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Employment Elasticity in India and the U.S., 1977-2011: A Sectoral Decomposition Analysis

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Abstract

This paper analyses the phenomenon of jobless growth in India and the US through the lens of employment elasticity. Analytical results are derived for decompositions of both the level and change of aggregate employment elasticity in terms of sectoral elasticities, relative growth and employment shares. Estimates of these decompositions are presented with employment and output data from relevant sources for both economies. In India, the agricultural sector was the key determinant of both the level and change of aggregate elasticity till the early 2000s. In USA, services is the most important determinant of the level of, but manufacturing remains an important driver of changes in, aggregate employment elasticity.

JEL Codes: E2; E24

Keywords: employment; output; elasticity

1. Introduction

In the last few decades, the phenomenon of a marked slowdown in the growth of employment has been noticed in many countries across the world. This is often referred to as jobless growth (ILO 2013; Caballero and Hammour 1997; Verme et al 2014). To be sure, it's not the case that employment has not been rising at all, even as output has grown. Rather, for each percentage point of output growth, the associated growth rate of employment has fallen. Hence, a more

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precise characterisation would be that the output elasticity of employment, which measures the responsiveness of employment to output growth, has been declining over time.[1]

In addition to the almost secular decline in employment elasticities over the long run, asymmetric fluctuations over phases of the business cycles have also been observed. For instance, Basu and Foley (2013) note that the responsiveness of employment to output growth in the US economy has been different between the downturn and recovery phases of business cycles. In particular, they point out that while labour is shed during the economic slowdown, as is to be expected, the pick-up of employment during the recovery phase has been weakening since the early 1990s (Basu and Foley 2013).

While these asymmetric employment responses at business cycle frequencies are interesting and important phenomena, the focus of this paper on longer term response of employment to output changes. In this respect, India is no exception to the global trend of declining labour absorption capacity of output growth (Papola 2006; Kannan and Raveendran 2009). Even as the growth rate of real GDP in India has accelerated since the late-1980s, employment growth has slowed down. Thus, the employment growth associated with each percentage point growth of real value added has drifted down over time. In Figure 1, we plot the aggregate output elasticity of employment, which measures the percentage change in employment for every percentage change in real value added, for India and US since 1977. It is immediately apparent from the figure that there is a clear downward trend in the output elasticity of employment over time in both countries.

[1] For the sake of brevity, henceforth we will refer to "output elasticity of employment" as "employment elasticity".

[Figure 1 about here]

The downward trend in employment elasticity highlights the key challenge facing policy makers in contemporary India. For a poor and labour surplus economy like India, employment growth is by far the most important mechanism for rapid and robust poverty reduction.[2] The fact that employment elasticity has been declining means that the capacity of output growth to absorb labour is weakening. To kick start an employment-intensive growth strategy, it will be necessary to address the issue of employment elasticity.

It is from this perspective that we investigate the phenomenon of declining employment elasticity in India and the US in this paper. We choose these two countries because they are both large and important in the contemporary world, but also quite different in terms of structure and levels of economic development. In India, a large poor country, agriculture continues to be dominant sector in terms of employment even as non-agricultural sectors have become important in terms of output. In the US, one of the richest countries in the world, the picture is quite different: services has become predominant both in terms of output and employment. Despite these important structural differences, we will see that they display a strikingly similar trend in terms of aggregate employment elasticity. The fact that these two very different economies face similar problems of labour absorption will highlight the widespread reach of the phenomenon under investigation. But our analysis will also show that the sources of low labour absorption are quite different in the two countries. Hence, policies

[2] There is the important consideration of quality of jobs that are being created. But the creation of jobs itself remains a major challenge.

fashioned to address the problem of employment will need to aware of common, worldwide trend but also sensitive to local conditions.

Aggregate employment elasticity, i.e., employment elasticity of the whole economy, is a blunt tool to investigate the complex of phenomenon that underlies declining labour absorption. The entire economy is composed of many sectors, which are very different from one another. Thus it would be analytically more rewarding to adopt a sectoral perspective, as has been the practice in much of the previous literature (see, for instance, Papola and Sahu 2012). While previous research has estimated aggregate and sectoral employment elasticities and also analysed its evolution over time, this paper makes two novel contributions.

First, we demonstrate two analytical results: (a) that the level of aggregate employment elasticity is a weighted sum of sectoral employment elasticities, with the product of sectoral employment shares and relative growth rate of output functioning as weights (we call this the level-decomposition); and (b) that the change of aggregate elasticity over a period of time is the sum of three components, one capturing changes in sectoral elasticities, the second arising from changes in employment shares and the third coming from changes in relative growth rates (we call this the change-decomposition). While the level-decomposition allows us to understand the influence of the employment elasticity of any particular sector on the *level* of aggregate elasticity, the change-decomposition enables us to investigate the importance of changes in sectoral elasticities and compositional changes on *changes* in aggregate elasticity.

Second, we use output and employment data from 1977 to 2011 for the Indian and US economies to operationalise our analytical results. This allows us to empirically investigate both

the level and change in aggregate employment elasticity for both countries. Our main empirical findings are the following. For the Indian economy, the agricultural sector was the most important factor determining the level of aggregate employment elasticity before the 2000s, and since then its importance has declined. An analysis of changes in aggregate employment elasticity shows that changes in sectoral employment elasticities is its most important determinant. Here too, the role of the agricultural sector was important till the late 1990s, and since then it has declined. For the US economy, we find analogous results: the services sector has been, and continues to remain, the main determinant of the level of aggregate employment elasticity. Analysis of changes show that changes in sectoral elasticities and changes in relative sectoral growth rates have both been important drivers of changes in aggregate employment elasticity, with the manufacturing sector playing an important role.

The rest of the paper is organised as follows. In section 2, we outline our empirical methodology; in section 3, we discuss the sources of our data and definitions of key variables. Section 4 contains a discussion of the main results and the last section concludes the paper.

2. Empirical Methodology

Employment elasticity captures the responsiveness of employment to changes in output. There are two common ways of measuring the output elasticity of employment (Mishra and Suresh, 2014). The first method calculates the *point* elasticity by regressing log-employment on log-output, where the coefficient on the latter is the estimate of elasticity. Since estimation of point elasticity relies on a regression, a researcher requires substantial data points to put it into practice. Often, enough data is not available to run regressions. In such cases, researchers turn

to the second method, which calculates the *arc* elasticity as the ratio of the growth rate of employment and growth rate of output over some period of time. In this paper, we use data on employment from the Employment-Unemployment Survey (EUS) of the National Sample Survey Organisation (NSSO), which is available only every 5 years. This makes regression analysis infeasible. Hence, we compute and work with arc elasticities.

The arc employment elasticity for the aggregate economy is defined as

$$\eta \equiv \frac{\left(\frac{\Delta E}{E}\right)}{\left(\frac{\Delta Y}{Y}\right)} = \frac{\Delta E}{\Delta Y} \times \frac{Y}{E} \qquad (1)$$

where E denotes employment, Y denotes real output (value added) and Δx stands for change in the variable x.

2.1. Level-Decomposition

The key idea of our empirical methodology rests on the recognition that the aggregate economy is composed of many sectors, which behave quite differently in terms of employment elasticity. Thus, our first task is to decompose the *level* of aggregate employment elasticity for any time period into sectoral elasticities, sectoral employment shares, and sectoral proportion of aggregate growth over the same period. To be more concrete, suppose there are $i = 1,2, \dots, n$ sectors in the economy, so that

$$E = \sum_i E_i \text{ and } Y = \sum_i Y_i \qquad (2)$$

then the aggregate employment elasticity in (1) can be written as

$$\eta = \sum_{i=1}^{n} \eta_i g_i e_i, \qquad (3)$$

where

$$\eta_i \equiv \frac{\left(\frac{\Delta E_i}{E_i}\right)}{\left(\frac{\Delta Y_i}{Y_i}\right)}$$

is the employment elasticity in the i-th sector,

$$g_i \equiv \frac{\left(\frac{\Delta Y_i}{Y_i}\right)}{\left(\frac{\Delta Y}{Y}\right)}$$

is the i-th sectors growth (of real value added) as a ratio of the rate of growth of aggregate value added, and

$$e_i = \frac{E_i}{E}$$

is the share of total employment contributed by the i-th sector. The expression in (3) shows that the aggregate employment elasticity is product of sectoral employment elasticity, employment share and growth summed across all the sectors of the economy. Thus, the contribution of any particular sector to the aggregate employment elasticity can be large if either of the three components – employment elasticity, employment share, or relative growth – is large.

2.2. Change-Decomposition

Our interest is not only in decomposing employment elasticity for a time period but also to investigate the factors that drive its change over time. Thus, our second task is to decompose the *change* in aggregate employment elasticity between two periods. To be more concrete, suppose t_0 refers to an initial period and t_1 refers to a final period; then the change in the aggregate employment elasticity between the initial and final period is

$$\eta^{t_1} - \eta^{t_0} = \sum_{i=1}^{n} e_i^{t_1} g_i^{t_1} \eta_i^{t_1} - \sum_{i=1}^{n} e_i^{t_0} g_i^{t_0} \eta_i^{t_0}$$

Adding and subtracting terms, this becomes

$$\eta^{t_1} - \eta^{t_0} = \sum_{i=1}^{n} e_i^{t_1} g_i^{t_1} \left(\eta_i^{t_1} - \eta_i^{t_0}\right) + \sum_{i=1}^{n} e_i^{t_1} \eta_i^{t_0} \left(g_i^{t_1} - g_i^{t_0}\right) + \sum_{i=1}^{n} \eta_i^{t_0} g_i^{t_0} \left(e_i^{t_1} - e_i^{t_0}\right)$$

so that

$$\eta^{t_1} - \eta^{t_0} = \Delta SEL + \Delta SGW + \Delta SEM \qquad (4)$$

where the first component, ΔSEL, captures changes in sectoral elasticities

$$\Delta SEL = \sum_{i=1}^{n} e_i^{t_1} g_i^{t_1} \left(\eta_i^{t_1} - \eta_i^{t_0}\right) \qquad (5)$$

and the second component, ΔSGW, captures changes in relative sectoral growth rates

$$\Delta SGW = \sum_{i=1}^{n} e_i^{t_1} \eta_i^{t_0} \left(g_i^{t_1} - g_i^{t_0}\right) \qquad (6)$$

and the third component, ΔSEM, captures changes in sectoral employment shares

$$\Delta SEM = \sum_{i=1}^{n} \eta_i^{t_0} g_i^{t_0} \left(e_i^{t_1} - e_i^{t_0}\right) \qquad (7)$$

The expression in (4) shows that the change in aggregate employment elasticity can be decomposed into three components, one driven by changes in sectoral employment elasticities, another by changes in relative sectoral growth, and the last by changes in sectoral employment shares. Let us look at each component in turn.

The first component, ΔSEL, is a weighted sum of changes in employment elasticity occurring within each sector between the final and initial period. The weights are the product of employment shares and relative growth rates in the final period. It represents the contribution to the change in aggregate output elasticity of employment coming from changes in the elasticity occurring *within* each sector. It will have a value of zero (or close to zero) if employment elasticities do not change much in every sector. On the other hand, if employment elasticity changes in sectors that have relatively large employment shares or in sectors that are growing relatively faster than average, then this component will have a large value.

The second component, ΔSGW, is a weighted sum of changes in the relative growth rates of each sector, with the product of employment share in the final period and the employment elasticity in the initial period used as weights. It measures the contribution to the change in aggregate employment elasticity coming from changes in the relative sectoral growth rates of real value added. If the relative position of all sectors with respect to the average growth rate of the economy remains more or less unchanged, then this component will has a value that is close to zero. On the other hand, if sectors change position relative to average growth, then the magnitude and sign of this component will depend on the magnitude and signs of employment elasticity and employment shares.

The third component, ΔSEM, is a weighted sum of changes in the employment share of each sector, where the product of employment elasticity and relative growth in the initial period are used as weights. This component represents the contribution to the change in the aggregate elasticity coming from changes in the employment share of each sector. If an economy is undergoing rapid structural change, this component might have a large value. Otherwise, it will be relatively small.

In this paper we use data on real value added and employment at the aggregate level and at levels disaggregated by major sectors in India and the US to investigate the level and changes in the aggregate output elasticity of employment since the mid-1970s. To understand the determinants of the level of employment elasticity for any time period, we compute the components of the level of elasticity given in (3) and study sectoral contributions. To investigate the drivers of change, we compute the three components of change in aggregate elasticity

given in (4) and investigate their relative sizes. But before we discuss our results, we would like to describe our data sources.

3. Data

Data for our analysis of employment elasticity in India come from two main sources. Data on aggregate and sectoral real value added comes from the *Economic Survey of India, 2013-14* (Government of India 2014). We use gross domestic product at factor cost, expressed in terms of 2004-05 prices, as our measure of real output. Output data is available for the whole economy (ALL) and for four major sectors: AGR (agriculture, forestry & fishing, mining & quarrying), MFG (manufacturing, construction, electricity, gas & water supply), TRD (wholesale & retail trade, hotel, transportation & communications), CSP (community, social and public services sectors).[3] Thus, the particular division into sectors that is used in this paper is determined by the availability of data on real output in India.

Data on aggregate and sectoral employment – that matches the above 4 sectors – is constructed from various rounds of the EUS. The EUS questionnaire uses three different reference periods to ascertain the activity status of any individual: one year (usual status), one week (current weekly status), and each day of the reference week (current daily status). Following common practice in the literature, we will use usual status to define employment.

With respect to the reference period of a year (usual status), each person is classified into one of three activity statuses: (a) working, (b) not working but available for work, and (c) neither working nor available for work. All those who fall in categories (a) and (b) are counted

[3] Note that the division into the 4 sectors is exhaustive. Thus, for both output and employment, ALL = AGR + MFG + TRD + CSP.

as part of the labour force, with those in category (a) being counted as employed and those in (b) as being unemployed. Those who fall in category (c) are counted as "not in the labour force".

Since it is possible for a person to be simultaneously belong to more than one of the categories (a), (b) and (c) over the reference period of a year, the EUS uniquely identifies a person as belonging to one of the three categories using the "major time criterion", and calls it the usual principal activity status. "The activity status on which a person spent relatively long time (i.e., major time criterion) during the 365 days preceding the date of the survey is considered as the *usual principal activity status* of the person." (NSSO 2011). To allow for the possibility that a person classified with the major time criterion performed some other economic activities for a shorter time span, the EUS uses *usual subsidiary status*. This is defined as the status for any economic activity performed over the past 365 days for a minor period not less than 30 days. In this paper, we will use the definition of "total employed" as all those persons who are counted as workers (i.e., falling in category (a) above) using either the principal status (PS) or subsidiary status (SS). To arrive at estimates of workers using this definition, we use three sources.

First, we extract the data on sectoral shares of employment from Statement 5.9, NSSO (2011). Second, we take data on levels of total employment from Himanshu (2011), who had used unit-level EUS data to construct his figures. Combining the two gives us levels of sectoral employment for from 1977-78 to 2009-10 (roughly every 5 years). Third, for the latest year, 2011-12, we use data on sectoral employment levels from Thomas (2014), who had used unit-level EUS data to generate his estimates.

Thus, the time period for our analysis runs from 1977-78 to 2011-12 but the frequency of our data set is not annual. While we do have annual data on real output, data on employment is only available roughly every 5 years, the years when the EUS was conducted by the NSSO. Hence, our data set for India consists of observation on real output and employment, at the aggregate level and for the 4 major sectors mentioned above, for the years 1977-78, 1983, 1987-88, 1993-94, 1999-00, 2004-05, 2009-10, 2011-12.

Data for the US economy come from the "GDP by Industry" data set available on the website of the Bureau of Economic Analysis of the US Department of Commerce.[4] For the US economy, our measure of real output is nominal gross domestic product – for the whole economy and for the four sectors that we are working with – deflated by the economy-wide GDP deflator with 2005 as the base year. Our measure of employment is the sum of full time and part time employees. To facilitate comparison with India, we use the same years of analysis. Thus, our data set for the US has observations on real output and employment, at the aggregate level and for the 4 major sectors, for the years 1977, 1983, 1987, 1993, 1999, 2004, 2009, 2011.[5]

[4] See http://www.bea.gov/industry/index.htm#annual

[5] The time periods in the Indian data sets span over consecutive calendar years. For instance, the time period 1977-78 starts in the middle of 1977 and runs till the middle of 1978. In the case of the US, the time periods in the data set are also the calendar years. As a matter of convention, we choose the first year from the US for comparison with the relevant period in India. For instance, to compare the accounting year 1977-78 in India, we use 1977 in the US.

4. Results

4.1. Overall Trends

Table 1 presents data on output and employment for India from 1977-78 to 2011-12, roughly every 5 years. Over this three and half decade period, India's real output (measured in 2004-05 prices) has increased more than 7-fold from about 7.4 trillion rupees to 52.5 trillion rupees. Over the same period, employment has increased from 268.3 million to 472.5 million. Thus, real output (measured in 2004-05 prices) per worker increased from about 27776 rupees/worker to 111058 rupees/worker, implying an average annual growth rate of about 4.2 percent per annum. Of course, the pace of change has been uneven over the decades so that the responsiveness of employment to output growth has also fluctuated over time.

[Table 1 about here]

The first row of Table 2 has employment elasticities over consecutive periods – which is also visually displayed in Figure 1 – computed from the data in Table 1. The data in Table 2 seems to suggest that there is a downward drift in the employment elasticity: it was 0.792 for 1977-78/1983, but fell to 0.166 for 2009-10/2011-12. In the intervening periods, it has fluctuated.

[Table 2 about here]

Table 4 presents analogous data on output and employment for the US economy. Over the period from 1977 to 2011, real output (measured in 2005 prices) in the US has increased only

about 2.5-fold from 5.4 trillion to 13.3 trillion USD. Employment has increased from 90 to 138 million. Thus, real output (measured in 2005 prices) per worker increased from about 59388 USD/worker to 96360 USD/worker, implying an average annual growth rate of about 1.4 percent per annum. Just like in the case of the Indian economy, the pace of growth of output and employment has been uneven over the decades, so that the employment elasticity has fluctuated. The first row of Table 5 shows that the aggregate employment elasticity has declined from 0.642 in the period 1977/1983 to 0.154 in 2009/2011.

Figure 1 has time series plot of aggregate employment elasticities for both India and the US. It is rather striking that despite the differences in the structures of the two economies, the aggregate employment elasticity shows similar levels and trends over the past three decades. For both countries, the aggregate employment elasticity starts at roughly similar values in 1977/1983 and falls to similar values by 2009/2011.

This aggregate picture hides enormous variation across sectors. For instance, in India the share of agriculture in output declined sharply from 40 to 16 percent over our period of study, but its share in employment declined much more slowly from 71 to 47 percent over the same period. In contrast to this, the share of manufacturing in output increased very slowly from 23 to 26 percent, but the share of employment increased much faster from 12 to 24 percent. These divergent trend movements in output and employment gives rise to divergent employment elasticities across sectors, which will be a key part of the analysis in this paper.

Much as in India, the aggregate picture in the US arises from very different sectoral patterns. While agriculture has been, and remains, the dominant sector in India, the services sector (CSP) plays an analogous role in the US. But there is a difference too: while the share of

agriculture in India's output and employment has fallen, the share of CSP in the US economy has increased. The share of output for CSP has increased from 49 to 65 percent; and the share of employment has also increased from 52 to 67 percent. The manufacturing sector in the US shows a trend that is similar to the role of agriculture in India: its share in output and employment has secularly declined. Naturally, these differing movements in output and employment give rise to different employment elasticities. We turn to an analysis of these next, with an investigation of elasticity levels first.

4.2. Level of Employment Elasticity

Table 2 and 5 present results of the decomposition of the level of employment elasticity for India and the US respectively. This decomposition uses (3) in section 2.1 above, which shows that the level of aggregate employment elasticity is the product of sectoral elasticity, employment share and relative growth summed over the different sectors.

From the first row of Table 2 we see that the aggregate employment elasticity in India had extreme values in two periods: in the period 1977-78 to 1983, the elasticity was high at 0.792; in the period 2004-05 to 2009-10, the elasticity was low at 0.009. Other than these two periods, the elasticity has hovered around 0.29, sometimes above and sometimes below this magnitude. The period of high elasticity was driven by low output growth (16.5 percent over a 6 year period) and a high employment growth (13 percent over the same period). On the other hand, the period of low elasticity was caused by very high output growth (52 percent over a 5 year period) and an exceptionally low employment growth (0.5 percent over the same period).

The next three panels in Table 2 present information on the three components of elasticity: sectoral employment elasticity, sectoral employment share and relative growth across sectors. We see some interesting patterns in these numbers. First, sectoral employment elasticity has declined for agriculture over the past three decades, with the two recent most periods, 2004-05/2009-10 and 2009-10/2011-12, registering negative employment elasticity. While other sectors do not display any pronounced trend in their within-sector employment elasticities, all the non-agricultural sectors have witnessed large increases in employment elasticities for the most recent period.[6] One may infer that the decline in the overall elasticity has been driven by the decline in elasticity in agriculture until very recently, when the former has increased even as the latter has declined. We shall get back to this point later. Second, the relative growth of the agricultural sector has always been below unity, i.e., the agricultural sector always grew at slower rates than the aggregate economy. All the other sectors have generally registered above (or close to) average growth. This is in line with existing evidence on the relative stagnation in the agricultural sector in India. Third, the employment share in agriculture has secularly, but slowly, declined. All other sectors have witnessed a growth in their employment shares. This suggests a slow process of structural transformation of the Indian economy, i.e., movement of labour out of agriculture, over the past three decades.

The last panel of Table 2 presents data on the relative contribution of each of the four sectors to aggregate employment elasticity. The number for each sector has been derived in two steps. First, for any sector the product of employment elasticity, relative growth rate and

[6] Comparing the last with the other periods calls for some caution because the duration of the last period is only 2 years while the others are of roughly 5 year durations.

relative employment share is calculated, as in the expression in (2). Second, the ratio of the above-derived number with the aggregate employment elasticity is obtained and reported (in the last panel of Table 2 and 5). Among the first five periods, agriculture was the main contributor in two (1977-78/1983, and 1987-88/1993-94) and important in one (1999-00/2004-05). The last two periods are very different from the first five. In the last two periods, the contribution of agriculture has turned negative and extremely large, i.e., aggregate employment elasticity has an opposite sign to that of employment elasticity in agriculture. Thus, from 2004-05 onwards, aggregate employment elasticity is being driven by the non-agricultural sectors, especially manufacturing. This is in line with existing evidence that the period since 2004-05 has seen rapid growth of employment in constructions, which is part of what we have called "manufacturing".

Table 5 presents similar numbers for the US economy. It is clear from the third panel that unlike in India, agriculture does not account for a significant part of the US employment. The last sector, CSP, which includes all services other than trade, hotels, transport and communication, employs the largest share of people. Employment elasticities of CSP have been reported in the second panel. Although there is some decline over time, the fall is not as drastic as was observed for agriculture in India. Much as in India, we find a decline is the overall elasticity, from 0.642 in 1977-83 to 0.154 in 2009-11. This decline in the aggregate employment elasticity is more pronounced than the decline in CSP elasticity. Therefore it must have been influenced by factors other than CSP's employment elasticity. Among other sectors, manufacturing displays volatility in employment elasticity even as it employment share has relentlessly fallen. TRD shows a mild long run decline in elasticity, which may have had a

bearing on the overall elasticity. AGR is not significant; like MFG it shows some volatility in the elasticity levels, but its employment share is too small to make any significant impact on the aggregate employment elasticity.

Examining the last panel of table 5, we find that CSP has indeed been the largest contributor to the overall elasticity in most of the periods (refer to the last row). The period 2004-09 was exception to this pattern, when the overall elasticity turned negative, although CSP's employment elasticity was positive. The manufacturing sector, which witnessed large negative relative growth, was main reason for the negative overall elasticity in 2004-09. Trade, hotels, transportation and communications sector added to the negative influence of the manufacturing sector with its own negative growth. The recent recession of US economy which rendered growth of these two sectors negative is thus the possible culprit. Figures for the period 2004-09 bear a lesson for the employment elasticity analysis. Even if all the sectors display positive employment elasticity (refer to the set of numbers in the second panel), the overall elasticity can become negative because of negative growth in some sectors.

In the above discussion, references to changes in employment elasticity across time, both of the overall economy and of individual sectors, have come up repeatedly. We made some conjectures about the influence of a particular sector's elasticity change on the change in aggregate elasticity. In the next section, we investigate these issues in greater detail and with more rigour.

4.3. Change in Employment Elasticity

In Table 3 and 6, we report results for the decomposition of the change of aggregate employment elasticity for India and the US respectively. The numbers in these two tables report the terms of equation (4) – where the change in overall elasticity is expressed as a sum of three components pertaining to change in elasticity within the sector, change in relative growth of the sector, and change in the employment share of the sector. For easy reference, the first row of the tables reports the change in aggregate employment elasticity between successive periods. The first panel (component 1) reports the component that is driven by change in sectoral employment elasticity; the second (component 2) report the component that comes from change in relative growth rate of sectors; and the third panel (component 3) reports the component that arise from change in sectoral employment shares. Each panel ends with a "Total" row, which adds up the numbers of that particular panel. This number gives the contribution of the particular component – component 1, 2 or 3 – to the change in overall elasticity.

The results for India (Table 3) show three interesting patterns. First, the numbers in the first row of the table shows that aggregate employment elasticity did not undergo monotonous change in India. Positive and negative entries have alternated with each other, giving a zigzag pattern to the corresponding line in figure 1. Since the magnitude of the negative entries have been larger, there is an overall decline.

Second, the entry in "Total" row for component 1 (change in sectoral elasticity) have dominated the corresponding "Total" row entries for component 2 and 3. This means that aggregate employment elasticity has been swayed in the direction of the change of elasticity

within individual sectors. The influence of the other two components have been weak in comparison. The reason for the weak effect of component 2 comes from the fact that relative position of sectors with respect to aggregate growth has not changed much over the periods; and the weak effect of the third component arises from the slow change in sectoral employment shares.

Third, if we compare the contribution of each sector to component 1 (which has been the most important driver of change in aggregate employment elasticity), we see that agricultural sector's employment elasticity appears to be the most influential. Irrespective of the changes in elasticity of the other sectors, aggregate employment elasticity has changed in the direction of change of the employment elasticity of the agricultural sector, except for the last period under consideration. For the first time aggregate elasticity and elasticity in agriculture have moved in opposite directions during the last period, 2004-05/2009-10 to 2009-10/11-12, the former having declined even as the latter rose. A probable reason for the dominance of agriculture in the past three decades and its declining influence of late, is the slow but sure fall of its employment share.

Referring to equation (5) we find that in the expression for the first component, ΔSEL, change in sectoral elasticity between two successive periods gets multiplied by employment share and relative growth of the sector in the latter period. The high employment share of agriculture meant that its elasticity change had a stronger impact on overall elasticity change compared to other sectors, making its elasticity change count for more. This is borne out by the numbers in table 2. Seen in this light, the divergence of elasticity movement of agricultural sector with the overall economy in the last period (2004-05/2009-10 to 2009-10/11-12) is

crucial. Even though the agricultural sector remains the largest employer, its share in total employment has been slowly eroded. By the mid-2000s, we seem to have reached a stage where numbers can stack up in such a way that sectoral elasticity change in agriculture no longer decides the direction of the aggregate elasticity.

Turning to the US economy, we observe less of the wavering zigzag pattern of employment elasticity that we saw for India (refer to the first row of table 6). In four of the six periods considered, the change has been negative. Over the whole period, the aggregate employment elasticity fell because the magnitude of the negative changes have been greater than that of the positive changes.

One of the key differences with India is that the first component has not always been the main driver of change in the aggregate employment elasticity in the US economy. In four of the six periods, it played an important role. But there are periods when the second component, namely, change in the growth rate of sectors, has played a determining role. For example, the last period, 2004-09 to 2009-11, is a case in point. The first component shows a negative entry, indicating that sectoral employment elasticities fell in general.[7] But the high and positive value of the second component pulled the overall effect in the positive direction. Thus, in spite of declining elasticity in most of the sectors, the economy as a whole showed a rising employment elasticity because relative growth rate of sectors (especially MFG and TRD) improved over time.[8]

[7] Except for the CSP sector which experienced a slight improvement.

[8] We observe that the CSP sector's growth rate fell during this time (refer to table 5). Hence its contribution to the second component has been negative (table 6). However this negative contribution from CSP got overwhelmed by the stronger positive effects coming from other sectors, especially MFG.

To compare with the Indian case, we can focus on the first component, namely, the component that arises from change in sectoral employment elasticities. In terms of sectoral employment elasticities, we find the manufacturing sector playing the role in the US that agriculture has been playing in India. Changes in the manufacturing sector's employment elasticity has had a decisive impact on the first component. For each period, component 1 is dominated by the manufacturing sector, i.e., the numbers reported in the "Total" row is impacted decisively by the numbers in the MFG row. This is probably because of the relatively higher volatility of employment elasticity observed for the manufacturing sector. Although the manufacturing's share in aggregate output and employment has been declining for a long time, this observation underlines the continuing influence of the sector on the overall employment elasticity change.

Finally, the "Total" row of the third component (driven by changes in the sectoral employment shares) is found to be most stable and small in absolute value. This is also case for the Indian economy, as seen from the bottom panel in table 3. In both countries, sectoral employment shares are the slowest to change compared to the other two factors, sectoral elasticity and sectoral growth. But there is a difference in the behavior and sectoral composition of the last component between the two countries. In India all the entries for the agriculture sector are negative numbers, an indication of the continuous decline of the employment share of the sector (except the last phase, when although employment share of agriculture fell, it got multiplied with negative elasticity of the former period, giving a positive entry). In the US economy it is the manufacturing sector which has been steadily declining in employment share (refer to table 5). Since it has long been experiencing negative elasticity, the

decline in employment share has got multiplied with negative employment elasticity, resulting in positive entries. But they – agricultural sector in India and manufacturing sector in the US – are essentially similar in this respect. Both are ceding employment dominance to other emerging sectors. In India, manufacturing and trade, hotel, transportation, communications are gaining employment share; in the US, it is the CSP (services minus trade, transportation and communications).

5. Conclusion

Employment generation is a key challenge for a poor, labour surplus economy like India. Quite unexpectedly perhaps, it has also emerged as a key challenge since the early 1990s for advanced capitalist countries like the US. In this paper we have the investigated this phenomenon of jobless growth in India and USA through the lens of employment elasticity, the responsiveness of employment to growth in output. Even though these two countries are very different in terms of their structure and stage of development, we find a strikingly similar pattern in the evolution of aggregate employment elasticity in both: since the mid-1970s, the aggregate employment elasticity has witnessed a long term decline, even as it has fluctuated over shorter periods. To better understand this dynamic, we adopted a sectoral perspective, informed by the recognition that different sectors have very different behaviour with regard to labour absorption. We operationalised this perspective with a two-step analytical strategy.

In the first step, we analysed the contributors to the level of aggregate employment elasticity by decomposing it into three components: sectoral elasticity, relative sectoral growth rates, and sectoral employment share. This allows us not only to study employment elasticities

of individual sectors but also to ascertain the relative contribution by different sectors to the level of aggregate employment elasticity. In the second step, we decomposed the change in aggregate elasticity into three analogous components, the first related to changes in sectoral elasticities, the second driven by changes in relative growth rates, and the third coming from changes in sectoral employment shares. Using employment and output data from relevant sources, we estimated these level and change components for both India and the US.

In terms of the level of aggregate employment elasticity in India, we find that the agriculture sector played a dominant role till the early 2000s. There is an important change underway since then because non-agricultural sectors have become important determinants of aggregate employment elasticity for the first time in the history of the Indian economy. An analogous analysis for the US showed that the services sector (minus trade, transportation and communications), has been the dominant determinant of the level of aggregate employment elasticity (other than in one period, 2004-09). Turning to the analysis of changes in aggregate employment elasticity in India, we see that the first component (that derives from changes in sectoral elasticities) has been the most important driver of change. Moreover, changes in the employment elasticity of the agricultural sector have been salient in determining the first component. Thus, changes in employment elasticity of the agricultural sector has been the most important factor underlying change in aggregate employment elasticity in India till the mid-2000s. Since then, non-agricultural sectors have started taking over.

In the case of the US economy, we see a different pattern. While the first component has been important for determining change in aggregate employment elasticity for many periods, the second component (that arises due to changes in relative growth across sectors)

has also been important in some periods. Focusing on the first component, we see that the manufacturing sector has been its most important sectoral determinant. Thus, despite losing employment share over the decades, the manufacturing sector remains important for the direction of change in aggregate employment elasticity in the US. We observe an important parallel between India and the US with respect to the third component (coming from changes in employment shares across sectors). In general, the third component has been unimportant because sectoral employment shares change slowly. While agriculture has been the key sector losing employment share in India, in the US it has been the manufacturing sector.

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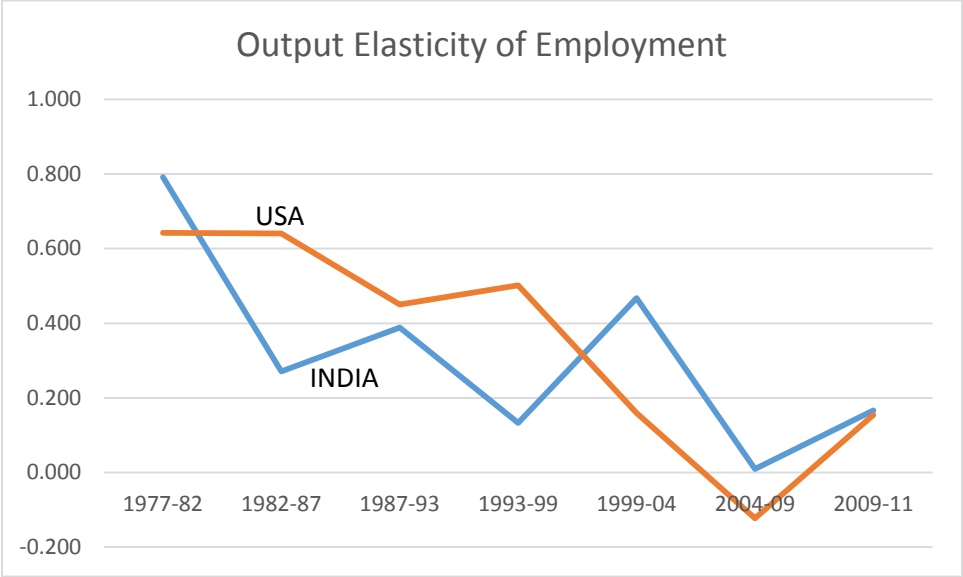

Figure 1. Output elasticity of employment for the aggregate economy. (Source: Table 2 and 5 below).

Table 1: Output (Rs. Crore in 2004-05 prices) and Employment (millions) in India

		1977-78	1982-83	1987-88	1993-94	1999-00	2004-05	2009-10	2011-12
AGR	Output	300873	323862	360949	479592	590696	650454	764817	864557
	Employment	191.7823	209.0246	212.9175	242.0752	242.5261	261.3757	241.17	224.4
MFG	Output	170123	197833	259641	357237	535730	744755	1173089	1369932
	Employment	32.6369	39.9473	49.38	53.2954	62.3585	83.0973	97.7914	111.2
TRD	Output	118084	149903	198578	274682	476088	727720	1197891	1402261
	Employment	21.9452	26.6363	31.7625	39.1135	55.4923	68.1653	72.2709	77.9
CSP	Output	155892	196494	275825	410833	643762	848535	1380274	1610780
	Employment	21.7539	26.7277	30.2612	39.7732	38.0839	45.3857	48.5353	59
ALL	Output	744972	868092	1094993	1522344	2246276	2971464	4516071	5247530
	Employment	268.3	303.4	324.9	374.2	397.9	457.9	460.1	472.5

Source: value added data is from the 2013-14 Economic Survey of India; employment (usual principal and subsidiary status) data is from various rounds of the Employment Unemployment Survey of the NSSO, Himanshu (2011) and Thomas (2014). Notes: AGR = agriculture, forestry, mining & allied activities; MFG = manufacturing, construction, electricity, gas & water supply; TRD = trade, transportation & communication; CSP = community, social and personal services; ALL = aggregate economy.

Table 2: Components of and Contributions to Employment Elasticity in India

		1977-78 /1982-83	1982-83 /1987-88	1987-88 /1993-94	1993-94 /1999-00	1999-00 /2004-05	2004-05 /2009-10	2009-10 /2011-12
Aggregate Elasticity		**0.792**	**0.271**	**0.389**	**0.133**	**0.467**	**0.009**	**0.166**
Sectoral Employment Elasticity	AGR	1.177	0.163	0.417	0.008	0.768	-0.440	-0.533
	MFG	1.375	0.756	0.211	0.340	0.852	0.307	0.817
	TRD	0.793	0.593	0.604	0.571	0.432	0.093	0.457
	CSP	0.878	0.327	0.642	-0.075	0.603	0.111	1.291
Relative Sectoral Growth	AGR	0.462	0.438	0.842	0.487	0.313	0.338	0.805
	MFG	0.986	1.195	0.963	1.051	1.209	1.106	1.036
	TRD	1.630	1.242	0.982	1.542	1.637	1.243	1.053
	CSP	1.576	1.545	1.254	1.192	0.985	1.206	1.031
Sectoral Employment Share	AGR	0.702	0.672	0.651	0.628	0.590	0.547	0.500
	MFG	0.127	0.142	0.147	0.150	0.169	0.197	0.224
	TRD	0.085	0.093	0.101	0.122	0.144	0.153	0.161
	CSP	0.085	0.091	0.100	0.101	0.097	0.102	0.115
Contribution to Aggregate Elasticity (%)	AGR	48.23	17.66	58.76	1.85	30.42	-880.91	-128.89
	MFG	21.69	47.26	7.69	40.16	37.29	725.09	113.93
	TRD	13.86	25.20	15.43	80.66	21.83	191.77	46.52
	CSP	16.22	9.88	18.12	-22.67	10.45	64.06	68.43

Source: calculated from data in Table 1. Notes: share of aggregate employment is the average for the two periods; elasticity is for the change over the period; proportion of aggregate growth is over the period.

Table 3: Decomposition of Change in Aggregate Output Elasticity of Employment in India

		Period 1 to Period 2	Period 2 to Period 3	Period 3 to Period 4	Period 4 to Period 5	Period 5 to Period 6	Period 6 to Period 7
Change in Aggregate Elasticity		**-0.520**	**0.118**	**-0.256**	**0.334**	**-0.458**	**0.157**
Component 1 (change in sectoral elasticity)	AGR	-0.299	0.139	-0.125	0.141	-0.224	-0.038
	MFG	-0.105	-0.077	0.020	0.105	-0.119	0.118
	TRD	-0.023	0.001	-0.006	-0.033	-0.064	0.062
	CSP	-0.077	0.039	-0.086	0.065	-0.061	0.140
	Total	**-0.504**	**0.103**	**-0.197**	**0.277**	**-0.468**	**0.282**
Component 2 (change in sectoral growth)	AGR	-0.019	0.043	-0.093	-0.001	0.010	-0.103
	MFG	0.041	-0.026	0.003	0.009	-0.017	-0.005
	TRD	-0.029	-0.016	0.041	0.008	-0.026	-0.003
	CSP	-0.002	-0.009	-0.004	0.002	0.014	-0.002
	Total	**-0.009**	**-0.008**	**-0.053**	**0.018**	**-0.019**	**-0.112**
Component 3 (change in sectoral employment share)	AGR	-0.016	-0.001	-0.008	0.000	-0.010	0.007
	MFG	0.021	0.005	0.000	0.007	0.029	0.009
	TRD	0.010	0.006	0.012	0.020	0.006	0.001
	CSP	0.008	0.005	0.001	0.000	0.003	0.002
	Total	**0.023**	**0.014**	**0.006**	**0.027**	**0.028**	**0.019**

Source: calculated from data in Table 1 and 2. Period 1 = 1977-78/1983; Period 2 = 1983/1987-88; Period 3 = 1987-88/1993-94; Period 4 = 1993-94/1999-00; Period 5 = 1999-00/2004-05; Period 6 = 2004-05/2009-10; Period 7 = 2009-10/2011-12

Table 4: Output (million of USD in 2005 prices) and Employment (thousands) in USA

		1977	1983	1987	1993	1999	2004	2009	2011
AGR	Output	251720	277268.9	234233	210785	201354	312096	332447	408775
	Employment	2411	2595	2094	1952	1890	1758	1881	2022
MFG	Output	1533112	1544903	1788028	1882213	2267607	2319452	2143362	2257177
	Employment	23360	22088	23590	22234	24594	22146	18667	18081
TRD	Output	978275	1032417	1209291	1369094	1749868	1886962	1834777	1939411
	Employment	17276	18357	21153	22023	25210	25293	24687	24857
CSP	Output	2608175	3270715	4075607	5054348	6552111	7728612	8447038	8692511
	Employment	47397	55557	63954	72842	83170	88615	91870	93042
ALL	Output	5371283	6125303	7307159	8516439	10770940	12247121	12757624	13297874
	Employment	90444	98597	110791	119051	134864	137812	137105	138002

Source: value added and employment (full time and part time employees) data are from GDP by Industry data from the US Bureau of Economic Analysis; Notes: AGR = agriculture, forestry, mining & allied activities; MFG = manufacturing, construction, electricity, gas & water supply; TRD = trade, transportation & communication; CSP = community, social and personal services.

Table 5: Components of and Contributions to Employment Elasticity in the US

		1977-83	1983-87	1987-93	1993-99	1999-04	2004-09	2009-11
Aggregate Elasticity		**0.642**	**0.641**	**0.451**	**0.502**	**0.159**	**-0.123**	**0.154**
Sectoral Employment Elasticity	AGR	0.752	1.244	0.677	0.710	-0.127	1.073	0.326
	MFG	-7.080	0.432	-1.091	0.518	-4.354	2.069	-0.591
	TRD	1.131	0.889	0.311	0.520	0.042	0.866	0.121
	CSP	0.678	0.614	0.579	0.478	0.365	0.395	0.439
Relative Sectoral Growth	AGR	0.723	-0.804	-0.605	-0.169	4.013	1.564	5.422
	MFG	0.055	0.816	0.318	0.773	0.167	-1.821	1.254
	TRD	0.394	0.888	0.799	1.051	0.572	-0.663	1.347
	CSP	1.810	1.275	1.451	1.119	1.310	2.230	0.686
Sectoral Employment Share	AGR	0.026	0.022	0.018	0.015	0.013	0.013	0.014
	MFG	0.240	0.218	0.199	0.184	0.171	0.148	0.134
	TRD	0.188	0.189	0.188	0.186	0.185	0.182	0.180
	CSP	0.545	0.571	0.595	0.614	0.630	0.657	0.672
Contribution to Aggregate Elasticity (%)	AGR	2.24	-3.50	-1.60	-0.36	-4.27	-18.05	16.26
	MFG	-14.52	11.99	-15.37	14.74	-78.05	454.59	-64.09
	TRD	13.08	23.24	10.36	20.27	2.79	84.91	18.96
	CSP	99.20	68.26	106.61	65.36	179.54	-421.45	128.88

Source: calculated from data in Table 4. Notes: share of aggregate employment is the average for the two periods; elasticity is for the change over the period; proportion of aggregate growth is the average for the two periods.

Table 6: Decomposition of Change in Aggregate Output Elasticity of Employment in USA

		1977-83 to 1983-87	1983-87 to 1987-93	1987-93 to 1993-99	1993-99 to 1999-04	1999-04 to 2004-09	2004-09 to 2009-11
Change in Aggregate Elasticity		**-0.360**	**-0.086**	**0.051**	**-0.342**	**-0.283**	**0.278**
Component 1 (change in sectoral elasticity)	AGR	-0.009	0.006	0.000	-0.045	0.025	-0.057
	MFG	1.337	-0.097	0.230	-0.139	-1.737	-0.446
	TRD	-0.040	-0.087	0.041	-0.051	-0.099	-0.181
	CSP	-0.046	-0.031	-0.069	-0.094	0.045	0.020
	Total	**1.241**	**-0.208**	**0.201**	**-0.329**	**-1.766**	**-0.664**
Component 2 (change in sectoral growth)	AGR	-0.026	0.004	0.004	0.040	0.004	0.059
	MFG	-1.175	-0.043	-0.092	-0.054	1.285	0.850
	TRD	0.105	-0.015	0.015	-0.046	-0.009	0.314
	CSP	-0.207	0.064	-0.118	0.058	0.220	-0.410
	Total	**-1.302**	**0.011**	**-0.190**	**-0.003**	**1.500**	**0.812**
Component 3 (change in sectoral employment share)	AGR	-0.002	0.005	0.001	0.000	0.000	0.002
	MFG	0.009	-0.007	0.005	-0.005	0.017	0.056
	TRD	0.000	-0.001	0.000	0.000	0.000	0.001
	CSP	0.032	0.019	0.016	0.008	0.013	0.014
	Total	**0.039**	**0.017**	**0.022**	**0.003**	**0.029**	**0.072**

Source: calculated from data in Table 4 and 5.