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# Did Employment Rise or Fall in India between 2011 and 2017?
## Estimating Absolute Changes in the Workforce

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# Did Employment Rise or Fall in India between 2011 and 2017?

## Estimating Absolute Changes in the Workforce[1]

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**Abstract**

The recently released data from the 2017-2018 Periodic Labour Force Survey have created a controversy regarding the quantity of employment generated in the past few years in India. Estimates ranging from an absolute increase of 23 million to an absolute decline of 15.5 million have been published. In this paper we show that some of the variation in estimates can be explained by the way in which populations are projected based on Census 2011 data. We estimate the change in employment using the cohort-component method of population projection. We show that for men total employment rose but the increase fell far short of the increase in working age population. For women, employment fell. The decline is concentrated among women engaged in part-time or occasional work in agriculture and construction.

**Keywords**

Employment, Periodic Labour Force Survey, Population projection, Cohort-component method

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## 1. Introduction

Prior to the slowdown of 2019 and subsequent extraordinary shock delivered by the COVID19 pandemic, the Indian economy had experienced a phase of moderate to high growth (exceeding 5% per annum in real terms) for nearly two decades. However, employment grew much more slowly as compared to GDP. (Kannan and Raveendran, 2009; Mehrotra, 2018; State of Working India, 2018) The exact nature of this phenomenon of "jobless growth" has proved controversial. Part of the problem, until early 2019, was a paucity of official data on employment. The release of the Periodic Labour Force Survey (PLFS) data in mid-2019, saw a considerable amount of interest over what it had to say about the Indian labour market and the changes that had taken place since the last NSSO Employment-Unemployment Survey (NSS-EUS 2011).[2]

However, questions such as how much did employment increase in absolute terms or did the growth in employment match the increase in the working age population or even did employment increase or decrease, have proved to be controversial in the recent literature. What is beyond dispute is that between 2011 and 2017, the workforce participation rate or the worker to population ratio (WPR) fell for rural and urban India, in principal and subsidiary status, for men and women. But when it comes to absolute numbers, different studies have provided us with different answers (Table 1). Bhandari and Dubey (2019) have argued that employment rose by 23 million during this period, while Mehrotra and Parida (2019), Himanshu (2019) and Kannan and Raveendran (2019) all observe that it has fallen. However, the estimates of the fall vary between 6.2 million to 15.5 million. As Misra (2019) notes in his column[3], these contrasts are surprising given that the underlying datasets used for all of these studies are the same- the 68$^{th}$ NSS-EUS and 2017-18 PLFS.

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[2] Recently, PLFS data for the year 2018-19 has also been released. We do not use this data here since the paper is concerned with what happened between 2011-12 and 2017-18.

[3] https://indianexpress.com/article/business/economy/india-employment-rate-study-azim-premji-university-6097024/ Accessed on 19$^{th}$ November, 2019

**Table 1: Estimates of the size of the Indian workforce (in millions) brought out by different studies**

| *Authors* | *2011-12 Workforce (millions)* | *2017-18 Workforce ( millions)* | *Difference (millions)* | *Reference Period Taken* | *Projection Method* | *Status applied* |
|---|---|---|---|---|---|---|
| Bhandari and Dubey (2019) | 433.1 | 456.7 | 23.6 | 1st January, 2012 & 1st January, 2018 | Trend extrapolation using monthly CAGRs for each State/UT (rural-urban) obtained from Census 01,11 | UPS |
| Mehrorta and Parida (2019) | 474.2 | 465.1 | -9.1 | December 2011 & December, 2017 | Monthly exponential growth rate | UPSS |
| Kannan and Raveendran (2019) | 467.7 | 461.5 | -6.2 | 1st January, 2012 & 1st January, 2018 | Trend extrapolation based on inter-census growth; state wise for each sex*sector segment of the population | UPSS |
| Himanshu (2019) | 472.5 | 457 | -15.5 | 1st January, 2012 & 1st January, 2018 | NA | UPSS |
| Present study | 462.4 | 452.4 | -9.9 | 1st June, 2011 & 1st June 2017 | Cohort-Component Method; | UPSS |
| | 425.3 | 439.3 | 14 | | Sex*sector by age group for all India and 21 major States | UPS |

Source: Various Studies

This wide variation in the absolute size of the workforce can be attributed to the fact that there were no official estimates of the population of the country at the time the PLFS data was released. Sample surveys such as the PLFS yield key ratios such as the worker-to-population ratio (WPR, also known as the employment rate), the labour force participation rate (LFPR) and the unemployment rate. The standard practice adopted by economists to go from ratios to absolute numbers is to multiply the WPR or LFPR from a sample survey with a relevant population estimate in order to arrive at absolute employment estimates. Thus, once the particular definition of workforce or labour force (principal or usual yearly status, weekly, or daily status) has been decided, whether a fall in the WPR will translate into a rise or a fall in employment in absolute terms, depends on the projected increase in population over the period.

The earlier Employment-Unemployment survey reports brought out by the National Sample Survey Office (NSSO) used to provide these population estimates in their appendix tables. If these were not available, the practice hitherto has been to use the official population estimates as brought out by the government. At the time of the release of the PLFS data, neither were available. It was only after five months of the release of the PLFS, that the technical group on population projections finally brought out its population estimates.[4] The absence of official statistics forced authors to produce their own population estimates. It is the variation in these estimates that produced, in part, the aforementioned variation in employment numbers.

One aim of this study is to examine the sources of variations in the estimation of the workforce numbers. Even with the release of the official population numbers, we believe that this study continues to hold relevance because it provides a detailed methodology for arriving at workforce estimates in the absence of official population estimates. This is useful in case any such instance (of lack of official data) arises in the future or when one wants to estimate the population of a sub group category whose official projections may not be available. We validate our numbers by comparing them to the official data.

We undertake three tasks here. First, we produce our own population estimates based on a method of population projection known as the "cohort-component method" and validate our numbers by comparing them to the official data. Next we explain why different studies can produce substantially different estimates of the Indian workforce via differences in the choice of survey mid-point, the nature of the population projection method, and the level of disaggregation used in the projection. Finally, we investigate what has taken place during the period in question. We show that in every demographic group (men, women, rural, urban), the rate of employment generation has lagged far behind the rate of growth of the working age population. We also show that the decrease in absolute employment commented on, in the recent literature, is concentrated among rural women working in a subsidiary capacity in agriculture and construction.

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[4] https://nhm.gov.in/New_Updates_2018/Report_Population_Projection_2019.pdf

The next section describes the key factors influencing absolute workforce estimates. Section 3 outlines how the cohort-component method can be used, Section 4 presents the results, and Section 5 concludes.

## 2. On Generating Absolute Workforce Estimates: Some Key Issues

Before we delve into two important methodological points, note that estimated workforce numbers are naturally sensitive to the definition of employment adopted. Thus a simple source of variation in Table 1 is that Bhandari and Dubey (2019) use the Usual Principal Status (UPS) definition while the rest use the Usual Principal and Subsidiary Status (UPSS) definition. The UPS identifies as employed only those who were working for more than six months in the last 365 days. The UPSS on the other hand, also includes in the workforce, those who were working for a period of 30 days but less than six months. Employment estimates based on the two definitions, thus, are bound to vary with the latter showing higher figures than the former. Which definition is appropriate, of course, depends on the question being asked of the data.

### *2.1 Method adopted for projecting population numbers*

The standard practice in the literature to estimate absolute workforce numbers is as follows:

Estimated absolute number of workers =

(Number employed / Number of working age individuals) X Projected working age population

As is well-known, the population estimated from the survey data using sample weights provided by the NSSO is significantly smaller than expectations based on Census data.[5] Hence most researchers take recourse to the Census, or to population projections based on the Census to

[5] In a paper brought out by the NSSO's own Survey Design and Research Division (SDRD) team, it was noted that the magnitude of divergence is very large in most cases. http://www.mospi.gov.in/sites/default/files/workshop/nsc_paper_SDRD_12jan09.pdf

calculate absolute workforce numbers. There are two, mathematically equivalent, ways this is done. The “Census multiplier” is first calculated as the ratio of Census (or Census-projected) population to population estimate from sample survey data. Next the WPR or LFPR is multiplied by the population estimate from the sample survey and then further multiplied by the Census multiplier. This is equivalent to taking the WPR or LFPR and multiplying it directly by the Census or Census-projected population (as in the equation above).

Absolute workforce estimates for years close to a Census year can be calculated directly by taking the Census population. But as we move farther away from a Census year, the need to accurately project the new population becomes more important. Usually such projections are available from sources such as the ILO, the UN, and of course, the Government of India. Hence researchers do not need to make the projections themselves except under exceptional circumstances when current projections are not available, as noted in the Introduction. Nevertheless, it is useful to understand the principal issues involved in producing the population numbers since important policy decisions depend on these data.

There are three methods for calculating population projections, namely (i) trend extrapolation, (ii) the cohort component method and (iii) structural mode (Smith et al. 2000). We focus on the first two approaches as they are the ones most regularly adopted in labour force estimation studies. All the studies mentioned in Table 1, with the exception of the present one, estimate the size of the Indian workforce using projections based on the trend extrapolation method (or they use population projections produced by others based on this method). This method involves fitting mathematical models to historical data to project future values of the variable of interest. Different functional forms (linear, polynomial, exponential etc.) correspond to different assumptions about how we expect the variable to behave in the future. The main advantage of this method is that it has low data requirements. But trend extrapolation, whether simple (linear, geometric, exponential) or complex (polynomial, ARIMA time series, logistic models), has some important shortcomings. The method does not account for what part of population growth is attributable to changes in fertility rates, mortality rates or migration. In case of societies experiencing rapid demographic transition, the farther one moves away from a census year, the less reliable trend extrapolation gets. It becomes important to bring in fresh data on fertility, mortality and migration rates. Second, trend extrapolation provides little or no information regarding the sub-group composition of the projected population (see George et. Al, 2004).

As per the literature on demography (see de Gans, 1999; O'Neill et.al, 2001), the preferable method is the cohort-component projection technique that takes into account the changes to the demographic compositions of the population that is to be projected. The cohort-component method divides the base year population into age-sex groups (cohorts) and accounts separately for the fertility, mortality and migration behavior of each cohort as it passes through the projection horizon (George et. al, 2004). Simply put, it enables one to take into consideration differences in the rates of fertility, mortality and migration of different age groups at a particular point in time, and to consider how these rates change over time for each of the individual cohorts. Projections that are made using this technique are bound to give rise to figures that are different from the trend extrapolation method laid out above. The limitation of this method is that it can only be projected to the point where fertility and mortality data are available.

A crucial factor here is the level of disaggregation at which the projection is made. According to a review paper brought out by the NSSO's Survey Design and Research Division (SDRD) team in 2008, the ideal procedure to generate workforce estimates is to first decide the lowest level at which the adjustment factor is to be applied. Next group wise adjustment factors are calculated using the Census or the projected population. Then these are integrated with survey weights (multipliers) (NSSO, 2008: 14). In other words, the employment ratios should be obtained for each domain at the lowest level decided upon and then these are to be applied to the adjusted population corresponding to that very domain. Summing each domain from the lowest to the highest level gives us our final figure for the combined domain.

Final workforce estimates are thus sensitive to the level of disaggregation made (Kannan and Raveendran, 2019, 39). Using the all India WPR ratio on a given population will give us a figure that is different from, say the workforce number arrived at by adding the figures that we obtain independently when we multiply the male WPR and female WPR of each age group of all the states to the corresponding population estimates of these domains.

*2.2 Choice of survey mid-point*

A second, somewhat less important, source of variation in the employment numbers is the chosen survey mid-point. As noted above, employment ratios obtained from labour force surveys are multiplied with a relevant population estimate in order to arrive at employment estimates. Generally, these population numbers are taken from the Census or from the projections thereof. However, in doing so, a problem arises. Since the Census as well as the sample surveys are carried out over a period of several months to a year, a particular point in time needs to be designated as the "time of survey" (the equivalent of what is called the "Census moment") so that the population estimate for that point in time can be produced and applied to the survey ratios. This is sometimes called the "survey mid-point". Different studies choose different mid-points and thus end up with different projected populations.

A number of studies working with the NSSO/PLFS data take the mid-point of the survey period i.e. January 1st, as the point of representativeness of the survey data. The survey period relates to the time during which the information is collected from the respondents, e.g. July 1st to June 30th. But employment indicators, such as the usual or principal status are based on a reference period of the preceding year. As the ILO has noted, the representativeness in time applies to the reference period covered rather than the survey period (Hussmans et al. 1990: 227).[6]

A moving reference period produces statistics which covers a length of time which is longer than the reference period itself. In the case of EUS 2011-12 (with a survey period of July 2011 to June 2012), when using the usual/principal activity status definition (with a 12-month reference period) the statistics produced covers a period of two years -July 2010 to June 2012. The midpoint of this two-year period is June 2011 and not January 2012. The ILO manual cites the NSSO survey of 1977-78 as an example to illustrate this point. Naturally, studies which take the mid-point as December 2011 or January 2012 arrive at higher absolute employment figures because they adjust their census population upwards by nine to ten months instead of three.

[6] If the reference period is small say the past week or the past day, then the issue does not arise.

The same applies for the PLFS 2017-18 carried out between the months of July 2017 and June 2018. As per the explanation provided above, the survey mid-point is June 2017 and requires one to extend the projection of the Census population to June 2017, in order to apply the ratios from the survey.

We would like to emphasise, though that the choice of survey mid-point does not affected estimated changes between two years, it only affects the absolute numbers.

## 3. Method used in the present study

### *3.1 The cohort component method*

We use the cohort-component method for producing both the national as well as state-wise population projections. As we have noted above, this method is an advance on trend extrapolations as it accounts for changes in the demographic composition of the population that is to be projected. It is widely used by demographers but less by economists. To the best of our knowledge, in recent years, this method has been used to generate workforce estimates for India only in one instance (NCEUS 2009).

George et. al (2004) provide us with a concise summary of the steps involved. The first step is to establish the base year population and make an estimation of the number of persons in it, who survive to the end of the projection interval. To do this, age-sex specific survival rates are applied to each cohort in the base population. The next step involves the calculation of migration that has taken place during the interval. For this, cohort specific migration rates are applied to age-sex group. The third step is to calculate the number of births that occur during the interval. Here age-specific birth rates are applied to the female population in each age group. The number of births that take place are added to the survived or expected-to-be-alive population and the number of net migrants to arrive at a projection of the population by age and sex. This figure then serves as the starting point for the next interval and the process is repeated until the final target year is reached.

The summary equation of the cohort-component method is as follows:

$P_{t+n}$ = survived population + births + net migrants

We used this method to project all India population figures as well the population figures for 21 major states for the years 2011 to 2018. Andhra Pradesh and Telangana are treated as a single state since EUS 2011-12 provides us with employment ratios of the undivided state. The ratios obtained from EUS 2011-12 and PLFS 2017-18 round are then applied to their respective projected populations to arrive at the final workforce numbers.

*3.2 Preparation of the base year data*

Data from the 2011 Census served as the base for our projection exercise. In order to arrive at the total population, we decided to make four separate projections-rural male, rural female, urban male and urban female. We first took the sex wise population data from the Census for both rural and urban segments for each five-year age group (0-4, 5-9…75-79, 80+). This exercise was carried out separately at both the national and sub-national level.[7] Age-sex data obtained from the Census, however, is known to be subject to errors of quality and coverage to different degrees across the states. For one, there are population figures for males and females whose ages are not specified. There is also a cultural bias towards reporting ages in digits ending with 0 or 5 as noted in the UNFPA (2014)[8] manual on demographic techniques. Thus, we need to smoothen the age–sex distribution.

[7] We estimated sector (rural/urban) by sex projections only at the all India level. At the State level we projected only male and female populations (i.e. rural and urban combined).

[8] https://india.unfpa.org/en/publications/training-manual-demographic-techniques Accessed on 15th October, 2019

In order to do so, we followed the 'Strong' method of smoothening which was also recommended by the technical group on population projections constituted by the National Commission on Population in 2006. The methodology followed is described below:[9]

If $W_1$, $W_2$, $W_3$,……., $W_n$ are respectively the n quinquennial age groups, 0-4, 5-9, 10-14 and so on up to 80+, then

$S(W_i) = 0.25^* O(W_{i-1}) + 0.50^* O(W_i) + 0.25^* O(W_{i+1})$.

where S is the smoothened population and O is the observed population.

In this way, smoothing of all the n-2 (all except $W_1$ and $W_n$) quinquennial age groups is carried out. $W_1$ has been smoothed as follows

$S(W_{0\text{-}4}) = O(W_{0\text{-}14}) – (S(W_{5\text{-}9}) + S(W_{10\text{-}14}))$

Similarly, $S(W_{80}+) = O(W_{15\text{-}80}+) – (S(W_{15\text{-}19}) + \ldots + S(W_{75\text{-}79}))$

Next, the population figures under the head 'age not stated' were distributed to all age groups in proportion to the age specific population share (as per the smoothened data). The final numbers thus obtained were our smoothened population figures as of 1st March 2011 (the Census moment).[10]

*3.3 Projection Exercise*

We use the module 'PROJCT' from the United Nation's MORTPAK software to project the smoothened population obtained above. The PROJCT module uses the cohort component method to carry out single-year projections of a population by age and sex, based on initial male

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[9] In the methodology adopted by the technical group, the open age group of the base population is 75+ while ours is 80+.

[10] The smoothening exercise was carried out for all states except Bihar and Jharkhand, where we obtained an overall negative figure for the open age group of the base population post the smoothening exercise. We used the un-smoothened census data for these states and added the 'age not defined' numbers in proportion to the un-smoothened age specific population share.

and female populations in 5-year age groups. Alongside the base year population by age-sex cohort of a region, the PROJCT module requires as inputs (i) sex ratio at birth for males and females, (ii) total fertility rate, (iii) life expectancy at birth for males and females, (iv) the age specific fertility rates, (v) net male and female migrants and (vi) migration pattern by sex. Input (i) is only required for the first projection period while for inputs (ii), (iii) and (v), one is required to fill in the values for the initial projection period and final projection period with an option of filling in the interim values if they are available. For age specific fertility rates (iv), one needs to fill in only the values for the initial and final period.

We used the SRS statistical reports brought out by the Office of the Registrar General & Census Commissioner, India to obtain the required all India (rural and urban) and state level information on mortality, fertility and life expectancy at birth.[11] For the latter, information is only available up till the year 2015 as the data comes out in the form of a five year moving average. We performed a linear trend extrapolation of the e(0**)** series to obtain data for the remaining years. We assumed that net migration at the all-India level (net international migration) was zero, given that it is a miniscule share of the total population. With respect to inter-state migration, we were hindered by the fact that the latest information on migration available is from the Census 2011. Given the above constraint, we assumed that there has been no drastic change in the inter-state migration pattern during this period of time (2011-12 to 2017-18) and applied the 2001-11 inter-censal migration rates to this period.[12] Furthermore, we used the UN South Asian life table model to estimate the age pattern of mortality.

[11] Data can be accessed at http://www.censusindia.gov.in/vital_statistics/SRS_Statistical_Report.html The total fertility rate and age specific fertility rate figures for the state of West Bengal were not available in the latest (2017) report so we had to use the figures of the preceding year. Similarly the total fertility rate and age specific fertility rate data for the state of Uttrakhand for the year 2011 was obtained from http://www.censusindia.gov.in/vital_statistics/Compendium/Srs_data.html With respect to life expectancy at birth for the state of Uttrakhand for 2011, data was obtained from the annual health survey bulletin for the state http://www.censusindia.gov.in/vital_statistics/AHSBulletins/files2012/Uttarakhand_Bulletin%202011-12%20(1).pdf

[12] The intercensal rates were calculated from Table D-13 of the 2011 Census.

### *3.4 Aligning projection data with survey reference period*

On running the PROJCT module, we were provided with four different projection estimates (sex by rural/urban) for each year between 2012 and 2018, centered on the 1st of March. This is because the module provides single year projections starting from the day of the base population which is 1st of March, 2011 i.e. the census moment. However, as we have already noted above, the NSSO/PLFS surveys are centered in June. We took the census population as on March 2011 and added three months of population growth to bring it up to June 2011 by taking the population differential for each age-sex cohort between the census figures for March 1st 2011 (smoothened) and our PROJCT estimates for March 1st 2012 (a period of 12 months) and dividing this by 4 in order to arrive at a rough three-month population increment (assuming constant population growth rates across the months). The latter was then added to the smoothened Census 2011 figures for each age-sex cohort to arrive at population figures for June 1st, 2011. Similarly, in order to arrive at the June 2017 (PLFS) population estimates we took the difference in population (by age-sex cohorts) between 1st March 2017 and 1st March 2018, divided it by 4 and added it to the former.

### *3.5 Applying age-cohort wise employment ratios to the projected data*

Having aligned the projected data with the survey reference period, we went on to apply the appropriate employment ratios. We divided our population into five different age cohorts for each sex*sector segment and applied the corresponding WPR of each age cohort to the respective population. These ratios were obtained from the EUS 2011-12 and PLFS 2017-18. Summing all of these together, we arrived at the total workforce size at the all India level. Not only does this method arrive at a more accurate estimate of the workforce, it also allows us to analyse the age wise shifts in the workforce over time

A similar exercise was adopted at the State level for 21 major states. This is necessary because demographic performances of states have varied greatly since the last Census. State population estimates cannot be made by using state share of the total population obtained from the labour force surveys because the state sample size for these survey is allocated in proportion to the population as per Census 2011. Taking state wise population ratios from these surveys, thus assumes that the relative growth of state populations has been constant during this period of time which is not the case.

## 4. Results

We now present the results of our study. Before delving into the substantive issue of employment growth, we present some results on absolute estimates.

### *4.1 Population and workforce estimates*

We start by comparing the total population estimated as of 1st March 2017 by our calculations to the official Government of India estimates that were recently made available (Table 2). Detailed projection comparisons by age-sex cohorts for the most recent year available in official data are provided in the Appendix. Note that Government of India population projections are also arrived at by using the cohort component method. This further strengthens our argument of using the cohort component method instead of a trend extrapolation in case of paucity of official data.

On the projected census moment, there was a difference of 0.008 percent between our estimate and the official one. In order to compare our estimates with those of the other recent studies cited in Table 1, we recalculated our numbers as well as the official population numbers for 1st of January, 2018 since these studies have taken the end of December/beginning of January as the survey mid-point. We find that our numbers were higher than the official figures by 0.7 million persons (difference of 0.06 percent). This difference is relatively small compared to the other studies (Table 2). Note that the percentage differences are small in all cases (1.04 percent to 3.65 percent), but the large base makes for large differences in absolute numbers.

We now show the variation in absolute workforce estimates that can result from some alternative assumptions. This will enable us to better understand why, even after using data from the same sources, different studies might present us with varying final figures.

**Table 2 Population Projections, 2017-18**

| | *Population on* | *Male* | *Female* | *Total* |
|---|---|---|---|---|
| Government Estimates | 1st March 2017 | 67,04,69,000 | 63,39,88,000 | 1,30,44,57,000 |
| Our Estimates | 1st March 2017 | 67,12,27,730 | 63,33,39,045 | 1,30,45,66,775 |
| Difference (%) | - | 0.113 | -0.102 | 0.008 |

| *Study* | *Population on 1.1.2018* | *Difference from official estimates* | *% Difference* |
|---|---|---|---|
| Official estimate | 1,31,63,07,833 | - | - |
| Current study's estimate | 1,31,70,31,890 | 0.7 mil | 0.06 |
| Mehrotra and Parida (2019) | 1,34,50,00,000 | 28.7 mil | 2.18 |
| Bhandari and Dubey (2019) | 1,36,43,64,405 | 48.1 mil | 3.65 |
| Himanshu (2019)[13] | 1,33,00,00,000 | 13.0 mil | 1.04 |

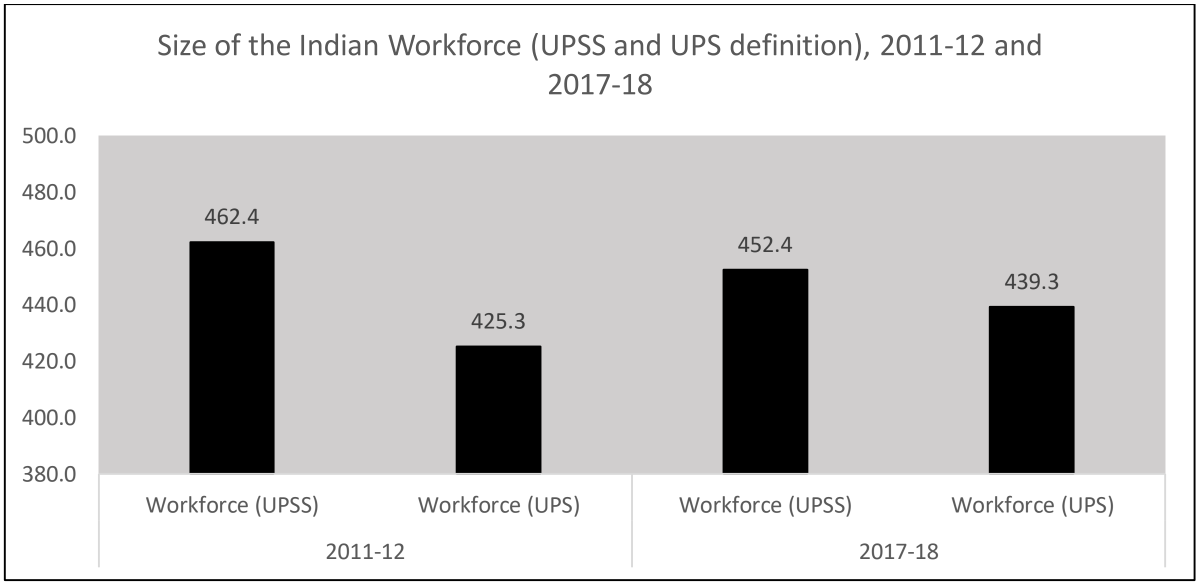
Source: Various Studies

First, note that the definition of employment is an obvious and important determinant which can influence the final workforce estimate. In Figure 1 we show workforce estimates for both UPSS and UPS definitions. As expected the latter are lower than the former for both years. But more importantly, we note that if we were to take the UPSS definition, there has indeed been a fall in total workforce size between the years 2011-12 and 2017-18, to the tune of around 9.9 million. However, by the UPS definition, there has been a rise of 14 million during the same time period. As noted earlier, this is an important reason for the differing estimates in the literature.

Which definition is the "correct one"? The answer is, of course, that it depends on the question being asked. If we are interested in regular and full-time employment, the UPS is a better approximation but if we want to look at occasional and part-time work as well, then UPSS is better. We discuss the economic significance of this divergence in the next section.

[13] This figure is from Mehrohtra and Parida (2019). We could not find population estimates as arrived by Kannan and Raveendran (2019)

**Figure 1: Size of the Indian workforce using UPSS and UPS definition, 2011-12 and 2017-18**




Source: Authors' calculations based on unit level EUS 2011-12 and PLFS 2017-18 data.

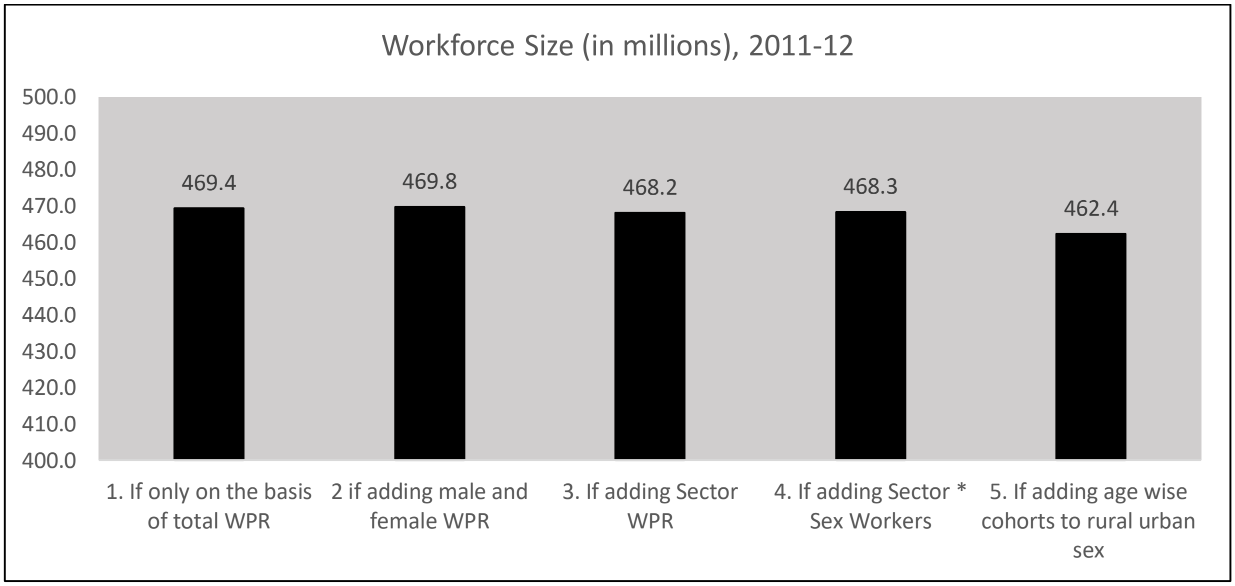
However, more subtle factors can also affect estimates. We estimated the size of the Indian workforce using WPR (UPSS) at different levels of disaggregation for June 2012 (mid-point of EUS 2011-12, as explained above) (Figure 2). If we apply the male and female WPRs separately to projected male and female populations and then add up the two, we arrive at a workforce figure of 469.8 million.[14] This is marginally higher than the 469.4 million that we get if we apply the total (male and female combined) WPR to the sum of male and female population directly.

Now if we apply sex by rural/urban WPRs to the total population of each sex in rural and urban India separately and then sum up the figures, our final estimate falls down to 468.3 million. If we further take age cohorts into consideration, the estimate falls to 462.4 million, a substantial difference of 7 million from the aggregate estimate. Following the rule that more disaggregated

[14]This effectively means having used two different Census Adjusted Multipliers (one for male and one for females) instead of one.

estimates are better, this last number is what we consider while carrying out the subsequent analysis.[15]

**Figure 2: Size of the Indian workforce (UPSS) at different levels of disaggregation, 2011-12**




Source: Authors' calculations based on unit level EUS 2011-12 data.

Alongside the level of disaggregation, a second aspect that we had discussed earlier was the choice of survey mid-point. We find that if one takes the disaggregated ratios calculated from the 68th round and applies them to the demographics obtained directly from the Census 2011 and then adds up the same, one would arrive at a population figure of 466.8 million. The reference period of the EUS here is the census moment. We if one takes the mid-point of the EUS survey as

[15] It is to be noted that ideally we should have had another level of disaggregation i.e. all the states and UTs, and added the workforce numbers for each age cohort by sex and sector to arrive at the national workforce estimates. A number of studies based on trend extrapolation, in fact, start from the subnational level. However, given that a number of crucial demographic information, necessary for cohort-component analysis, is not available for each state, we had to leave out this level of disaggregation.

January, 2012, the workforce estimate is 472 million.[16] If, instead June 2011 is taken as our mid-point the workforce estimate is 468.3 million. Of course, as noted earlier, while the choice of the mid-point will affect the level of estimated employment at a point in time, as long as the same mid-point is applied across survey rounds, the estimated change in employment should not differ by much.

*4.2 Employment growth vis-a-vis population growth*

Having explored the principal issues that arise when estimating absolute employment numbers, we now turn to an important policy question raised in the Introduction: did the number of employment opportunities keep pace with the increase in working age population in the period between 2011 and 2017. Here a caveat is necessary. The usual definition of "working age population" in India is 15 years and above (or sometimes 15-59). However, as educational enrollment increases, a larger proportion of 15-20 year olds choose to stay on in education rather than join the workforce. Thus, to the extent that educational enrollment rises (a desirable development), new job opportunities do not have to keep pace with the entire growth in the 15+ population.

We take a conservative approach and only look at the rate of growth of the cohort aged 25 years and older. These individuals are unlikely to be out of the workforce due to education. The results are shown in Table 3. For all our sub-groups (rural men, rural women, urban men and urban women), the rate of growth of population among those aged 25 years or above was around 2.5% per year (CAGR). But the rate of employment growth varied greatly. As per the UPSS definition, even the fastest rate of growth (1.92% for urban women) fell far short of the population growth rate for that group (2.56%). For rural women, employment declined at the rate of 3.17% per year in this period.

[16] We did not disaggregate these figures by age cohorts as none of the studies mentioned in section 1 do the same. We wanted to arrive at numbers similar to the aforementioned studies.

**Table 3: Growth in working age population versus employment growth for various groups**

| | *WAP Growth* | *UPSS Growth* | *UPS Growth* |
|---|---|---|---|
| RM | 2.51 | 1.46 | 1.47 |
| RF | 2.47 | -3.17 | 0.34 |
| UM | 2.52 | 1.53 | 1.54 |
| UF | 2.56 | 1.92 | 3.67 |

| *UPSS* | *Projected based on pop growth* | *Hypothetical Difference* | *Actual Difference* |
|---|---|---|---|
| RM | 216717575 | 30251747 | 16898019 |
| RF | 92442444 | 12730465 | -14011963 |
| UM | 106661074 | 14992581 | 8726057 |
| UF | 25636331 | 3644936 | 2658896 |

| *UPS* | *Projected based on pop growth* | *Hypothetical Difference* | *Actual Difference* |
|---|---|---|---|
| RM | 215611894 | 30097405 | 17033484 |
| RF | 66292644 | 9129315 | 1172278 |
| UM | 106338220 | 14947199 | 8754640 |
| UF | 21998181 | 3127669 | 4561813 |

Source: Authors' calculations based on unit level data from EUS 2011-12 and PLFS 2017-18.

Even by the UPS definition, the picture is grim. Perhaps even grimmer, considering that a fall in subsidiary employment could at least in part be explained by women withdrawing from such employment due to an improvement in household incomes. Although there is no absolute decline in employment by the UPS definition (as noted above), the rate of employment growth falls far short of the rate of population growth for all groups except urban women.[17]

For example, among urban men for employment (UPS) to have kept pace with population growth, the former should have grown by 15 million over six years (Table 3, Hypothetical Difference). Instead, it grew by 8.7 million (Table 3, Actual Difference). The corresponding figures for rural men are 30 million and 17 million. Thus, the concerning fact to be emphasised is that even for men aged 25 and above, (in rural and urban areas), employment grew at 60% the rate of population growth. This difference offers a concrete way to measure the extent of jobless

[17] Expectedly, this is the only sub-group that shows an increase in WPR during the period of analysis.

growth. The result is an increase in open unemployment as well as a fall in the labour force participation rate.

**Table 4: Change in the size of the Indian workforce between 2011-12 and 2017-18 (in millions) by UPSS and UPS definition**

| | *UPSS Definition* | | | *UPS Definition* | | |
|---|---|---|---|---|---|---|
| | *2011-12* | *2017-18* | *Change* | *2011-12* | *2017-18* | *Change* |
| Rural Male | 230.5 | 238.2 | 7.7 | 226.8 | 236 | 9.2 |
| Rural Female | 97.5 | 73.9 | -23.6 | 68.9 | 65.1 | -3.8 |
| Urban Male | 108.1 | 112.8 | 4.7 | 107.1 | 112.2 | 5.1 |
| Urban Female | 26.4 | 27.6 | 1.2 | 22.5 | 26 | 3.5 |
| Total Males | 338.5 | 351 | 12.4 | 333.9 | 348.2 | 14.3 |
| Total Females | 123.8 | 101.5 | -22.4 | 91.4 | 91.1 | -0.3 |
| Total Workers | 462.4 | 452.4 | -9.9 | 425.3 | 439.3 | 14 |

Source: Calculated by author using unit level EUS 2011-12/ PLFS 2017-18 data on projection estimates

### *4.3 Fall in Subsidiary Status employment between 2011-12 and 2017-18*

We now analyse the nature of employment decline by the UPSS definition that has been observed by the authors mentioned above. Table 4 breaks the above down by sector and sex. Also given alongside, for comparison, are the UPA-based numbers. Note that total male employment has risen by roughly the same amount during this period of time irrespective of the activity status definition that is employed. Furthermore, both rural and urban areas experienced an increase in employment though, as shown in the previous section, it was not enough given the increase in working age population. In contrast to men, however, female employment fell by only 0.3 million as per the UPS status but by more than 22 million by the UPSS definition. Further, there is a striking difference between rural and urban areas. The decline in employment is found entirely in rural areas and there has been a fall in rural female employment by both UPS and UPSS definitions though the fall is much larger in subsidiary as compared to principal status employment.

As we had noted earlier, the difference between UPSS and UPS is accounted for by activities known as subsidiary activities i.e. economic activities carried out by an individual for 30 days or more (but less than six months) during the reference period of the last 365 days preceding the date of the survey. Thus, the job loss story of the past six years is predominantly about the fall in the number of subsidiary economic activities pursued by rural women.

We now explore the demographic and sectoral dimensions of this striking fall. Table 5 presents the change in the size of the female workforce (both rural and urban) engaged in subsidiary activities by age. The absolute number of women engaged in subsidiary activities (including those engaged in a principal activity alongside the subsidiary activity) fell by around 32 million between 2011-12 and 2017-18. More importantly, the total number of women engaged only in subsidiary activities fell by close to 23 million during this time. This fall is not due to women opting to move out of the labour force into education as much of the decline (around 62%) took place in the age bracket of thirty years and above. This decline in employment could be due to factors such as a rise in family incomes resulting in withdrawal of women from the workforce or a decline in availability of work. We do not address this question in the present study.

**Table 5: Change in the size of the female workforce engaged in subsidiary activities by age cohorts (between 2011-12 and 2017-18)**

| *Age -Cohorts* | *Change in Female Workforce (in millions)* | |
|---|---|---|
| | *Engaged In Subsidiary Activities* | *Engaged only in Subsidiary Activities* |
| 0-14Y | -0.5 | -0.5 |
| 15-19Y | -2.5 | -1.8 |
| 20-24Y | -3.9 | -2.8 |
| 25-29Y | -4.7 | -3.7 |
| 30 and Above | -20.6 | -14 |
| Total | -32.3 | -22.8 |

Source: Calculated by author using unit level EUS 2011-12/ PLFS 2017-18 data on projection estimates

**Table 6: Change in the size of the female workforce engaged in subsidiary economic activity by industrial groups (between 2011-12 and 2017-18)**

| Industrial Group | *Engaged in Subsidiary Activities* | *Engaged only in Subsidiary Activities* | |
|---|---|---|---|
| | *Absolute Change (in millions)* | *Absolute Change (in millions)* | *Contribution to Change (in %)* |
| Agriculture, Forestry and Fishing | -20.6 | -16.1 | 70.7 |
| Mining and Quarrying | -0.1 | 0 | 0.1 |
| Manufacturing | -3.7 | -3.3 | 14.4 |
| Electricity, Gas, Water Supply | 0 | 0 | 0.1 |
| Construction | -6.6 | -2.1 | 9.3 |
| Services | -1.3 | -1.2 | 5.5 |

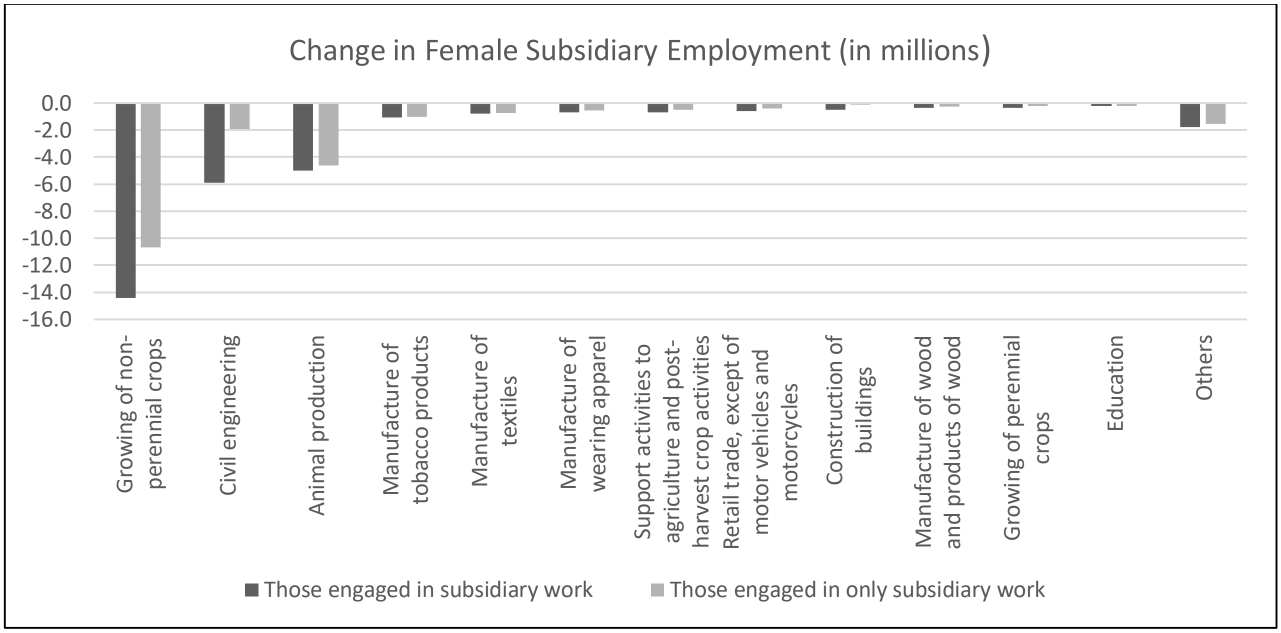
Source: Calculated by author using unit level EUS 2011-12/ PLFS 2017-18 data on projection estimates

Much of the aforementioned decline in the number of female workers engaged in subsidiary activities was in the agricultural sector (Table 6), followed by manufacturing and construction. Overall, the subsidiary female workforce decreased by around 16 million in 'Agriculture, Forestry and Fishing'. Breaking this down[18] (Figure 3), we note that in absolute terms, the largest fall in female subsidiary employment has taken place in the activity 'growing of non-perennial crops' (14.4 million), followed by 'animal production' (5 million) and 'construction of road and railways' (4 million).

Not surprisingly, the industries that show a large decline in subsidiary female employment are, to begin with, large employers of women workers, for e.g. agriculture and livestock, construction, tobacco, apparel and textiles. To adjust for this, we take the ratio of sectoral contribution to change between the two time points to the sector wise share of female subsidiary workers in the base year (2011-12) to arrive at an index of disproportionality (see Figure 4).

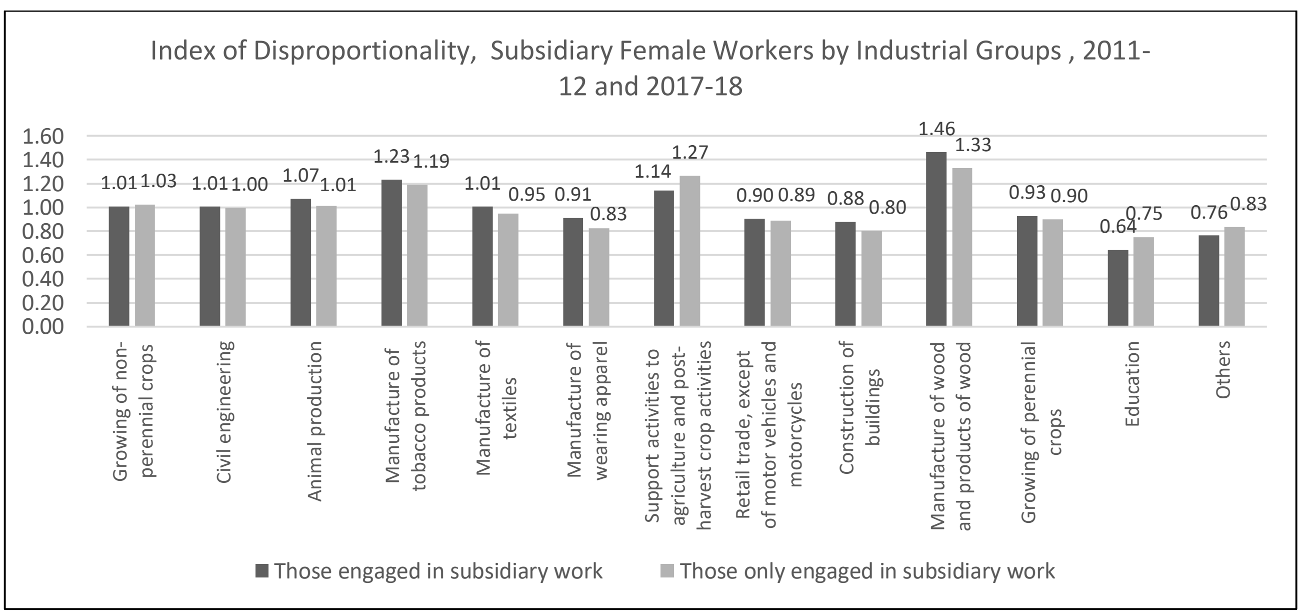
[18] The disaggregation happens at a National Industrial Classification (NIC) 2/3 hybrid level where all agricultural groups are presented at the NIC 3-digit level and all non-agricultural groups at the NIC 2 digit

**Figure 3: Change in Female Subsidiary Employment (in millions) by NIC 2/3 digit Industrial Groups, 2011-12 and 2017-18**




Source: Authors' calculations based on unit level data from PLFS 2017-18 and EUS 2011-12.

**Figure 4: Index of Disproportionality, Subsidiary Female Workers (Decline), by NIC 2/3 digit groups, 2011-12 and 2017-18**




Source: Authors' calculations based on unit level data from PLFS 2017-18 and EUS 2011-12.

Sectors with a value of more than 1 such as manufacturing have thus seen a more than proportionate fall in the number of female subsidiary workers while subsidiary workers engaged in agricultural activities have moved out of the workforce in proportion to their overall share in the base period. It is clear from the foregoing, that the absolute decline in employment in the period of study is driven by women doing subsidiary work in agriculture, and to a lesser extent in construction and labour-intensive manufacturing.

**5. Conclusion**

India faces a significant challenge of adequate employment generation in the years to come. Effective policy making requires good data as well as sound methods for measuring employment generation over time. In this paper we have presented a relatively less used, but demographically sounder technique of projecting absolute workforce numbers. The cohort-component method makes use of demographic data produced subsequent to the most recent Census, and thus produces more reliable population estimates. Using this method, the paper also showed two key aspects of employment dynamics in the 2011-2017 period. Firstly, employment growth has been weak in every demographic group (men, women, urban, rural) and has lagged far behind population growth. The result has been falling rates of labour force participation and rising rates of unemployment in every group. Second, employment has not grown at all, and has in fact fallen for rural women. The implications of this fall are ambiguous without more information on whether the withdrawal of women from subsidiary farm work took place due to disappearing work opportunities or an improvement in household incomes. Further research is needed to address this question.

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APPENDIX: Population Projection comparison between our estimates and official estimates by sex and age groups (As on 1.3.2016)

| Age Group | Our estimates (in '000) | | | Official Estimates (in '000) | | | Difference (in %) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Persons | Male | Female | Persons | Male | Female | Persons |
| 0-9 | 119883 | 110423 | 230306 | 123130 | 112003 | 235133 | -2.64 | -1.41 | -2.05 |
| 10 - 14 | 65172 | 59733 | 124905 | 65160 | 59763 | 124923 | 0.02 | -0.05 | -0.01 |
| 15 - 19 | 67349 | 61030 | 128379 | 67241 | 60965 | 128207 | 0.16 | 0.11 | 0.13 |
| 20 - 24 | 63754 | 57606 | 121361 | 63545 | 57456 | 121001 | 0.33 | 0.26 | 0.30 |
| 25 - 29 | 57602 | 53592 | 111195 | 57310 | 53441 | 110750 | 0.51 | 0.28 | 0.40 |
| 30 - 34 | 51169 | 49466 | 100635 | 50834 | 49341 | 100176 | 0.66 | 0.25 | 0.46 |
| 35 - 39 | 45739 | 44973 | 90712 | 45364 | 44875 | 90239 | 0.83 | 0.22 | 0.52 |
| 40 - 44 | 41696 | 40657 | 82353 | 41320 | 40586 | 81906 | 0.91 | 0.17 | 0.55 |
| 45 - 49 | 37003 | 35249 | 72252 | 36643 | 35191 | 71834 | 0.98 | 0.16 | 0.58 |
| 50 - 54 | 31118 | 29145 | 60263 | 30773 | 29088 | 59861 | 1.12 | 0.20 | 0.67 |
| 55 - 59 | 24730 | 23382 | 48112 | 24428 | 23356 | 47784 | 1.24 | 0.11 | 0.69 |
| 60 - 64 | 19411 | 19356 | 38768 | 19154 | 19324 | 38478 | 1.34 | 0.17 | 0.75 |
| 65 - 69 | 15489 | 16249 | 31738 | 15214 | 16149 | 31363 | 1.81 | 0.62 | 1.20 |
| 70 and above | 22887 | 24789 | 47676 | 23231 | 25980 | 48581 | -1.48 | -4.59 | -1.86 |
| Total | 663003 | 625651 | 1288654 | 663346 | 626889 | 1290235 | -0.05 | -0.20 | -0.12 |

Source: Report on Technical group on Population Projections, 2019 and author's population projections.