu-Hoke S, Känzig DR, Surico P (2021) The distributional impact of the pandemic. Eur Econ Rev 134:103680
Hale T, Angrist N, Goldszmidt R, Kira B, Petherick A, Phillips T, Webster S, Cameron-Blake E, Hallas L, Majumdar S, Tatlow H (2021) A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5:529–538
Hendren N (2017) Knowledge of future job loss and implications for unemployment insurance. Am Econ Rev 107:1778–1823
Heyden K, Heyden T (2021) Market reactions to the arrival and containment of COVID-19: an event study. Financ Res Lett 38:101745
Holobiuc AM, Miron D (2022) Economic and social cohesion in the European Union: rhetoric and reality. Proc Int Conf Bus Excell 16:1015–1026
Huang X, Li Z, Jiang Y, Li X, Porter D (2020) Twitter, human mobility, and covid-19. arXiv preprint arXiv:2007.01100
IMF (2022) World Economic Outlook, October 2022
Jordà Ò, Singh SR, Taylor AM (2022) Longer-run economic consequences of pandemics. Rev Econ Stat 104:166–175
Kapetanios G, Neuteboom N, Ritsema F, Ventouri A (2022) How did consumers react to the COVID-19 pandemic over time? Oxf Bull Econ Stat 84:961–993
Klose J, Tillmann P (2021) COVID-19 and financial markets: a panel analysis for European countries. J Econ Stat 241:297–347
Kuchler T, Zafar B (2019) Personal experiences and expectations about aggregate outcomes. J Finance 74:2491–2542

Li Y, Sun Y, Chen M (2021) An evaluation of the impact of monetary easing policies in times of a pandemic. Front Public Health 8:627001

Li Y, Zeng Y, Liu G, Lu D, Yang H, Ying Z, Hu Y, Qiu J, Zhang C, Fall K, Fang F (2022) Public awareness, emotional reactions and human mobility in response to the COVID-19 outbreak in China: a population-based ecological study. Psychol Med 52:1793–1800

Makin AJ, Layton A (2021) The global fiscal response to COVID-19: risks and repercussions. Econ Anal Policy 69:340–349

McKibbin W, Fernando R (2021) The global macroeconomic impacts of COVID-19: seven scenarios. Asian Econ Pap 20:1–30

Muggenthaler P, Schroth J, Sun Y (2021) The heterogeneous economic impact of the pandemic across euro area countries. ECB Econ Bull 5/2021

Phillips PCB, Sul D (2007) Transition modeling and econometric convergence tests. Econometrica 7&5:1771–1855

Phillips PCB, Sul D (2009) Economic transition and growth. J Appl Economet 24:1153–1185

Porcher S, Renault T (2021) Social distancing beliefs and human mobility: evidence from Twitter. PLoS ONE 16:e0246949

Sheridan A, Andersen AL, Hansen ET, Johannesen N (2020) Social distancing laws cause only small losses of economic activity during the COVID-19 pandemic in Scandinavia. Proc Natl Acad Sci 117:20468–20473

Stengos T, Yazgan ME, Özkan H (2018) Persistence in convergence and club formation. Bull Econ Res 70:119–138

Van der Wielen W, Barrios S (2021) Economic sentiment during the COVID pandemic: evidence from search behaviour in the EU. J Econ Bus 115:105970