iFeel
A TOOL FOR STUDYING THE EFFECT OF THE PANDEMIC AND THE LOCKDOWN ON SOCIO-ECONOMIC BEHAVIOURS

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1. Introduction

In the early months of 2020, Italy had to face the spread of Covid-19, by intensifying the preventive public health and social distancing measures initially in some restricted areas, and gradually extended to the entire territory, up to the lockdown on 11 March 2020. The pandemic and the lockdown have changed people's lives with important economic, social and health implications. Several studies conducted during the acute phase of the pandemic revealed the negative impact on business and economic outcomes of Italian families. Other surveys showed how Italians have been affected by feelings such as anxiety, boredom, loneliness, panic, and the quality of sleep.

Now that the acute phase has finished it is interesting to measure if and to what extent some attitudes/behaviours and upsets that occurred during the acute phase have persisted over time, or if they have changed, both in an evolutionary and involutional sense, over a short and medium-term period.

In this paper we present the experience of a pilot study that aimed at measuring the impact of the pandemic and the lockdown on the socio-economic behaviour of the Italian population in the short and medium term, by conducting a survey with a smartphone APP. The research design is proposed as a framework to collect longitudinal data, in order to measure the impact of an event as a change over time in the behavioural profile of individuals in everyday life. We also present some analyses on a first extraction of data (in November 2021), with the aim of illustrating the potentiality of the framework proposed.

2. Data and methods

2.1. Research design

The target population is represented by the Italian population aged 14 or over[1]. The survey design is of a longitudinal observational type with repeated measurements during the first year after lockdown, ideally every two months. The survey was conducted by the smartphone APP "iFeel", developed with the ANDROID system. The app was launched by the Communication Office of the University of Milan - Bicocca through institutional social media (Facebook, Twitter, etc.). The survey detected some socio-demographic variables related to the pre and post lockdown. At each measurement, both the current attitude/behaviour and the expected one in the short (two-month window) and long-term (one-year window) were detected. The difference between what the respondent projected and what was achieved in the period considered provides a measure of the gap between observed and expected behaviours.

The framework for recording responses to questionnaires provided by respondents has a one-way client (APP) server (cloud) architecture, to ensure the safety and anonymity of the respondents while preserving the possibility of analysing time series of the same individual. The choice to use smartphones as a client is due to their diffusion, their pervasiveness in daily life and the ease of use to fill out a questionnaire.

The survey is composed of two questionnaires: the first must be filled in just the first time, the second questionnaire is proposed each time the respondent decides to participate. The first questionnaire includes socio-demographic questions: age, gender, zip-code, household size, number of minor children in the household, presence of disabled in the household, and, finally, whether the respondent had been working during the lockdown. The second questionnaire is composed of three sections: the first section aims to capture the discomfort generated by the epidemic (occupational status, having a general discomfort thinking of Covid, having trouble sleeping because of Covid, having contracted Covid, knowing people who came down with Covid, having relatives or friends who died for Covid, changes in working intensity and in economic situation, expectations about future working and economic difficulties, opinions on loosening family and friends relations, and the sense of loneliness); the second section focuses on on-line purchasing behaviours

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[1] The App was initially addressed to the students of the University of Bicocca, however, it was launched through social media (such as Facebook, Twitter and so on) by the Communication Office of the University, therefore it reached people outside the community of the University and its territory.

during the lockdown and intentions to maintain new habits (technology, food, medicines, books music and films, banking insurance and postal services, catering); the third section is meant to detect opinions about constraints and opportunities for own life provided by the pandemic (to critically reconsider aspects of own life, to increase skills and competences in the use of technology, to discover new opportunities for lifestyle improvement, to rediscover relationships and friendships, and to imagine new job opportunities), and to evaluate sentiments about the short/long-term future (fear, uncertainty, opportunity, reconstruction, community, solidarity, poverty, inequality, sustainability, inconsistency).

2.2. *Methods used in the analyses*

To illustrate the potentiality of the framework proposed we analyse three issues addressed in the questionnaire: first, the sense of loneliness following the lockdown, second, we examine the changes in expectations over time about future working situation, own economic situation, and economic situation of family by comparing the first and the last responses given by the respondents, and, finally, we analyse the respondents' sentiments about short and long-term future.

The first item is addressed by applying a robust Poisson regression model to the dichotomous variable "Are you feeling more alone, compared to before the epidemic?". We selected the following covariates: 'Gender', coded "Man" (reference) and "Woman"; 'Age class', coded "< 20", "20-30", "30-40", "40-50", "50-60", "60 or over"; 'Occupational status' at the interview, coded "Working" and "Other"; the dichotomous variables 'Minor children in the household, 'Family relations' (worsened after the lockdown); 'Labour reduction' (after the lockdown); 'Income reduction'; and finally, 'Discomfort score', ranging 0-5, built as the sum of positive answers to having a general discomfort thinking of Covid, having trouble sleeping because of Covid, having contracted Covid, knowing people who came down with Covid, having relatives or friends who died for Covid. Poisson regression was preferred to the logistic regression due to high frequency of outcome and since the prevalence ratio is more interpretable and easier to communicate to non-specialists than the odds ratio (Barros and Hiraka, 2003; Chen *et al.*, 2018). We used a robust estimator for the standard errors to take into account the correlation between repeated measurements.

The second item (i.e., change in expectations over time) is analysed by adopting the method of decomposition of the contingency table of each variable in times 1 and 2 in multiplicative components of the saturated log-linear model, traditionally applied to spatial migration flows in a closed system (Rogers *et al.*, 2002a, 2002b; Rogers *et al.*, 2010; Raymer and Rogers, 2007; Raymer *et al.*, 2006). Here we

transform transition in space to transition in time. Therefore, a contingency table that describes the transition flows n_{ij} from time 1 (O = origin) to time 2 (D = destination), with i and j the categories of the variable can be reproduced by a saturate log-linear model as in equation (1):

$$n_{ij} = T \cdot O_i \cdot D_j \cdot OD_{ij} \tag{1}$$

Where T is the total number of responses ($T = \sum_i \sum_j n_{ij}$), and represents the overall level of responses, O_i and D_j are the proportion of responses to the i-th category in time 1 (origin effect), and the proportion of responses to the j-th category in time 2 (destination effect), respectively.

Then,

$$OD_{ij} = n_{ij}/\left(T \cdot O_i \cdot D_j\right) \tag{2}$$

The interaction component OD_{ij} is defined as the ratio of an observed flow of responses from category i to category j, and the expected flow in the case of no interaction. Interactions greater than one (case of independence) mean association between O_i and D_j. Decomposition adopt the total sum reference coding (Raymer and Rogers, 2007; Rogers *et al.*, 2010).

For the third item, (respondents' sentiments about short and long-term future) we used simple descriptive statistics to compare the share of preferences conferred in first and last responses, to the following words: fear, uncertainty, opportunity, reconstruction, community, solidarity, poverty, inequality, sustainability, inconsistency.

3. Results

3.1. Characteristics of the sample

In November 2021 a first extraction from the data set counts 330 responses, corresponding to 189 individuals (Table 1). Of them, only 83 gave 2 responses.

Although of extremely limited size, the sample extracted looks quite balanced as for the main structural characteristics (Table 2).

Table 1 – *Frequency distribution of individuals by number of responses.*

N. responses	N. Individuals	N. ind. cum.	% cum.
1	106	189	100.0
2	25	83	43.9
3	51	58	30.7
4	4	7	3.7
5	3	3	1.6
Total	189		

Table 2 – *Socio-demographic characteristics of the individuals.*

		Freq.	%
Gender	Women	108	57.1
	Men	81	42.9
Age class	< 25	56	29.6
	25 – 34	32	16.9
	35 – 54	75	38.6
	55 – 64	5	2.6
	>= 65	23	12.2
Working condition	Student	72	38.1
	Self-employed	18	9.5
	Employee	80	42.3
	Retired	12	6.3
	Unemployed	1	0.5
	Other	6	3.2
Family size	1	8	4.2
	2	38	20.1
	>=3	134	75.7
Minors in household	Yes	82	43.3
	No	107	56.6
Disabled in household	Yes	24	12.7
	No	165	87.3
Total obs.		189	100.0

3.2. Some results

We analyse three issues addressed in the questionnaire: first, the sense of loneliness following the lockdown, second, we examine the changes in expectations over time about future working situation, own economic situation, and economic situation of family by comparing the first and the last responses given by the respondents, and, finally, we analyse the respondents' sentiments about short

and long-term future. As aforementioned, these analyses are of illustrative purposes of the potentiality of the framework proposed.

We first analysed the sense of loneliness that arose or worsened due to the lockdown. Table 3 reports the descriptive statistics of the variables used in the analysis. We considered the first answer to the outcome variable 'Are you feeling more alone, compared to before the epidemic?'.

Table 3 – *Frequency distribution of first responses: covariates by dependent variable (%).*

Variables		Are you feeling more alone compared to the epidemic?		
		Yes	No	Total
Gender	Women	67.7	46.9	57.1
	Men	32.3	53.1	42.9
Age class	< 20	10.8	4.2	12.7
	20 - 30	37.6	34.4	32.3
	30 - 40	6.5	9.4	9.0
	40 - 50	20.4	18.8	20.1
	>= 50	24.7	33.3	25.9
Working condition	Working	44.1	59.4	51.9
	Other	55.9	40.6	48.1
Minors in household	No	49.5	63.5	56.6
	Yes	50.5	36.5	43.4
Family relations worsened	No	69.9	88.5	79.4
	Yes	30.1	11.5	20.6
Family size	No	53.8	75.0	64.6
	Yes	46.2	25.0	35.4
	No	65.6	65.6	70.9
Labour activity reduction	Yes	34.4	24.0	29.1
	0	1.1	12.5	6.9
Income reduction	1	17.2	24.0	20.6
	2	41.9	41.7	41.8
Discomfort score [a]	0	1.1	12.5	6.9
	1	17.2	24.0	20.6
	2	41.9	41.7	41.8
	3	24.7	12.5	18.5
	4	7.5	7.3	7.4
	5	7.5	2.1	4.8
Total obs.		93	96	189

Notes.(a) the discomfort score is built as the sum of positive answers to having a general discomfort thinking of Covid, having trouble sleeping because of Covid, having contracted Covid, knowing people who came down with Covid, having relatives or friends who died for Covid

Results of robust Poisson regression model applied to the dependent variable 'Are you feeling more alone, compared to before the epidemic?' (Table 4) show that, holding the other variables constant, women are significantly much likely to

feel increasing alone after the lockdown, than men (the prevalence ratio for women is 1.776 the p.r. for men). Age is not significant. Working is a protective factor against the sense of increasing loneliness (the prevalence ratio for who do not work is 1.523 the p.r. for those who work). The presence of minor children in the household is not significant. The reduction of family relations and labour activity have substantial impact on increasing loneliness (the p.r. for those who have gone through these experiences are respectively 1.402 and 1.502 the p.r. of the others). Conversely, income reduction is not significant. Finally, the more the sense of discomfort caused by the Covid, the higher the sense of increased loneliness.

Table 4 – *Results of the robust Poisson regression. Prevalence Ratios. Response variable: "Are you feeling more alone, compared to before the epidemic?" (reference "No").*

Variables		p.r..
Gender (ref. Men)	Women	1.776***
Age class (ref. <20)	20 - 30	0.875
	30 - 40	0.954
	40 - 50	1.276
	>= 50	0.922
Working condition (ref. Working)	Other	1.523**
Minors in household (ref. No)	Yes	1.197
Family relations worsened (ref. No)	Yes	1.402**
Labour activity reduction (ref. No)	Yes	1.552***
Income reduction (ref. No)	Yes	0.801
Discomfort score	0	1.156**
Constant	4	0.153***
N. Observations		189

*** p<0.01. ** p<0.05. * p<0.1

Then, in we analysed the variables 'Expectations about work', 'Expectations about own economic changes in expectations about future working situation, own economic situation, and economic situation of family by comparing the first and the last responses difficulties', and 'Expectations about the economic difficulties of the family' are coded as "worsening", "stability" and "improvement". From Table 5 we can draw interesting features. In the general framework where stability prevails in both the two times observed, expectations improve over time: the effect of "worsening" decreases for the three domains (from 0.266 to 0.127 for work, from 0.203 to 0.139 for own economic difficulties, and from 0.190 to 0.165 for

family difficulties), while the effect of "improvement" increases, as well for the three domains. Examining the interactions, it is interesting to notice the positive effects "worsening-improvement" for own economic-difficulties, and for the economic difficulties of the family, and "stability-improvement" for work. These results suggest that the negative impact of the lockdown on the expectations tends to reduce over time.

Finally, we analysed the sentiments about the short/long-term future (fear, uncertainty, opportunity, reconstruction, community, solidarity, poverty, inequality, sustainability, inconsistency).

Table 5 – *Multiplicative components of the saturated log-linear model for the contingency table first response-last response, using total sum reference coding.*

First response		Last response			
		Worsening	Stability	Improvement	Total
Expectations about work	Worsening	1.505	0.926	0.940	0.266
	Stability	0.817	1.027	1.022	0.734
	Improvement	-	-	-	-
	Total	0.127	0.823	0.051	79
Expectations about own economic difficulties	Worsening	2.244	0.748	2.469	0.203
	Stability	0.706	1.060	0.648	0.772
	Improvement	0.000	1.197	0.000	0.025
	Total	0.139	0.835	0.025	79
Expectations about the economic difficulties of the family	Worsening	2.836	0.576	2.633	0.190
	Stability	0.570	1.099	0.617	0.810
	Improvement	-	-	-	-
	Total	0.165	0.810	0.025	79

Figure 1 – *Frequency distribution of first and last responses to the question "Choose at most three words, among those listed, that come to mind, thinking about the future". % over total responses.*
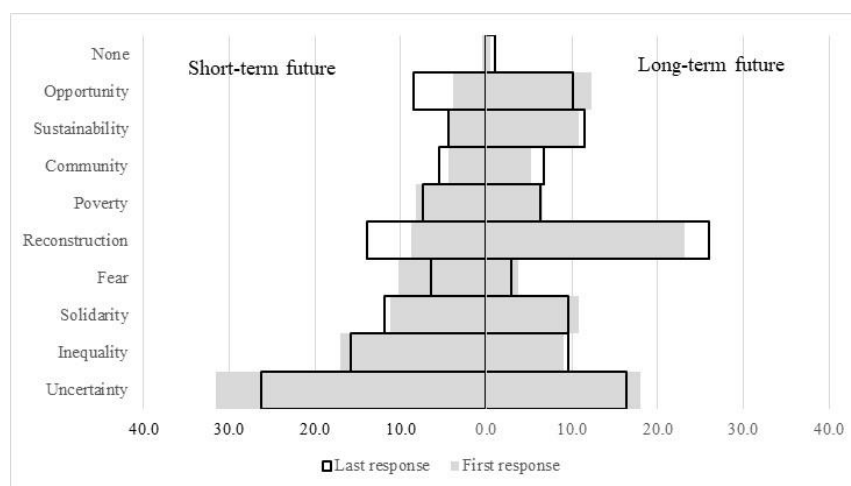
Note: words are ordered by increasing share in first response.

Figure 1 compares first and last responses. As far as the first response is concerned, the pessimistic feelings predominate in the short-term future: the sense of uncertainty, followed by the feeling of increasing inequality and poverty; conversely, fear (presumably related to health) appears to play a minor role. In the long-term future people are more confident; it emerges the importance of the positive feelings of reconstruction, opportunity, and sustainability. Looking at the last response, we observe the negative feelings shrinking, both in short- and long-term future, and the positive feelings expanding, especially the feeling of reconstruction.

4. Conclusions

The paper proposes a framework of research based on the adoption of the technique of survey by an instant app to collect longitudinal data. In this pilot study, the aim was to capture the impact of an unexpected and sudden event that modify the daily lives of people, such as the Covid pandemic. In this circumstance, the app *iFeel* is devoted to the consequences of the pandemic and the lockdown on the socio-economic behaviour of the Italian population in the short and medium-term.

The potentiality of the tool is supported by the results of some analyses: socio-demographic characteristics of people (working, being female, and having experienced the event on oneself) determine the magnitude of the impact on loneliness; over time, the negative impact of the lockdown on the expectations tends to reduce, confirming the hypothesis of adaptation to critical circumstances; optimism about the future demonstrates the desire for resilience in the face of an event, albeit dramatic.

However, the tool proposed has some critical limitations. First, the survey does not follow a sampling design, and this prevents from proposing results that are representative of the population, unless a very high number of interviewees is reached, and post-stratification weight are applied. Second, respondents are free to respond or not in the following times after the first, therefore the number of multiple responses for individual decreases over time.

In order to contain the limitations described, some precautions can be used such as, for example, an invitation message to recompile the questionnaire at the appropriate deadlines. Moreover, the use of this tool must be accompanied by an appropriate communication campaign addressed to increase diffusion and awareness of importance of results among people involved in the project.

Finally, based on the evidence of an ongoing research on another subject, we found that this tool can be more effective when applied to specific populations (such as a school or a set of working domains, for example), where the research team can control and stimulate the adhesion to the project.

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SUMMARY

In the early months of 2020, Italy had to face the spread of Covid-19, by intensifying the preventive public health and social distancing measures initially in some restricted areas, and gradually extended to the entire territory, up to the lockdown on 11 March 2020. The pandemic and the lockdown have changed people's lives with important economic, social and health implications. In this paper we present the experience of a pilot study that aimed at measuring the impact of the pandemic and the lockdown on the socio-economic behaviour of the Italian population in the short and medium term, by conducting a survey with a smartphone APP. The research design is proposed as a framework to collect longitudinal data, in order to measure the impact of an event as a change over time in the behavioural profile of individuals in everyday life. The survey has detected some socio-demographic variables related to the pre and post lockdown. At each measurement, both the current attitude/behaviour and the expected one in the short (two-month window) and long term (two-year window), have been detected. The survey is composed of two questionnaires: the first must be filled in just the first time, and the second questionnaire is proposed each time the respondent decides to participate. In November 2021 a first extraction from the data set counts 330 responses, corresponding to 189 individuals. In this paper we present some analyses od these data, with only illustrative purposes of the potentiality of the framework proposed. The potentiality of the tool is supported by the results of some analyses: socio-demographic characteristics of people (working, being female, and having experienced the event on oneself) determine the magnitude of the impact on loneliness; over time, the negative impact of the lockdown on the expectations tends to reduce, confirming the hypothesis of adaptation to critical circumstances; optimism about the future demonstrates the desire for resilience in the face of an event, albeit dramatic. Although potentially very informative, the tool proposed has critical limitations: first, the survey does not follow a sampling design, and second, respondents are free to respond or not, in the following times.

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