Employment Boom in Construction
A Tentative Explanation*

R Nagaraj

Abstract

From 2000 to 2012, construction employment in India grew annually at over 9 per cent – an outcome of a sharp rise in fixed investment to GDP ratio. Rural construction employment – accounting for over ½ of the total in 2000 – grew annually at 12 percent, compared to just 5 per cent in urban areas. Is the rural employment growth illusionary, because of temporary (or circular) migration to urban areas (most significant sites of construction)? Or, does the employment growth represent rising rural capital formation? We contend it is the latter. Rising rural wages and falling real price of cement seems to have expanded the market for rural construction. Growth in per capita income and in housing credit explains the growth of GDP in construction (as a proxy for the employment). Cement production (as a proxy for supply or access) and housing credit (to a much less extent) explain the inter-state variation in construction employment.

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December 22, 2016

* Paper is prepared for the conference on "Political Economy of Contemporary India (Second Edition), held at the Indira Gandhi Institute of Development Research, Mumbai, during January 9-10, 2017. **Acknowledgement**: Author is grateful to Vikash Vaibhav for analysis of the NSS data reported in the paper. Usual disclaimer applies.

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During 12 years since 1999-2000, employment in construction boomed in India at an annual rate of 9.3 per cent. Its share in total workforce – as measured by NSS principal and subsidiary status (UPSS) – more than doubled: from 4.4 per cent in1999-2000, to 10.5 per cent in 2011-12.[1] The boom is stark when compared to manufacturing, over a longer period. In 1980-81, manufacturing sector employed about 11 per cent of the work force; construction was a mere 1.6 per cent. Three decades later, construction sector's share has risen to 9.4 per cent, while manufacturing sector's share has practically stagnated. In fact, the rise in industrial employment (that is, mining, manufacturing, electricity gas and water, and construction) share is almost entirely on account of construction.

What accounts for the boom, and what are its welfare implications? *Prima facie*, the proximate causes seem obvious: (i) economy's sharply rising capital formation rate rising close to 40 per cent of GDP until 2011-12, (ii) (marginally) faster urbanization rate in the last decade, and (ii) a rural employment guarantee programme after 2004. Though intuitively appealing, there is perhaps more to it than what casual empiricism meets the eye.

The paper seeks to offer a more nuanced explanation. After presenting broad facts and trends in construction sector in Section I, Section II engages in an analytical discussion on the possible reasons for the employment expansion; Section III reports the results of a quantitative analysis seeking to explain the boom, and Section IV concludes by summarizing the paper's main findings, and raising issues for further inquiry.

Section I
A Preliminary Discussion

The Context:

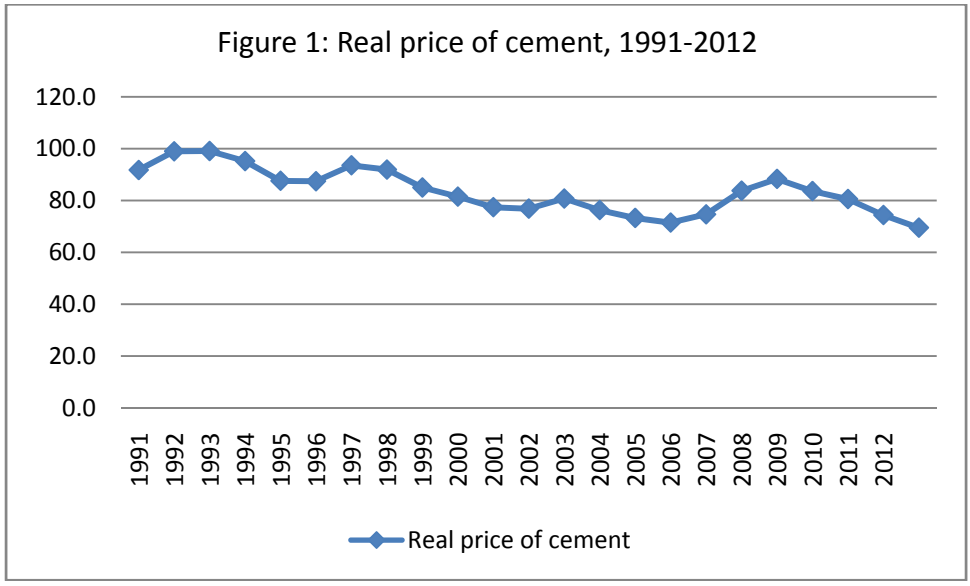
In the early post-independence decades, cement was a perennially scarce commodity with its black-marketing widely acknowledged. The problem got best epitomized in 1982, when the corruption scandal involving black marketing of cement to enrich private trusts (named after Indira Gandhi) run by the then ruling Congress party that brought down A R Antulay's government in Maharashtra showed what the shortage of such a basic good can do body politic. The political crisis that ensued was perhaps the proximate cause for initiating the decontrol of cement production, prices and distribution.[2]

Thus, the construction sector growth is associated with easing of the supply constraints of the principal raw material, and a fall in its real (or relative) price by 20 percentage points over 3 decades since 1981-82 (Figure 1). Cement production grew annually at 7.4 per cent on a trend basis during this period, compared to an annual industrial output growth rate at 6.5 per cent (as measured by the index of

[1] We have skipped using 2004-05 NSS employment –Unemployment survey data showed an unusual spike in female employment, vitiating compound growth rates estimates. See Ajit Ghosh, 2013, for a critical analysis of the 2004-05 NSS data.

[2] Arun Ghosh committee on cement decontrol (1982) laid out a road map for the policy reform; outlined partial decontrol until 1989, and full decontrol thereafter, which was implemented, by and large.

industrial production).[3] In fact, India is now the world's second largest cement producer after China – though a distinct second. In principle, the boom is welfare enhancing, as construction activity is largely labour intensive – despite visible signs of mechanization.



Apparently the starting point of the recent construction boom was the previous NDA government's two major road construction initiatives in 2000, namely (i) the Golden Quadrilateral Programme connecting the metro cities, and (ii) the rural road connectivity programme to build motarable roads to all villages with a population of 500 and above (PMGSY). These initiatives were continued under a different name, Bharat Nirman, after 2004. Likewise, Bihar is said to have made a substantial progress in public works (roads and bridges) in the last decade – "crowding-in" private investment in housing and private transport, thus contributing to the regional growth (Nagaraj, 2013). Third, the IT outsourcing boom and modern retailing (malls) also created a large-scale demand for high quality commercial real estate, met by private sector, mostly in the big cities.

Patterns in Construction Employment:

Share of rural areas in total construction employment has been more than ½ since 1993-94 and steadily rising to 3/4th in 2011-12 (Figure 2).[4] The boom is wide spread across the major states (Table 1), though 5 states accounted for over one-half of total construction employment (Table 2). Five states, namely, Uttar Pradesh (UP), Rajasthan, Maharashtra, Andhra Pradesh and Tamil Nadu (in descending order of shares) account for half of construction employment both in 1999-2000. In 2011-12, Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, and Tamil Nadu were the top states account for 55 per cent of total construction employment.

[3] Foreign trade in cement is very low, for two reasons: one, lime stone, the principal raw material for manufacturing cement, is widely available; two, value to weight ratio is low making long distance trade of cement not very economical.

[4] Construction employment estimates exclude employment generated under NREGA.

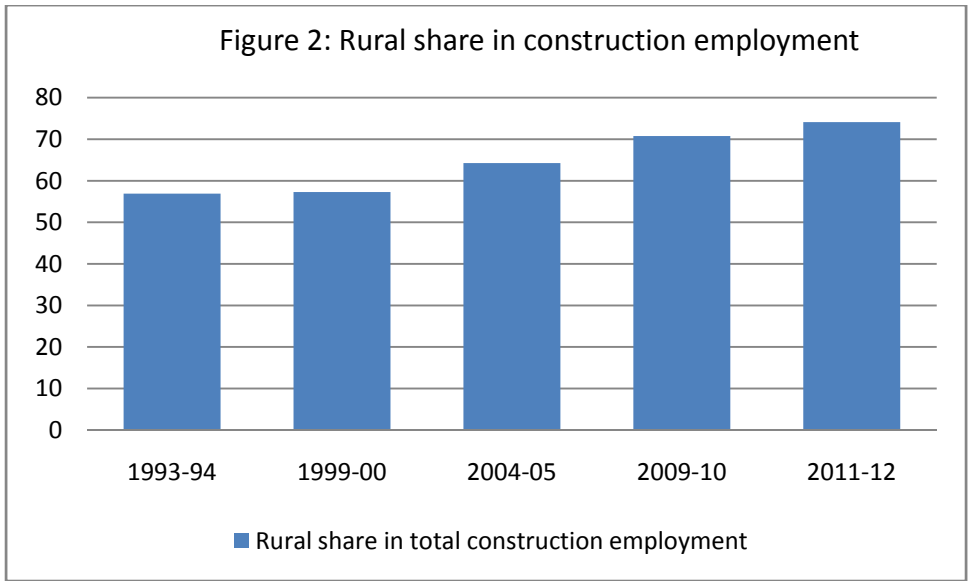


Table 1: Growth in Construction Employment 1999-00 to 2011-12, by major states

	Rural	Urban	Total
Andhra Pradesh	9.8	4.2	7.0
Assam	13.3	6.7	11.8
Bihar	17.0	10.3	15.8
Gujarat	4.1	1.1	2.6
Haryana	8.4	9.4	8.7
Himachal Pradesh	6.2	-0.3	5.9
J & K	11.3	6.3	10.1
Karnataka	9.4	3.0	5.3
Kerala	3.6	8.9	5.4
Madhya Pradesh	16.7	8.2	13.3
Maharashtra	8.2	3.1	5.2
Orissa	13.2	4.3	11.4
Punjab	10.7	4.2	8.9
Rajasthan	9.7	5.5	8.9
Tamil Nadu	12.2	3.9	8.8
Uttar Pradesh	14.2	7.5	12.6
West Bengal	14.1	3.8	9.9
All India	**11.7**	**4.9**	**9.3**

Source: NSS Employment and Unemployment Surveys (published reports).
Note: The growth rates represent compound annual average growth rates (CAGR). Figures for Bihar, Madhya Pradesh and Uttar Pradesh include figures of Jharkhand, Chhattisgarh and Uttarakhand respectively.

Table 2: Top 5 states in terms of construction employment in 1999-2000 and 2011-12

1999-2000		2011-12	
States	Share in the total	States	Share in the total
Uttar Pradesh	12.6	Uttar Pradesh	17.9
Rajasthan	11.0	Rajasthan	10.5
Maharashtra	9.7	Bihar	10.1
Andhra Pradesh	8.4	Madhya Pradesh	8.7
Tamil Nadu	8.4	Tamil Nadu	8.0
Share of the 5 states	50.1	Share of the 5 states	55.2

Composition of construction employment in 2011-12 is as follow: 51 million workers were employed in construction.[5] 26 per cent of them are employed in urban areas; 11 per cent are women; 7 per cent children (aged 18 years or less) – roughly the same proportions as in manufacturing sector. Wage employment dominates construction, with only 10 per cent of the workers self-employed; construction is the principal status for 90 per cent of the workers; predominantly working in the unorganized sector, with only 2.6 per cent employed in the organized sector (compared to 15 per cent in manufacturing, as per the data reported in the *Economic Survey*).

It is believed that rural construction employment mostly consists of migrant workers from rural areas, engaged in urban areas or at large infrastructure sites such as highways, dams and airports.[6] But such perception may be incorrect for the following reasons:

1. Contrary to popular belief and images, rural-urban migration has remained modest even by the 2011 census estimates which show some rise in the migration rates compared to the earlier decades. Within migration, those working in construction form a small share. K C Pradhan (2013)
2. Further, it is believed that construction workers form part of circulatory migrants who get enumerated in rural areas but spend substantial time in urban construction (Srivastava, 2014). But only about one-fifth of circulatory migrants are engaged in construction
3. Granting there is rural-urban circulatory or commuting migration, Chandrasekhar (2011) shows, using NSS data, that only about 30% of them work in construction industry. Could it explain the boom in construction employment? I wonder.
4. A closer look at the NSS data showed that majority of workers report construction as their principal status in rural areas, so they are unlikely to be spending majority of their time in urban construction sites (in which case they would be counted as urban construction workers). Moreover subsidiary status workers form a just about 10 per cent of total workers; this is true of major sources of migrant workers such as Bihar or Orissa. So, the argument that workers from

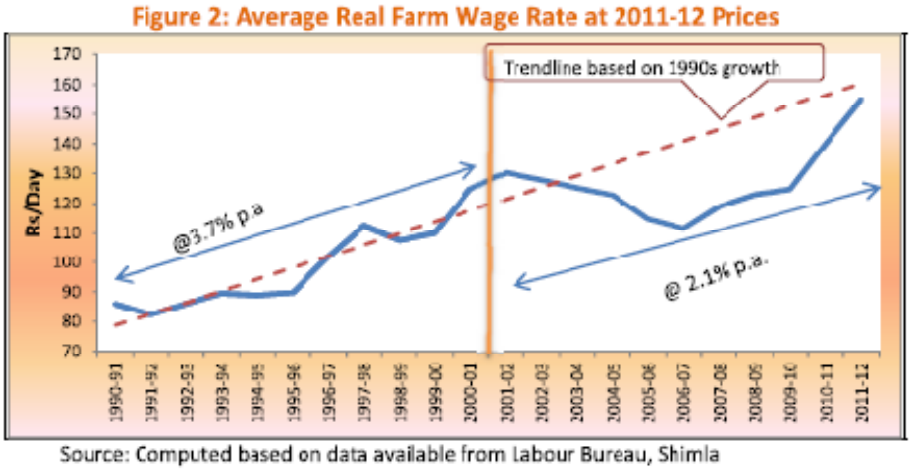
[5] The estimate is based on the published data as in the printed reports (or their PDF copies). This figure is higher by 22 per cent than the estimate obtained from the unit level data made available in the soft copy. The ratios reported in the rest of the paragraph are based on the unit level data.

[6] Santosh Mehrotra *et al* said, "Increase in employment in construction sector along with increased infrastructure investment gave a major boost to total employment attracting agricultural workers, contributing to a rise in rural wages. The biggest increase in non-agricultural employment has been in construction, both rural and urban, from a total of 17 million in 2000 to 50 million in 2011-12, with a doubling in total employment in a matter of seven years since 2004-05." (Santosh Mehrotra *et al*, 2014)

these states migrate more (as evident from micro studies) does not find support in the aggregate data.

Therefore, if the foregoing reasoning is correct, then the argument that construction employment boom is mostly an urban phenomenon may not hold. Perhaps what is happening – invisible to urban eyes – is large scale minor (incremental) construction by households, such as converting mud walls to brick and cement walls, and thatched roofs replaced by concrete roofs, and cement lining of irrigation channels. With a fall in real price of cement and rising real wages, price-income ratio for cement has declined, expanding the market (Figure 3)'. These minor investments by rural households are now possible now with improved availability of steel and cement with better market integration.

Figure 3: Real agriculture wages, 1990-91 to 2011-12 (Source: Ashok Gulati *et al*, 2013)



Section II
An Analytical Discussion

In economic terms, cement has only one use: it goes into fixed capital formation. India witnessed a sharp decline in the share of construction in total fixed capital formation, from about 70 per cent in 1950 to about 40 per cent by 1980, and a corresponding rise in machinery's share on account of the 'heavy industrialization' strategy (Nagaraj, 2008). This reflected the national priorities, as enshrined in the official slogan at the time: "Build machines, build India".

This was, however, contrary to the experience of early industrialization elsewhere. As Arthur Lewis had argued in "The Theory of Economic Growth" (1955), much of capital formation in the early stages of development simply involved public works, requiring considerable absorption of unskilled labour. To quote Lewis, "The great importance of construction is not generally realized, many people think of capital formation mainly in terms of installing machinery, while in truth it consists to a greater extent of building structures of one sort or another; civil engineering is the key industry in capital formation, with mechanical engineering following some distance behind" (Lewis, 1955: 213).

During the 1990s, construction's share in fixed capital formation turned around. However, the rise did not represent a boost to public works, as the share of public investment has declined; nor was it on account of residential construction either, but consisted largely of non-residential construction (for details see, Nagaraj, 2013a). Though what this precisely constitutes is not clearly known, it seems reasonable to a guess that it mainly consists of commercial real estate.

What explains labour demand in construction sector? It is a derived demand, based on construction output, which, in turn, can be postulated to be a function of (i) growth in fixed investment, (ii) per capita income and (iii) relative price of cement. Fixed investment in construction broadly consists of two kinds: public works, large scale infrastructure projects like dams, ports, airports (mainly public goods), and private goods (mainly housing and non-residential structures like factories, offices, and built-up spaces for commercial purposes). Public investment has an autonomous character, and usually consists of public works.

However, private housing demand is largely a function of housing credit, which has in fact grown significantly after the reforms; commercial real estate seems to have expanded very rapidly after foreign capital was permitted into real estate and Special Economic Zones (SEZs). Moreover, with rising share of the services the domestic output, a growing demand for physical structures to accommodate the services seems discernible. Thus, private demand for construction is likely to be a function of per capita income, bank credit and housing mortgages. As per capita income has growth has accelerated since 1980, demand for construction is likely to have gone up correspondingly. Considering the legacy cement shortage, growth in construction could also be on account of pent-up demand.

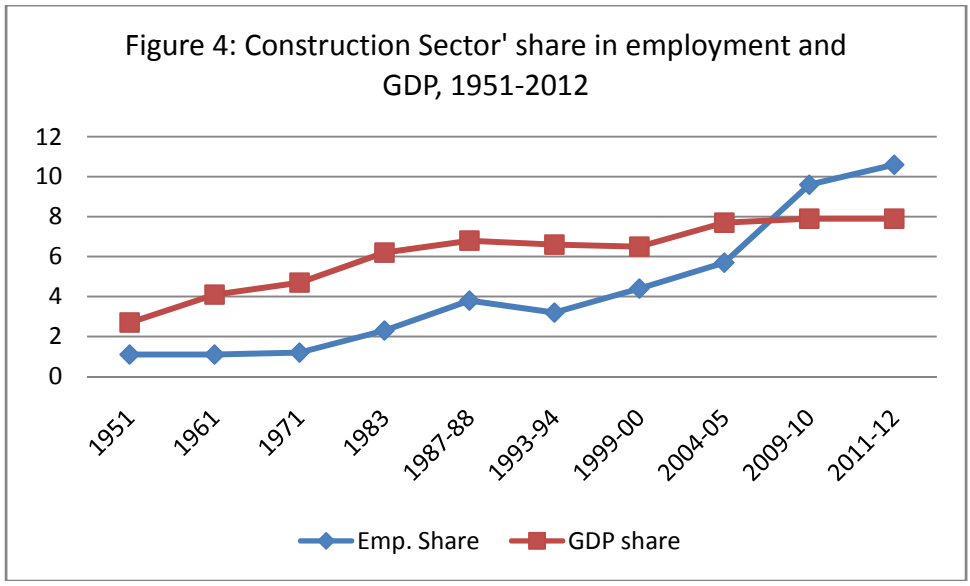
As nearly 70 per cent of population still resides in rural areas, and over 50 per cent of workforce still engaged in agriculture, factors affecting rural construction demand are likely to be different from that in urban areas. As is widely acknowledged, the rural areas suffer from poor infrastructure, and private housing is still far from *pucca* and concrete structures. So, it is likely that rural construction would be a function of rural incomes (which in turn would depend on agriculture productivity), and public investment (that is budgetary resources); while urban construction demand is likely to come from corporate investment, housing credit and urban infrastructure expenditure.

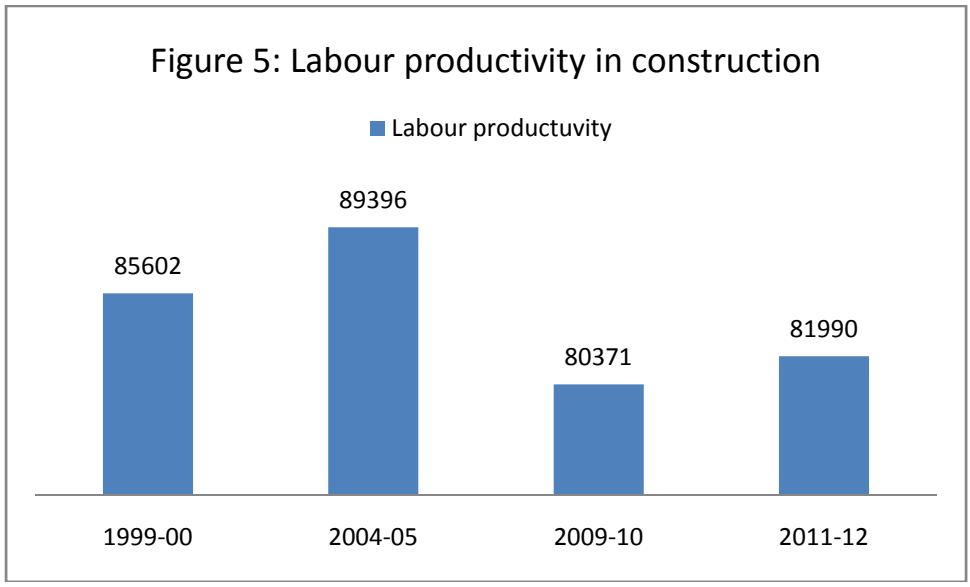
Section III
A Quantitative Analysis

Comparing the shares in workforce and in GDP:

Figure 4 plots the shares of construction in (i) GDP, and (ii) workforce since 1951.[7] Evidently the ratios have moved up gradually. But the employment share has moved up much more briskly during the last decade, overtaking the GDP share in 2009-10. In other words, construction's share in employment has risen at a much faster rate than that of GDP, resulting in a fall in output per workers (that is, labour productivity) (Figure 5). A possible reason for it could be an underestimation of the output. This is surprising considering widespread mechanization of construction work.

[7] Workforce data for 1951, 1961 and 1971 are taken from the decennial population census, for the later years they are from the quinquennial NSS surveys on employment and unemployment. Data for GDP are from the *National Accounts Statistics*.





In seeking to explain the construction employment boom, we postulate construction GDP (as a proxy for employment) as a function of (i) per capita income (X1), (ii) GFCF in construction (X2), (iii) real price of cement (X3), and (iv) housing credit (X4); all the variables are in terms of yearly growth rates, from 1980-81 to 2009-10. *A priori*, based on the foregoing analytical discussion, we expect a positive relationship between growth in construction output (the dependent variable) and (i) per capita income, growth in GFCF in construction, and housing credit, but a negative relationship with relative price of cement. The estimated linear equations are reported in Table 3:

Table 3: Time-series analysis

Constant term	X1	X2	X3	X4	N	Adjt R2
1.954	0.5321	0.3006			28	0.258
	(1.658)	(3.026)*				
3.622	0.495	0.1566	0.0395		28	0.206
	(1.536)	(1.558)	(0.344)			
1.211	0.5033	0.1088	0.0584	0.0956	28	0.364
	(1.740)	(1.185)	(0.566)	(2.594)*		
-0.7859	0.99452			0.108142	29	0.414
	(3.670)*			(2.676)*		

Note: Figures in the brackets are estimated t values

The explanatory power of the model is modest, with the adjusted R[square] being in the range of 0.25 to 0.36. It is reasonable, therefore, to infer that the growth in construction output is explained by growth in (i) GFCF in construction, and (ii) growth in bank credit for housing; but, per capita income and real price of cement are not found to be significant.

To find out if the foregoing results are vitiated by multi-collinearity among the independent variables, inter-correlation matrix of all the variables is estimated, as reported in Table 4.

Evidently, the price variable is not correlated with any other variable, though it has the expected negative sign with the dependent variable. However, bank credit for housing is significantly correlated with the dependent variable with expected positive sign. Interestingly, per capita income and GFCF are significantly correlated with the dependent variable, as well between them.

Table 4: Inter-correlation matrix

	Y	*X1*	*X2*	*X3*	*X4*
Y	1				
X1	0.538*	1			
X2	0.478*	0.461*	1		
X3	-0.106	0.085	0.184	1	
X4	0.457*	0.101	0.217	-0.063	1

Y- Growth in GDP construction, X1: Growth in per capita income,
X2: growth in capital formation, X3: real price of cementx4: Growth in
In housing credit.

To discern which of the two independent variables has the dominant influence on the dependent variable, after controlling for the other variable, a partial correlation coefficient is estimated, as reported below. Evidently, the growth in construction output and growth per capita income are statistically significantly correlated, after netting out the effect of growth in GFCF. But, the correlation coefficient between growth in construction output and growth in GFCF is not statistically significant after netting out the effect of per capita income. That is, per capita income has a greater independent influence on construction GDP. Therefore, it seems reasonable to infer that per capita income growth and housing credit explain the growth in construction GDP.

Partial correlation coefficient: YX2.X3 is 0.407 is statistically significant at 95% level; N is 27
Partial correlation coefficient: YX3.X2 is 0.306 is not statistically significant. So, Per capita income growth is the best explanatory variable for growth in GDP in construction.

Cross-section Analysis:

Though useful, the above analysis seems inadequate for two reasons: one, as the rise in construction employment is not proportionate to the rise in construction output, one is not sure how much of the employment growth is explained by the growth in construction GDP; two, the variation in construction employment growth across the states suggest that there are spatial aspect of the growth that would get missed in the aggregate economy-wide explanation. Therefore, it would be useful to complement the time-series analysis with a state wise cross-section regression.

Inter-state variation in construction employment is sought to be explained as a positive function of (i) per capita NSDP (per capita income), (ii) share of urban construction work force, (iii) bank credit for housing, and (iv) a negative function of cement price. We also include cement consumption as an explanatory variable as a proxy for supply (or access to cement). We would like to have included per capita plan expenditure as a measure of public investment, but dropped it for lack of adequate data. The equation is estimated both for levels (to capture inter-state variations), as well as for growth, across 17 major states for the years 2004-05 and 2009-10; the growth equation is estimated for the period 2009-10 over 2004-05. These equations are estimated separately for rural and urban as well as for total construction employment. We first examine the inter-correlation matrix among all the variables. The results (not presented here) can be summarized as follows:

1. Cement prices are not correlated with construction employment – this is consistent with the findings of the time series analysis.
2. Per capita income also does not have any correlation except in rural for 2009-10, but with a negative and significant sign – contradicting the time-series analysis.
3. Cement consumption has a uniformly high and positive correlation with construction employment. This could be partly representing technical (input-output) relationship between them.
4. Cement consumption and share of urban areas in construction employment are uniformly positively correlated.
5. Housing credit and cement consumption are also positively correlated in 2004-05.

These findings seem to be corroborated by regression analysis, reported in Table 5. It contains (i) level-regression separately for 2004-05 and 2009-10, and (ii) a growth regression between the two time points.

Table 5: Cross-section regression analysis – across the major states

Year/type of regression	Type of employment in construction	X1	X2	X3	X4	Adjusted R2
2004-05 Level regression	Total	-0.017	-0.002	20115	0.235	0.736
		(-1.374)	(-1.372)	(0.258)	(4.249)*	
	Rural	-0.014	-0.002	0.623	0.180	0.551
		(-1.180)	(-1.861)	(0.078)	(3.342)*	
	Urban	-0.003	0.001	1.491	0.055	0.945
		(-1.300)	(-2.549)*	(1.054)	(5.738)*	
2009-10 Level regression	Total	-0.063	0.000	-0.224	0.264	0.608
		(-3.093)*	(0.116)	(-0.013)	(4.415)*	
	Rural	-0.062	0.000	-3.145	0.179	0.456
		(-2.997)*	(0.066)	(-0.184)	(2.945)*	
	Urban	-0.001	0.000	2.921	0.084	0.859
		(-0.242)	(0.325)	1.170	9.458*	
2005-10 Growth regression	Total	-0.105	-.0.000	9.719	0.243	0.301
		(-2.001)	(-0.471)	0.367	1.796	
	Rural	-0.101	-0.000	(8.476)	(0.187)	0.434
		(-1.976)	(-0.182)	(0.329)	(1.435)	
	Urban	-0.004	-0.001	1.243	0.055	0.742
		(-0.647)	(-2.276)*	(0.364)	(3.126)*	

Note: Figures in brackets represent estimated 't' values; * represents statistical significance at at least 95% level. Dependent variable: employment in construction; X1 – Per capita income; X2 – Housing credit, X3 – Cement price, X4 – Cement consumption. N= 17 in all the regression.

To sum up: Nevertheless, growth construction GDP as a proxy for the employment (in the absence of the time series data) is best explained by growth in per capita income and housing credit. Construction employment across the major states is best explained by cement consumption and housing credit (for urban areas). Cement prices are uniformly not found to have any explanatory power. The model does not perform well at all for rural areas and for growth in employment across the states.

Section IV
Summary and Conclusions

Employment in construction sector grew annually at 9.3 per cent for 12 years since 1999-2000 – the sole bright spot in the otherwise bleak employment scenario. Contrary to the popular impression, rural employment growth at 12 per cent per year (accounting for over 50 per cent of the total in 1999-2000)

was distinctly higher in rural areas than urban (5 per cent). On the face of it, the employment is the result of a rapid rise in fixed investment to GDP ratio in the last decade close to 40 per cent. But there perhaps is more to it looking at the growth in a disaggregated fashion. Seeking to explain the boom is the purpose of this inquiry.

Descriptively speaking, growth in construction employment is spread across all major states. However, five states accounted for nearly one-half of employment and cement consumption in 1999-2000, as well as in 2011-12. Over the last 3 decades (1980-81 to 2011-12), the sector's share in workforce has risen from 1.2 per cent to 9.4 per cent; the rise is at a faster rate than the sector's contribution to the domestic output. But, no correlation is discernible between the growth in employment and in output.

It is widely believed that rapid rural employment growth is on account of seasonal migrant workers to urban construction sites. Such an argument would imply that most of the construction is taking place in urban areas, but workers are getting counted as rural because their response is recorded there. We contend that such an argument has many limitations. One, rural-urban migration has not gone up significantly in the last decade compared to earlier decades. Two, of the circulatory migration, which has gained some currency, those working in construction is modest. Three, 90 per cent of construction workers in rural areas claim construction as their principal status, implying that majority of their time is spent in rural areas; therefore they cannot be counted as circulatory migrants who spend small part of the year in urban areas.

So, we are inclined to believe that the employment is getting generated in rural economy itself. The reason for it could be expansion of construction demand on account of (i) fall in real price of cement (the principal raw material for construction), and (ii) rising real agricultural wages, especially after 2005. If this analysis is correct, then we should see a rise housing quality – from *kuccha* house to *pucca* house. I understand NSS has some housing data which needs to be explored. If our proposition is correct then it implies improvement in rural welfare with better housing and also perhaps improved agricultural productivity.

We also attempt an econometric analysis. For rural economy cross-section analysis does not show any influence of cement prices or per capita income on rural employment.

As construction employment is a derived demand, we sought to explain the growth in construction GDP as a function of growth in (i) per capita income, (ii) GFCF, (iii) real price of cement, and (iv) housing credit. A linear regression equation is fitted to the annual time-series for the period 1980-81 to 2009-10. Growth in per capita income and housing credit were found to be statistically significant.

To explain the inter-state variation in construction employment, a cross-section (linear) regression was fitted with (i) per capita income, (ii) cement consumption, (ii) housing credit and (iv) cement price as the explanatory variables. The equation was estimated for levels and as well for growth, separately for rural, urban and total employment (as the dependent variable). Cement consumption was the only variable with consistently (statistically) significant explanation. In urban India, besides cement consumption, housing credit seems to be the next important explanatory factor. For rural India, none of the estimated regression equations are statistically significant.

The close association discerned between construction employment and cement consumption could be merely a technical (input-output) relationship. However, it could also signify an improved access to cement in recent decades. As cement was for a long time a shortage commodity, it is conceivable that

with the expansion of supply, households have started to use cement more widely even for minor improvements in farms, factories, and houses and thus creating demand for construction labour.

Our effort in this study is a modest success. Surprisingly, price of cement does not seem matter at all: perhaps suggesting a need for a finer specification of the variable. We really do not know what could explain rural employment in construction sector.

Based on our study we suggest the following are a few issues for further inquiry.

1. Validate the trends in construction employment reported in the study by analyzing the 2011 census employment data.
2. Analyse NSS data on housing to verify the proposition of improvement in rural housing reported in this study.
3. Econometric specifications to explain construction employment growth need further refinement and estimation using unit level NSS data.

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