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DEPARTMENT OF ECONOMICS

Working Paper

Profitability and Investment: Evidence from India's Organized Manufacturing Sector

by

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Working Paper 2015-14



**UNIVERSITY OF MASSACHUSETTS
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Profitability and Investment: Evidence from India's Organized Manufacturing Sector[¥]

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Profitability and Investment: Evidence from India's Organized Manufacturing Sector

Abstract

Using a state-industry panel data set at the 3 digit national industrial classification (NIC) level of disaggregation for 19 major Indian states over the period 1983-84 to 2007-08, we analyze the contemporaneous and long run impacts of the rate of profit and its components – profit share, capacity utilization rate, and capacity-capital ratio – on investment. Our results show that: (a) the rate of profit has both short and long run positive impacts on investment; (b) the profit share and capacity-capital ratio have only long run positive impacts, and the capacity utilization rate has only a contemporaneous positive impact on investment.

Keywords: profitability; investment; manufacturing; India.

JEL Codes: B51; E12; E22.

1. Introduction

The assumption in economics that capitalist enterprises are driven by the profit motive has stood the test of time. Right from Adam Smith, who attributed the efficacy of the “invisible hand” to the self-love of producers,¹ to Karl Marx who conceptualized capitalists as being subjected to ruthless competition to earn profits,² to the profit maximization exercise undertaken by firms in present-day economics textbooks – it has been a fascinating journey. The assumption that producers are interested in earning as much surplus as possible on the capital they lay out is one of the few features which unify different traditions of economic theory. It stands to reason therefore that research would pay attention to understanding the role of profitability as a key determinant of capitalist investment behavior.

¹ “It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest.” (Smith, 1776 [2003])

² “[T]he development of capitalist production makes it constantly necessary to keep increasing the amount of the capital laid out in a given industrial undertaking, and competition makes the immanent laws of capitalist production to be felt by each individual capitalist, as external coercive laws.” (Marx, 1867 [1990])

A large part of the early growth literature concurs with the centrality of the profit rate. From Ricardo to von Neumann, Harrod and Kaldor, growth theorists agreed that the long run growth rate is proportional to the rate of profit, as long as the saving rate is constant (Kaldor, 1961). At an operational level, if we consider a particular sector rather than the entire economy, it is easy to see that a high rate of profit would attract more investment to that sector. More investment would push up the growth rate of the sector. Furthermore, “limited capital market” and “increasing risk” render firms dependent on their internal funds (i.e., the gross savings of firms) when they seek to undertake investment. A rise in profitability would be instrumental in expanding savings and jacking up investment (Kalecki, 1971). Thus, not only does a high profit rate lure in new capital, it also gives existing firms the wherewithal to expand.

Curiously, neoclassical economics does not pay much heed to the profit rate while examining investment. The heterodox tradition is more attentive to the importance of the rate of profit with both the Marxist and post-Keynesian traditions positing the rate of profit as a key determinant of investment.³ In Marxist theory the rate of profit is a barometer of the state of capitalist economy. As crisis unfolds, either due to rising labor costs or rising competition among capitalists that increases mechanization of the production process, the effect is felt in terms of declining profit rates (Shaikh, 1978). But these are not the only factors which affect the rate of profit. As Weisskopf (1979) argues in an important paper, realization problems, which are emphasized by Keynesians and post-Keynesians, can also reduce the profit rate.

Prompted by Weisskopf’s (1979) pioneering work on profitability in the US economy, a rich empirical literature has developed (Weisskopf, 1979; Shaikh, 1987; Moseley, 1991; Duménil and Lévy, 1993; Basu and Vasudevan, 2013; Basu and Das, 2015). While the main focus on this literature has been advanced capitalist economies, some papers have also studied developing countries like Brazil

³ For example, see Robinson (1962), Weisskopf (1979), Shaikh (1987), Bhaduri and Marglin (1990), and Foley and Michl (1999).

(Marquetti et al., 2010) and India (Sau, 1989; Felipe and Kumar, 2010; Basu and Das, 2015). The general approach taken in this literature is to decompose the rate of profit into its components and then ascertain relative contributions of each component to movements in the rate of profit. If one adopts a medium run perspective, the profit rate is decomposed into the profit share and the output capital ratio; if a short run perspective is adopted, it is decomposed into the profit share, the capacity utilization rate and the capacity-capital ratio (Basu and Das, 2015). While such decomposition analyses are useful in identifying factors that change profitability, they do not address the question of the impact of profitability on capital accumulation, which seemed to have, in large measure, motivated the profitability analysis in the first place.

The first contribution of this paper is to address this lacuna in the existing Marxist literature by investigating the causal relationship between profitability and capital accumulation using Annual Survey of Industries (ASI) data from India's organized manufacturing sector. By explicitly analyzing the relationship between profitability and capital accumulation, this paper adds to and extends a small literature that has previously addressed this important question. Glyn (1997), which had reviewed the previous literature and also empirically analyzed the link between profitability and capital accumulation for the manufacturing sector in 12 OECD countries, is closest to this paper. Glyn's (1997) analysis, even though extremely useful, suffers from some shortcomings: he had used the gross profit share as the measure of profitability, in effect ignoring the other components – capacity utilization, and the capacity-capital ratio – of the rate of profit; he had used a bivariate, cross sectional regression, and was thus unable to use variation across time or control for other covariates. Using a state-industry panel data set, the empirical analysis in this paper exploits variation across states, industries and time to address these issues and thus strengthen the results in Glyn (1997).

The second contribution of this paper is to connect to a vast heterodox macro literature that derives from the pioneering contribution of Michal Kalecki (1971) and John Maynard Keynes (1936). We trace the historical evolution of the important conceptual tool of the “investment function”, and estimate three canonical investment functions. To investigate the link between profitability and capital accumulation, we estimate three increasingly comprehensive investment functions. The first specification is the simplest and posits investment as being dependent on the rate of profit (Robinson, 1962); we call this the Keynes-Robinson investment function. The second specification generalizes the first by allowing for the effect of capacity utilization but replaces the rate of profit with the profit share to avoid unwarranted restrictions (Bhaduri and Marglin, 1990); we call this the Bhaduri-Marglin investment function. The third specification further generalizes the second by allowing independent role for all the three components of the rate of profit: profit share, capacity utilization rate and the capacity-capital ratio. This investment function was used in Foley and Michl (1999, ch. 10) in their discussion of investment-constrained growth models. We call this specification the Foley-Michl investment function. For each of the above three specifications, we estimate *dynamic* investment functions with a distributed lag specification, where we allow contemporaneous and lagged – up to 5 lags – impacts of profitability, or its components, on investment. The dynamic specification provides a flexible framework because it allows us to estimate both impact (contemporaneous) and long run multipliers of profitability vis-à-vis investment.

Investment behavior is complex and it is almost certainly the case that other covariates – tax policies, financial market conditions, state of the national and international economy, developments that eases infrastructural bottlenecks, and other related variables – would impact the level of investment. Unfortunately, our data set does not have information on such covariates. But we try to control for the possible confounding effects of these omitted variables by including an extensive set of alternative controls: state-industry fixed effects, year fixed effects, state-specific time trends, industry-

specific time trends, a dummy variable for “economic reforms” (which takes the value 1 for years after 1990 and 0 otherwise), and aggregate growth rate of the industries as a whole in each state. While state-industry fixed effects control for time-invariant factors at the state-industry level, year fixed effects control for temporal factors common to all state-industries. State and industry specific time trends control for factors that vary over time at the state and industry levels. The “economic reforms” dummy controls for the effect of the wide-ranging reforms initiated in 1991 on investment, and aggregate growth operates as a proxy for the overall state of the economy (at the state-level).

The third contribution of this paper is to connect with an emerging literature on the process of industrialization and economic growth in India (Kochhar et al., 2006; Kotwal et al., 2011; GOI, 2015). With the launch of the “Make in India” campaign by Prime Minister Narendra Modi in 2014, the centrality of manufacturing in India’s future growth trajectory has been emphasized by the highest policy quarters of the country. Some of the issues investigated in this literature have been the constraints on growth of organized manufacturing, the continued expansion of the unorganized manufacturing sector, the feasibility of a service-led structural transformation instead of the more traditional route of industrialization and the low employment elasticity of output growth. While these are all important issues, the aspect of profitability in relation to capital accumulation in the organized manufacturing sector has not been investigated. Since most firms in the organized manufacturing sector are privately owned, the aspect of profitability seems important for understanding investment and growth in this sector. This paper addresses this gap in the existing literature by re-focusing attention on profitability (and its components) as an important determinant of business investment. In doing so, we also extend previous work on the drivers of profitability in Indian organized manufacturing (Sau, 1989; Felipe and Kumar 2010; Basu and Das, 2015).

On the basis of our empirical analysis, we find that the rate of profit has a positive and significant effect on investment, both in the short and in the long runs, when it is taken as the only explanatory variable (the Keynes-Robinson investment function). Estimating the Bhaduri-Marglin investment function, we find that the profit share has a positive (and significant) effect on investment only in the long run, and the capacity utilization rate has a positive (and significant) effect only in the short run. In the most general specification (the Foley-Michl investment function), where profit share, capacity utilization and capacity-capital ratio are explanatory variables, we find a similar pattern: the profit share and capacity-capital ratio have positive (and significant) effects on investment only in the long run; the capacity utilization rate has a positive (and significant) effect on investment only in the short run. The “economic reforms” dummy and aggregate growth are not found to be significant in any specification.

The empirical findings of this paper point towards two important conclusions. First, it shows that rate of profit is salient in stimulating investment in the organized manufacturing sector in India, both in the short and in the long run. This provides evidence for the heterodox, and especially the Marxist, perspective that emphasizes profitability as an important determinant of investment by capitalist firms. Second, we find that the impact (contemporaneous) multiplier for capacity utilization is positive but the long run multiplier is zero. We also find that the profit share and the capacity-capital ratios have positive long run multiplier but zero impact multipliers.⁴

⁴ Our findings have some parallels with recent discussions in heterodox macroeconomics about wage-led and profit-led growth. While the parameter estimates from our empirical analysis suggest that the Indian organized manufacturing sector is wage-led in the short run but profit-led in the long run, we are hesitant to draw those conclusions for two reasons. First, the results of wage-led and profit-led growth relate to the whole economy; it comes from the macroeconomic equilibrium condition (the savings-investment equality). Our analysis refers to only the organized manufacturing sector (only a sub-sector of the whole economy). Thus, the parallel is weak. Second, the results about wage-led and profit-led growth depend on both savings and investment behavior. Since, we have only estimated investment functions, our results cannot make claims about both investment and savings.

The nuanced ways in which the components of profitability affect investment spending calls for further theoretical investigation; here we offer some initial thoughts. Technological improvements (captured by the capacity-capital ratio) and availability of internal finance (captured by the profit share) affect investment only in the long run. Technology, by promising lower costs and increased competitiveness, boosts investments by capitalist firms. The profit share is important both because it acts as a spur on accumulation – a higher share of the realized pie induces investment in the expectation of earning even more – and also because it provides firms with the wherewithal to invest. Most replacements, and much of net investment, are financed by realized profit flows, which are boosted when the profit share rises *ceteris paribus*. Moreover, the ability of firms to borrow from external sources can also be a function of realized profits. But these factors do not have any contemporaneous effect on investment. On the other hand, the state of demand (captured by the capacity utilization rate) impacts investment only in the short run (through the operation of the acceleration principle, for instance); it does not have any long run impact on investment.

The rest of the paper is organized as follows: in section 2, we provide a brief review of the heterodox literature on the investment function; in section 3, we discuss our data sources and variable definitions; in section 4, we outline our empirical strategy; in section 5, we discuss our main results; and section 6 concludes the paper. An appendix gives details of the construction of 3-digit industry codes.

2. Evolution of the Investment Function

One of the key conceptual innovations introduced by the work of Michal Kalecki (1971) and John Maynard Keynes (1936) related to positing separate determinants for flows of investment and savings. While the decision to save, i.e., refraining from consuming the total income, was the preserve of wealth holders (potentially all households), the decision to invest, i.e., purchase capital goods, was understood as being undertaken by entrepreneurs (or firms). There is no reason why the two decisions should

automatically come to the same result in any given period, i.e., intended investment need not equal planned savings. It was thus that with the conceptual tool of what later came to be called an “independent investment function”, the economics of Kalecki and Keynes (and their followers) marked itself off from both the classical and neoclassical traditions, both of which had assumed the equality between the flows of savings and investment because all that is saved is automatically invested.

2.1 Animal Spirits

An independent investment function called for explicit specification of the determinants of the level of investment. To address this issue, Keynes introduced the notion of the marginal efficiency of capital (MEC) in chapter 11 of the *General Theory*. The MEC was understood as the “rate of discount which would make the present value of the series of annuities given by the returns expected from the capital-asset during its life just equal to its supply price.” The supply price of a capital asset is not the market-price at which it can be currently purchased but “the price which would just induce a manufacturer newly to produce an additional unit of such assets, i.e. what is sometimes called its *replacement cost*.” Moreover, capital-asset i would have its own marginal efficiency of capital, MEC_i , and the “marginal efficiency of capital in general” could be defined as the maximum MEC over all capital assets, i.e., $MEC = \max_i MEC_i$. Keynes proposed that the level of investment “will be pushed to the point ... where the marginal efficiency of capital in general is equal to the market rate of interest.” One could add a risk premium to the rate of interest to make the analysis more realistic, but the main point remains unchanged.

According to Joan Robinson, Keynes did not take such marginalist analysis very seriously (Robinson, 1962, pp. 37). A reading of the *General Theory* corroborates this contention because in the very next chapter, i.e. in chapter 12, Keynes seems to jettison the whole framework developed in chapter 11. Instead, he emphasizes that the level of investment is more a function of “animal spirits” than the result of careful calculation. “Most probably, of our decisions to do something positive, the full

consequence of which will be drawn out over many days to come, can only be taken as the result of animal spirits – of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities” (Keynes, 1936, pp. 161-162).

Since investment by firms were crucially dependent on their ‘animal spirits’, it became necessary to theorize the latter. Influenced, perhaps, by Kalecki (1971), Joan Robinson noted, correctly in our opinion, that “to sustain a higher rate of accumulation requires a higher level of profits, both because it offers more favorable odds in the [investment] gamble and because it makes finance more readily available.”⁵ This led her to propose that “the ‘animal spirits’ of the firms can be expressed in terms of a function relating the desired rate of growth of the stock of productive capital to the *expected* level of profits” (Robinson, 1962, pp. 37-38).

Expected level of profits cannot be observed. So, to operationalize the ‘animal spirits’ function, one would need to make explicit the process of expectation formation and relate expected profits to observed variables. Robinson (1962) offers two scenarios for consideration. In the first situation, the economy is operating on a smooth path where the rate of profit expected on new investment has been constant for some time. Hence, firms can hold very “confident expectations” that the expected rate of profit will equal the constant (realized) rate of profit. Thus, the expected rate of profit is equal to the current rate of profit. In the second situation, past experience regarding the rate of profit has been varied, i.e., expected and realized rates of profit have not always coincided. In such a situation, “confident expectations” cannot be held and “there is a propensity for present experience to be overweighted in the formation of expectations.” Thus, the expected rate of profit is a complex function

⁵ As noted by, among others, Sawyer (1982) and Glyn (1997), Kalecki’s work on the dynamics of capitalist economies emphasized the role of realized profitability as a key determinant of investment, both because it could impact expectations and because it could ease financing constraints. Some of Kalecki’s work on the determinants of investment predates Robinson (1956, 1962).

of realized rates of profit with the current rate of profit having the greatest weight. Most researchers in the heterodox tradition have taken this to mean that *the current rate of profit can be used as a proxy for the expected rate of profit*, a point we will return to shortly. We can summarize these insights into what we will call the Keynes-Robinson investment function as

$$\frac{I}{K} = f(r) = \alpha + \beta_1 r, \quad (1)$$

where I/K is the level of investment normalized by the capital stock, $r = \Pi/K$ is the rate of profit (ratio of the flow of profits and the stock of capital valued at replacement cost), and $f(\cdot)$ denotes a function, and the right most expression is a commonly used linear specification of $f(\cdot)$, where α and $\beta_1 > 0$ are parameters. The Keynes-Robinson investment function, or its close variants, was popular in the heterodox tradition for many years and has been used, among others, by Asimakopoulus (1969), and Marglin (1984).

2.2 Excess Productive Capacity

An important shortcoming of the Keynes-Robinson investment function is that it does not allow for considerations of excess capacity to influence investment decisions of firms. This is clearly unrealistic and goes against our understanding of how real capitalist firms behave. For it is conceivable that firms, having earned a high rate of profit in the current period, would be hesitant to make fresh capital outlays if they happened to be saddled by excess capacity (probably because they were just emerging from a long recession). Initial attempts to address this lacuna can be found in the work of Bob Rowthorn and Amitava Dutt in the early 1980s. Dutt (1984) provided a formal treatment of the issue by adding the capacity utilization rate – ratio of actual and full capacity potential output – as an additional and independent variable in the Keynes-Robinson investment function.

The intuition for positing a positive relationship between the capacity utilization rate and the level of investment could be found in the work of Josef Steindl, who had been deeply influenced by

Michal Kalecki. Steindl (1952 [1976]) argued that firms desire to hold some excess productive capacity even in long run equilibrium, much like they wish to hold idle reserves of commodities or money. There can be at least two reasons for this. First, excess capacity allows firms to quickly respond to unforeseen fluctuations of demand and could be an important factor that prevents them from losing market share. Second, holding excess capacity is a way in which firms can prepare for the expected secular growth of the market over time by building ahead of demand. But could firms not change capacity in a smooth manner to accommodate growth of the market? Steindl (1952 [1976]) thinks that is not possible because of inherent indivisibilities and durability of plant and equipment. Change in capacity occurs in discrete steps, but the market grows smoothly. The result is that “a planned and deliberate reserve of excess capacity is at all times held by most producers” (Steindl, 1952 [1976], pp. 10)

The desired excess capacity (the planned and deliberate reserve of excess capacity), thus defined, has a decisive influence on the investment behavior of firms. When the utilization of capacity rises above the desired level, firms increase investment to build additional capacity; when utilization falls below the desired level, firms disinvest and allow capacity to get reduced. These insights can be summarized through the Steindl-Dutt investment function

$$\frac{I}{K} = g(r, z) = \alpha + \beta_1 r + \beta_2 z, \quad (2)$$

where, in addition to the terms defined in (1), z denotes the capacity utilization rate (ratio of actual and potential full capacity output), $g(\cdot, \cdot)$ denotes a function, and $\beta_2 > 0$ is a parameter. The Steindl-Dutt investment function, or its close variants, has been used, among others, in Rowthorn (1981), Dutt (1984), and Taylor (1985).

While the Steindl-Dutt investment function defined in (2) is an improvement over the Keynes-Robinson investment function in that it explicitly allows for the effect of capacity utilization, it has an in-

built, unwarranted restriction: it rules out what has come to be called profit-led expansion i.e., an increase in the growth rate of output (or capacity utilization) when the share of profit rises. Since there is no reason to rule out such a possibility *a priori*, the Steindl-Dutt investment function is theoretically unsatisfactory (Bhaduri and Marglin, 1990, pp. 380). The problem can be addressed, and the unwarranted restrictions removed, by replacing the rate of profit with the profit share

$$\frac{I}{K} = h(h, z) = \alpha + \beta_4 h + \beta_5 z, \quad (3)$$

where, in addition to terms defined in (1), $h = \Pi/Y$, denotes the share of profit. The investment function defined in (3) was proposed in Bhaduri and Marglin (1990) and we will refer to it as the Bhaduri-Marglin investment function, which has become a workhorse of neo-Kaleckian macroeconomic models (for instance, see, Blecker, 2002; Taylor, 2004; Barbosa-Filho and Taylor, 2006; Blecker, 2010).⁶

2.3 Components of Profitability

While the Bhaduri-Marglin investment function has been widely adopted by heterodox economists, it also hides, in our opinion, an important and unwarranted restriction. Bhaduri and Marglin (1990) had motivated the derivation of their investment function from a commonly used three-part decomposition of the rate of profit:

$$r \equiv \frac{\Pi}{K} = \frac{\Pi}{Y} \frac{Y}{Y^*} \frac{Y^*}{K} \equiv hzv \quad (4)$$

where r is the rate of profit, h is the profit share, z is the capacity utilization rate, and v is the capacity-capital ratio. Following the logic of the Keynes-Robinson investment function, they accepted the

⁶ One interesting and rapidly growing strand of recent heterodox macroeconomics has concerned itself with the long run relationship between desired and actual capacity utilization. In this debate, the neo-Kaleckian position has argued that the desired and actual capacity utilization need not coincide even in the long run; critics of the neo-Kaleckian position have argued why that implication of the neo-Kaleckian investment function might be theoretically and empirically problematic (see the papers published in *Metroeconomica*, Volume 63, Issue 1, February 2012, and especially Skott (2012), for an overview of and references to the vast literature). In this paper, we do not engage with this literature because our focus is on the impact of profitability on investment and this literature usually ignores profitability as a determinant of investment (probably for tractability).

centrality of profitability in the determination of investment. But they wanted to allow each component of profitability to have its own and independent effect on investment. That is why they replaced the rate of profit by its components. But they did not use all the three components – profit share, capacity utilization rate and the capacity-capital ratio – because of an additional assumption: the capacity-capital ratio is constant in the short run. Hence, the two independent determinant of investment, in the Bhaduri-Marglin investment function, are the profit share and the capacity utilization rate.

There are at least two problems with ignoring the capacity-capital ratio as an independent determinant of investment *if the logic underlying the Keynes-Robinson investment function is accepted*. To see the first problem, imagine a researcher trying to estimate an investment function using cross sectional, firm (or industry) level data. One way to carry out this estimation for the Bhaduri-Marglin investment function would be to regress investment (normalized by the capital stock) on profit share and capacity utilization. The implicit assumption in such an exercise would be that the capacity-capital ratio is part of the constant in the regression function, i.e., it does not vary across firms. This immediately highlights the problem in the Bhaduri-Marglin investment function: there is no theoretical justification to support the claim that the capacity-capital ratio would be the *same* across all firms. If we understand the capacity-capital ratio as a reflection of the technological capability of firms, there is bound to be a wide variation in its value across firms and industries at any point in time. Hence, ignoring the capacity-capital ratio as a determinant of investment is tantamount to imposing the restriction that the contemporaneous impact of technological change on investment is zero. This is both theoretically and empirically unwarranted.

The second problem is that in any real capitalist economy, it is difficult to determine the length of the “short run” in terms of what Joan Robinson called “historical time”. For most advanced capitalist economies, the highest frequency at which aggregate macroeconomic variables are regularly observed is

at a quarterly frequency. It is quite unlikely that the capacity-capital ratio will be constant at such frequencies for most commonly used ways of measuring capacity output. Hence, the assumption of constant capacity-capital ratio would be difficult to sustain empirically.

For both these reasons, it seems a better theoretical strategy to work with a full generalization of the Keynes-Robinson investment function and allow all the three components of the rate of profit – share of profits, capacity utilization rate, and the capacity-capital ratio – to be independent determinants of investment, as in Foley and Michl (1999, pp.188):

$$\frac{I}{K} = h(h, z, w) = \alpha + \beta_6 h + \beta_7 z + \beta_8 v, \quad (5)$$

where all the terms are as defined in (3) and (4). The Foley-Michl investment function defined in (5) has the advantage that it does not impose any *a priori* restrictions on the impact of the components of profitability on investment. Thus, it generalizes the theoretical impulse of the Keynes-Robinson formulation and nests the Bhaduri-Marglin specification as a special case.

2.4 Dynamics

All the three specifications of the investment that we will estimate in this paper – the Keynes-Robinson, the Bhaduri-Marglin and the Foley-Michl investment functions – do not allow for dynamic effects. In each of these models, the determinants of investment have contemporaneous, but cannot have lagged, effects on investment. This is an unnecessary restriction and, quite paradoxically, goes against the basic ideas set out in Robinson (1962).

As we have indicated above, Robinson (1962) started out by positing that expected profitability is a key determinant of investment. In a situation of steady-growth, it might be justified to assume the equality of expected and realized profitability. But, when the economy is out of steady-state, Robinson (1962) noted that expected profitability will be a complex function of current and past profitability, with

a preponderant weight assigned to current profitability. Robinson (1962) and later researchers have interpreted this – large weight being assigned to the current period – to mean that the current profit rate can be used as a proxy for the expected profit rate, in effect ruling out the possibility of lagged, dynamic impacts. This restriction seems unwarranted and a more flexible specification, which allows past *and* contemporaneous profit rates to determine expected profitability, and through it, investment, seems a superior alternative:

$$\frac{I_t}{K_t} = f(r_t^e) = f(g(r_t, r_{t-1}, r_{t-2}, \dots, r_{t-k})) = \phi(r_t, r_{t-1}, r_{t-2}, \dots, r_{t-k})$$

where t indexes time, r_t^e is the expected profit rate, and k is the number of lags of the profit rate that enter into the determination of the expected profit rate (and investment). The key advantage of such a dynamic specification is that it allows a researcher to separately estimate both short run and long run impacts on investment without imposing any *a priori* restrictions about lagged effects. Following this logic, we will use dynamic versions of the three investment functions – the Keynes-Robinson, the Bhaduri-Marglin and the Foley-Michl investment functions - and estimate distributed lag regression models.⁷

In the next section, we describe our data and variables. But before that some comments on the mainstream literature on investment is in order. Mainstream macroeconomics has a long and distinguished tradition of studying investment behavior. This literature goes back at least to the work of Jorgensen on the neoclassical theory of investment, develops into the q-theory of investment, and then moves towards incorporating adjustment costs, irreversibility and uncertainty into dynamic optimization models of investment behavior (see the seminal contribution of Fazzari, Hubbard and Petersen (1988) for the early literature, and Caballero (1997) for the post-1990s developments).

⁷ Skott (2012), drawing inspiration from the work of Roy Harrod, notes the need to distinguish short and long run impacts on investment. Kalecki (1971) also emphasized the role of dynamics and lagged effects in investment functions.

From our perspective, what is most unsatisfactory in the mainstream work on investment is the lack of attention to profitability. A comprehensive survey of mainstream work on business fixed investment (Chirinko, 1993) finds very little use for the notion of profitability. While Chirinko et al., (1999) does include the gross profit rate (ratio of cash flows and capital stock) in their specification of the investment equation, it is primarily meant to capture the effect of liquidity on investment. Moreover, having the rate of profit and an accelerator-type effect at the same time – which the main specification in Chirinko et al. (1999) has – creates unwarranted restrictions, as pointed out by Bhaduri and Marglin (1990). If we look at the literature as it has percolated down to graduate-level textbooks (e.g., Romer, 2011), the chapter on “investment” does not even feature the concept of the *rate of profit*. If we focus on India, a recent survey article by Kotwal et al. (2011) would also be a case in point. Among other things, this comprehensive survey article analyses the acceleration of economic growth in recent decades in India. But the dynamics of the profit rate is hardly ever discussed.

The closest that the mainstream literature comes to any notion of profitability is when it uses Tobin’s q (ratio of the market value of a firm and replacement cost value of its capital stock) as a determinant of investment. In India’s organized manufacturing sector, the vast majority of firms are not listed on the stock market. Hence, a measure like Tobin’s q cannot be computed for most firms. This is one more reason we prefer to specify the investment function in terms of the rate of profit (profit income as a ratio of the replacement cost value of fixed capital) and its components. Moreover, we define profit income as net value added less wages of productive labor, rent and interest. Thus, we incorporate the “cost of capital” (rent and interest) in our definition of the rate of profit.

3. Data: Sources and Variables

3.1 Source of Data

The primary source of data for the empirical analysis presented in this paper is the Indian Annual Survey of Industries (ASI). The ASI is one of the most reliable sources of information regarding various aspects of the manufacturing sector in India and has been conducted every year by the Central Statistical Office (CSO) of the Government of India since 1959 (except 1972). It replaced the previously conducted Census of Manufacturing Industries (CSI) and the Sample Survey of Manufacturing Industries (SSMI), and combines elements of a census and a sample survey. While the ASI covers all factories registered under sections 2(m)(i) and 2(m)(ii) of the Factories Act of 1948, its sample can be divided into two parts, a census sector and a sample sector.⁸ The census sector involves full enumeration covering all industrial units in 5 less industrially developed states – Manipur, Meghalaya, Nagaland, Tripura, and Andaman & Nicobar Islands – and all units having 100 or more workers in the other states and union territories (UTs). The sample sector involves stratified random sampling of units in states other than those considered industrially less developed.⁹

The ASI collects detailed information about industrial units – number and types of workers, value of capital, value of inputs, value of output and other details of operation – for a reference period running from April 1 of any year to March 31 of the next year. For the analysis in this paper, we use data released by the ASI at the 3 digit NIC level of disaggregation for Indian states for the period 1983-84 to 2007-08. The ASI has changed its industrial classification system multiple times over the past few

⁸ A factory, the primary statistical unit of enumeration of the ASI, is defined as any premise where a manufacturing process is being carried out by 10 or more workers working with the aid of power, or 20 or more workers working without power (GOI, 2011). In addition to sections 2m(i) and (ii) of the Factories Act, the ASI also covers bidi and cigar units registered under the Bidi & Cigar Workers (Conditions of Employment) Act of 1966.

⁹ Strata involving 4 or less units are included in the census sector.

decades, and we have used concordance tables provided by it to construct a consistent 3 digit industry code that runs over the whole period of our analysis.¹⁰

3.2 Variables and Summary Statistics

To study the main question of this paper – the relationship between profitability and investment – we use data on the following variables from the ASI: net fixed capital formation, stock of fixed capital, net value added, wages of workers, total emoluments (wages and salaries of workers, supervisors and managers), benefits, rent and interest payments. We construct a panel data set of these variables, where the unit of observation is a 3 digit industry in a state in a particular year. After leaving out smaller states and UTs, our data set includes 19 states/UTs that account for, in most years, more than 95 percent of the net value added of the whole manufacturing sector.¹¹ Based on our 3 digit consistent codes, we have 55 industries, and our sample covers the period 1983-84 to 2007-08.

We measure investment by the ratio of net fixed capital formation and the stock of fixed capital (at the beginning of the period). The ASI reports fixed capital on the basis of historical cost valuation (GOI, 2011, pp. A-629). We use the wholesale price index of machines & machinery (WPIMM) to revalue fixed capital in terms of replacement cost valuation.¹² The rate of profit is defined as the ratio of profit income over a period and the replacement cost stock of fixed capital at the beginning of the period.

¹⁰ NIC-1970 was used till 1988-89; NIC-1987 was used from 1989-90 to 1997-98; NIC-1998 was used from 1998-99 to 2003-04; NIC-2004 was used from 2004-05 to 2007-08 (GOI, 2011). Appendix 2 provides details of the construction of our 3 digit industry codes.

¹¹ The 19 states in our sample are the following: Andhra Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. Bihar, Madhya Pradesh and Uttar Pradesh were each bifurcated into two states in 2001. For those years, we have merged data for the relevant states to generate comparable series for the original states.

¹² We use the following recursion to compute replacement cost capital stock: $K(t+1) = K(t) \times \frac{P(t)}{P(t-1)} + I(t)$, where $K(t)$ is the value of replacement cost capital stock at the beginning of period t , $I(t)$ is the net fixed capital formation over period t , and $P(t)$ is the value of the national WPIMM in period t . In the initial period, $t = 0$, $K(0)$ is the historical cost value of capital stock. We start the recursion in the year 1983-84 because our data for WPIMM starts in 1982-83.

Profit income, in turn, is defined as net value added less wages of productive labour, rent and interest payments.¹³

Following Weisskopf (1979), it is common to decompose the rate of profit as

$$RP \equiv \frac{\Pi}{K} = \frac{\Pi}{Y} \frac{Y}{Y^*} \frac{Y^*}{K} = PS \times CU \times CC \quad (6)$$

where RP is the rate of profit defined as the ratio of the profit income over a period (Π) and the stock of capital at the beginning of the period (K), Y is actual output (net value added), and Y^* is potential (full capacity) output. We can see that in (6), the rate of profit can be decomposed into the profit share ($PS = \Pi/Y$), a measure of distributional struggles between capital and labor; the capacity utilization rate ($CU = Y/Y^*$), a measure of the state of demand; and the capacity-capital ratio ($CC = Y^*/K$), a measure of technological capabilities. We measure potential (full capacity) output as the trend in the time series of the net value added. We compute the trend of the net value added series by fitting a Hodrick-Prescott (HP) filter to the corresponding series for each state-industry.¹⁴

Table 1 presents summary statistics for the key variables in our analysis for the whole sample and for three selected years.¹⁵ Mean investment increases from 11.05% in 1985-86 to 21.86% in 1995-96 before falling off to 11.42% in 2005-06. The mean of the rate of profit falls remained flat at about 45% between 1985-86 and 1995-96, but then climbed up sharply to 63.39% in 2005-06. The mean of the

¹³ The concept of productive labour is important in Marxist political economy. It refers to labour that creates value and surplus value in capitalism. For the analysis in this paper, we calculate wages of productive labour (WP) as follows. We start with data on wages of workers (W) and wages & salaries of workers, supervisors & managers (WS), the latter including the former. The ASI also provides data on benefits (BT) for all employees together, without separating it out for workers, supervisors and managers. Then, we calculate wages of productive labour as: $WP = W + (W/WS) \cdot BT$. Thus, our implicit assumption is that BT gets divided between workers and other employees in the same ratio as W and WS.

¹⁴ Our data set is an unbalanced panel because all industries are not present in all states in all years. Hence, we fill gaps in the net value added series using linear interpolation.

¹⁵ To prevent outliers from driving results, we exclude observations corresponding to the top and bottom 1 percent of the distribution of investment, profit rate, capacity utilization, profit share, and capacity-capital ratio. We also drop observations where the profit share was higher than 100.

share of profit increases over the decades, from 25% in 1985-86 to 36% in 1995-96, and then sharply up to 67% in 2005-06. Average capacity utilization rate increases for a decade before flattening out, and the mean capacity-capital ratio and aggregate growth (of state-level net value added) shows an inverted U-shape.

Table 1: Descriptive Statistics for Key Variables

	All Years	1985	1995	2005
	Mean/SD	Mean/SD	Mean/SD	Mean/SD
Investment (% of K)	9.89 (23.49)	11.05 (25.47)	21.86 (32.49)	11.42 (22.65)
Rate of Profit (%)	46.66 (76.64)	45.65 (68.93)	44.86 (65.98)	63.39 (95.39)
Share of Narrow Profit (% of NVA)	38.98 (48.81)	24.54 (59.80)	35.98 (41.91)	67.13 (25.82)
Capacity Utilization Rate (%)	78.76 (97.93)	72.64 (137.37)	103.71 (64.48)	101.04 (48.65)
Capacity-Capital Ratio (%)	62.34 (226.45)	59.51 (237.25)	106.32 (131.14)	79.34 (118.14)
Aggregate Growth (%)	13.73 (32.34)	9.27 (10.88)	20.54 (17.61)	15.44 (21.28)
Observations	15892	597	553	559

This table reports descriptive statistics of key variables for a panel data set of 55 manufacturing industries (3 digit level of disaggregation) for 19 Indian states for the period 1983-84 to 2007-08. Aggregate growth refers to the growth rate of net value added of the whole manufacturing sector in each state. K = capital stock; NVA = net value added.

4. Empirical Strategy

The main question investigated in this paper is the impact of profitability (and its underlying components) on investment. To motivate our empirical analysis we provide scatter plots of investment against the rate of profit, share of profit, capacity utilization rate, and the capacity-capital ratio, in Figure 1. Each scatter plot includes the regression line from a bivariate regression of investment against the variable and a constant. The scatter plot shows that all the four variables – the rate of profit and its three components – have positive relationships (of varying degrees of strength) with investment. While Figure 1 provides suggestive evidence that profitability and its components have a contemporaneous

positive impact on investment, we study this question more rigorously by estimating three *dynamic* investment functions using a regression framework.¹⁶ All specifications have some common elements, and we start by discussing these.

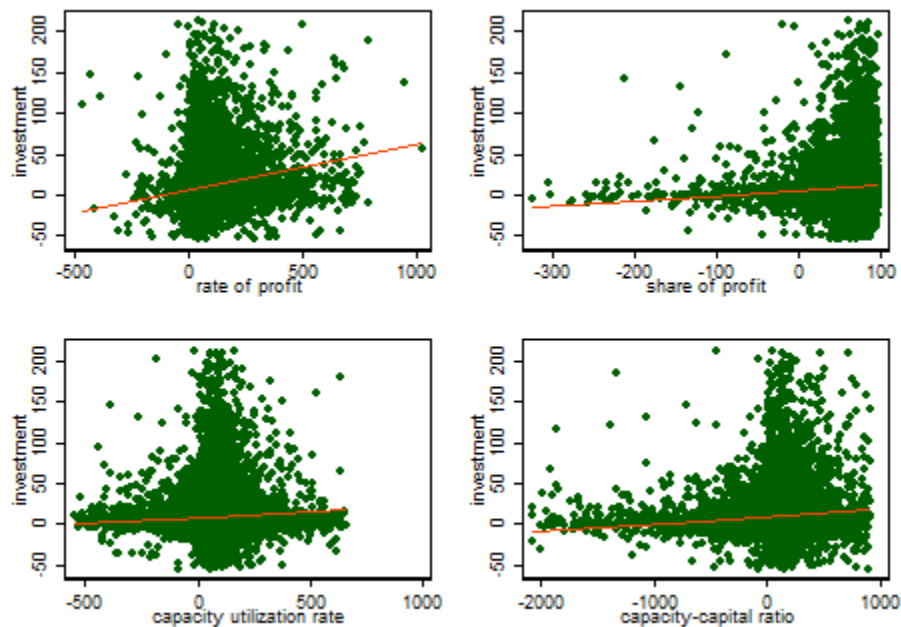


Figure 1: Scatter plot with linear, bivariate regression line of investment (as a proportion of the capital stock) and the rate of profit (top left), share of profit (top right), capacity utilization rate (bottom left), and the capacity-capital ratio (bottom right).

First, our unit of observation is an organized manufacturing industry (at the 3-digit level of disaggregation) in one of the Indian states (or union territories) in a given year. Second, in all our specifications, we regress investment (measured by the ratio of net fixed capital formation and the capital stock) on some measure of profitability or its component parts. We estimate dynamic specifications in the following sense: investment is regressed on contemporaneous and 5 lags of

¹⁶ Lavoie, et al. (2004) also estimate 4 different investment functions to test between post-Keynesian and Marxist theories of capital accumulation. We find their rendering of Marxist theories of capital accumulation problematic because of the absence of profitability. The sole focus of Lavoie, et al. (2004) seems to be on the capacity utilization rate. We differ from them by including the profit share and the capacity-capital ratio, in addition to the capacity utilization rate, as determinants of investment. See Skott (2012) for a critique of the main empirical results reported in Lavoie, et al. (2004).

profitability (or components of profitability), in addition to controls. The dynamic specification allows for a flexible manner in which profitability (or its components) can have short and long run impacts on investment. For instance, we think that the profit share is important because it makes internal finance available to capitalist firms. In a context where credit market imperfections are important, the availability of internal finance can spur investment by easing credit constraints. But this effect can be expected to operate only with some lag because generation of profit income is seldom committed to new capital outlays immediately. In a similar manner, technological improvements (captured by improvements in the capacity-capital ratio) can have very delayed impact on investment. On the other hand, economic theory suggests that demand shocks (captured by the capacity-utilization rate) might only have short run (contemporaneous) impacts on investment. A full dynamic investment function allows for such complicated lagged effects to operate, and does not force the researcher to opt for *a priori* restrictions.¹⁷

Third, it is arguably the case that investment decisions depend on covariates, other than the components of profitability. These might be tax policies of state and central governments, dividend payments by particular firms and industries, availability of electricity and other infrastructure, linkages to export markets, measures of financial market imperfection, and other relevant variables.

Unfortunately, our data set does not contain information on these variables. To alleviate concerns about endogeneity – arising from omitting such variables – we use a host of controls that a state-industry panel data set allows.¹⁸ In particular, all our specifications include the following controls: state-industry

¹⁷ We minimize Akaike's Information Criterion and Schwarz's Bayesian Information Criterion (starting with a maximum of 5) to arrive at the 'optimal' number of lags. Since we are using annual data, we think 5 years is a reasonable maximum number of lags to consider. Both information criteria lead us to choose 5 lags. Hence, we use 5 lags in all our dynamic models.

¹⁸ Problems of endogeneity arising from bidirectional causality are, in our opinion, less severe in our regression models. While it is conceivable that investment has an impact on profitability, this effect is likely to occur only in the future. For instance, if a firm adopts cost-cutting technology by investing in new machinery and equipment, the impact of such investment will only show up in future profits. It is unlikely that investment will have contemporaneous impacts on the components of profitability.

fixed effects and year fixed effects; state-specific and industry-specific time trends; a “economic reforms” dummy; and a variable measuring the growth rate of net value added for the whole manufacturing sector in a state. State-industry controls for time-invariant state and industry level factors (like state-level policies, industry level unobserved heterogeneity); year fixed effects control for time-varying factors that are common to all state-industries (like country-wide policies, and temporal shocks); state-specific and industry-specific time trends are meant to control for factors that change over time within states (like the increasing pro-business tilt of certain state governments, or the greater efficiency of some state bureaucracies) and industries (like the growth of leverage in certain industries, or the systematic change in dividend policies in certain industries); the economic reforms dummy takes a value for all years after 1990, and attempts to capture the effect of the sharp change in the policy environment after the onset of the economic reforms in 1991; the growth rate of aggregate net value (at the state level) added tries to capture both demand side factors like aggregate demand shocks or complementary demand, and supply side factors like easing of credit and infrastructural bottlenecks.

Our first specification of an investment function is the simplest: we regress investment (measured by the ratio of net fixed capital formation and the capital stock) on the rate of profit and the set of controls. Based on our discussion in section 2, we call this the Keynes-Robinson investment function:

$$I_{ist} = \beta_{10}RP_{is,t} + \beta_{11}RP_{is,t-1} + \dots + \beta_{15}RP_{is,t-5} + \gamma_1RF_t + \gamma_2AG_{s,t} + \mu_{is} + \gamma_t + \eta_it + \zeta_st + \varepsilon_{ist} \quad (7)$$

where i, s, t indexes industry, state and year; I_{ist} is the ratio of investment over, and the capital stock at the beginning of, period t ; $RP_{is,t-k}$ is the rate of profit earned in period $t - k$ ($k = 0, 1, \dots, 5$); RF_t is an economic reforms dummy which takes the value 1 if $t \geq 1991$, and 0 otherwise; $AG_{s,t}$ is the growth rate of manufacturing net value added in state s in period t ; μ_{is} is an industry-state fixed effect; γ_t is a year fixed effect; η_it are industry-specific time trend; ζ_st are state-specific time trends; and ε_{ist} is a

stochastic error term. Our primary interest in (7) is in estimating the following: (a) the impact multiplier of the rate of profit, $IM_{RP} = \beta_{10}$; and (b) the long run multiplier of the rate of profit, $LRM_{RP} = \sum_{i=0}^5 \beta_{1i}$.

Our second and third specifications follow from the decomposition of the rate of profit given in (6) above, which shows that a given rate of profit can arise from different combinations of its three components: profit share, capacity utilization rate and capacity-capital ratio. Thus, it is important to go beyond the simple specification of the investment functions in (7) and investigate the effect of the three underlying components profitability on investment. Bhaduri and Marglin (1990) start from the decomposition in (6) but then assume that potential output and the capital stock is fixed in the short run, so that variations in the rate of profit arise only from variations in the profit share and the rate of capacity utilization. Based on our discussion in section 2, we call this the Bhaduri-Marglin investment function:

$$I_{ist} = \beta_{20}PS_{is,t} + \beta_{21}PS_{is,t-1} + \dots + \beta_{25}PS_{is,t-5} + \beta_{30}CU_{is,t} + \beta_{31}CU_{is,t-1} + \dots + \beta_{35}CU_{is,t-5} + \gamma_1 RF_t + \gamma_2 AG_{s,t} + \mu_{is} + \gamma_t + \eta_i t + \zeta_s t + \varepsilon_{ist} \quad (8)$$

Here, in addition to the terms defined in (7), $PS_{is,t-k}$ is the profit share in period $t - k$; and $CU_{is,t-k}$ is the rate of capacity utilization in period $t - k$. For the Bhaduri-Marglin investment function, we are interested in estimating the following: (a) the impact multiplier of the profit share, $IM_{PS} = \beta_{20}$; (b) the impact multiplier of capacity utilization rate, $IM_{CU} = \beta_{30}$; (c) the long run multiplier of the profit share, $LRM_{PS} = \sum_{i=0}^5 \beta_{2i}$; and (d) the long run multiplier of the capacity utilization rate, $LRM_{CU} = \sum_{i=0}^5 \beta_{3i}$.

We estimate a third specification of the investment function, where all three components of profitability are used as regressors. We call this the Foley-Michl investment function:

$$I_{ist} = \beta_{40}PS_{is,t} + \beta_{41}PS_{is,t-1} + \dots + \beta_{45}PS_{is,t-5} + \beta_{50}CU_{is,t} + \beta_{51}CU_{is,t-1} + \dots + \beta_{55}CU_{is,t-5} + \beta_{60}CC_{is,t} + \beta_{61}CC_{is,t-1} + \dots + \beta_{65}CC_{is,t-5} + \gamma_1 RF_t + \gamma_2 AG_{s,t} + \mu_{is} + \gamma_t + \eta_i t + \zeta_s t + \varepsilon_{ist} \quad (9)$$

Here, in addition to the terms defined for (7) and (8), $CC_{is,t-k}$ is the capacity-capital ratio in period $t - k$.

For the Foley-Michl investment function, we are interested in estimating the following: (a) the impact multiplier of the profit share, capacity utilization rate, and capacity-capital ratio, respectively,

$IM_{PS} = \beta_{40}; IM_{CU} = \beta_{50}; IM_{CC} = \beta_{60}$; (c) the long run multiplier of the profit share, capacity utilization rate, and capacity-capital ratio, respectively, $LRM_{PS} = \sum_{i=0}^5 \beta_{4i}; LRM_{CU} = \sum_{i=0}^5 \beta_{5i}$; and $LRM_{CC} = \sum_{i=0}^5 \beta_{6i}$.

All our regression models are estimated by the “within-group” estimator (using state-industries as groups) and standard errors are clustered by state-industry. Thus, the standard errors are robust to arbitrary within-panel autocorrelation.

5. Main Results

To prepare for regression analysis, we first conducted panel unit root tests on all variables. In Table 2, we report results of a Fisher test of unit root in panel data sets for each variable. The null hypothesis for each test is that all panels contain unit roots and the alternative is that at least one panel is stationary.¹⁹ We reject the null strongly for all variables, which suggests that problems of unit roots are not serious for our regression analysis.

The main results of our regression analysis, and estimates of impact and long run multipliers, are presented in Table 3. While the impact multiplier is an estimate of the *contemporaneous* effect of profitability (or its components) on investment, the long run multiplier captures the *long run* effect of profitability (or its components) on investment. To see the difference between the two multipliers, let y and x denote investment and some measure of profitability, and let investment be an infinite distributed lag of profitability: $y_t = \beta_0 x_t + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \dots + \varepsilon_t$. The impact multiplier is given by

¹⁹ We conducted the panel unit root tests using STATA’s “xtunitroot” function. We could only use the Fisher test because we do not have a strongly balanced panel. Other commonly used tests like the Levin-Lin-Chu (2002) or the Im-Pesaran-Shin (2003) require strongly balanced panels.

$IM = \frac{\partial y_t}{\partial x_t}$; on the other hand, the long run multiplier is the effect on y of a *permanent* increase in x from

period t onwards, i.e., $LRM = \lim_{k \rightarrow \infty} \sum_{i=0}^k \frac{\partial y_{t+k}}{\partial x_{t+i}} = \sum_{i=0}^{\infty} \beta_i$.²⁰

Table 2: Panel Unit Root Tests

	Investment	Rate of Profit	Share of Profit	Capacity Utilization Rate	Capacity-Capital Ratio	Aggregate Growth
Inverse chi-sq	0.000	0.000	0.000	0.000	0.000	0.000
Inverse logit	0.000	0.000	0.000	0.000	0.000	0.000
Inverse normal	0.000	0.000	0.024	0.000	0.000	0.000
Modified inverse chi-sq	0.000	0.000	0.000	0.000	0.000	0.000
N	15892	15892	15892	15892	15892	15293
Groups	798	798	798	798	798	798
Average Number of Periods	19.91	19.91	19.91	19.91	19.91	19.16

This table reports p-values associated with the inverse chi-sq, inverse normal, inverse logit, and modified inverse chi-sq statistics for the Fisher test of panel unit roots. The null hypothesis is that all panels contain unit roots, and the alternative is that at least one panel is stationary.

Let us start with contemporaneous effects. The results in Table 3 show that the rate of profit has a positive and significant contemporaneous effect on investment (0.071). Among the components of profitability, only the capacity utilization rate has a significant impact multiplier at about 0.032. In both the Bhaduri-Marglin and the Foley-Michl investment functions, the profit share has statistically insignificant impact multipliers. Turning to long run effects, we see that the rate of profit has a statistically significant positive long run multiplier of 0.139 in the Keynes-Robinson investment function. In the Bhaduri-Marglin specification, the profit share has a statistically significant long run multiplier of 0.041 but capacity utilization has a zero long run multiplier. In the Foley-Michl specification, the profit share and capacity-capital ratio have statistically significant long run multipliers of 0.04 and 0.047, respectively, but the long run multiplier of capacity utilization rate is not statistically significantly different from zero.

²⁰ In our model, the distributed lag model has up to 5 lags. Hence, the long run multiplier is given by $\sum_{i=0}^5 \beta_i$.

Table 3: Impact and Long Run Multipliers for a Dynamic Investment Function

Dep Var: Investment (% of Capital Stock)			
	(1)	(2)	(3)
Impact Multipliers			
Rate of Profit (%)	0.071*** (0.007)		
Share of Profit (% of NVA)		-0.002 (0.007)	-0.005 (0.007)
Capacity Utilization Rate (%)		0.031*** (0.005)	0.032*** (0.005)
Capacity-Capital Ratio			0.005 (0.013)
Aggregate Growth (%)	0.003 (0.010)	0.003 (0.011)	0.003 (0.011)
Reforms Dummy (Year>=1991)	1.577 (2.249)	1.298 (2.283)	0.903 (2.323)
Long Run Multipliers			
Rate of Profit (Sum of 0-5 Lags)	0.139***		
P-value (H0: Sum of 0-5 Lags = 0)	0.000		
Profit Share (Sum of 0-5 Lags)		0.041***	0.040***
P-value (H0: Sum of 0-5 Lags = 0)		0.007	0.008
Capacity Utilization Rate (Sum of 0-5 Lags)		0.000	0.007
P-value (H0: Sum of 0-5 Lags = 0)		0.993	0.457
Capacity-Capital Ratio (Sum of 0-5 Lags)			0.047***
P-value (H0: Sum of 0-5 Lags = 0)			0.000
State-Industry Fixed Effect	Y	Y	Y
Year Fixed Effect	Y	Y	Y
State-Specific Time Trends	Y	Y	Y
Industry-Specific Time Trends	Y	Y	Y
Groups (State-Industries)	663	663	663
N	9404	9404	9404

This table reports parameter estimates and standard errors using the "within estimator" for different versions of investment functions estimated with an annual state-industry panel for India's organized manufacturing sector. Our data set spans the period 1983-84 to 2007-08 and has information on 55 industries (at 3-digit NIC level of aggregation) in 19 major Indian states. Specification 1 (Keynes-Robinson) has 5 lags of the profit rate; specification 2 (Bhaduri-Marglin) has 5 lags of profit share and capacity utilization rate; specification 3 (Foley-Michl) has 5 lags of profit share, capacity utilization rate and capacity-capital ratio. All standard errors are clustered by state-industry. ***p<0.001, **p<0.01, *p<0.05.

Thinking of all the specifications together, we interpret the results as evidence in favor of the broadly defined Marxist specification of the investment function. By itself, profitability is an important determinant of investment spending in India's organized manufacturing sector. In terms of the components of profitability, our results show that easing of financial constraints (measured by the profit share) and technological improvements (captured by the capacity-capital ratio) have positive impacts on investment in the long run but no contemporaneous effects. On the other hand, the state of demand (captured by the capacity utilization rate) has a positive contemporaneous effect (acting possibly through the accelerator mechanism), but no long run effect, on investment. Our results seem to be in line with much macroeconomic thinking where demand shocks are understood to have short run, but technological and financial shocks are seen as having long run, impacts on investment and growth.

The last point to note about our results refer to the wide-ranging policy changes introduced in India since the early 1990s, which have often been seen as a way to spur investment and growth in the industrial sector (Kotwal, et al., 2011). Hence, we included an "economic reforms" dummy – which takes the value 1 for all years after 1990 and 0 otherwise – in all our regressions to see if we could find evidence for its effect on investment. In all our regressions, the coefficient on the "economic reforms" dummy is positive but statistically insignificant. Thus, our results indicate that the positive impact of the economic reforms, if at all present, is weak at best.

6. Conclusion

In heterodox macroeconomic theory, especially in the Marxist tradition, profitability is an important determinant and driver of capital accumulation. This paper investigates the issue empirically using Indian data of recent decades. Economy-wide data required for this exercise is unavailable; hence, we restrict the investigation to the organized manufacturing sector in India. Moreover, by focusing on this particular segment of the economy, this paper connects with and extends earlier research on the drivers

of profitability in India's organized manufacturing sector (Sau, 1989; Felipe and Kumar 2010; Basu and Das, 2015).

The results of our empirical analyses underline the importance of profit rate on investment decisions, thereby buttressing the Marxist understanding of capital accumulation. But it goes further by identifying the patterns of impact of the underlying factors of profitability on investment. Technological improvements (captured by positive movements in the capacity-capital ratio) and growth of internal finance (captured by the profit share) are found to stimulate investment over the long run. These factors have no contemporaneous positive impact on investment. On the other hand, positive demand shocks (captured by the capacity utilization rate) have contemporaneous positive impacts on investment, but no long run impact. We also find that the much discussed economic reforms do not have any strong positive impact on investment in India's organized manufacturing sector.

The analysis in this paper can be extended in several directions, and here we mention two. First, over the past few decades, the service sector has increasingly become important in India. An analysis of profitability trends and estimation of investment functions for the service sector would be an appropriate extension to pursue. Second, one possible limitation of the analysis in this paper is the exclusion of financial variables (like leverage, debt-equity ratio, dividend policy) from the investment function. With the increasing financialization of the economy, financial considerations might have become important determinants of investment expenditure. Even though we have attempted to capture these aspects with state-industry and year fixed effects, and state-specific and industry-specific time trends, explicitly incorporating financial determinants of investment could be another fruitful extension of the research reported in this paper. Using firm-level data might be a way to address these issues in a better manner.

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Appendix

In this appendix, we provide details of the construction of our 3-digit industry codes.

Industry Name	NIC-1998	NIC-1987	NIC-1970	OUR 3 DIGIT CODE
Production, processing and preservation of meat, fish, fruit, vegetables, oils and fat	151	200, 202, 203, 210, 211, 212	200, 202, 203, 210, 211, 315	101
Dairy product	152	201	201	102
Grain mill products, starches and starch products & prepared animal feeds	153	204, 217, 218	204, 216, 217	103
Other food products	154	205, 206, 207, 209, 213, 214, 215, 219	205, 206, 207, 209, 212, 213, 214, 219	104
Beverages	155	220, 221, 222, 223, 216, 224	220, 221, 222, 223, 215, 224	105
Tobacco products	160	225, 226, 227, 228, 229	225, 226, 227, 228, 229	106
Spinning, weaving and finishing of textiles	171	231, 232, 233, 234, 235, 240, 241, 242, 244, 245, 247, 250, 251, 252, 253, 254, 255, 256, 236, 243, 246, 248, 257, 258, 259	233, 234, 235, 236, 231, 240, 242, 241, 245, 247, 250, 251, 252, 253, 251, 253, 232, 243, 246, 248, 252, 258	107
Other textiles	172	267, 268, 263, 264, 261, 262, 269	266, 267, 263, 244, 259, 261, 262, 269	108
Knitted and crotcheted fabrics and articles	173	260	260	109
Wearing apparel, except fur apparel	181	265, 266, 292, 964	264, 265, 292, 964	110
Dressing and dyeing of fur; manufacture of articles of fur	182	294, 295, 296	294, 295, 296	111
Tanning and dressing of leather, manufacture of luggage handbags, saddlery & harness	191	290, 293, 299	290, 293, 299	112

Footwear	192	291, 311	291, 301	113
Saw milling and planing of wood	201	270	271	114
Products of wood, cork, straw & plaiting materials	202	271, 272, 273, 274, 275, 279	270, 272, 273, 274, 275, 279	115
Paper and paper product	210	280, 281, 282, 283	280, 281, 282, 283	116
Publishing	221	285, 284	285, 284	117
Printing and service activities related to printing	222	286, 287, 288, 289	286, 287, 288, 289	118
Coke oven products	231	318, 319	306, 307	119
Refined petroleum products	232	314, 315, 316	304, 315, 305	120
Processing of nuclear fuel	233	317	317	121
Basic chemicals	241	300, 301, 302	310, 312, 311, 316	122
Other chemical products	242	303, 304, 305, 208, 307, 309	312, 313, 314, 208, 317, 319	123
Man-made fibers	243	306	315	124
Rubber products	251	310, 312	300, 302	125
Plastic products	252	313	303	126
Glass and glass products	261	321	321	127
Non-metallic mineral products n. e. c.	269	322, 323, 320, 324, 327, 326, 325, 329	322, 323, 320, 324, 327, 328, 326, 325, 329	128
Basic iron and steel	271	330, 331, 332	330, 331, 332	129
Basic precious and non-ferrous metals	272	333, 334, 335, 336, 338, 339	333, 334, 335, 336, 339	130
Casting of metals	273	337	337	131
Structural metal products, tanks, reservoirs & steam generators	281	340, 341, 352	340, 341, 352	132
Other fabricated metal products; metal working service activities	289	344, 345, 343, 346, 349	344, 343, 345, 349	133
General purpose machinery	291	356, 391, 354, 359, 393, 397, 399	356, 391, 354, 359, 393, 397, 399	134
Special purpose machinery	292	350, 390, 357, 392, 351, 353	350, 390, 357, 392, 351, 353	135

Domestic appliances n. e. c.	293	355, 364, 388	355, 388	136
Office, accounting & computing machinery	300	358, 367	358, 366	137
Electric motors, generators & transformers; electricity distribution & control apparatus	311, 312	360, 395	360, 395	138
Insulated wire and cable	313	361	361	139
Accumulators, primary cells & primary batteries	314	362	362	140
Electric lamps & lighting equipment	315	363	363	141
Other electrical equipment, n. e. c.	319	369	369, 365	142
Electronic valves and tubes & electronic components	321	368	367	143
Television and radio transmitters & apparatus for line telephony and line telegraphy; Television and radio receivers, sound or video recording or reproducing apparatus, and associated goods	322, 323	365, 366, 396	364	144
Medical appliances and instruments & appliances for measuring, checking, testing, navigating and other purposes, except optical instruments	331	380	380	145
Optical instruments and photographic equipment	332	381	381	146
Watches and clocks	333	382	382	147
Motor vehicles; bodies for motor vehicles; trailers and semi-trailers; parts & accessories for motor vehicles & their engines	341, 342, 343	373, 374	374	148
Building & repair of ships and boats	351	370	370	149
Railway and tramway locomotives & rolling stock	352	371, 372	371, 372, 373	150
Aircraft and spacecraft	353	377	377	151
Transport equipment n. e. c.	359	375, 376, 378, 379	375, 376, 378, 379	152
Furniture	361	276, 277, 342	276, 277, 342	153
Manufacturing n. e. c.	369	383, 384, 385, 386, 387, 389	383, 384, 385, 386, 387, 389	154
Others	5555	5555	5555	155
Total	9999	9999	9999	156