

Summary

Thesis Title: An analysis of the Indian business cycle, 1991-2009

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Business cycles are fluctuations (not necessarily periodic) that are observed in aggregate economic activity, and, to varying degrees of synchronicity, in all its sectors. These fluctuations are observed across multiple time series pertaining to an economy and often occur with a reasonable degree of synchronicity. The cycle consists of an expansionary component that usually occurs throughout the economy at roughly the same time, followed by a recessionary component that is similarly observed throughout the economy, at roughly the same time.

In essence, business cycles consist of fluctuations in (production of, and consumption of) output, prices and employment.

Business cycles are observed in those economics that “organize their work mainly in business enterprises”. In other words, business cycles are most easily and definitively observed in those economies that have a sizeable, or at least a growing, industrial sector. Economies that have been and continue to be excessively dependent on the agricultural sector will therefore not experience business cycles in the sense in which we understand them in light of what has been written above. For that reason, among others which shall be specified later, we shall stick with the definition supplied above, and therefore date the Indian business cycle from 1991 onwards, as cycles in the Indian economy were driven by the monsoon more than anything else prior to this period.

The theory of, techniques related to the measurement of, and the underlying causes of business cycles have all been the source of much controversy over the years, and even today, consensus about any of these issues is scarcely to be found. While this thesis will cover some of this theoretical ground in some detail, it is neither convenient nor desirable in this thesis to do an exhaustive study of all of the theoretical advancements in this field. As such, we shall limit ourselves to conducting a review of most of the mainstream theories along with a detailed

coverage of those that are most relevant to our work herein. As regards measurement of business cycles, we will limit ourselves to the application of some of these methods. The emergence, refinement and suitability of these methods has grown to be a separate field in and of itself, and our thesis does not concern itself with this field.

Broadly speaking, the cause of business cycles can either be found in monetary factors, real factors, or a combination of the two. Our thesis focuses for the most part upon building a theory of the business cycle that depends upon the need to replace fixed capital in an industrial economy, along with assumptions that industrialists may make about the state of the economy, and accordingly scale up (or down) their level of economic activity.

In other words, we hypothesize that a business cycle can be generated (and more importantly) perpetuated, on the basis of the not unreasonable assumption that fixed capital will depreciate over time, and will therefore need to be replaced. The rate at which this replacement takes place, and the rate at which fixed capital augmentation takes place in turn depends upon the level of optimism industrialists might possess, famously characterized by Keynes as ‘animal spirits’. These simple assumptions alone, as it turns out, are enough to generate a business cycle that is undying and perpetual in nature.

Our modeling relies upon the methodology first espoused by Einarsen, itself predated by Marx’s approach to the problem of the business cycle. In addition, our work is based upon a paper written by (Parchure, 2008), which posits an aggregative economy whose balance sheet is examined over time, with a clearly defined replacement period for its capital stock. (Parchure, 2008) begins his analysis with a firm that is representative of the economy, which used fixed capital K , raw material stocks S and labour (which is paid fixed wages W) as inputs. It is assumed that r is the competitive rate of profit. Technology is assumed to be static throughout the course of the investigation.

For a firm such as this, it’s balance sheet may be represented thus:

Table 1: Balance Sheet of a representative firm

Liabilities		Assets	
Equity	E	K	Fixed Capital
		S	Stocks
		W	Wage Fund
Total Liabilities		Total	

“The gross national product of this economy is obtained as follows:

$$\frac{K}{\sum d_t} + (S + W)(1 + r) = G \quad (1)$$

where $d_t = 1/(1+r)^t$ is the discount factor for year t so that the first term of equation (1) shows the annuity that must be charged every period to recover the value of the fixed capital with profit over the n periods of its life. The annuity splits into two parts, one representing the depreciation charge and the other representing the net profit on the book value of the fixed asset. The second term shows the working capital including the stocks of raw materials and/or spare parts required to maintain fixed assets and wages advanced to workers. The gross national product G may be expressed as PQ where P is the price of production and Q is the gross output. The net national product is simply the gross national product less stocks consumed and depreciation, alternatively expressed as wages plus net profit.

Net profit itself is expressed as $\pi = r(B + S + W)$ where B is the book value of the asset. Furthermore, if we suppose the fixed assets to be new, the book value (unrecovered investment) and depreciation charges over the years are given below:

$$D_t = (1 + r)^{t-1} \left[\frac{1}{\sum d_t} - r \right] K \quad t = 1 \dots n \quad (2)$$

$$B_t = \left[(1 + r)^t - \frac{\sum_{t=0}^{t-1} (1 + r)^t}{\sum d_t} \right] K \quad t = 1 \dots n \quad (3)$$

As has been mentioned earlier, this model is an extension of the model that has been explained in Parchure (2008). However, our extension makes some modifications to the underlying assumptions, which make the model richer in the sense that it now more closely approximates decisions that a capitalist might undertake, given the choices available to him.

We no longer assume that savings must necessarily equal investment in the economy. It is possible, indeed probable, that the capitalist will base his decisions on sales realized in the previous year, and accordingly scale up (or down) his business activity in the current year. Accordingly, we posit that the capitalist may now choose to increase his cash balances in case the economy shows a recessionary trend (or conversely, decrease his cash balances and increase the amount of total assets in the firm in case the economy shows an expansionary trend).

Based upon the model shown earlier, it is assumed that the representative firm has datum as shown in Table 2. Capital (K) = 1000, Stock/Raw Material (S)=Wages (W)=500. In addition, we assume that the firm owner chooses to retain a portion of his assets as cash-on-hand, to be used as deemed fit in response to an uncertain future. Note that the assets side of the balance sheet is neatly split into a ratio that corresponds to:

Fixed Assets: Cash on Hand: Wages: Stock (40:20:20:20)

This completes the description of the assets on the firm's balance sheet.

On the liabilities side, it is assumed that the firm owner chooses to fund part of his balance sheet through debt, which itself is divided equally (at the outset) into short and long term debt. Also note that the debt to equity ratio at the outset is 1:1. This ratio may (and indeed does) change over time in response to changing conditions in our representative economy. The capitalist may choose to incur additional debt in order to finance an expansion of his fixed assets in response to an expansionary phase in the economy.

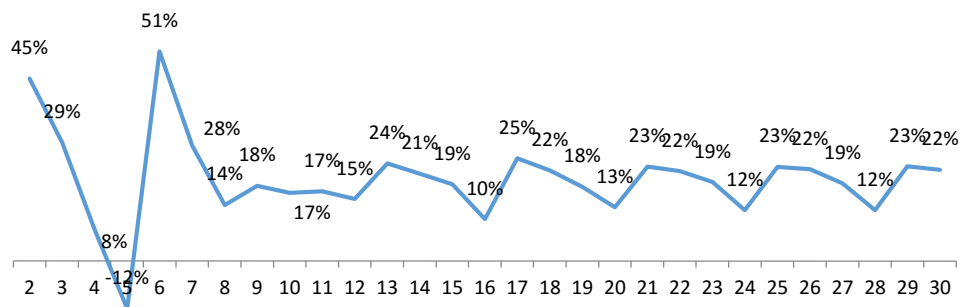
The methodology followed is based for the most part on (Parchure, 2008). We assume that the machinery works with constant efficiency over its life, and that wages are fully consumed and

profits wholly saved. Prices determination in our economy is a simple matter of applying a markup over and above the cost of production, which themselves are split up as wages and raw material costs. Accordingly: $(s + w)(1 + m) = P$. It is important to note that m , the markup in this case is assumed to have a value that translates into a profit rate of 20% on invested capital.

As has been explained above however, we diverge from the model in Parchure (2008) in assuming that investment may in fact be **more** than savings. Therefore, on the basis of the not unreasonable assumption of the share of fixed capital being fixed as a percentage of the assets, the balance sheet for the second year is constructed, with one important qualification. The firm owner, on the back of the strong performance seen in the first year, chooses to draw down upon his cash balances. In practice, the model works thus: the capitalist takes into account the net fixed assets available to him at the end of the first year, notes that his ROE has been 20%, and is therefore able to account for the additional funds available to him in the next year. This amount he then proceeds to distribute between the purchase of a new machine, and additions to stocks, wages and cash on hand, such that the additional amount distributed between the four is in the ratio of 40:20:20:20 respectively.

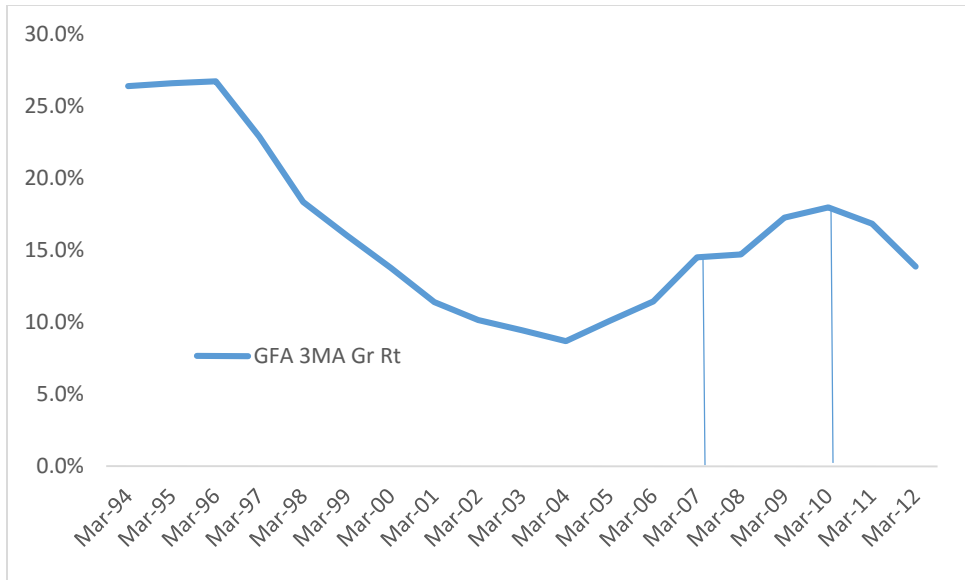
In other words, the firm owner has decided to augment fixed capital during a boom period, while choosing to not lower debt as a percentage of liabilities. Such an economy now proceeds to grow along the lines described. It bears repetition: the emergence of the business cycle in this case is entirely because of the depreciation of fixed capital and decisions made by the capitalist as regards his balance sheet and his assessment of the economy's prospects in the year to come (based upon the economy's performance in the preceding year)

On the basis of these assumptions, the economy is traced over a period of thirty years. Shown below is the business cycle generated as a result of our stylized economy.



For purposes of empirical validation, we have preferred to use the aggregated, annual data from the CMIE database (Prowess) as a proxy for nationwide output. The Prowess database contains information gleaned from the annual report of individual companies (both listed as well as non-listed). In cases where a firm is listed on a stock exchange, information shared with the stock exchange is also utilized. The net sales (aggregated) of all of these firms is used as a proxy for output during the course of empirical validation.

A question that naturally arises, given the methodology followed in this thesis, is whether the addition to gross fixed asset series mirror the movements seen in the reference cycle. In other words, one would expect, on the basis of our theoretical modeling, a measure of pro-cyclicality between addition to gross fixed assets and net sales. The correlation between Net Sales and Gross Fixed Assets comes in at 98%, indicating a very strong and positive correlation between the two variables of interest, and confirming the results predicted in our modeling from the previous section.



As can be seen in the chart above, the peak of 1996 is well corroborated in the gross fixed asset cycle as well. Two points of interest make themselves apparent in the chart, however. In the first instance, the peak of 2001 is conspicuous by its absence, while the downturn in the latter case starts well after 2008. Two reasons can be posited for this. Firstly, the additions to gross block themselves may have happened at such a large scale and rate immediately post liberalization that the excess capacity generated during that time period may well have lasted the second turning point in the Indian economy. Secondly, as far as the 2008 recession is concerned, it may well be (once again) that the addition to gross block tapered off, leading eventually to a tapering off of the GFA cycle itself.

However, the correlation between sales and cash balances turns out to be positive in the case of data pertaining to the Indian economy, as is to be expected. Firms will naturally choose to increase their cash balances during expansionary phases. Our modeling in the previous section, however, is built upon an assumption that the capitalist will in fact reduce cash balances during an expansionary phase in order to expand productive capacity. The reason for this seeming discrepancy is that the expansion of productive capacity in our modeling comes from a reduction in cash balances. Empirical analysis shows that such expansions tend to happen because of an increase in debt, infusions of equity, or sales of extant assets. However, corroboration with our model is to be obtained via the steps enumerated below.

While it is certainly true that firms tend to draw up cash balances over time, and indeed have done so in the case of the Indian economy since 1991, the *rate* of increase in cash balances may well show a cyclical pattern. In other words, a regression of the natural logarithm of net sales explaining cash balances will have a positive slope, but will also show cyclical perturbations around the trend.

We now correlate the residuals from our regression exercise with first the growth rate of total inventory, and second with the growth rate of gross fixed assets. In each case, we should expect the correlation to be negative, since we hypothesize that while there is a baseline increase in cash balances given an increase in net sales, the perturbations are to be viewed as a response of firms to changing economic conditions, similar to (and for the same reasons) the hypothesis advanced in our modeling: that the drawing up (down) of cash balances is to be viewed as a response to recessionary (expansionary) conditions in the economy. Therefore, we posit that an increase in Gross Fixed Assets (GFA) will cause a reduction in the rate of increase of cash balances, and vice versa, and that a similar logic will apply in the case of Total Inventory. Such a negative correlation is indeed obtained, as shown in the table below, validating both the approach and the outcome in the preceding section.

Table 2: Correlation Analysis of Residuals from Regression of ln (Net Sales) on ln (Cash Balances) with:

Total Inventory Growth Rate	-0.503625362
Gross Fixed Assets Growth Rate	-0.580268477

The attempt in this thesis, then, has been to establish three interlinked aspects pertaining to business cycles in India.

For the first part, a systematic review of the literature pertaining both to Indian business cycles and the theory of business cycles in general has revealed the fact that replacement cycles as a

theory for generating and more importantly, perpetuating business cycles has been grossly under-studied, and particularly so in the Indian case.

Second, our theoretical modeling, described in Section 2, reveals the existence of a cycle that emerges in a theoretical economy as a consequence of the need to replace fixed capital after a certain period of time, along with assumptions about the behavioral response that industrialists are likely to make in response to changing business cycle conditions making as regards the drawing up or down of cash balances. Not only does such a cycle emerge, it also perpetuates, and settles into a rhythmic, unvarying and undying pattern over the course of many years. This business cycle, although generated due to the need to replace fixed capital, is observed when one studies the GDP of the theoretical economy.

Third, empirical evidence from the Indian economy after the period 1991 strongly suggests that the need to replace fixed capital in the case of listed Indian firms (addition to gross block) also generates a cycle which bears close synchronicity with the overall business cycle for the Indian economy. While we have not attempted to establish evidence of causation on part of the former where the latter is concerned, the theoretical modeling in Section 2 lends credence to the view that this is strongly possible.

Finally, we examine ways in which the modeling in this thesis could plausibly be made to approximate reality more closely. There are three modifications that suggest themselves in this regard.

Firstly, one could build in an assumption of varying capacity utilization: firms might tend to use their fixed assets more intensively during expansionary phases of the business cycle, and might similarly tend to keep fixed capital idle during recessionary phases.

Secondly, we might be able to assume a variable rate of profit. This variable rate of profit might make the cycle vary rather more in terms of amplitude, by invoking the famous Keynesian assumption of 'animal spirits'.

Thirdly, we might assume that technology doesn't remain constant over the life of the model and improves (presumably for the better). Each of these assumptions might well serve to make

the model more appropriately reflect reality, but we feel confident that results obtained from such models will only reinforce our findings, and not contradict them.