



# The Impact of COVID-19 on the Household Economy of India

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Accepted: 1 November 2021 / Published online: 17 November 2021

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## Abstract

COVID-19 has disrupted the Indian economy. Government-enforced lockdown to restrict the spread of infection has impacted the household economy in particular. We combine aggregates from national income accounts and estimates from the microdata of a labour force survey covering more than 0.1 million households and 0.4 million individuals. The aggregate daily loss to households is USD 2.42 billion. While loss to earnings accounts for 72% of the total, the rest 28% is wage loss. Service-based activities account for two thirds of wage loss, and natural resource-based activities are responsible for most of the earning loss. The dominance of informal job contracts and job switching in labour markets intensifies this, with the most vulnerable group consisting of 57.8 million in casual engagement, who have a high degree of transition from one stream of employment to another on a daily basis.

**Keywords** COVID-19 · Household economy · Loss · Vulnerability · India

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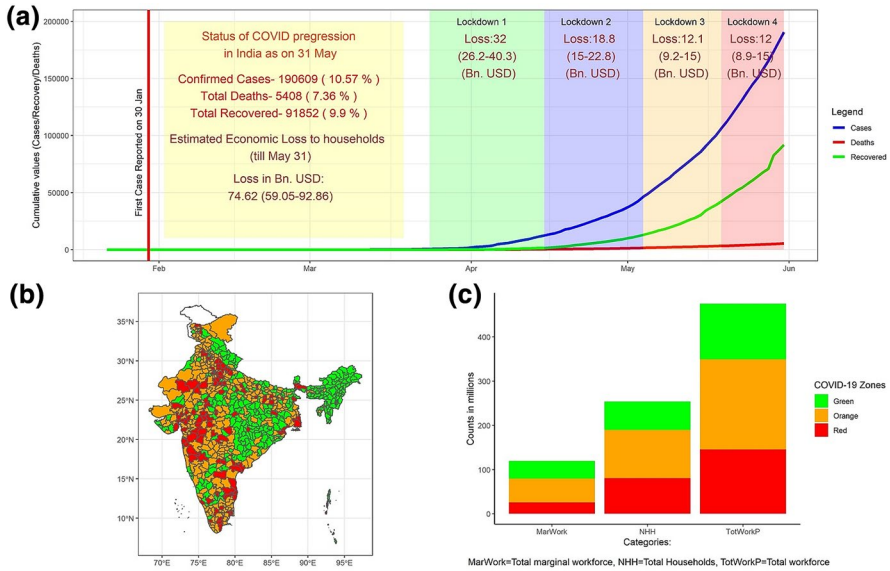
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## 1 Introduction

The COVID-19 outbreak and ensuing lockdowns resulted in multiple economic challenges for transitional economies like India. Policy responses to mitigate the impact of shutdown are dependent upon the assessment of losses. The relief packages announced for India range between 0.1 and 11% of the national income (IMF 2020). Most of these government backed packages are found on crude calculations of impacts at the aggregate level while ignoring the bearings on livelihood of the households. The households play a pivotal role in the circular flow of goods and services in the economy, especially in the Indian context, where the informal sector is a major contributor to the economy (Sengupta et al. 2008; National Commission for Enterprises in the Unorganised Sector 2008). The Indian labour market vastly differs from geographies like USA, Europe and China since regular wage employment accounts for a mere one-fourth of total employment, while for the above set of geographies regular wage employment forms the core (International Labour Organization 2020). In the absence of jobs that are aligned with any form of employment relation, as in India, streams of employment tend to be embedded with the household economy that has principal stakes in production, consumption and distribution (Baker et al. 2020). Therefore, the impact of lockdown due to pandemics for India will be very different from the above geographies. However, our results may be representative of other countries in South Asia. No study has explored these multifarious attributes that proliferate the vulnerability of households (Morduch 1994). The issue of vulnerability pertinent to households is captured through three constructs: (1) wage loss, (2) earning loss and (3) extremely vulnerable workforce (high chances of shifting employment within a small window of 7 days).

We develop a systematic method to account the impacts of such risks on consumption, production and distribution from the standpoint of households in India based on microdata (Deaton 1997). We have done two novel things: (1) we control for formal employment relations and (2) we account for earning loss. Quite importantly, wage is an outcome of formal or informal employment relations, while earning emanates from self-employment. Further, we disaggregate losses with respect to principal and subsidiary engagements. Further, we compute the probability of transition in the stream of employment during a small window of 7 days, capturing the magnitude of what we term as ‘extreme vulnerability’.

The first confirmed COVID-19 case in India was reported on 30 January 2020. Till the last week of March, the spread of COVID-19 cases in India was slow (Fig. 1a). Anticipating an intensive spread, the Government of India declared the first lockdown on 25 March that continued till 14 April with strict social distancing norms and regulation on outdoor movement. Although the spread of COVID-19 was very slow during this period, the suspension of economic activities has devastated labourers. Our thesis is on the pivotal role of households in the Indian economic system. The household, as an institution compared to other two major institutions—government and corporate sector—constitutes a principal share in employment, production and consumption and therefore very important in the



**Fig. 1** COVID-19 progression in India. **a** The percentage values in the parenthesis (brown font) show the growth rate of confirmed cases, recovered cases and deaths, respectively. The values in the parenthesis corresponding to the loss show lower and upper bounds of the estimation. **b** The location of green, orange and red zones. The white fill is the administrative boundary and shows non-availability of data in **b**. **c** The number of marginal workers, total households and total workforce in the green, orange and red zones based on Census 2011 (International Labour Organization 2020)

circular flow of economic resources (Table S1 in the Appendix). While this is conveyed by macroeconomic identities, the manuscript uses a large sample survey data to pinpoint the significance of households in the economy.

## 2 Data and Methods

### 2.1 Data

#### 2.1.1 COVID-19 Cases

Data on COVID-19 progression (as shown in Fig. 1a) were taken from the Centre for System Science and Engineering at John Hopkins University, tracking daily records of confirmed, deaths and recovered cases due to COVID-19 from 22 January 2020 to till date. We used India specific data for the period from 22 January 2020 to 31 May 2020. The data set was downloaded on 11 June 2020.<sup>1</sup>

<sup>1</sup> The data can be accessed from <https://github.com/CSSEGISandData/COVID-19>.

### 2.1.2 Census 2011

District-scale total number of households, marginal workforce and total workforce (as shown in Fig. 1c) were extracted from Census 2011.<sup>2</sup> These data are merged with the district-wise zoning information obtained from Government of India notification (National Accounts Statistics 2019a, b; Census of India 2012; PIB 2020a, b, c, d).

### 2.1.3 Periodic Labour Force Survey (PLFS) Data

For loss assessments, we use the recent microdata on labour from the Periodic Labour Force Survey (PLFS<sup>3</sup>), to disaggregate wage with respect to economic activities that include diverse set of activities spread across primary, secondary and tertiary industries (PLFS 2019; PLFS Microdata 2019). The total number of household records accessed is 102,113, and the records for members are 433,339.

## 2.2 Methods

### 2.2.1 Counting and Accounting the Labour in an Economy

Fundamentally, labour is a major segment of the population that generates both wage and earning for a household. The total population ( $P$ ) of a country can be divided into two parts: (1) persons who are being engaged in the labour market ( $L_b$ ) and (2) those who do not participate in the labour market ( $N$ ). Primarily, participation in the labour market is subject to the person's age being higher than the minimum age limit prescribed by the law. For instance, in India, engaging persons who are 14 years. Below this age, paid work is illegal and such engagements are identified as child labour.<sup>4</sup>

### 2.2.2 Employment and Unemployment Status

Those who are in the labour force are either engaged in the paid work (the category of employed  $E$ ), or waiting (searching or not searching) for opportunities to engage in paid work (the category of unemployed  $U$ ). While  $L$  and  $N$  constitute  $P$ , the labour market is defined by  $E$  and  $U$ . This structure may be expressed as follows:

$$P = L_b + N \quad (1)$$

<sup>2</sup> The census 2011 data can be accessed from <https://censusindia.gov.in/2011census/dchb/DCHB.html>, downloaded on 10 April 2020. Individual district data can be accessed from this link.

<sup>3</sup> We obtained the unit records of The Periodic Labour Force Survey 2017–2018 (published in May 2019) from the weblink <http://www.mospi.gov.in/sites/default/files/README.pdf>. The households level information of PLFS data can be downloaded from the source [http://www.mospi.gov.in/sites/default/files/FHH\\_FV.TXT](http://www.mospi.gov.in/sites/default/files/FHH_FV.TXT), and the household member data can be downloaded from [http://www.mospi.gov.in/sites/default/files/FPER\\_FV.TXT](http://www.mospi.gov.in/sites/default/files/FPER_FV.TXT).

<sup>4</sup> Government of India. (2020). About Child Labour, Ministry of Labour and Employment, New Delhi. <https://labour.gov.in/childlabour/about-child-labour> (Accessed on 20 July, 2020).

Further,

$$L_b = E + U \quad (2)$$

### 2.2.3 Types of Employment

The category labelled as employed ( $E$ ) comprises three groups: (1) self-employed (SE), (2) regular wage-salaried employees ( $R$ ) and (3) casual work ( $C$ ). SE consists of own account worker, employer and working as a helper in household enterprises.  $R$  includes a whole range of employment for which workers are paid at regular intervals (for example monthly) for a continuous engagement in the paid work. On the other hand, workers who belong to category  $C$  are engaged in paid activities that lack continuity. Formally,

$$E = SE + R + C \quad (3)$$

While engagement in SE generates earning for a person that is a mix of wage, profit, interest, and rent, other two categories (i.e.  $R$  and  $C$ ) provide wage to the persons engaged.

### 2.2.4 Status of Employment: Principal and Subsidiary

Drawing cues from National Sample Survey Organization (NSSO), employment in terms of principal and subsidiary engagement, is classified into three: (1) workforce being engaged in principal activity, however not pursuing any subsidiary activity, (2) engaged in both principal and subsidiary activities and (3) engaged only in subsidiary activity. To consider any activity as subsidiary, the engagement should not be less than 30 days during a year. By using subsidiary engagement, measurement of employment becomes broader compared to counting only principal engagement as employment. Table S4 (Appendix) provides a schema of principal and subsidiary employment.

## 2.3 Computing the Losses to Household Engagements due to Lockdown

### 2.3.1 Wage and Earnings

We classify direct losses incurred by households due to economic lockdown into wage loss ( $L_w$ ) and earnings loss ( $L_y$ ). These two losses sum to loss ( $L$ ) to the household if the economy falls into an economic lockdown. The national income accounts provide the aggregate of wage in the economy ( $W_t$ ) for a particular year, known as compensation to employees. However,  $W_t$  only captures the workforce who are in the ambit of formal and informal employment relationships. The aggregate  $Y_{ht}$  is

the measure of earning and operating surplus (earnings from rent and profit) of the households in the economy, principally capturing self-employed persons.

### 2.3.2 Wage and Earnings across Different Sectors of an Economy

We begin with the wage of household members who were engaged in formal or important employment relations ( $w_i$ ). Aggregating the cross-sectional data of  $w_i$  produces the combined total for a particular industry for a given year ( $\sum_{i=1}^n w_{ist}$ ). In a similar vein, we compute the sum of  $\sum_{i=1}^n w_{ist}$  all economic activities, generating a double sum of wages for ‘ $i$ ’ individuals and ‘ $s$ ’ economic activities during the year ‘ $t$ ’ ( $\sum_{s=1}^k \sum_{i=1}^n w_{ist}$ ). To find the share of a particular economic activity in the wage being earned by households, we divide economic activity-specific sum of wage by the sum of industry aggregates to  $\left(\frac{\sum_{i=1}^n w_{ist}}{\sum_{s=1}^k \sum_{i=1}^n w_{ist}}\right)$ . Multiplying  $\left(\frac{\sum_{i=1}^n w_{ist}}{\sum_{s=1}^k \sum_{i=1}^n w_{ist}}\right)$  by  $W_t$ , we get the annual losses if the economy is in full lockdown.

Nevertheless, exercise of this sort seems to be far off from reality. Even during the full lockdown, some people may get wages, depending on the nature of employment contracts. For instance, in the case of formal employment contracts, subject to the mandate of labour law and social security rules and caveats, payment of wage and social security benefits is unlikely to be interrupted. Therefore, it makes sense to control the effect of formal employment relations, which we perform next by aggregating the wage earned through formal employment contract ( $\sum_{i=1}^n wf_{ist}$ ) and computing its share in total wage across all economic activities  $\sum_{i=1}^n w_{ist}$ . Hence,  $\left[1 - \left(\frac{\sum_{i=1}^n wf_{ist}}{\sum_{i=1}^n w_{ist}}\right)\right]$  provides the proportion of wage received through informal means of employment. This measure, to a greater extent, gauges the aggregate of wage, controlling for the impact of wage protection during a complete lockdown in the economy.

To calculate the loss of wage ( $L_w$ ) to households in the economy on any lockdown day, we multiply the ratio of economic activity-specific sum of wage to sum of activity aggregates  $\left(\frac{\sum_{i=1}^n w_{ist}}{\sum_{s=1}^k \sum_{i=1}^n w_{ist}}\right)$  by the control for wage earned through formal employment  $1 - \left(\frac{\sum_{i=1}^n wf_{ist}}{\sum_{i=1}^n w_{ist}}\right)$ . Finally, we multiply the product of these ratios by  $W_t$  and divide the measure by the number of days in a year, i.e. 365. To put above arguments formally,  $L_w = \left[\left(\frac{\sum_{i=1}^n w_{ist}}{\sum_{s=1}^k \sum_{i=1}^n w_{ist}}\right) \left(1 - \frac{\sum_{i=1}^n wf_{ist}}{\sum_{i=1}^n w_{ist}}\right) \left(\frac{1}{365}\right)\right] \times W_t$ . To compute  $L_y$ , i.e. the loss for earnings, we follow similar procedures except that we control for the formal wage since earning is the outcome of self-engagements like own account work, employer or being an associate or helper in self-employment.

To put things in an analytical framework, we examine the aggregate from the national income accounts, measuring the earnings accruing to households by pursuing production and service activities, either for profit or not for profit. This aggregate ( $Y_{ht}$ ) captures the operating surplus or earning to the households in the economy. Similar to the previous computation of wage loss, we rely on the microdata of PLFS to find first the sum of earning ( $\sum_{i=1}^n y_{ist}$ ) in a particular economic activity, delimiting the domain

**Table 1** Distribution of daily losses across employment status and gender

Employment status	Daily loss in US\$ Millions					
	Total		Men		Women	
	Wage	Earning	Wage	Earning	Wage	Earning
Only principal engagement	663.39	1637.09	548.50	1551.42	114.96	86.10
Principal plus subsidiary engagement	14.89	95.82	13.65	90.29	1.25	5.57
Unemployed but engaged in subsidiary activity	0.07	0.46	0.04	0.39	0.03	0.08
Not in labour force but engaged in subsidiary activity	0.59	7.61	0.31	1.40	0.21	5.75
<b>Total</b>	<b>678.94</b>	<b>1740.98</b>	<b>562.50</b>	<b>1643.50</b>	<b>116.45</b>	<b>97.48</b>

Sample size = 433,339; estimated count: 1,074,040,298 (adjusted for current population); source: authors calculations based on PLFS microdata (2019) and PIB (2020d)

to self-employed persons. Secondly, we calculate the aggregate of sums across economic activities  $\left(\sum_{s=1}^k \sum_{i=1}^n y_{ist}\right)$  and divide the first measure (sum of earnings) by the second measure, to get the ratio  $\left(\frac{\sum_{i=1}^n y_{ist}}{\sum_{s=1}^k \sum_{i=1}^n y_{ist}}\right)$ . To arrive at an estimate of daily loss, we multiply the above ratio with  $Y_{ht}$  and then divide the whole expression by 365 days. Formally, the procedures are stated as follows:

$$L_y = \left(\frac{\sum_{i=1}^n y_{ist}}{\sum_{s=1}^k \sum_{i=1}^n y_{ist}}\right) \left(\frac{1}{365}\right) \times Y_{ht} \tag{4}$$

### 2.4 Aggregating Employment with Losses in Wages and Earnings Across Different Sectors and Groups

Now, we combine the schema of employment status presented in Table 1, with the decomposition  $L_w$  and  $L_y$  with respect to households engaged in primary employment status, subsidiary employment status and not in the labour force  $(E_p, S)$ ,  $(E_p \sim S)$ ,  $(U_p, S)$  and  $(N_p, S)$ . Further to decompose the loss, we compute shares of wage  $\left(\frac{W(E_p, S)}{W(E_p, S) + W(E_p \sim S) + W(U_p, S) + W(N_p, S)}\right)$  and earning  $\left(\frac{Y(E_p, S)}{Y(E_p, S) + Y(E_p \sim S) + Y(U_p, S) + Y(N_p, S)}\right)$  with respect to each of these categories. Next, we multiply shares of wage and earning by  $L_w$  and  $L_y$ , respectively.

Formally,

$$L_w(E_p, S) = \frac{W(E_p, S)}{W(E_p, S) + W(E_p \sim S) + W(U_p, S) + W(N_p, S)} \times L_w \tag{5}$$

$$L_W(E_P, \sim S) = \frac{W(E_P, \sim S)}{W(E_P, S) + W(E_P \sim S) + W(U_P, S) + W(N_P, S)} \times L_W \quad (6)$$

$$L_W(U_P, S) = \frac{W(U_P, S)}{W(E_P, S) + W(E_P \sim S) + W(U_P, S) + W(N_P, S)} \times L_W \quad (7)$$

$$L_W(N_P, S) = \frac{W(N_P, S)}{W(E_P, S) + W(E_P \sim S) + W(U_P, S) + W(N_P, S)} \times L_W \quad (8)$$

$$L_Y(E_P, S) = \frac{Y(E_P, S)}{Y(E_P, S) + Y(E_P \sim S) + Y(U_P, S) + Y(N_P, S)} \times L_Y \quad (9)$$

$$L_Y(E_P, \sim S) = \frac{Y(E_P, \sim S)}{Y(E_P, S) + Y(E_P \sim S) + Y(U_P, S) + Y(N_P, S)} \times L_Y \quad (10)$$

$$L_Y(U_P, S) = \frac{Y(U_P, S)}{Y(E_P, S) + Y(E_P \sim S) + Y(U_P, S) + Y(N_P, S)} \times L_Y \quad (11)$$

$$L_Y(N_P, S) = \frac{Y(N_P, S)}{Y(E_P, S) + Y(E_P \sim S) + Y(U_P, S) + Y(N_P, S)} \times L_Y \quad (12)$$

Therefore,

$$L_W = L_W(E_P, S) + L_W(E_P, \sim S) + L_W(U_P, S) + L_W(N_P, S), \text{ and} \quad (13)$$

$$L_Y = L_Y(E_P, S) + L_Y(E_P, \sim S) + L_Y(U_P, S) + L_Y(N_P, S) \quad (14)$$

Further, using similar computation procedures, we disaggregate losses in wage and earning from men ( $L_{W \text{ MEN}}, L_{Y \text{ MEN}}$ ) and women ( $L_{W \text{ WOMEN}}, L_{Y \text{ WOMEN}}$ ). Computation is stated as follows:

$$L_{W \text{ MEN}} = L_{W \text{ MEN}}(E_P, S) + L_{W \text{ MEN}}(E_P, \sim S) + L_{W \text{ MEN}}(U_P, S) + L_{W \text{ MEN}}(N_P, S) \quad (15)$$

$$L_{W \text{ WOMEN}} = L_{W \text{ WOMEN}}(E_P, S) + L_{W \text{ WOMEN}}(E_P, \sim S) + L_{W \text{ WOMEN}}(U_P, S) + L_{W \text{ WOMEN}}(N_P, S) \quad (16)$$

$$L_{Y \text{ MEN}} = L_{Y \text{ MEN}}(E_P, S) + L_{Y \text{ MEN}}(E_P, \sim S) + L_{Y \text{ MEN}}(U_P, S) + L_{Y \text{ MEN}}(N_P, S) \quad (17)$$



$$L_{Y\text{ WOMEN}} = L_{Y\text{ WOMEN}}(E_P, S) + L_{Y\text{ WOMEN}}(E_P, \sim S) + L_{Y\text{ WOMEN}}(U_P, S) + L_{Y\text{ WOMEN}}(N_P, S) \tag{18}$$

$$L_W = L_{W\text{ MEN}} + L_{W\text{ WOMEN}} \tag{19}$$

$$L_Y = L_{Y\text{ MEN}} + L_{Y\text{ WOMEN}} \tag{20}$$

### 2.5 Computing Chances of Daily Transition

We compute chances of an employed person switching from any stream of employment to the another across any pair of days over a week. For example, what are the chances of a person who was self-employed on day 1 to shift to casual employment on day 2, while joining back to self-employment the rest of the week. To measure the change of this sort, we compare the status of employment between any pair of days. The number of pairs of days out of a week is  $C_2^7$ .

First, we compute the share of employed who remained in the same stream of employment ( $Stable_k$ ) on any particular pair of days, out of the count of employment during any pair of days during a week ( $\sum_{i=1}^n E_{idk}$ ), and summing it across all pairs of days

$$\left[ \sum_{d=1}^{21} \left( \frac{\sum_{i=1}^n Stable_{idk}}{\sum_{i=1}^n E_{idk}} \right) \right].$$

To compute the average proportion of  $Stable_k$ ,

we divide the computed sum by  $C_2^7$ . Deducing this measure from absolute 1 yields the chances of shifting employment from the status  $k$  to  $l$  denoted by  $(p_{k \rightarrow l})$  that varies from 0 to 1. Supposing  $p_{k \rightarrow l} = \frac{1}{4}$ , the chance of changing from employment  $k$  to  $l$  is 1 out of 4, implying that the chance of remaining in the same employment stream is  $\frac{3}{4}$ . Presumably, switching over from one employment to another one every day within a short duration of 7 days is a coping strategy to survive in a transient labour market. Therefore, we use  $p_{k \rightarrow l}$  to compute the size of extremely vulnerable employment ( $EV_k$ ). To arrive at  $EV_k$ , we multiply  $p_{k \rightarrow l}$ , share of a particular employment stream in total employment ( $\alpha_k$ ), and total employment ( $E_{PS}$ ). Formally, it is stated in the following equation and Table 2 describes the notations used.

$$EV_k = [p_{k \rightarrow l} \times \alpha_k \times E_{PS}] \quad \text{where, } p_{k \rightarrow l} = 1 - \left[ \frac{\sum_{d=1}^{21} \left( \frac{\sum_{i=1}^n Stable_{idk}}{\sum_{i=1}^n E_{idk}} \right)}{C_2^7} \right] \tag{21}$$

### 2.6 Scenarios for Loss Calculation during Lockdown Periods

The scenarios for calculating the losses to wage and earning across the lockdown periods are derived from the information provided in the Press Information Bureau of Government of India. They are created according to the level of relaxation allowed in each broad sector of the economy across the four lockdown periods. In

**Table 2** Chances of transition and count of extremely vulnerable workforce across employment streams

Nature of employment	Stream of employment	Chances of transition ( $P_{k \rightarrow l}$ )	Share in employment ( $\alpha_k$ )	Count of extremely vulnerable workforce (Million) ( $EV_k$ )
Casual	Participation in NREGA	0.291	0.004	0.6
	Causal wage labour	0.217	0.236	24.3
Regular	Casual wage labour only in public works	0.189	0.004	0.4
	Worked as regular salaried/wage employee	0.116	0.240	13.1
Self-employed	Employer	0.104	0.019	1.0
	Worked as helper in household enterprise	0.095	0.123	5.5
	Own account worker	0.073	0.373	12.9

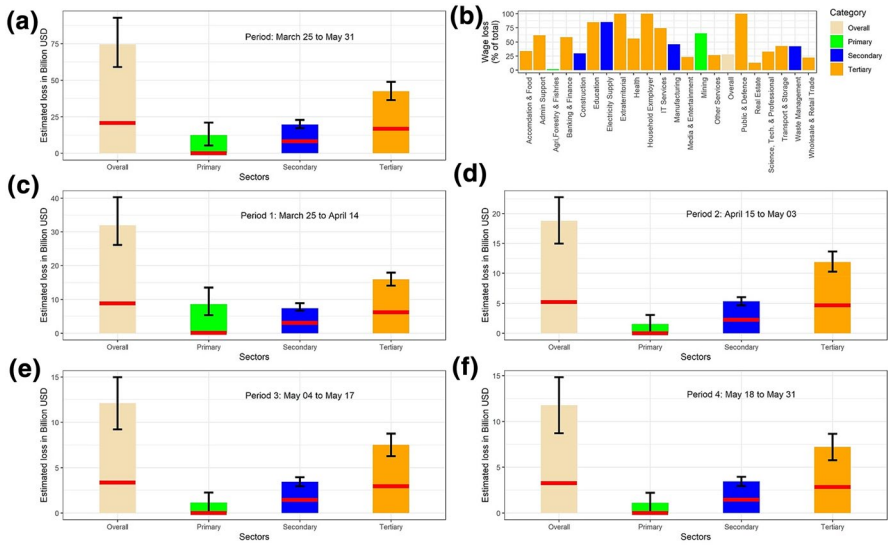
Sample size = 433,339; NREGA is National Rural Employment Guarantee Act of the Govt. of India that ensures 100 days of employment; source: authors calculations based on PLFS microdata (2019)

essence, a full lockdown of the sector implies that the sector works at 0%, while a complete relaxation ensures that the sector works with 100% of its capacity. For instance, the services pertaining to the delivery and provisioning of essential commodities were operational across all the four lockdown phases and hence we assume that the sector worked with full capacity (100%). The lower and the upper bounds of the losses correspond to the lowest and highest working capacity under each scenario permissible for that sector, respectively. Table S5 (Appendix) describes the extent to which economic activities were functional.

### 3 Results

The household's income has two components: wage and earning. While a household earns from sources such as rents from property and interest or dividend from investments, the share of wage and earning combined together is too big to compare with other sources of income (National Accounts Statistics 2019a, b). Besides, wages and earnings are outcomes of economic activities that are discernibly vulnerable to shocks like economic lockdowns or to any other exogenous risks. We find that suspension of economic activities results in a daily loss of about 2.42 billion USD for Indian households, of which approximately 0.679 billion USD (28%) is due to wage loss and the rest 1.741 billion USD (72%) is loss in earning, discounting for wage protection present across some occupations. Our estimate does not account for the losses to the industry and government sectors, which would escalate the figures of economic loss considerably upwards.

The total estimated loss to households during the series of lockdowns (25 March 2020–31 May 2020) is about 74.6 billion USD, which is close to the order of 2.75% of the total gross domestic product of India. Some sectors were allowed to operate with varying capacities to facilitate the flow of essential goods and services. We create scenarios for the level of functioning across different sectors based on the government's notifications, which, in essence, varies from complete closure (0%) to full relaxation (100%) (PIB 2020a). The lower and upper bounds of our estimates are 59 and 93 billion USD, respectively. Most of this is due to loss of earnings to households except in a few sectors like mining and information technology (IT) services (Fig. 2). The Government of India announced a second lockdown from 15 April to 3 May. Over this period, the restrictions to economic activities were slightly relaxed as the country was divided into three zones, green, orange and red, to facilitate differential economic relaxation (Fig. 1b) (PIB 2020b). Green zones were the districts reporting no new infections, orange zones were the ones with limited cases of infections, and red zones were regions of COVID-19 infection hot spots (PIB 2020b). Most of the economic activities were under suspension in red and orange zones, while little relaxation was allowed in green zones. However, red and orange zones accounted for more than 80% of households and total workforce of the country (Fig. 1c). Interestingly, red and orange zones were also the regions with intensive economic progress and also districts with maximum population of marginal workers (Fig. 1c).



**Fig. 2** Sector-wise distribution of losses due to lockdown. **a, c, d, e, f** The horizontal red line in bars indicates the division of wage and earning loss of a sector. The error bar indicates lower and upper ranges of the estimated loss for a sector. **b** Wage loss (as the percentage of total loss) of individual industries and their classification as primary, secondary and tertiary sectors

Impacts during the second lockdown were roughly of the same order as in the first lockdown, particularly for the marginal workforce hoping for normalcy after enduring the hardship of the first lockdown. The estimated loss for the second lockdown was about 18.79 billion USD (14.96–22.75) (Fig. 2). The third and the fourth lockdowns were comparatively relaxed in the green zone, but in the red and orange zones the degree of restrictions was the same as before (PIB 2020c , d). The estimated loss for the third lockdown and the fourth lockdown is about 12.1 billion USD (9.22–14.96) and 11.77 billion USD (8.72–14.83), respectively. Apart from the loss suffered by households, permanent loss of jobs and job opportunities is the bigger concern that will have longer-term impacts and will aggravate the household vulnerability, in particular to exogenous risks like the incidence of natural disasters that are likely to worsen in the context of changing climate (Krishnan et al. 2020).

In essence, the four lockdowns have had a maximum impact on the services sector with the loss standing at 33.59 billion USD (28.06–39.44) (Fig. 2a). The losses accruing to the secondary and primary sector are 19.68 billion USD and 12.42 billion USD, respectively, with a high variability (Fig. 2a). We observe that the wholesale (retail and trade) sector is the most affected with a loss of 16.26 billion USD during 68 days of lockdown. This is followed by the manufacturing sector with a loss of 12.65 billion USD (Table S3 in the Appendix). The estimated loss for agriculture (including forestry and fishing) is 12.21 billion USD (Table S3, Appendix).

Indian households are already vulnerable due to untenable job markets; the lockdown due to COVID-19 has intensified this (Chen et al. 2002; Paul and Muralidharan 2020). The ability to generate fewer new jobs implies that the expansion in

employment is incommensurate with the pace of economic growth in the recent past. This pattern remained tenacious. In the absence of regular wage engagements, nearly half of employed are engaged in self-employment by producing diverse goods and services, while slightly above one-fourth are in irregular wage engagements (Ostrom 2010). Throughout India's post-colonial history, the share of formal employment that assures social security for employed persons remained below one-tenth of employment (Paul and Muralidharan 2020). Recent data show that nearly one-fourth of employed earn regular wage, by being engaged in formal or informal employment contracts (Table S2 in the Appendix). The constituent called self-employed consists of own account workers, employers and unpaid family-based helpers. Irregular wage engagements depend upon seasons, in particular agricultural activities and variation in labour requirement. In the absence of regular paid work, labour supplied by the household tend to migrate from the rural to the urban, donning on seasonal roles like agricultural labour in the rural and spot labour force in the urban construction sites (PIB 2020a). Instantaneous lockdowns due to COVID-19 are not only devastating on their employment and livelihoods of workers (stalemate in production), but also drives them to precipices of starvation (scarcity in consumption). This is exacerbated by the heterogeneity in the labour market (Table 1).

Another important dimension of employment is the coverage of engagement in terms of principal and subsidiary, based on the time being utilized for a certain paid work (GoI 2019). A fraction (less than one-tenth) of the workforce just settles around subsidiary engagements. In gauging growth of employment, measuring principal and subsidiary engagements presents the broader picture of the absorption of workforce in employment. A major chunk of the wage and earning loss, due to the stoppage activities that serve as the principal source of employment, is 663 and 1637 million USD, respectively (Table 1). The daily loss of earnings is consistently above the wage loss across every form of employment, highlighting the informal nature of job engagements and the resulting vulnerability. Another persistent feature of the Indian labour markets is gender discrimination, resonated in discernibly lower work participation rates of women over decades (Mehrotra and Parida 2017). This is also reflected in the loss figures across both segments, wage and earnings, and also across all employment status except for the last category representing people who are not in the labour force but only engaged in subsidiary activity (Table 1). Here, a major share of the daily loss in earnings (USD 5.75 million) is due to women not being able to participate in subsidiary activities, particularly in the care economy.

To what extent a household's participation in any stream of employment remains stable is defined by chances of remaining in the same engagement during a short temporal span of 7 days, although this also varies considerably even for a week. Transition of a household's employment is defined as shifting from one employment stream to another. The chances of shifting employment from the stream  $k$  to  $l$  ( $p_{k \rightarrow l}$ ) appear to be sensitive to the nature of stream of employment. For streams such as self-employed (SE) and regular wage employment ( $R$ ), chances vary in the range of 0.07–0.1 (Table 2), while, for casual employment ( $C$ ), the measure varies from 0.19 to 0.29. Intuitively, the higher the  $p_{k \rightarrow l}$ , the more will be the vulnerability of the household, since the person is in search of employment, almost daily. Nearly one-fourth of the employed in India fall in the category of casual employment. Other employment

streams tend to be relatively more tenacious with regard to staying in the same employment on a daily basis since either they have access to any property rights (for example, self-employed) or they are in formal or informal contract with the employer (for example, regular wage employment). Due to lower consumption levels, regular wage employment and employers, nearly three-fourth of employed are considered vulnerable to poverty. Extremely vulnerable employment ( $EV_k$ ) is a subset of vulnerable employment.  $EV_k$  exemplifies not just precarious consumption pattern, but also uncertainties due to frequently changing prospects in the labour market. During uncommon events like economic lockdown, households with higher  $p_{k \rightarrow l}$  tend to leave without any alternatives, being entrenched by diverse miserable circumstances. While 25 million casual worker force ( $C$ ) are extremely vulnerable,  $R$  and  $SE$  report 13 million and 20 million  $EV_k$ , respectively (Table 2).

## 4 Discussion

Our analysis shows the sector-wise variations in wage and earning losses and hence can provide useful feedback for accommodating differential requirements across sectors. Further, a large section of households in India fall in the bracket of vulnerable employment (PLFS Microdata 2019). Vulnerable employment includes almost the whole of irregular wage employment (casual employment) and self-employed except employers. Nearly three-fourth of Indian workforce stands out vulnerable and three-fifth of regular wage employment eludes entitlements like social security, forcing them to the margins of vulnerability (World Bank 2020). In exceptional scenarios such as economic lockdowns or events creating similar circumstances, a sizeable segment of the household economy may plunge into depths of irreversible deprivations that entrench even the living of posterity.

Our assessments indicate structural change like lockdown because COVID-19 may have a permeable impact on the extremely vulnerable unless the state implements a stream of inclusive public policy benefitting households. In this context, we suggest that public policies may envisage: (1) upgradation of household-based production of goods and services into high value-added activities across supply chains in the economy, (2) absorption of casual workforce, in particular transient actors like migrants, to productive public work systems (public goods creation and infrastructure), both in urban and in rural areas, that aims to create assets for sustainable and inclusive society, (3) building of proactive labour market intelligence systems that coordinate matching between supply of and demand for labour through affordable digital solutions and (4) direct transfer of monetary benefits to the extremely vulnerable transient labour. To build a self-ordered and sustainable economic system in post-colonial societies like India, it is important to safeguard the primacy of the household as a labour, employer, owner of property rights, consumer and the core facilitator of exchanges. Whether the lockdown is desirable or not presents a normative issue but can form the basis of future work and so also is the case with segregation on the basis of sector (rural vs. urban) or gender. Importantly, post-COVID-19 household economy needs to mitigate the degree of unfairness in terms of trade between economic activities being pursued by

households. More succinctly, the systems of governance require to facilitate an extant trust-based interdependent household economy in India (Ostrom 2010).

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s41027-021-00352-8>.

**Funding** The authors have no relevant financial or non-financial interests to disclose.

#### Declaration

**Competing interest** The authors have no competing interests to declare that are relevant to the content of this article.

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