Scale Effect versus Young's 'Acceleration Principle': The Empirical Issues

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This paper maintains that the conceptualization of a large firm that is based on the realization of increasing returns to scale phenomenon, which is based on pecuniary external economies created by other such large firms, is problematic. It, by design, is dependent on the external increase in the size of the market. An alternative is the Youngian conception of the 'increasing returns' phenomenon that provides a better policy focus. It discusses the conditions under which investment by a 'large firm' in an industry that is productive (i.e. embodies technological improvement) creates external economies, and forms the basis of further investments that are more productive. The Youngian external economies-based 'acceleration' principle propagates in a cumulative way, permitting in turn continuous advanced growth.

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Introduction

One of the initiatives of a liberalization process is the provision of proper incentives to make the firms more dynamic. The expectation is that this transition would bring in more 'developed' overall growth processes and confer a developed status to the economy. This is an important thrust area. Here, the Schumpeterian tradition suggests that intense competition defines such firms who rely on technological improvements as a competitive strategic conduct. In this, there is no role of normal profits. The firms are driven by the desire to increase (maintain) higher profits and their technological improvements support such objectives.

In this context, the present paper holds that the conceptualization of dynamic firms is an important policy concern; in a way, the basic Schumpeterian insight into the role of higher profits (as such) prompts two different types. One is the profitable firms who take advantage of higher scale economies and the other is the ones who seek higher profits through industrial differentiations, as discussed by Young (1928), where produc-

tion processes are sub divided into many tasks and different firms of different size carry out such tasks.

This distinction is important if the 'competitive' environment that supports higher growth prospects is a concern. Chandra and Sandilands (2005) note that the recent endogenous growth literature gives more importance to the increasing returns to scale that glorifies monopoly profits, rationalized by the incidence of higher fixed costs, and it undermines the growth inducing competitive forces that are generated by the Youngian industrial differentiation. The present paper goes further to underline the need for the elaboration (see I below) that the very conceptualization of a growth process based on scale economies (and monopoly elements) is a problematic one, as borne by the fact that technological progress does not co-exist with monopoly profits.

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There is another important motive at play. If there is the discussion of a link between the working of the dynamic firms and the growth of aggregate output (or technological progress), the minimal assumption is that the firms create external economies. Different conceptualizations of dynamic firms provide different conceptualizations of the economies. The present paper tries to show that their specificity in the context of scale economies is such that the scale adjusts to higher growth of output (and demand), rather than being the cause of growth. On the other hand, in the context of industrial differentiation, their discussion (as in Young, 1928) provides the understanding of how more productive investment (that aim at higher profits) creates external economies and begets further such opportunities and this 'acceleration' principle is responsible for higher growth that is associated with technological progress.

The issues raised above are taken up in Section I of the present paper. Section II deals with the empirical issues to distinguish the different conceptions of dynamic firms and Section III provides the related data set for the Indian industry, to conclude.

I Firm & the Developed Status: Stylized Facts of Growth

In the development economics literature, higher developed status can underline the importance of Rosenstein-Rodian industrialization based on scale economies. This does not require any change in technology and takes place with unchanged endowments and preferences (Murphy, Shleifer & Vishny, 1989), but in an important way, shows that higher monopoly profits are consistent with higher aggregate output. Here, an important assumption is that higher scale economies is associated with higher fixed costs and calls for compensation in terms of higher profits. Since these profits are specific to higher output realization to take advantage of the scale economies, the outcome (with the assumption that all profits are spent) can generate higher aggregate demand, which, amounting to pecuniary external

economies, can support such investment elsewhere. The only catch is that its own profitability based on higher output expectations also depends on such pecuniary external economies created by the large-scale investments in other sectors. In other words, there are strategic complementarities between large investment projects across sectors based on pecuniary external economies. However, the market mechanism fails to coordinate such diverse investment programs. There is therefore the possibility of multiple equilibria when the market outcome is based either on pessimism where no one takes the initiative to industrialize, which pins down investment by others, or on optimism where every one simultaneously takes the investment decision, supporting each other. Pessimism leads to bad outcome (say, pre-existing low productivity level) and optimism realizes increasing returns to scale in an aggregate sense. However, commenting on such models, Solow (1998; also see Mookherjee and Ray, 2001) notes that they do not compare to the models that can predict; the outcomes depend on such factors as history, expectations, accidents, psychological factors etc. (Krugman, 1991; Ray, 1998; Mookerjee and Ray, 2001). In other words, these formalizations have a Keynesian flavor (in as much as Keynesian theory depends on imperfect markets) that highlights the role of government to 'big push' the economy.

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In this sense, the purpose of this paper is to highlight that if 'technological progress' is mainly viewed as achieving higher scale economies, its actualization is dependent exogenously on more profitable investment opportunities (or, on one time subsidy (Phelps, 1970: 508), which through pecuniary external economies, would push the aggregate economy towards good outcome). Then, such technological progress is exogenous and has to be supported by higher pace of capital accumulation. It should be noted that Solow in his Nobel (prize) acceptance lecture recognized the importance of the association between pace of capital accumulation and technological progress. A particular form of the embodiment hypothesis could be that higher pace of investment leads to the realization of higher scale economies. However, if there is a possible slackening of the exogenous investment opportunities, it is more likely to be associated with periodic non-realization of scale economies-based profits i.e., the possibility of short run Keynesian problems (Solow, 1998; 2003).

In any case, even if the pace of exogenous growth of income is maintained (how so ever generated), there are also inherent problems regarding the growth of technological progress based on ever growing scale economies. There are surely limits to the expansion of a plant (Scherer & Ross, 1990: 151-3) even if the demand conditions (howsoever generated) are favorable. In addition, large scale (and large organizational form), in fact, provides disincentive to technological progress that results from learning by doing (Arrow, 2000). It is true that the

endogenous growth theories try to avoid this possibility by posting the role of externalities, with continuous possibilities of higher scale economies matched by aggregate demand (in a synchronized balanced growth fashion), there have been the criticisms. They note the underlying grossly unrealistic modeling strategy (Solow, 2000) as well as the unrealism of the notion of Marshallian externalities (Pack, 1994).

In this context, this paper maintains that an alternative and better understanding of the 'demystifying the technological progress' exercise can focus on the growth processes that typify the incidence of industrial differentiation, which provides a different understanding of the conception of a dynamic firm.

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The particular focus is on Young's (1928) division of labor-led growth process. As discussed by Padhi (2014; 2015; 2015a), the dynamic firm that initiates division of labor which, following Kaldor (1972), should be viewed as a new finance-led investment that increases aggregate market size (in the Keynesian fashion). The firm obtains higher market access with higher profits, which induces external economies in the sense that there is the incentive for other firms in other industries to adopt it, each targeting new investments involving some form of division of labor. This external economies-based acceleration principle then forms the basis of the possibility of 'increasing returns in production possibilities, i.e., higher volume of production in one line of production would be attended by higher production elsewhere in the economy. This in turn signifies competitive conditions'[1], inducing further external economies in terms of investment opportunities in further scope of division of labor i.e., greater roundabout methods of production that manifest itself in specialized tasks, new industries, etc. This is because, (Stigler, 1951), if the generalized adoption of division of labor in Young's language takes place, many tasks undertaken by the firms, but common to them, can now be undertaken by specialize firms.

[1] As Young (1928) elaborated, the competitiveness is not with reference to price competition that ensures the realization of market in a static sense. The focus is on greater competitiveness through cost reduction that ensures larger market and higher returns. Young (1928: 536), much before Keynes and Rostow, emphasized that investment in a cost reducing sense is not dependent on ordinary cost profit calculations but is guided by potential market and endogenous forces create this potential market. While discussing the emergence of industrial capitalism, he noted that commerce is an agent of industry (rather than the other way around). In other words, the focus should not be on prior existence of specialized trading activities to absorb higher production. Investment used in a cost reducing sense permit the manufacturing firm to undertake trading activities on a larger scale to capture existing market from others that necessarily takes into account making inroad into larger geographical market. This shows that the augmentation of profits does not depend on an exogenous increase in market but that the market is created by reducing costs that absorbs trading costs.

Such specializations, therefore, transform the economy, marking a phase of constant evolution of new tasks, new products, new processes, etc., which are typical of the technological progress witnessed in developed countries. This scope of specializations in many new lines also supports technological progress: as Scherer (1967) noted about the basic characteristic of knowledge gathering activity: the existence of many alternative technical possibilities provide the *base* that supports greater learning by doing.

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The issue is not only about higher profits to the firms. As Padhi (2014; 2015a) adds to Young, the competitive conditions also permits higher employment opportunities that comes with higher money and real wages; this is when the technological progress, now, underlines the importance of specialized skills, highlighting the importance of the role of scientists and technocrats (who do not come cheap). This perspective therefore gives importance to the imperatives of 'efforts and talents', but views the actualization of technological progress as dependent on the working out of the external economies-based acceleration principle that brings in more resources in more productive fields, which in turn is dependent on a permissive financial structure.

II Empirical Issues

The focus is to distinguish the source of technological progress: whether the realization of higher scale economies or industrial differentiation dominates. In a sense, the former is an adjustment to demand shocks that leads to higher profits (market power). In fact, there have been studies that try to see whether technological progress (say as captured by the Solow residue in the index form) is an adjustment to demand shock (Houthakkar, 1979; Shapiro, 1987) or whether specific to oligopolisic competition with static monopoly power (Hall, 1988). Alternatively, the focus can be on the decomposition of the residue into pure technological progress, scale economies and monopoly power (Morrison, 1992). However, allowing that there is no 'pure' technological progress as such, this procedure, relying on the roles of demand shocks and existence of positive profits, cannot distinguish between 'scale economies' and 'economies of division of labor'. The latter also induces demand shocks and permits positive profits.

There is, however, the direct evidence on which one can rely on. To focus sharply on such evidence, it is assumed that large-scale production entails higher transaction costs with respect to the dependence on market, and, therefore, should support vertically integrated plants (a la Williamson, 1971). In addition, such integration can be a strategy to limit entry that confirms higher monopoly profits; the scale economies involve higher fixed costs that have to be recouped by such higher profits. On the

other hand, it can be hypothesized that the division of labor-led technological progress would highlight greater incidence of industrial differentiation. Therefore, the empirical issue can concentrate on whether vertical integration (with few firms) or industrial differentiation (with many specialized firms) dominates the industrial sector.

Here, the existing studies that maintain that the incidence of vertical integration should mainly be seen in terms of an increase in value added to output ratio in specific industries in an individual industry-wise study (Levy, 1984). To elaborate, in these studies, vertical integration in an industry implies less of outsourcing (and more use of capital and labor by firms to produce the inputs themselves), which, assuming away differential increases of input and output prices, translates into higher value added per unit of output.

The problem is even in the case of industrial differentiation, the possibility of the intermediate costs reduction (say, through more efficient outsourcing) in the face of sticky prices (Padhi, 2014) also permits higher value added per unit of output (in the relevant industries). Therefore, the higher ratio in an industry can also confirm the incidence of higher industrial differentiation.

In fact, the empirical studies, following Stigler (1951)'s suggestion that higher growth would be associated with industrial differentiation, find that higher growth phases are generally associated with higher value added per unit of output (Levy, 1984). The studies however view that the increase in the ratio should always indicate higher vertical integration. To reconcile it with higher growth, there has been the attempt to modify Stigler's hypothesis and allude to the possibility that higher growth can create informational problems (Levy, 1984) or can underline the importance of barriers to entry (EIberfeld, 2002) that supports vertical integration.

However, the present paper maintains that managerial adaptability to higher growth phases does not have to indicate a movement towards vertical integration. A division of labour-led high growth phase can indicate different managerial adaptability that highlights the importance of industrial differentiation. To elaborate, top management in a firm is nothing but a reflection of specific abilities of a few individuals and it would be difficult for them to supervise different narrow specialization that division of labor brings in. There is therefore the support for a managerial adaptability where the specialized functions are undertaken by the specialized firms. Such firms with a narrow focus can undertake specialized functions more efficiently as compared to a vertically integrated firm. Moreover, if the specialized firms improve the tasks/functions (say, through learning by doing), there is the possibility

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of further growth in terms of scope for further industrial differentiation. If so, a firm that depends on outsourcing would be in a better position with respect to further higher growth prospects, compared with a vertically integrated firm (also see, Saxienian, 2000).

Alternative Focus

The above discussion shows that a focus on 'higher value added per unit of output' as such can indicate the nature of firm either way and therefore has to be supplemented by other data set. A particular alternative focus can be on the profitability analysis. For example, scale economies assume monopolistic profits, and suggest a higher positive correlation between increase in profitability and prices, i.e. the higher fixed costs led profits would translate into monopoly power that would outweigh the possibility of costs reduction per se (cost reduction permits monopolization and higher monopoly related profits). Industrial differentiation, on the other hand, would suggest higher profits through intermediate cost reduction specific to sticky prices. This has an important implication. If one assumes that higher scale economies would entail higher profitability with lower real wages, the higher profits resulting from the incidence of industrial differentiation would allow for both higher money and real wages. This needs elaboration because the underlying conditions sharply distinguish scale economies from that of the economies associated with industrial differentiation.

Industrial differentiation would suggest higher profits through intermediate cost reduction specific to sticky prices.

The transition to higher scale economies is a 'once for all' transition, without permitting growth of capital productivity. The (exogenous demand led) growth possibility would rely mostly on increases in labor productivity, via increase in plant size, achieved through greater rationalization of vertical integration that reduces the demand for employment, and would be associated with less than proportionate increases in money wages. That is, as plant size is increased, the labor requirement to operate the plant may not increase proportionately. This reduced demand for labor, and that there are no new tasks (or scarcity of specialized labor) as such, means that the money wages would also lag behind.

In this context, if higher scale economies-based higher fixed costs also enjoin higher monopoly profits, and is achieved by higher price of the product in relation to the economies achieved, the monopoly profits would be sustained by higher labor productivity. The capital productivity would lag behind and higher profits would be associated with less than proportionate increase in money wages, with decreases in the real wages.

On the other hand, the division of labor-led growth process would signify the employment of costly specialized machinery (and labor force) that is made more economical by targeting higher volume of output. The focus therefore is on higher

capital productivity. This would also be associated with higher specialization labor-based labor productivity that results in the intermediate costs reduction. If the price of the product remains the same, this cost reduction permits higher value added per unit of output in specific industries, which in turn can permit higher profits with higher real wages, in principle. Here, industrial differentiation typifies coming up of new tasks (magnifying the scarcity of specialized labor) that would command higher money wages. Therefore, the incidence of both higher money and real wages would be higher.

The Present Focus

The present paper focuses on the entire manufacturing/industrial sector to interpret the changes in value added per unit of output. If industrial sector is viewed as a single aggregate sector[2], it is but true that nominal value added would equal nominal output[3]; however, the industrial sector in India cannot be seen as an aggregate single macro sector. There is the possibility of changes in the value added per unit of output, reflecting the nature of the possible transition of this sector in the market reform era. To elaborate, the market reform regime inherited a highly diversified industrial base that typified higher import intensiveness (especially with respect to capital/intermediate goods) of the hitherto import substitution regime. The industrial performance, say, with respect to successful industrial differentiation (that should facilitate better exports performance) however was absent. One possible hypothesis therefore is that the market reform provides the incentives (and financial opportunities) to access better technology for the purpose of domestic production of intermediate products and such replacement of the imports would imply higher value added per unit of output. On the other hand, the market reform regime with less stringent regulations can support higher market led imports of more sophisticated intermediate goods imports (Goldberg et al, 2010). In this case, value added per unit of output would decrease, if it were also to be implied that the differential increase in price of product and materials would decrease.

In these contexts, the profitability analysis can be used for the purpose of evaluation of the changes in value added per unit of output, if the latter trace out the changing impact of the imports (or, approximated by changing pattern of domestic intermediate goods production).

[2] Both integration and outsourcing also involve other sectors of the economy. The present paper however assumes that the ratio of raw materials to output remains the same and the incidence of services closely follows the incidence of industrial differentiation in manufacturing sector that provides the greater scope.

[3] Profitability analysis is still relevant. If there is the differential increases in the prices of products and the materials used i.e., increase in the (nominal) value added per unit of output is more than that of the increase in the real (double deflated) value added per unit of output i.e. emergence of trading profits (Padhi, 2014). The profitability analysis is important to explain whether it is due to higher market power associated with scale economies or is due to higher industrial differentiation that enjoins lower material price in relation to the sticky product price.

III Empirical Results & Concluding Remarks

Table 1 below provides the basic data, covering the period from 1990-91 to 2011-12. In this table the value added output ratio takes in to account the gross value added arrived at by deducing only the material costs from gross output. The two sub-periods in the table take into account the fact that though in the entire period the ratio has decreased, the first period from 1990-91 to 1997-8 witnessed an increase in it. It can be seen that if the increase of the ratio in the first sub period is associated with higher value added growth (as compared to its growth recorded for the entire period), a decrease in the ratio in the second sub period from 1998-99 to 2011-12 is also associated with still higher growth rate. Therefore, the growth patterns by themselves are not sufficient to indicate the factors that shape the pattern of change in the ratio. A particular focus can be on whether the change in the pattern of imports of intermediate goods is the factor. For this purpose, we focus on the changing pattern of domestic production of intermediate goods, with the assumption that under the new regime it can be viewed as an alternative to the imports of such goods. Table 2 shows that as compared to the increased domestic production of intermediate goods (and its 'better' growth performance in relation to the overall index of industrial and durable goods production) in the first phase, there is a distinct deterioration of the same in the second phase. This pattern

Table 1 Value Added Growth in Relation to Value Added per unit of Output Ratios

Periods	Growth in Value added	Value added per Output
1991- 2012	6. 87	- 0. 62
1991- 1998	8.94	2.09
1999-2012	10.58	-1. 19

Sources: Annual Survey of Industries (National Income Accounts for the implicit price data);Growth rate in all tables refers to compound growth rate (% per year) calculated with logest excel formula

Table 2 Pattern With Respect to the Index of Intermediate Goods

Periods	Growth of the Index of Intermediate Goods	Growth of the Index of Intermediate Goods in Relation to Index of Industrial Production	Growth of the Index of Intermediate Goods in Relation to the Index of Durable Goods
1991- 2012	0.99	- 0. 20	-4.45
1991- 1998	1.05	1.57	-1.23
1999-2012	0.94	-1.54	-7.05

Source: rbi.org.in

Analysis shows that as compared with the first sub-period, the profitability has decreased in the second (and entire) period.

of change traces out the pattern with respect to the ratio i.e., the first phase could refer to the domestic production replacing the imports while the second phase marks a reversal of this trend.

It is clear that this increase in first period is associated with higher capital intensity, but the labor productivity witnessed a less than proportionate growth, resulting in a sharp fall in capital productivity. The increase in profitability is also much sharper than the increase in real wages. There is therefore the indication that the increase in value added per unit of output in the first sub period, after all, is an indication of the realization of higher scale economies that carries through higher monopolization (and vertical integration).

If the second period indicates lower domestic production of intermediate goods, with the possibility of imports that in turn indicate the increased participation in international division of labor, there has been a distinct improvement with respect to the resultant growth rate of value added. This shows that the increased imports of intermediate products (and decrease in the value added per unit of output in the period) are associated with higher incidence of industrial differentiation, which, via Young-Stigler's hypothesis, supports higher growth momentum. The data for this period show that the decrease in the ratio is accompanied by higher capital productivity, associated with improvements in the real wages. (Table 3)

Increased imports of intermediate products (and decrease in the value added per unit of output in the period) are associated with higher incidence of industrial differentiation.

Table 3 Pattern of Growth Rates of Supplementary Data

Periods	Profitability	Real wage rate	Capital labor ratio	Labor productivity	Capital productivity
1991-2012	3.85	1.04	6.15	5.08	-1.00
1991-1998	7.34	1.26	11.57	7.25	-3.87
1999-2012	6.99	1.49	4.54	5.25	0.69

Sources: as in table1

However, does the evidence of the second period support the thesis that India has entered the crucial phase, which can sustain further growth momentum? Here, tables 1 and 2 in a way suggest that higher domestic intermediate goods production in the first period was not internationally competitive enough and was replaced by imports in the second phase. This lack of domestic sophistication in intermediate goods production can be an important concern. It is domestic production of intermediate goods i.e., production function exhibiting more variety, which induces higher capital formation including foreign capital (Rodriquez-Clare, 1996; Chanay & Ossa, 2013). Such domestic capabilities permit the

supply-chain that is more efficient in providing timely, rapid, and cost effective inputs, which in turn makes the country internationally more competitive (Porter, 1992). Also, the domestic incidence of increased industrial differentiation adds to domestic knowledge creation in terms of additional tasks and specializations that can support more profitable further investment opportunities in the intermediate stage production, signifying the working of the Youngian acceleration principle. The resources released from the final goods should be redeployed in the more specialized intermediate goods production, and the overall capital formation (and its rate) should increase, especially in the intermediate production stage. In addition, such domestic structural change within the industrial sector also supports higher specialized labor force in the intermediate goods sector that warrants higher money and real wages. Therefore, the decrease in the dynamism of the domestic capabilities can raise concerns. Table 4 summarizes some relevant data set.

Table 4 Data for a Reinterpretation of Second Sub-period Results

Periods	Growth of money wages	Growth of price of manufacturing	Growth of workers	Growth of capital stock
1991-2012	6.48	5.34	1.70	7.97
1991-1998	9.27	7.39	1.57	13.33
1999-2012	6.67	5.48	5.07	9.83

Sources: as in table 1

There has been in fact a decrease in the growth of capital stock in the second sub-period, which can be traced back to the decrease in profitability in this period as compared to its growth in the first sub-period. That is, the increase in capital productivity cannot be traced to higher capital accumulation. Second, there has also been a decrease in the growth rate of money wages in this period. The increase in real wages therefore is due to a decrease in the prices of final products. There is no evidence of increased capital accumulation associated with an increase in wages to support the labor force that is more specialized. That is, there is the possibility of increased imports of intermediate products that are assembled with lower capital deployment but with the help of higher employment, taking advantage of lower money wages. These imports can also explain the decrease in prices of final products that in turn can account for the higher real wages, associated with lower profitability.

The concern therefore is that the slowdown of profitability would affect capital accumulation that implies not only a slowdown of the dynamism of the domestic intermediate goods production but also a reduced domestic ability for further industrial differentiation (with reduced capacity for learning by doing), resulting in lower performance with respect to manufacturing exports (Padhi, 2015). The lack of such capability can be a concern. India could be becoming too dependent on 'exogenous' imports

(and therefore capital) inflows. At the same time, the present data analysis suggests a policy focus. The increased imports competition (and the exposure to sophisticated industrial differentiation) should be accompanied by Indian industry's concentration on few selected specializations in which it has advantages. This is an important policy focus; the advantage of the focus is that it can support 'knowledge creation' that in turn can induce more specializations (and increase in more productive capital accumulation) in the future. What is important is that it has gained experience with respect to the impact of sophisticated intermediate goods that result in higher capital productivity, which, in principle, can contribute to higher employment opportunities with higher wages. India has surely entered a crucial phase in her international career.

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