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The New Consensus Macroeconomics: A Lakatosian Perspective*

D.M. Nachane#

Abstract :

This paper uses the perspective of Lakatos to examine the evolution of the new consensus macroeconomics from the post-Keynesian debates on macroeconomic theories .

Key Words : New Consensus Macroeconomics, Micro-foundations , Rational Expectations Hypothesis ,Ergodic Uncertainty

JEL Classification Codes :B 22, E10, E12,E32.

I. New Consensus Macroeconomics (NCM)

The *New Consensus Macroeconomics* (NCM) which established itself in the 1980s as the *weltanschauung* of the macroeconomics profession, essentially represented an "uneasy truce" between the then dominant *New Classical School* (Lucas (1972), Sargent (1979) etc.) and the nascent Neo-Keynesian view (Mankiw (1989), Phelps (1968), Taylor (1980) etc.) — a truce achieved by securing the *micro-foundations* of Keynesian sticky prices and wages with optimization under rational expectations.

The NCM (and especially its twin pillars –the Rational Expectations Hypothesis (REH) and the Efficient Markets Hypothesis (EMH)) also supplied the intellectual basis for the wave of financial liberalization that rose in the 1980s throughout the world.

Most macroeconomists today would identify modern mainstream economics with the NCM and would be equally in agreement that it maintains several features of the neo-classical economics that prevailed in the period 1870—1930, especially in its Walrasian variant. The NCM essentially incorporates most aspects of the New Classical and Real Business cycle schools, but with the important new Keynesian feature of limited flexibility of prices (and wages), though the latter is now solidly grounded in micro-foundations with representative rational (i.e. model-consistent) expectations optimizing their objectives of utility (for consumers) and profits (for producers) (see Bagchi (1994) for a lucid exposition).[1]

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Thus, the following elements may be said to constitute the key theoretical propositions of the NCM (Goodfriend & King (1997), Gali & Gertler (2007), Woodford (2003, 2009) etc.):

1. *Micro –Foundations, Representative Agent & Rational Expectations :* The NCM builds its "micro-foundations" on the assumption of a representative agent basing his consumption decisions on an inter-temporal utility maximizing framework, in which expectations about the future are formed rationally i.e. by making best use of all available resources. It also incorporates the important neo-Keynesian insights flowing from the extensive discussion on state dependent or Calvo pricing which attempts to model temporary wage and price stickiness in terms of transaction and menu costs, staggered price setting etc. (see Calvo (1983), Yun (1996), McAdam and Willman (2007) etc.).

2. *Ergodic Uncertainty:* Uncertainty is "ergodic" i.e. future events can be attached specific probability generating functions which are reasonably stable over the typical short-run horizons that concern macro-economists. Within such a framework, a "rational" individual's subjective probability distributions can be used to generate "fan charts" which will converge (with possibly some allowance for "learning") to the true or objective probability distributions. This is the famous Rational Expectations Hypothesis (REH) of the NCM.

3. *Complete and Efficient Markets :*The NCM makes two key assumptions of market organization, on which several of its conclusions rest. These assumptions get rarely spelt out explicitly, but are often assumed as a "matter of fact" or as a "sufficiently good approximation to the real world". The first is that markets are *complete,* whereas the second refers to the *efficiency* of financial markets. *Complete markets* imply that there are markets for every good to cover the space of all possible states of nature (see Flood (1991), Anderson and Raimondo (2008) etc.). The hypothesis of efficient financial markets (EMH) posits that current market prices of financial assets embody all the known information about prospective returns from the asset. Future uncertainty is of the "*white noise*" kind. It is not ruled out that "*noise traders*" (speculators) may succeed in pushing the markets temporarily away from equilibrium.[2] But with market clearing continuously, "*rational traders*" will bring the system back to equilibrium, by taking countervailing positions, and imposing heavy losses on those speculators who bet against the fundamentals. Equilibrium asset prices will thus be altered only when there are "*shocks*" to the fundamentals.

4. *NAIRU Hypothesis*: This hypothesis maintains that the long-run Phillips curve is vertical , though its short-run counterpart could be upward sloping (see Friedman

(1968) and Phelps (1968)). The *natural rate* of unemployment is fixed in the short-run and importantly, is independent of the level of aggregate demand, its determinants viz. structural characteristics of the labour market, wage bargaining mechanisms, social benefit system etc. changing only in a secular manner (see Mankiw (2001), Ball & Mankiw (2002), Blanchard & Katz (1997) etc.).

5. *Transversality condition*: A rather innocuous looking assumption in the NCM has shown up as a major limitation post-crisis. This, of course, is the "transversality condition" (Blanchard & Fisher (1989) Appendix 2A), which postulates that in the inter-temporal optimization of the representative individual, all debts are paid in full, thus effectively leaving no space for money, finance and liquidity to enter the model in a meaningful way. This renders the model particularly inappropriate to analyse the real world problems of credit risk and default.

In any attempt at appraisal of a theory, a methodological approach is called for and the approach most in vogue currently is that due to Lakatos (1968, 1978).

II. The NCM – A Lakatosian Perspective

Lakatos (1978) advanced a methodology that purports to resolve the perceived conflict between *Popper's falsification* principle and Kuhn's view of scientific progress through successive paradigm replacements. The central concept in his methodology is that of a scientific research programme (SRP) which comprises three features (see Heise (2014)):

(i) a *hard core* of central theses that are deemed irrefutable. The *hard core* lies beyond the ambit of *falsification, either* because the scientists subscribing to that SRP are reluctant to abandon the constituent hypotheses or because the hypotheses are devoid of empirical content (a good example of such a hypothesis in the NCM is ergodic uncertainty).

(ii) a number of auxiliary hypotheses/theories that support the SRP but which are *falsifiable* (in the Popperian sense) and which are termed the *protective belt or periphery* and

(iii) a methodology that is deemed admissible or "scientific".

SRPs in the Lakatosian schemata are modified via a process called *heuristics,* which includes both a positive and a negative aspect. The *negative heuristic* specifies that a subset of theories within the SRP are insulated from revision or "tinkering" (*hard core*), while the *positive heuristic* refers to revision of the theories comprising the *periphery*.

The Lakatosian framework outlined above is particularly suitable for putting the

NCM critique as well as its defence in a methodological perspective. This has been attempted earlier by De Paula and Saraiva (2016) and Heise (2014), though the approach we adopt here is considerably different from theirs. The hard *core* has been defined as the group of *central theses* that are considered inviolable. In a strictly Lakatosian interpretation, these are not *empirically falsifiable* because they are tautological, axiomatic or devoid of empirical content. However such a view becomes too restrictive in the social sciences and hence a more flexible interpretation of the Lakatosian hard core is adopted to include also those hypotheses which are strictly speaking *empirically falsifiable* but which the proponents of the SRP (scientific research programme) are reluctant to abandon (see Weintraub (1985) and de Paula & Saraiva (2016)). The assumptions of microeconomic foundations, representative optimizing agents and ergodic uncertainty underlying the NCM can be taken as constituting the *core* (or central hypotheses) in the strict Lakatosian sense, whereas rational expectations are admissible as central hypotheses under the flexible interpretation. Adopting the flexible Lakatosian scheme, we may then list the following three as *central hypotheses* of the NCM:

(i) Micro-foundations and Reductionism with representative optimizing agents

(ii) Rational expectations

(iii) Ergodic Uncertainty

Opinions differ as to the hypotheses constituting the *periphery. T*here is some difference of opinion about the precise status of the assumption of continuously clearing markets within the NCM. A similar zone of disagreement is also evident in the case of the Natural Rate Hypothesis (long-run verticality of the Phillips curve) and the transversality condition.A fairly acceptable list for the periphery would then include:

(i) Classical dichotomy /Natural Rate hypothesis/Long-run verticality of the Phillips curve

(ii) Transversality condition

(iii) Irrelevance of income distribution for explaining business fluctuations

(iv) Irrelevance of institutional features in explaining business cycles

The inclusion of categories (iii) and (iv) is justified following the criticisms levied by Stiglitz (2010), Rajan (2010), Bernanke (2010) and others on lack of attention to these issues in the NCM.

Apart from the *core* and the *periphery,* the Lakatosian framework posits a *scientific* methodology for falsifying the peripheral hypotheses. The purported *scientific* methodology adopted in the NCM in recent years has been the DSGE (dynamic stochastic general equilibrium) model, which combines a formal deductive mathematical approach with

sophisticated empirical testing procedures, based on micro-econometric calibration techniques and stochastic simulation.

Modifications to the *protective belt* occur continuously but they do not constitute a paradigm shift. The latter is said to occur only when the *hard core* is touched. Thus the important contributions to information theory, transaction costs and externalities by Arrow, Stigler, Stiglitz, Townsend, Coase, etc. do not constitute a significant departure from the neo-classical core of the NCM, only its continuation and reaffirmation under more general boundary conditions. In view of the Lakatosian distinction introduced above, essentially any challenge to the NCM has to be based on a demonstrably convincing rejection of a majority of the three postulates listed above as comprising the *hard core*.

There has been a maverick literature attempting to challenge the core assumptions but this body of thought, has been neglected by the mainstream profession, which has steadfastly avoided confronting the many significant challenges posed therein. This paper is an attempt at a critique of the NCM core, taking cognizance of the varied, but often scattered and piecemeal dissident literature. We thus review critically each of the three main constituents of the NCM core.

1. Micro-foundations

The intellectual basis of the micro-foundations dogma in economics is rooted in what philosophers refer to as *reductionism ormethodological individualism* (see Murphy (2010)). We shall be using these two terms interchangeably, though philosophers tend to regard *methodological individualism* as an off-shoot of reductionism. However, there is considerable disagreement among philosophers about the precise connotation of these terms (see Udehn (2001) for a critical review of the semantic and historical aspects of this debate).

The philosophical controversies were not without effect on economic semantics. Schumpeter (1909) seems to have been the first to use the term *methodological individualism* in economics (see Hodgson (1997)) in the sense of starting from the individual to derive relations between economic aggregates. However, he did not recommend it as a necessary procedure for investigations in the social sciences, using it simply to demarcate "pure theory" from other lines of inquiry. Much later Schumpeter (1954), (see e.g. Hodgson (1997)) also introduced the term *sociological individualism* to describe the doctrine that viewed all social phenomena as resulting from the decisions and actions of individuals. The micro-foundations project, currently espoused by the mainstream is closely in the spirit of Schumpeter's *sociological individualism,* though it must be noted that Schumpeter himself largely believed this approach to be sterile (see Schumpeter (1954), p.888).

A lucid history of micro-foundations in economics beginning with Weintraub's first

use of the term (Weintraub (1957)), and taking us through the views of Machlup (1963), Arrow (1967) , Phelps (1969), Harcourt (1977), Negishi (1979) etc. is offered in King (2012) and we do not go into it here. Suffice it to say that even though there had been periodic references to the necessity or otherwise of micro-foundations for macro-economics[3], the micro-foundations project really crystallized into a dogma after the emergence of the New Classical School (in the mid-1970s) together with its twin offshoots viz. the Real Business Cycle School and the DSGE models.

Among the economists, one may distinguish four distinct attitudes to *methodological individualism.* The first attitude is best articulated in terms of Elster's (1982, p.453) phraseology that "(*methodological individualism*) *is the doctrine that all social phenomena ... are, in principle, explicable only in terms of individuals — their properties, goals and beliefs*". It is in this strict sense that *methodological individualism* seems to have been interpreted by the majority of the mainstream NCM theorists, and by virtually all of the Real Business Cycle School. The second view maintains that individual decisions, attitudes and value systems are important in understanding the behavior of *social collectives,* but they do not constitute the totality of the explanation. It must be remembered that even though modern NCM proponents trace their lineage to Walrasian general equilibrium analysis, economists primarily associated with general equilibrium such as Hahn, Arrow and Patinkin use the term micro-foundations in this more flexible sense. Arrow (1994, p. 4-5) for example, remarks that "… individual behavior is always mediated by social relations. These are as much part of the description of reality as individual behavior" (quoted in Hodgson (1997)). The third view is reflected in the writings of the Cambridge Keynesian School (comprising among others Kaldor, Robinson, Harrod, Scitovsky, Pasinetti etc.). It accords primacy to the macroeconomic dimension over the microeconomic, without denying the role of microeconomics as a separate field of investigation. A modern exponent of this view is Colander who in several of his writings makes out a case for macro-foundations of microeconomics.[4]Finally, in direct opposition to *methodological individualism* is the doctrine of *collectivism*, originally attributable to Rousseau wherein the common good of the whole of society must always outweigh the rights of individuals to make decisions. Hegel's views are similar in that he believed that the individual realizes his true freedom in total submission to the laws and institutions of the nation state (see Wallace and Miller (1971), being a translation of Hegel's original German work). Weber (1930) talked about collectivism among Catholics (interpreted by him as hierarchical interrelationships among people) and contrasted it with Protestant individualism. Marx (see McLellan (2000) postulated an orderly and rational society based upon the principle of economic and social equality – individual welfare being augmented by the welfare of the society. Society is thus the key to fulfilling the needs of individuals.

Of course, the subject of *methodological individualism* is vast and our focus is limited primarily to the use of the term in its strictest sense by the NCM adherents (viz. the first aspect noted above).

2. The Appeal of Micro-foundations

There is no denying that micro-foundations exercise some kind of a seductive appeal for economists. Both in its Walrasian equilibrium and disequilibrium forms, it offers a fairly straightforward way of integrating macro and micro-economics (this is, of course, not to deny that the mathematics involved is fairly intricate). Secondly, micro-economic foundations fit in well with the political philosophy of classical liberalism. They seem to accord the individual primacy over the state and society, in contra-position both to the earlier views of the over-arching mercantilist state and the views of Marx and Hegel on state and society (see the preceding section). Skouras and Kitromilides (2014, p.69) quote from a popular aphorism attributed to Margaret Thatcher which articulates this viewpoint in typical common sense Thatcherite fashion "*…there is no such thing as society; there are individual men and women…*".

But perhaps, if a typical mainstream economist were asked to elucidate the rationale for micro-foundations, his explanation would run in terms of the *Lucas Critique*. The intuition behind the *Lucas Critique* (Lucas (1976)) is fairly straightforward. Agents base their actions on their expectations about government policy; hence any change in government policy is likely to affect their behavior. If policy does not factor in this change of behavior, then that policy will not achieve its intended effect. The main thrust of the critique was directed at the large-scale econometric models (mostly Keynesian) used for policy in the 1970s and 1980s. Such models were estimated over a particular time period during which a certain set of policies may have been followed. The models were then used to derive optimal policies by comparing alternative "feedback policy rules", under the strong assumption that the estimated parameters and the lags involved remained invariant to alternative policies[5]. Lucas, however, maintained that each feedback policy rule would affect agents' behavior by altering their expectations, rendering the entire exercise vacuous.

The Lucas Critique (see Nachane (2018), p. 69-70 for a formal treatment) brought out the severe limitations of policy analysis based on *reduced* forms of econometric models. The need was highlighted for building models which were based on *microeconomic foundations in which expectations and optimization processes of agents were explicitly modeled*. The structural format of such models would involve *structural/deep parameters* which would be largely invariant to policy changes. This rationale prepared the ground for the emergence of DSGE (dynamic stochastic general equilibrium) models, a decade or so after the Lucas Critique made its original appearance.

The final factor enhancing the appeal of micro-foundations to economists is their traditional desire to give their subject a scientific semblance by emulating the natural sciences, particularly physics.[6] Physics, at least in popular understanding, seeks fundamental explanations in the behavior of micro-entities such as atoms and electrons, and economists seem to find reaffirmation of their own micro-foundational predilections in these methods of physics.

3. Disequilibrium Macro-economics

Most of the mainstream macroeconomic research in the decades following the publication of the *General Theory,* took the view that since wages could be legitimately regarded as inflexible in the short-run, the Keynesian theory was essentially applicable in the short-run and the neo-classical Walrasian theory applied in the long-run when wages were flexible (this view of course ignores Chapter 19 of the *General Theory*, wherein Keynes had tried to show that his theory applied even when wages were flexible downwards). This view was also regarded as a neo-classical synthesis. We will call it the *Keynes-Walras synthesis* to set it apart from the IS-LM synthesis discussed by Hick (1937) and Harrod (1936) earlier. The difference between the two syntheses is well-brought out by Woodford (1999), p.9-10) when he states "*The neo-classical synthesis, as developed by John R. Hicks and Paul A. Samuelson, among others, proposed that both the Keynesian theory and neoclassical general equilibrium theory could be viewed as correct, though partial accounts of economic reality… The details of how one got from the Keynesian short-run to the "classical" long-run were not really worked out ...*". Similar views have been expressed by Howitt (1987), Mankiw (2006), De Vroey and Duarte (2012) etc.

The early attempt at showing how the Keynesian short-run coalesced into the Walrasian long run such as Samuelson (1947) and Klein (1947) were somehow off the mark. Their dynamic stability analysis managed to show that the neo-classical system converged to a Walrasian long-run equilibrium, whereas the Keynesian short-run system converged to a long-run disequilibrium one, which could hardly be regarded as a Keynes-Walras synthesis. Patinkin (1956) in chapters 13 and 14 of his book, tried to show how in a Walrasian market system, markets clear instantaneously, while in the Keynesian case because of the presence of wage and price rigidities, the adjustment is sluggish, producing the typical Keynesian short-run disequilibrium. Thus Patinkin sought to account for (short-run) involuntary unemployment via a spillover from commodity to labour markets. However, in the long-run wages and prices adjust and this induces a "real balance effect" which restores a long-run equilibrium (see Mankiw (2006)). This long-run equilibrium is identical to the Walrasian one. Though Patinkin's analysis is not fully rigorous from a mathematical point of view, its intuition was fairly acceptable as evidence of a Keynes-Walras synthesis. However, as pointed out by Donzelli (2007), De Vroey and Duarte (2012) etc., in contrast to Walras, who had by assumption, ruled out trading at *disequilibrium prices*. Patinkin allows for such trading.

Hence the long-run equilibrium reached via Patinkin's analysis, is not identical to the Walrasian neo-classical long-run. Later, Barro and Grossman (1971) showed that a Keynes- Walras synthesis of the type envisaged above seems impossible.

The 1970s witnessed an upsurge of interest in establishing the micro-foundations of macroeconomics, not by the Walrasian route of competitive equilibrium (which as we have seen was recognized as incompatible with Keynesian unemployment), but via a discarding of the fictional role of an auctioneer in a tatonnement process. The main protagonists in this approach were Clower, Leijonhufvud , Malinvaud and the French school, whose respective approaches we now discuss briefly.

Clower (1965) also attempted a synthesis between the classical and Keynesian positions . In his view, the crucial flaw in the neo-classical theory of general equilibrium was the notion that market excess demand functions are independent of current market transactions. He postulated the so-called *dual decision hypothesis* in which (i) sellers set *asking prices* and offered goods for sale on a take-it-or leave-it basis (ii) *planned* sales would typically diverge from *actual* sales and (iii)the change in *asking prices* is dependent on the differences between planned and actual sales and the *spread* among *asking* prices of the different sellers (see Backhouse and Boianovsky (2005). In Clower's analysis, since prices respond to effective (actual) demand rather than *notiona*l demand (i.e. demand at Walrasian equilibrium prices), the dynamics will not be the one postulated by Walrasian general equilibrium. In such a system, there would be no pressure for real wages to fall under unemployment, (since, as Walras' law may not hold, wages and prices do not necessarily move in opposite directions – see Davidson (2006), p. 145). Clower, thus, demonstrated that the Walras' law is inconsistent with Keynesian economics i.e. in general market prices would deviate from the Walrasian general equilibrium, the two coinciding only under full employment.

Leijonhufvud's (1968) main focus was on the behavior of an economy in the absence of the Walrasian auctioneer. He, like Clower, postulated that in such a situation, prices will fail to clear markets, trade will occur at disequilibrium prices and demand-supply mismatches will arise across markets. However, Leijonhufvud, did not confine himself to coordination failure at a point of time, but went on to an analysis of inter-temporal coordination failure. Interpreting the rate of interest as representing the trade-off between present and future consumption, he claimed that Keynesian liquidity preference theory was about how and why, the rate of interest would fail to coordinate economic activities. Speculative activity could push rates of interest above a level that brought planned savings and investment into equality. As underlined by Boianovsky and Backhouse (2006), heterogeneity of individuals was crucial to Leijonhufvud's analysis, since if all agents were identical, with identical expectations, the problem of coordination would be non-existent.

The important paper by Barvo and Grossman (1971) brought all the above strands together in an elegant and formal model. They augmented both Patinkin's analysis of labour markets and Clower's *dual-decision* hypothesis, resulting in a model where demand for both labour and for commodities was constrained by realized sales in the other market. In so doing, they seemed to have provided a rigorous micro-theoretic formulation for Keynesian economics. However, their central contention was that individual markets were locked into prices before a general equilibrium could be established. These 'false prices' resulted in disequilibrium. Thus, in their view, Keynesian analysis was essentially one of fixed prices. This view, in the later literature proved to be controversial.

The disequilibrium economics literature was strongly influenced by the Barro-Grossman model but there were other influential strands to the literature also. Much before the Barro-Grossman paper, Negishi (1961) and Hahn and Negishi (1962) had approached disequilibrium macro-economics, as a phenomenon arising out of imperfect competition. In their models, firms were heterogeneous, each with a distinct conjectural demand curve, which would depend not only on the prices confronting them, but also on macroeconomic variables.

The French school of disequilibrium economies, made several important contributions. They essentially functioned in a fixed prices framework. Malinvaud (1977) developed a theory of unemployment, based on disequilibrium analysis. Malinvaud adopted a fixed prices approach (as being more realistic in modern industrial economies), and assumed that adjustments in markets occurred via quantities. He argued that unemployment could arise, either from rationing in the goods or in the labour markets. He gave his famous "cross-diagram" in the wages-prices plan, with two upward sloping lines representing combinations of wages and prices representing equilibrium in the labour and goods markets respectively. The intersection of these two curves represented a Walrasian equilibrium (p*, w*). He then distinguished four cases –

(i) Wages and prices both higher than the equilibrium levels, leading to an excess supply of goods and labour (Keynesian unemployment) and wages higher than their equilibrium levels.

(ii) Prices lower than their equilibrium levels leading to a curtailment of production and unemployment of labour (classical unemployment)

(iii) Prices higher and wages lower than their respective equilibrium levels, leading to over production and under-consumption.

(iv) Prices and wages both lower than their equilibrium levels, representing 'repressed inflation'.

Malinvaud (op-cit) offered different policy prescription depending on which of the above states an economy found itself.

Another important contribution to the "French School" was Dreze (1975). He introduced the so-called Dreze equilibrium at which supply is constrained only when prices are inflexible downward, whereas demand is constrained when prices are inflexible upward. While commodities might be rationed, money is not. Other important contributors to the French disequilibrium school were Benassy (1975), Grandmont (1975), Younes (1975), Sneesens (1981), etc.

However, by the late 1970s disequilibrium macroeconomics seemed to have reached a dead-end. While disequilibrium economists recognized the flaws in the tattonement process, they failed to plug the lacuna in an explanation of how prices changed in real time. While the model of instantaneous price changes was discarded by many, and price inflexibility introduced, the resulting mathematical complexity, impelled them to adopt a fixed prices approach. The fixed prices approach earlier adopted as a provisional step, rapidly became established as the *sine qua non* of disequilibrium macroeconomics.

The inflationary context of the 1970s in the U.S. and Europe rendered the 'fixed prices' assumption extremely suspect in the eyes of theorists as well as policymakers. Macroeconomics then swerved into two different directions. On the one hand, you had the New Classical School, built up on foundations laid by Barro (1976, 1977), Barro and Fisher (1976), Grossman (1978, 1983 and 1987), Lucas (1972) etc. Fixed prices were abandoned, but the assumption of representative agent was retained, and the key element of rational expectations was introduced. The New Classical Macroeconomics (and its off-shoot the Real Business Cycle school) thus reverted to the old neo-classical Walrasian paradigm of micro foundations based on equilibrium in perfectly competitive markets, secured through optimizing representative agents with rational expectations. The observed real world of business fluctuations was reconciled with this framework, using the errors in expectations '*deus ex machina*'.

The other direction to which a great deal of macroeconomics was devoted was New Keynesian economics. They did take up many of the issues that had exercised earlier disequilibrium macroeconomics such as limited information, monopoly, coordination failure etc. as they applied to labour markets. But they abandoned the old disequilibrium agenda, focusing instead on partial equilibrium analysis of single markets, with a view to seek explanations for wage and price rigidities.

Thus, one tends to agree with Boianovsky and Backhouse (2006, p.8-10) that the microfoundations of disequilibrium macroeconomics were lost by the 1980s. Macroeconomics was reconciled with microfoundations through the highly artificial stratagem of the

representative agent, with rational optimizing behavior and competitive markets. In any meaningful sense of the term, the micro-foundations of macroeconomics had been abandoned.

III. Micro-foundations : Two Sceptical Views

The upshot of the discussion in the previous section was that attempts to secure the micro-foundations of macro-economics via disequilibrium analysis proved abortive, and what resulted (in mainstream economics) was a reversion to the micro-foundations of Walrasian competitive equilibrium based on optimizing representative agents with rational expectations. This state of affairs found many skeptics, who wondered whether micro-foundations were necessary at all, and even further, whether they were pernicious.

The criticisms levied on the mainstream micro-foundations project can be grouped into two major categories. The first group does not discard micro-foundations, but is critical of the New Classical and Real Business Cycle schools, primarily on the ground that the micro-foundations they espouse do not constitute proper micro-foundations at all. The second group strikes much deeper, maintaining that *methodological individualism/reductionism* is an inappropriate approach to adopt in the social sciences generally, and in macro-economics in particular.

A. Post-Walrasian Critique

The first group of criticisms may be appropriately labeled as post-Walrasian (see Colander (1996), Gale (1983), Weintraub (1979), Mirowski (1990) etc.). While there are several strands to this literature, following Colander (1996) we may distinguish four major strands viz.

Existence and Stability of General Equilibrium : The existence and stability of an overall economic equilibrium, is tied up to the possibility of aggregating over individual demand/ supply curves to arrive at their market counterparts. Sraffa (1960) had demonstrated the futility of measuring capital independent of distribution and prices, thus demolishing the neoclassical concept of an aggregate production function (except in the trivial one commodity "Ricardian corn" model). Sraffa's contribution however was not generally accepted as a refutation of neo-classical economics for two reasons. Firstly, missing in Sraffa is any theory of human agency and interaction, thus making it a *technical* rather than a *behavioural* theory. Secondly, his criticism is confined to the aggregate neoclassical production function only, leaving intact other disaggregated versions of neoclassical theory such as the general equilibrium model of Arrow & Hahn (1971), in which capital was treated as heterogeneous. This criticism has been refined and formalized through the successive writings of Debreu (1974), Sonnenschein (1972) and Mantel (1974), and goes by the name of the DSM theorem. The DSM theorem may be explained in several ways. Our exposition here is based on Kirman

(1989). The foundations of neoclassical economics rest on the assumption that if individual demand functions satisfy Wald's (1936) WARP (weak axiom of revealed preference) (implying individual demand curves are downward sloping) then a unique stable market equilibrium exists. The DSM theorem asserts that whereas the WARP is sufficient to ensure the existence and *local uniqueness* (of a market equilibrium), global uniqueness and stability are not ensured by WARP (or by even stronger restrictions on individual demand functions).[7] As Kehoe (1998) further shows, the necessary and sufficient conditions for uniqueness are so restrictive, that they are unlikely to be satisfied by any realistic description of the complex simultaneous relations characterizing an actual economy. In spite of Hahn's (1975) admission that the DSM results are "most damaging to neoclassical theory", the mainstream economics profession has largely ignored these implications, (plausible reasons for this neglect are discussed in Hodgson (1997) and Rizvi (1994)).

Bounded Rationality: Bounded rationality is a term used in Decision Theory to connote the situation wherein individuals have access to limited information and have a pre-specified amount of time in which to make their decisions within the cognitive capacity of their minds. In post-Walrasian analysis, it is recognized that the macroeconomy is so complex that fully rational decisions are outside the ambit of individuals. Hence their decisions may be sub-optimal, and the resulting aggregate equilibrium may not represent any reasonable approximation to the rational Walrasian equilibrium (see Aumann (1997) Santos (2002), Geng (2018), etc.).

Non-price Coordinating Mechanisms: In spite of the two obvious sources of overall market instability noted above, markets in the real world are fairly stable. Post-Walrasians explain this paradox via the presence of multi-layered institutions (legal system, cultural values, preferences and practices conditioned by numerous social factors such as religion, schooling, etc.). All these limit the actions of individuals within well established ranges and impart some kind of stability to their behavior). Thus institutions play a crucial role in post-Walrasian economics, and are an integral part of the analysis (see Vaughn (2013), Calderi (2010), etc.).

Thus, this group of criticisms, essentially attempts to rescue the microfoundations of macroeconomics by better aligning them with empirical realities, than is usually done in the New Classical and Real Business Cycle Schools.

B. Abandoning Micro-foundations

The second group of microfoundations critics believes that the entire approach is misleading and has led the subject of economics astray.

King (2002, 2012), a leading exponent of this genre of criticisms insists that if the microfoundations project is to be evaluated, then this must be done on its strictest interpretation

as being mandatory for macroeconomics, and not on a looser interpretation of it being just a possible approach to macroeconomics (see King (2008) p.14). As Kuipers (2001, p.156) notes, one may distinguish three varieties of reductionism viz.,

(i) Radical reductionism which believes that every macro-concept can be reduced to micro principles i.e., every macro-concept is derivable from micro-principles and these alone.

(ii) Radical holism, being "the belief that all (interesting) concepts and laws of the domain cannot be reduced" and

(iii) Restricted reductionism which states "that some concepts and laws may be reducible, but others may not be".

I think, while mainstream economists usually avoid methodological discussion, if pressed on the point would admit to being radical reductionists. But radical reductionism prevents the emergence of any new fundamental strand of thinking. The following quotation from Rothschild (1988) p.17 underscores this point very aptly "A freedom from narrow methodological prescriptions has often proved to be an essential precondition for new insights and the birth of new theories; and this is no less true for the natural sciences than for the social sciences". Strict reductionism confines research to the straitjacket of "hypothesis testing" impeding "hypothesis discovery". "Exploratory data analysis" is not ad-hocery but a necessary step "in the difficult stages of developing new theories or extending old ones" (Rothschild op.cit. p.17).

Radical reductionism presupposes that macroeconomic propositions can be derived without reference to social institutions and organizations. But in actual life such institutions (banks, credit system, culture, political organization, etc.) circumscribe the decisions of consumers, producers and other agents in the economy. Thus this form of reductionism "is arbitrarily ruling out (or denying finality to) most ordinarily acceptable explanations, as used in everyday life". (Lukes (1968), p.121).

Restricted reductionism, on the other hand, assigns an important role to social institutions in explanations. But once the role of social institutions is admitted microtheory can no more be considered as the foundations of macro-economics, rather one admits of links between the two distinct fields, which then stand on an equal footing. Thus one talks about the micro-macro bridges rather than microfoundations. And anyway, this weaker version of methodological individualism is hardly what the NCM adherents have in mind when they talk of microfoundations.

There are several criticisms of the microfoundations approach to macroeconomics, both statistical and philosophical. The basic statistical problem arises from the difficulty of

consolidating individual demand/supply schedules into aggregate schedules (see Nachane (2018) p.234-235).The term *representative agent* in mainstream economics is used in at least two alternative senses. A stronger sense of the term in which all consumers/firms are identical and a weaker sense in which agents differ but their preferences are such that the aggregate of their individual choices is mathematically equivalent to the decision of one individual. Irrespective of the sense in which the term is used, representative agent reductionist models, which are at the heart of the NCM, postulate that aggregate demand/supply curves can be arrived at by aggregating over individual demand/supply curves. But this is valid (in the current state of knowledge) only under either the very restrictive case of *exact aggregation* or (if preferences are allowed to be heterogeneous then) under the conditions detailed in Blundell and Stoker (2005) (Chapter 3 Section 2.1). The violation of these assumptions can lead to aggregation *biases* (see Banks et al (1997)).

To philosophers, the statistical problem of aggregation is a manifestation of what is called the *simplistic fallacy of composition*. This was noted by Keynes in the *General Theory* itself and both by early writers such as Tarshis (1947) and more recently by Howitt (2006), King (2012), Skouras and Kitromilides (2014) etc.

This type of fallacy arises because aggregates comprise not only individual entities but also a set of interrelationships among these entities. In typical aggregation schemes these interrelationships are underplayed, with the result that the whole is assumed simply to be a sum of its parts (see Rothschild (1971), Kapeller (2015)).

The interrelationships among individual entities assumes many forms such as social evolution (see for example Veblen (1899) or Marx and Engels (1845)), emergence of routines in organizations (Nelson and Winter (1982)), the evolution of cooperation (Bowles &Gintis (2011), Axelrod (1984), Grabner&Kapeller (2015)) etc.

The second aspect of the fallacy of composition is its so-called *dogmatic* aspect, which denies the possibility that higher level phenomena can be studies independently of individual behavior. If one believes that 'man is a social animal' then all economic actions are situated in a social content. But social and economic structures have properties that cannot be reduced to those of individuals taken singly, because of which economic action cannot be reduce to a simple calculus of utility or profits maximization.

There is yet another aspect of the compositional fallacy which is termed the *static f*allacy of composition. This pertains to the fact of 'emergent' properties i.e., properties that arise when individuals interact but are absent when individuals act in isolation. One such 'emergent' property is the division of labour, another is corruption. Innovation needs carriers and transmitters and hence is also basically a social activity, as are telecommunications and leisure industries (see Grabner&Kepeller (2015)).

Finally, micro-foundations presume that there is an upward causation from micro units to aggregates. But it is quite conceivable that in fact causation might be *vertical* i.e., downwards from the aggregative levels to the micro-units. The neglect of this upward causation, is an instance of the *hierarchical* aspect of the fallacy of composition. As early as in 1948, Mill (1848, II, p.1-2) had referred to 'macro-foundations' (without actually using the term) when he outlined the role of environmental, historical and societal forces in defining the constraints within which economic activity is located. The early Keynesians also pointed out that the behavior of micro-units is conditioned by the prevailing macro situation. To quote an example, King (2008, p.27) points out that perfect competition in the labour market is only possible under full employment, since only then is the supply of labour to the individual firm perfectly elastic. Scitovsky ((1952) p.9) had made the same point much earlier when he said that " (when) a scarce resource becomes unemployed, it no longer matters whether it is used efficiently or not".

Thus, meaningful micro-analysis is only sensible in a macro-context (see Colander 1996, p.61). Without switching to the polar extreme of a switch-over from micro-foundations to macro-foundations, it is perhaps advisable to adopt a middle position a la Kalecki (1943). Kreisler (1989, p.123) in summarizing Kalecki's position observes that "Rather than any form of hierarchical relationship (between micro and macro theories) the two theories lie side by side (so to speak) … the interrelation of the two yields further information not obtainable from either in isolation" (quoted in King (2008) p.30). This is what is meant by King's metaphor of *bridges* linking micro and macro-economics.

IV. Rational Expectations Hypothesis

Let me now briefly turn to what I consider as the second pillar of the NCM *hard core* viz.

the rational expectations hypothesis (REH). Its role in New Classical Economics is by now quite familiar to economists and often accepted uncritically. However, its empirical validity is seriously in doubt. Behavioural scientists (Kahneman and Tversky (1979), Kahneman & Riepe (1998), Kunreuther (1978), Gleitman (1996) etc.) have shown in laboratory experiments that decisions under uncertainty suffer from systematic biases. Actual behavior of economic agents rarely mimics the REH, with agents failing to discover "rational expectations equilibria" in repeated experiments.[8]More recent empirical evidence from financial markets points to the robustness of such earlier claims (see Lo et al (2005), Coates and Herbert (2008) etc.). Rather than exhibiting rational behavior, individuals seem to function within a "bounded rationality" framework (see the discussion in Section 5).

These considerations have important implications for example, in modeling inflation expectations .A more realistic assessment of inflation expectations formation will have to contend with the limits on individuals' cognitive and computational abilities as well as their

inability to separate their perceptions of their local environment from the overall macro environment (see Sims (2003), Shiller (1997), Akerlof et al (2000) etc.). Because of this, *euphoria (irrational exuberance) and panics* are both distinct possibilities in the complex world of modern finance. Thus essentially individuals have an "order-of-magnitude less knowledge than our core macroeconomic models currently assume" (see Caballero (2010), p. 91).

The concept of "bounded rationality" has attracted considerable interest and is seen by many mainstream economists themselves as a valid criticism of the REH. Sargent (1993) in an early contribution, while recognizing the limitations of REH and the validity of the bounded rationality thesis, seeks to salvage the REH by introducing an "adaptive learning mechanism" for agents. The question then is whether *rational* agents, with a limited knowledge of the economic mechanism, can converge to a *ration*al expectations equilibrium via an adaptive learning mechanism (see Grune-Yaanoff (2007), p. 545). A number of later articles have explored this issue in greater detail (see Bray (1982), Guesnerie (1992),Adam and Marcet (2011) etc.) .

Attempts to incorporate insights from psychology and behavioural finance into macroeconomics are still in the making. Lo (2007), in an important contribution, proposes the AMH (Adaptive Markets Hypothesis), where economic agents display "bounded rationality." In this view, "Financial markets should be viewed within an evolutionary framework, where markets, policy instruments, institutions and investors interact dynamically in Darwinian (evolutionary) fashion. … Behaviour evolves through natural selection … through a process of trial and error, rather than through "optimizing" behavior." (see Allington et al (2011), p. 13).

In a much-cited post-crisis contribution, Stiglitz (2011) questions the applicability of rational expectations to situations such as the recent Global Financial Crisis, which are rare (almost once-in-a-lifetime) occurrences and for which past experience can be no guide for the future. Similar considerations apply to a government contemplating a policy never tried out before. Will there be a full rational expectations equilibrium in which the *reciprocal expectations* of the government and economic agents about each other's behaviour is simultaneously achieved? Conditions under which such Nash equilibria exist and are achieved in finite time seem fairly difficult to achieve in practice (see Bray (1981), Marcet and Sargent (1988), Evans and Hankapohja(2011), Hommes (2011) etc. for details).

V. Nature Of Uncertainty

One of the central features of Keynes' *General Theory* was the crucial role assigned to expectations in shaping investment decisions. In view of the fact that Keynes viewed investors as facing uncertainty in a Knightian sense (or what is often called as "non-ergodic"

uncertainty), he was led to emphasize the *conventional* nature of expectations characterized by a belief that there is *wisdom in numbers*, leading to *herdbehavior* in financial markets. Taking its cue from the standardized IS-LM model set forth by Hicks in 1937, and the martingale result of Samuelson (1965), current mainstream (NCM) economics, however, seems to have taken a position directly antipodal to that of Keynes. The REH, in particular, presumes that the future is ergodic and hence *predictable* (within known error bounds). Given the inevitability of unanticipated changes in the real world, the REH if it claims any pretension to realism, requires a mechanism whereby individuals can quickly acquire complete knowledge of the altered probability generating mechanisms (see Frydman and Goldberg (2008), Allington et al (2011) etc.).

The justification of the NCM for the introduction of new complex financial instruments, such as CDOs and CDS, is very interesting (though often left unstated). Walrasian general equilibrium theory as expounded in the standard Arrow-Debreu (1954) model shows mathematically that all uncertainty can be eliminated if there are enough contingent claims (which in the world of today are equated with derivative instruments). From this, it is but an easy step to the strong belief that the introduction of derivatives enhances social welfare by contributing to financial stability. Such reasoning conveniently overlooks that the Arrow-Debreu result applies only to *ergodic uncertainty*.

The global crisis brought out starkly, the dangers inherent in assuming that agents possess knowledge of well-defined probability distributions (or at least their first two moments), over all possible future states (as presumed by the REH). In the *non-ergodic real* world, derivatives more often than not, can turn out to be (in Warren Buffet's popular phrase) "weapons of mass destruction". As is now well-known, the elaborate models used by credit rating agencies to rate / monitor complex products like CDOs predicated on complicated multidimensional probability distributions and *copulas*,[9] were simply inappropriate to foresee the illiquidity in U.S. money markets that arose from investor *herd*behavior in the face of the non-ergodic uncertainty intrinsic in new complex financial innovations (see Mackenzie and Spears (2014) for a detailed view on this)[10].

The foundations of a more realistic macroeconomics need to be based on a theory of decision making under non-ergodic uncertainty. Such a theory, in a rudimentary form was proposed by Hurwicz (1950) and has more recently been formalized by Gilboa and Schmeidler (1989) under the rubric of "max-min expected utility". A promising line of thinking emanating from such considerations is "agent-based modeling" (see Mantegna and Stanley (2000), Rosser (1999), Gilbert (2007) etc.). In the context of financial crises, these theories would tend to focus on the complex institutional structure of financial markets and decision rules circumscribing the behavior of market participants. From an operational point of view, this line of thinking prompts regulators to pay close attention to networks and nodal interactions

within the financial sector and the build-up of systemic risk (see Kirman (2011), Fafchamps and Gubert (2007) etc.).However, it must be remembered that while some of these approaches to non-ergodic uncertainty appear promising, they have not yet been incorporated into a systematic theoretical macro-economic framework.

VI.Conclusions &The Way Forward

While the NCM theory , both in its theoretical variants and in its empirical models (such as the DSGE) does give an impression of being "scientific", a closer look casts strong doubts on the validity of such a claim. More appropriately, the theories and applications seem scientific but are, in fact, vacuous. Real world phenomena of crucial significance to policymakers are side-stepped including incomplete markets, bargaining power, strategic interactions and coordination problems between agents, on-line learning etc.

The DSGE modelers would possibly plead that they recognize the importance of these problems but they are analytically intractable. Economic policy is "hard" in the sense of being difficult to solve *formally* (see Rust (1997) for a definition of "hard"). Faust (2005) has introduced two approaches in this context (i) Type A approach in which a simplified version of the problem is solved formally and (ii) Type B approach in which the problem is not simplified but non-formal solutions are admitted.

The DSGE approach seems a typical Type A approach based on the implicit assumption that successively elaborating the simple prototype model and solving it formally will ultimately converge to the ideal solution[11]. A more pragmatic approach would be the Type-B approach where all (or at least most) of the interesting real world features are retained but solution methods are less than fully formal. In other words, models to be of relevance to the real world must essentially rest on two pillars: (i) the micro behavior of individuals and (ii) the structure of their mutual interactions (see Colander et al (2008), Faust and Leeper (2015) etc.).

Two such approaches are emerging in the literature. The first is *the econophysics* literature which shifts the focus away from individual equilibria to systems equilibria and wherein evolving micro-dynamic interactions are consistent with macro equilibrium. Micro-foundations are abandoned in favour of *dimensional* analysis and the use of traditional topological methods are replaced by the methods of statistical physics (see Farmer et al (1988), Aoki and Yoshikawa (2006) and Colander (2006)).

A second, and perhaps more promising approach is the ACE (agent-based computational economics) put forth by Epstein and Axtell (1996), Tesfatsion and Judd (2006), LeBaron and Tesfatsion (2008). ACE modeling allows for a variegated taxonomy of agents including a spectrum of cognitive features ranging from passive cognition to the most

sophisticated cognitive abilities. A second important aspect of ACE modeling is that it examines the evolution of macro dynamics as the number of interacting agents increases and as their interactions become more complex. The method relies heavily on experimental designs to make inferences about the behavior of different agents. The interactions are determined by the agents' internal structures, information sets, beliefs and cognitive abilities. Agent behavior is not restrained by artificial external boundary conditions such as homogeneity, stability or transversality. Using the so-called Zipf distribution, Axtell (2001) reports a model with millions of interacting agents (see also Adamic (2011))

Nevertheless, neither of the above two approaches really validate the data in manner that could satisfy the rigorous demands of our profession. This deficiency is important and will possibly not be long in getting satisfactorily resolved. Meanwhile should we persist with the NCM and its empirical off shoot DSGE approach in spite of its problematic foundations? Solow (2010) in his testimony before the U.S. House of Representatives Committee on Science and Technology severely indicts the DSGE business "*The point I am making is that the DSGE models have nothing useful to say about anti-recession policy because they have built into its essentially implausible assumptions the "conclusion" that there is nothing for macroeconomic policy to do. ....There are other traditions with better ways to do macroeconomics...*". Similarly talking about the Bank of England's disillusionment with DSGE models in the aftermath of the global crisis, Buiter (2009) refers to "the chaotic re-education" at the institution.

This "re-education" could usefully incorporate three fundamental considerations viz. (i) lesser reliance on pre-selected formal models and greater scope for exploratory data analysis (ii) robustness across model specifications in policy choices and (iii) ethical responsibility of economic researchers.

One approach which is less formal (than DSGE models) and which gives greater scope for exploratory data analysis is the CVAR (co-integrated VAR) approach developed by Johansen (1996) and elaborated in Juselius (2006) and Hoover et al (2008) . It is shown in Juselius and Franchi (2007) that the assumptions underlying a DSGE model can be translated into testable hypotheses in a CVAR framework. A second approach by Del Negro and Schorfheide (2004) (DSGE-BVAR) seems even more promising. Here the estimated parameters from a DSGE model are used as priors in an associated Bayesian VAR. A hyper-parameter ë controls the tightness with which the priors are imposed. These priors are fed into the likelihood function of the VAR to obtain the posterior distribution of the parameters. The shape of the posterior distribution for ë can help us adjudge the suitability of the tested parameters of the underlying DSGE (from the point of view of goodness-of-fit as well as model complexity). While neither of the above two approaches can claim to be perfect, they

have the merit of going beyond the narrow DSGE view and allowing greater room for the data to speak.

The issue of robustness across model specifications is a largely neglected issue in the literature. In the real world policymakers are uncertain about the model(s) that they use. This uncertainty has several dimensions viz. parameter uncertainty, uncertainty about the persistence of shocks, uncertainty about the data quality etc. In such a situation what is required is a method to study the sources of model errors. The *Model Error Modeling*literature from control theory can be useful here (see Ljung (1999)). Introducing robustness considerations in economics has been studied from a different viewpoint in McCallum (1988) Hansen and Sargent (2001), Onatski and Stock (2002) etc. These ideas however have not yet filtered down to real-world policy making.

Finally, the recent global crisis has brought to the fore the ethical responsibility of the economics profession. As the financial wizards went into top gear with their innovations in the build-up to the crisis, the regulators failed to get adequate and timely warning about the potential for systemic damage in these developments, from macroeconomists in general. Are we to believe that the leading lights of our profession were simply ignorant about the dangers posed by an over-leveraged, over-securitized and skewedly-incentivized financial sector, or as is more likely they simply looked the other way ? Either view does not redound to the profession's credit. Perhaps economists should take their ethical responsibilities far more seriously than they do now and issue timely warnings to policymakers and the general public of developments which (in their opinion) are fraught with serious consequences for society at large.

Solow's (1997) characterization of academic economists as "the overeducated in search of the unknowable" is apt in the current context. Economists would be more usefully employed if instead of pursuing the Holy Grail of the true but unknown and formally perfect model, they set up a more modest agenda of studying the knowable. The lines of thinking noted briefly in the previous paragraphs (viz. the, ACE, CVAR and DSGE-BVAR models) represent precisely this line of thinking. One could not agree more with Colander ((2000), p. 131) when he sets up an agenda for those he terms the New Millennium economists as

" ..a search for patterns in data, try to find temporary models that fit the patterns, and study the changing nature of those patterns as institutions change".

Our paper has thus, tried to present a convincing case for a rebuttal of the hard core of the NCM in a Lakatosian framework. We feel that it is now time to start looking for new paradigms for macroeconomics, along the lines indicated by some of the promising alternatives discussed in this concluding Section.

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Notes :

[1] Both the New Classical school (and its more stringently neo-classical version, the Real Business Cycle school), are strongly rooted in Walrasian principles of general equilibrium .

[2] Of the vast literature on this topic for the sake of brevity I cite only three references viz. Fama (1970), De Long et al (1989) and Lowenstein and Willard (2006).

[3] Phelps (1969, p.147), for example, insists that "…*macroeconomics needs a microeconomic foundation*", whereas earlier Machlup (1963, p. 109) had written that " … it is not a duty for every macro-theorist to search for the hidden micro-relations that lie at the root of the macro-relations".

[4] Colander (1996, p. 61) for example, argues that "…*before there is any hope of undertaking meaningful micro analysis*, *one must first determine the macro context within which that micro decision is made".*

[5] Feedback policy rules are rules where the policy variables depend on the state of the economy. An example of a feedback policy rule is the Taylor rule in which the interest rate (policy variable) is set equal to a weighted average of the output gap and inflation.

[6] With hindsight it is often felt that the subject of economists would have been more enriched if following the lead of Marshall (1898) and Veblen (1898), they had emulated the methods of biology rather than physics (see Norgaard (1992), White (1998), Bergh et al (2013) etc.).

[7] In this connection, it is interesting to note that Wald (1936) had correctly observed that "*there is a statistical probability that from the assumption that [WARP] holds for every household, the validity of [WARP]for the market follows*". In other words WARP at the micro level *can* lead to WARP at the macro level. The later neoclassicals conveniently interpreted the *can* as *wi*ll.

[8]Their main findings were that (i) individuals exaggerate the importance of vivid over pallid evidence (TV montage over reports in newspapers/scientific journals) (ii) there is exaggeration of probabilities of recent events over those occurring earlier (iii) individuals' errors are systematic rather than random (they are reluctant to give up pre-conceived notions, more favourably disposed towards accepting evidence confirming initial beliefs than contra-evidence etc.) and (iv) individuals react sluggishly to new information, preferring very often to rely on heuristic decision rules in such cases.

[9] For an introduction to copulas and their uses in finance, kindly refer Brigo et al (2010).

[10]We recognize, of course, that securitization was one among several factors leading up to the crisis.Nevertheless, securitization will continue to be a key element in any narrative of the crisis.

[11]Mathematically speaking if the Kolmogorov complexity of the problem is polynomially bounded, this approach will succeed (see Garey and Johnson (1983)).

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UNEMPLOYMENT AND TECHNOLOGICAL CHANGE: ARE WE HEADING TOWARDS A BRAVE NEW WORLD?[1]

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I. Introduction

The current unemployment situation in India is estimated to be the worst in more than four decades. Population has grown since then and technological changes affecting production processes and factor proportions have altered significantly. India also has a large proportion of its labour force in the form of very young people who are often referred to represent the demographic dividend for the economy. The labour market has changed too in the previous three decades, since the economic reforms of 1991. Trade unions are far weaker than in the past and hence their bargaining power has all but disappeared. The work force has become much more informal with the sharp rise in contract labour. There is the rise of what is referred to as the 'gig' economy where people earn income as and when required, and as and when work is available on a piece rate, or for completing a particular project. The share of labour in national income has declined over time. Economic inequality in income and wealth has magnified to alarming levels.

On the technological front, labour displacing changes have been substantial with the advent of the information and communication technologies (ICT) revolution. The current developments in robotics, artificial intelligence and machine learning make the prospects of new employment opportunities extremely limited. Many standard jobs we know of currently will disappear in a decade or two. There is very little understanding of what new jobs might be in demand, except that they will require intelligence and skills of an exceptionally high order. These changes are not only affecting Indiaor other developing economies. The changes are being observed across the world.

Is there a serious cause for concern? Or will it be just another phase of disruptive technological change that will play out in terms of new employment created, and new skills identified for those jobs? The debate is on. In this lecture I will share my own concerns about how old structural unemployment has begun to coexist with new types of technological unemployment in India, and what it might mean for the future functional distribution of income.

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[1]S.N.Sen Memorial LectureDelivered at the 40th Annual Conference of the Bengal Economic Association, February 29, 2020

II.The Past Nature of Unemployment in India

When India became independent it inherited, as legacy, a vast number of agricultural workers and small and marginal farmers. The manufacturing sector and the formal services sector were rather small and the organized sector labour force was a tiny proportion of the total labour force. The non-formal sector essentially comprised of disguised or underemployed people in the definition of Lewis (1954). There is a lot of debate about the extent of disguised unemployment as well as the more important division of the labour force between formal and the informal sector (within which all disguised unemployment exists). According to the World Bank Development Indicators in 1990 the labour force in India was of the size 317.68 million. By 2019 the labour force had grown to 517.49 million. Hence in the past three decades the Indian labour force has grown at 1.69 per cent per annum. The labour force includes all persons working or actively seeking work in the economy. Within this this labour forcethe proportion of the informal sector has been estimated to be anywhere between 85 per cent and 93 per cent. Many of these workers in the informal sector have a precarious existence with no security of employment, social insurance and rights.

The Lewis version of structural transformation is described as the process by which workers are drawn out of the informal sector into the modern formal sector with better wages, more secure employment and well-defined working class rights. The transformation is complete when all the disguised unemployed people have migrated to the modern sector. The informal sector also begins to work on the basis of market scarcity and abundance. The entire economy is supposed to become a modern market driven economy with all workers brought into the modern formal sector. This transformation has its own problems and constraints like availability of food at relatively cheap prices as workers leave the informal (mainly agricultural rural sectors) to the non-food industrial manufacturing sectors. This process of structural transformation can be slow and even get aborted. Even in the most modern of economies, the transformation is never complete. There will always remain some people in the informal economy. This proportion could be very low but positive, somewhere around 5 per cent to 10 per cent.

One can make a conservative assumption that currently 80 per cent of the total labour force is in the informal sector, and that even a total transformation of the economy would keep about 10 per cent of the labour force in the informal sector. A quick estimate shows that in India (The Wire). If the labour force continues to grow at the current trend rate of 1.69 per cent, the required growth rate of formal sector employment would have to be 4.80 per cent if the transformation is to be completed by 50 years. If the labour force does not grow at all, the required growth rate of formal sector employment would be 3.05 per cent per annum for the transformation to be completed by 50 years. According to the Economic Survey (2019) organized or formal sector employment in India grew during the past two decades at an

average annual rate of 0.48 per cent per annum. If only the private sector is taken into account the rate of growth of employment was only 2.13 per cent annum, with employment in the formal public sector actually shrinking between 1991 and 2011.

What the above estimates suggest is that the Lewis's prediction of a structural transformation of the Indian economy is far from complete. At current rates it might take even more than a century. That is one of the reasons that the government has been putting so much emphasis on self-employment, start-ups and entrepreneurship so as to discourage labour market entrants from seeking employment. However, there are some obvious difficulties with start-ups based on innovative ideas. They are not always successful. For one success story there are at least a hundred cases of failures. Some fail because the idea cannot be scaled up into a commercially viable market. In other cases the venture appears too risky and does not find friendly investors who are willing to finance the project and share the risks. Technology-based start-ups, even if initially successful, often suffer from the effects of obsolescence of the technology. Two recent examples are the disappearance of print films and the entire small enterprise of printing and developing films, and the metred long distance telephone calling booths.

II. Informalisation of the Labour Force

One of the great paradoxes of the use of labour in Indian industry has been the strict regulatory framework that governed employment in the formal sector. This was necessary to ensure that workers in a poor country were not exploited by employers. Employers on the other hand often found the labour laws extremely inflexible and the organized trade unions a nuisance to handle. Shedding workers had become impossible, and producers began to treat labour as a fixed cost, which once incurred would be difficult to reduce. In the public sector, employment was more often than not used as a political tool to trade support against a job offer. Such employees typically would shirk work and have very low productivity. The public sector became heavily loaded with people who were effectively a fixed cost to the enterprise making no contributions.

After the advent of neo-liberal economic reforms of 1991, there was a gradual shift in the political stance of economic policy. A consensus emerged that the public sector was characterized by over-employment and the private sector with an extremely inflexible regulatory framework. Hence, there was a change in the approach to employment from creating jobs to shedding jobs. Voluntary retirement schemes and other forms of disengagement became common. Whatever new employment opportunities arose, they were offered on a contract basis. Contractual labour has become extremely prevalent in the formal sector. These workers are distinctly discouraged to form unions. The existing unions found their powers clipped as permanent employees feared disengagement and also feared the new jobs being

offered to low paid contract workers. Organized labour in the formal sector lost its political clout.

Two discernable trends can be found in the labour market today. One is at the low end of the skill ladder. The work force is almost entirely on contract with little or no retirement benefits, no guarantee of how long the job would remain, and no organizational rights or clout. Typical examples are staff that look after gardening, housekeeping, catering, security services, sales force, and even banking agents in formal sector establishments have in the last three decades come under contractual employment all over India, in both the private as well as the public sector, and government offices and establishments. The second discernable trend is in the middle and even some upper ends of the skill spectrum where jobs are not even offered on a regular contractual basis. The skilled worker is called in as when required just like households get hold of a plumber or a carpenter as and when required. This is referred to as the gig economy where the claim made by experts is that skilled workers no longer need to be tied down to one organization or employer. They can also choose when they desire to work and for how long. However, these are rather rare examples of high end consultants and technical experts who are called in for a project or for a very specific purpose. Most other workers in the middle levels of skill find it difficult to find regular employment as such jobs are hardly advertised.

These trends point toa major shift in twenty-first century market capitalism as compared to the last century. In the twentieth century the state and capital had some moral obligation to look after its labour force. There would be some social insurance, some old age benefits from producing for society for a long time in the form of pensions and provident funds. Now, the state and capital have moved away from the earlier obligation. The previous social contract with labour has all but disappeared. Now, if one fails to find employment or other support when ill luck or misfortune descends on an individual, it is considered the individual's problem. The institutional support from society has become feeble and sporadic. Labour as a political class has been weaker than in the past politically, socially and economically. Life has become more uncertain and beyond one's immediate control.

What could have been the wider implications of this shift in the labour market in terms of wages, labour's share in national income, and the consequences of the trends in technological change? I turn to these issues in the next two sections.

III. Falling Labour Share in India

The labour share refers to the fraction of national income accruing to labour. There are some definitional complexities that affect measurement. For example, there could be debates about what comes under the rubric of labour's income: is it only wages, or wages and salaries, or all income including other perquisites and benefits. There are also some

difficulties in including all self-employed people like professionals. Associated with this measure other difficulties exist too. For instance what is to be measured in the denominator of the fraction: gross domestic or gross national product? Are the national income measures to be computed at factor costs or at market prices (Luebker, 2007, OECD 2015)? In whatever way the labour share is measured, the decline interestingly, is noticeable for the last two decades, though the extent of decline varies according to the specific measures. It can also vary from one sector of the economy to another.

A decline in the share of labour does not necessarily mean a decline in wages. It reflects the fact that the returnto labour is rising at a rate lower than that of labour productivity. It also reflects rising inequality. The causes discussed in the literature are many: beginning from technological change to globalization which shifts capital and labour internationally, labour market institutions, and the bargaining power of workers. There is a wide diversity in the literature on the relative importance of these effects (OECD 2015). It might also be noted that the decline in labour's share does not necessarily have a straight-forward correspondence with the personal distribution of income. However, for most workers of low skill and education, the alternative sources of income are extremely limited in scope and insignificant in size.

Indian data (Jayadev and Narayan 2018) shows that there is a long term decline in the share of labour in the formal sectors of the economy. The share has declined from about 30 per cent of national income in the 1980s to around 10 per cent by 2015. In India the major causes of this trend are found to be the adoption of capital intensive technology, the rise of low cost labour and the decline of the bargaining power of workers. While the empirical results hold for workers in the formal industrial labour force, the trend might be true for the entire work force (including the informal sectors of the economy). The formal sector is one where the bargaining power of workers is likely to be the strongest, and the conditions of work and compensation the best in the economy. In the informal sectors of the economy even though capital intensity might be much lower than in the formal sector, the average level of compensations and the quality of jobs are significantly worse.

Hence, one observation from the empirical studies on India's labour share is that the decline is likely associated with a large part of the work force being squeezed in terms of income and job-security and work-place benefits. The second observation is that conventional wisdom beginning from Lewis (1954) and Kravis (1962) and Kuznets and Murphy (1966) would lead us to believe that economic development and industrial growth would increase the share of labour in national income during the period of transformation to a developed economy. However, the trend of labour share indicates that the conventional wisdom does not hold for India. The concern arising from the declining labour share is that over and above the problem of open and disguised unemployment, the rising inequality is an added issue to

deal with. There are social and political consequences of inequality. In India workers receive less than 10 per cent of the gross value added as compensation. The declining trend is noticeable in all industries and in all states (Goldar and Aggarwal 2012). This remains true despite a period of rapid growth the Indian economy has experienced during the last 20 years. The bonanza of growth has not translated in to bread and butter propositions for the working class.

This declining trend during the last two or three decades is not unique to India. It is a global trend shared by developed as well as emerging economies.I turn to a brief discussion of this global phenomenon in the next section. One implication of this is that if labour's share is falling world-wide, and employment opportunities are shrinking due to technology, then the talk of India having a demographic dividend makes no sense at all.

V. The Global Trend of Falling Labour Shares

For the developed market economies, labour share in national income was for a long time considered to be a stable proportion. Yet during the last three decades or so there is a growing body of evidence that suggests a secular decline in this share. The consequences are all negative and similar to what we discussed in the previous section. The rise in national income may not lead to a commensurate improvement in the economic conditions and incomes of the working class. Persistent and growing inequality can erode faith in market economic outcomes for many people(Piketty 2013).

For OECD countries the data suggests that over the period 1990 to 2009 the share of labour compensation in national income declined in 26 out of the 30 countries and the decline was on average from 66.1 per cent to 61.7 per cent. In Europe, according to one study (see OECD 2015) the top 10 per cent in the wage distribution earns 25 per cent of the total wage bill while the top 10 per cent in the capital distribution owns 60 per cent of total capital. In USA the corresponding figures are 35 per cent and 70 per cent respectively (Piketty 2013). These trends affect macroeconomic aggregates too. Falling wage shares mean growing constraints on household demand. However, low wage costs can lead to more exports and more investments. This might be an indication to suggest that lower wage costs can lead to greater investments and new job creation. However, this has not been true in developed economies. In the OECD economies between 2000 and 2007 the capital share grew by 2 percentage points. Investment as a share of national income remained stable at a little over 22 per cent. In fact since the financial crisis the ratio of investment to national income has actually declined steeply. It had come down to around 20 per cent by 2013.

Why is there no obvious text-book like connection between growing profits and investments? The changes in the structure of the global economy have led to the growing profits accumulating in the financial sector where investments are seldom in physical capital.

In a similar vein the rising profits in the manufacturing sector have gone largely towards dividend pay-outs and investments in financial assets. Finally, weak growth in household and international demand has restricted investment. Hence, if falling consumption demand is not offset by rising investments, then national income has to be shored up by greater household debt, greater public debt, or greater foreign demand. In global financial markets the rising debt burdens could lead to asset bubbles or to increasing financial instability and volatility. If aggregate demand cannot be shored up in any stable way, the global consequences will be weak and slowing growth rates along with recessionary trends.

An interesting upshot of this evidence suggests that while investments have been sluggish and weak, technical innovations and growth of factor productivity has been quite astonishing in the last two or three decades. One possible explanation is that the advent of the ICT revolution has made capital goods and production processes incredibly cheap. Hence production has become more capital intensive. There wasalways, in the twentieth century, a high degree of substitution between low-skilled labour and capital. There has been some degree of complementarity though between capital and high and moderately skilled workers. Now, even the high-skilled workers are beginning to be replaced by machines. Very high skilled workers are still in demand, those who are creative, have entrepreneurial skills and are generally highly qualified human resources. All other forms of labour seem to be replaceable by technology.

One interpretation of the new technological trends observed after the arrival of ICT is that there will be a trend that will be biased against low and medium skilled workers, and heavily biased in favour of high skilled workers. The growth of high-skilled labour force may actually call for innovations that make augmented use of these people. On the other hand there is the possibility that ICT has changed the essential nature of technological change where there will be increasing use of machines and robots that will replace all types of labour in production processes that will be for all practical purposes fully automated. In fact over the long haul one could think of capital owners who own not only financial assets or physical capital, but thinking machines. In the limit one could arrive at a world where the labour share declines to zero (Mookerjee and Ray 2019).

One important implication of the above discussion is that while many old skills will become obsolete in the near future, the new skills that workers are supposed to have in the age of intelligent machines are not yet known. This means that the educational systems across the world are likely to experience disruptive change.

VI.Current Trends in Unemployment in India

In November 2019 the formal sector unemployment rate according to the Centre for Monitoring the Indian Economy (CMIE) estimates stood at 8.45 per cent having risen from

7.48 per cent in October 2019. The upward trend has been continuous since July 2017 when it was 3.37 per cent. The data also points to the fact that in November 2019 the urban unemployment rate was 8.89 per cent and rural unemployment stood at 6.82 per cent. There has also been a decline in the labour force participation rate implying fewer people are looking for work. It has fallen to the lowest level ever at 42.37 per cent in November 2019.

A study, by Mitra and Verick (2013), based on available official statistics have found that youth unemployment has gone up alarmingly. Youth is defined by people in the age group 15 to 29 years. In this category the number of unemployed stood at 8.9 million in 2004-05 and increased to 9 million in 2011-12. In 2017-18 the number had climbed to 25.1 million. In six years the number has increased by more than two and half times. While youth unemployment during this six-year period has increased for all categories of education; in percentage terms, the higher the level of education the higher is the observed rate of unemployment. The study also found that all major states of India housed most of the 25.1 million unemployed youths – Uttar Pradesh, Andhra, Tamil Nadu, Madhya Pradesh, West Bengal, Karnataka, Rajasthan, Odisha, Gujarat and Kerala, all has unemployment, in this age group, of over one million. In agriculture, the study found, that total jobs are declining massively. During 2011-12 to 2017-18 the jobs lost were to the tune of 27 million. This might considered a desirable trend if this excess labour can be absorbed in industry and manufacturing. In India this sector has actually lost 4 million jobs during the period under discussion. Poorly educated and untrained farm hands that become unemployed can only get manual jobs in the services sector as coolies and unskilled workers. Even if these low paid workers cannot be absorbed, there is very little scope for college graduates and engineers to find jobs. The number of youth declaring themselves as not in the labour force, education or training, has increased by 17 million during 2011-12 to 2017-18.

As per the Reserve Bank of India's database, of a total 48 crore workers in the year 2015-16, 42 per cent were in agriculture, 14 per cent in construction, 12 per cent in trade, restaurants and hotels, another 12 per cent in manufacturing, 11 per cent in community, social and personal services, and the rest were in other industries. Within the 42 per cent in agriculture, 27 per cent were farmers and 15 per cent were agricultural labourers.

But much of the new jobs generated in the past were restricted to very few industries. Between 2010-11 and 2015-16, around 1.5 crore new entrants joined the workforce throughout the country, averaging around 70 lakh new workers each year. Business services attracted these entrants the most (23 per cent), followed by manufacturing (17 per cent), education (12 per cent), trade (11 per cent) and transport and storage (11 per cent).

Even within manufacturing, there were job losses. The textile and leather sectors lost around 12 lakh workers and the wood and furniture sector has lost around 9 lakh workers during these five years. Much of the employment has happened in the electronic and optical

equipment industries. The food and beverages sector attracted just 1 lakh new entrants a year.Unemployment is now rapidly becoming India's largest economic problem surpassing even the imminent threat of climate change.

VII. Technology and Employment

To labour an obvious assertion, we are living in an age of phenomenal technological change in the form of information technology, computational technology, bio-technology and nano-technology. The flow of new capabilities to process data and streamline productive tasks is extremely rapid and fundamental. Change is so pervasive that many scholars have talked of a singularity arriving even in our lifetimes. A singularity (Kurzweil 2005) occurs when changes are such that nothing old or observed at an earlier date can be observed. It would be like a human being from the stone-age being brought suddenly into the twenty-first century. Some of the key features of the new technologies are already visible. For instance the development of quantum computing can improve our computational abilities by leaps and bounds, an order of magnitude faster than anything contemporary computers can do. Obviously, with this new speed and ability to process massive doses of data, analytics as a branch of knowledge has become popular and increasingly used to help improve business decisions, health care decisions, and social policy decisions to name a few areas of application.

We now have machines that can learn and then make corrections in the tasks they can do. Artificial intelligence allows machines to perceive their environment and take action accordingly so as to maximize the achievement of tasks set as goals for the machines. They are capable of doing cognitive tasks associated with the human mind such as problem solving. Hence robots can do tasks that are not only mechanical and repetitive; they are capable of learning at a phenomenal speed and making corrections through that learning. It is claimed that robots can, in the near future, be taught to emote too. This is where bio-technology comes in. The cracking of the human genome has led to an understanding that the human body – its physiological functions as well as its psycho-emotional reactions are nothing but a set of algorithms. These algorithms can be programmed and inserted as bio-chips in robots which can then think and feel like a human being. Their productivity will be much higher: their hunger, sleep, fatigue, can all be minimized (Harari2017).

The reason we digressed in to technological developments is the fact that the relentless drive towards automation has implications for jobs and earnings of labour. Since 2000 till date only 0.5 per cent of new jobs created never existed prior to 2000. Now, 173 million jobs are going to be lost to automation by 2025 in the G7 countries. In 2016 an OECD Working Paper titled "The Risk of Automation for Jobs in OECD Countries" found that 14 per cent of all jobs would be lost to automation and another 32 per cent of jobs would be under severe risk of being lost. According to Acemoglu and Restrepo (2018) calculated that one robot per 1000 workers depressed wages by 0.5 per cent. According to Frey and Osborne (2013) 702

professions that used middle-skill levels in terms of routine cognitive and manual applications would be lost to automation in the next two years.

What does this all imply for India and its labour markets? According to Frey and Osborne (2013) India, which has 65 per cent of global off-shore IT work and 40 per cent of global business processing, could find 69 per cent of its jobs in the formal sector automated by 2030. If this is to hold, are there policies that can mitigate the problem of massive unemployment? In India 60 per cent of jobs in the formal sector (which itself is small) are middle skill jobs like clerks, sales persons, service providers, skilled agricultural workers and trade related work. All of these are likely to be automated in the next decade. This will have a number of effects, both macro and micro in nature (Kuriakose and Iyer (2018)). At the macro level there will be significant changes in the required skill profile of the work force, and firms will have to be re-organized and restructured consistent with the new technologies. New skills will require the capability to work with automated processes and quickly adapt to changes. It will according to experts also require systems-skill involving complex problem solving abilities. Social skills or human interaction skills will change too. Perception and ability to take action in diverse situations will be more in demand than skills that focussed on content and approach. There will be a gender implication too. Typically call centre jobs, jobs in retail and administration are done by women. These jobs will be virtually wiped out by machines. On the other hand jobs of data cleaning and creation of digital infrastructure are done by men, and these are likely to go up in demand.

At the microeconomic level, the meaning of work or a set job is likely to get altered. A job will be a discrete set of tasks requiring a portfolio of skills. There will be a network of teams that do a set of distributed tasks. New employment contracts will look more like piece rate remunerations and hence bargaining power of workers and their employment benefits will shrink even further than that experienced in the last three decades. The gig economy will grow bigger.

Are there policy responses to growing unemployment, new re-skilling needs and workers' benefits and security? Firstly, there is the need for new education curricula, training of trainers and new training done on a continuous basis would be needed. Secondly, there would be a need to redesign the social security measures and even consider an universal basic income in some form. Workers with low job security and benefits are likely to face chronic periods of unemployment with no income. Thirdly, there is an urgent need to look beyond manufacturing and industries for potential jobs. One such sector that receives a lot of attention in policy circles is the care economy. According to the ILO, every day unpaid care work, used two billion labourers equivalent of work at an average of an 8 hour work day. This sector has the potential to create more than 200 million jobs. This sector is likely to benefit women more than men given the nature of the jobs created.

VIII.WhatIs The Consequence For The Future?

For the labouring class, getting a decent job with a modicum of security has always been a matter of high priority of life. It is more a matter of survival than of choice. In India this has been so always. Unemployment and disguised unemployment has been a constant problem that policy makers have not been able to solve over decades. Associated with unemployment are the problems of poverty and illiteracy, poor health and a general low standard of living. However, whenever there have been rapid investments in India along with the use of new and modern technologies, the expectation has been that new jobs will be created. In the latest round of worries regarding the sweeping phase of automation, the optimists point out that this concern was also raised in the earlier round of computerization in the 1990s. Everyone thought that jobs would be lost, but so many new and high paying jobs were created and indeed India was able to identify a new area of comparative advantage in international trade, namely, Information Technology Enabled Services (ITES). This same experience is being expected in this round. Jobs losses will be there but hosts of new jobs will arrive.

Two caveats are in order. Despite different rounds of technological change in India starting from the second five year plan, to the green revolution, to the arrival of computers, new jobs have been created, but overall the problem of unemployment and disguised unemployment has remained. The transformation of labour from the traditional to the modern sector has languished over decades. Hence even if the optimistic prediction is true, the problem of unemployment, inequality and poverty will not go away according to past experience. The second issue to keep in mind is the intrinsic nature of this round of technological change. Human beings are known to possess two broad sets of skills – manual and cognitive. So far all historical changes in technology have taken place around the replacement of manual tasks by machines. Hence cognitive tasks became more remunerative and sought after. This replacement of humans by machines has grown more and more sophisticated with new waves of technology climbing up the skill ladder as it were, to middle level and even some upper level skills. The last wave of computerization took away many tedious and repetitive tasks some of which had a cognitive aspect. This time around the replacement is being created for primarily cognitive tasks – learning by doing, problem solving and completing displacing human agency like a driverless car. If cognitive tasks go away to machines, then humans are incapable of doing any other kinds of tasks where machines have not taken over. There is the distinct possibility that unemployment will have a new dimension apart from its rising numbers – the unemployed will be unemployable despite some amount of education and skills. There will be the rise of a useless class without any hope of being productively used by society. There will a handful few with extraordinary skills and intelligence who will find work. The machines will be owned by the owners of capital. Labour's share will plummet and the share of capital will tend towards one. The social and political responses in India to rising

unemployment and lack of employability, job insecurity and frightening inequality could be disturbing. It seems to be turning out to be very violent and vicious.

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Trade and Transport Services in Indian Economic Growth[1]

Madhusudan Datta*

I. Introduction

Taking a long view rather than year-to-year fluctuations, we find thatIndia's growth trend (5-year moving average, centered in the middle)[1] shows a small bump, reaching a peak at about five percent level, during the Fifth Plan (1974-79) period (Figure-1). The last year of the decade saw India's worst drought in several decades; agricultural production nosedived by fifteen percent and GDP by five percent[2]. Then came oil-price shock along with disturbance in the north-eastern state of Assam leading to retardation in the growth of the manufacturing sector. Government's response to the shocks was a break from the past tendencies – 'expansionary adjustment' with encouragement to export. (Little and Joshi, 1994, p.59). Using endogenous break-point analysis several scholars have found a structural break in trend growth toward the end of the 1970s (Balakrishnan and Parameswaran, 2007;Dholakia and Sapre,2011) which seems to be the handiwork of the severe drought, not change in economic fundamentals. The average centered on the drought affected year was above 4 percent; and after a couple of disturbed years since then, India's 5-year moving average rate of GDP growth did not fall much below the rate of five percent during the next decade and a half to mid-1990s. With some fluctuations in the annual rates, the trend growth rate further moved up over the subsequent decade and a half to create a hump above eight percent level over the quinquennium 2005-10.

How did the different major sectors of the economy behave to result in the above secular trend of aggregate output? Particularly, how does the general perception of weakness of the growth of the manufacturing sector and sturdy growth of services interlaced with this sector, like trade and transport services, as we will discuss in some detail, reconcile with the story? The present paper explores the above questions.

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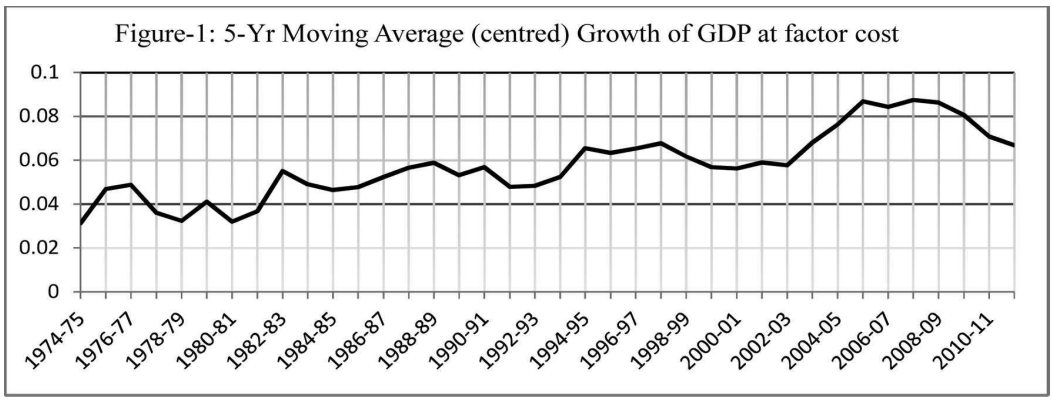
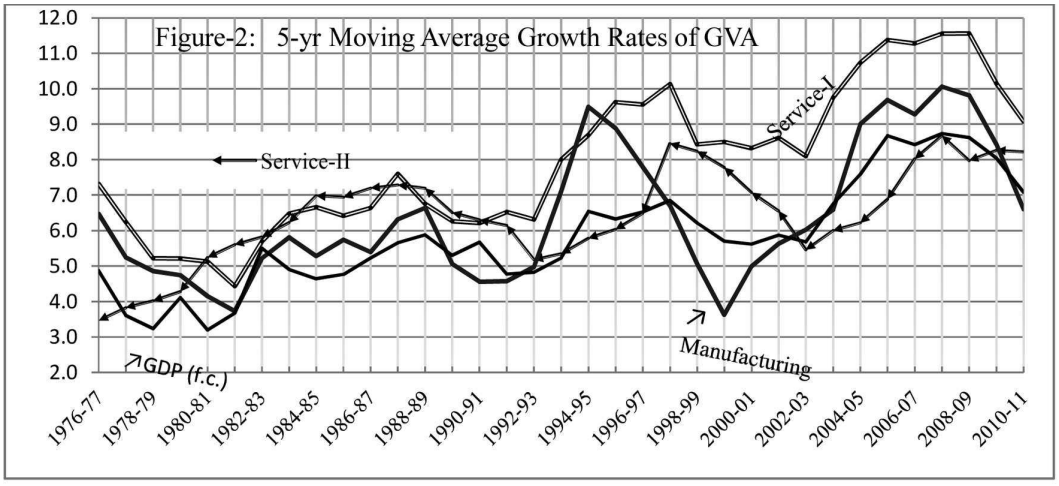
1. 4th GiribalaKarmakar Memorial Lecture delivered at the 40th Annual National Conference of Bangiya Arthaniti Parishad, at Bethune College, Kolkata, on February 29, 2020.



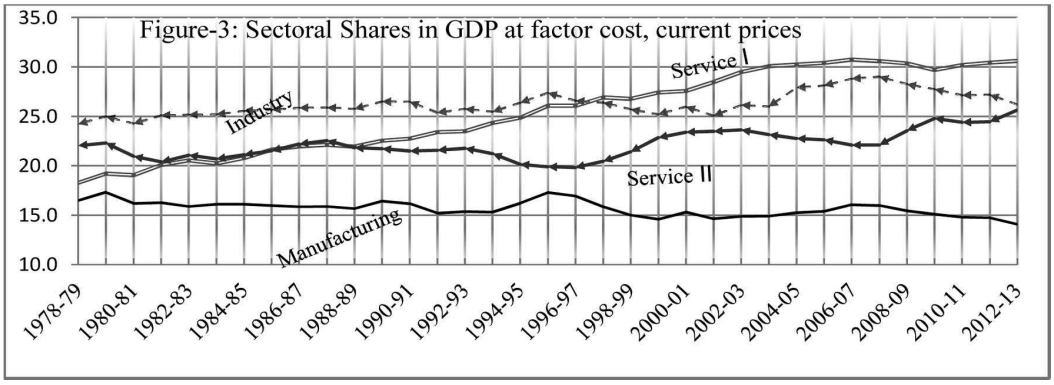
Source: mospi.nic.in/data; accessed in October, 2018.

II. Growth of Sectoral GVA

Figure-2 shows average growth rates (of GVA at 2004-05 prices) of the major sectors (other than agriculture) for more than three decades since the turn of the 1970s. The figure clearly shows the trend line for service-I, which comprises of trade, transport, communications and "banking and finance", to be above manufacturing's line all along barring a short phase in the mid-1990s when growth rate of manufacturing shot up temporarily from a very low level. This fact is reflected in the relentless rise in the share of Service-I in GDP over the whole period (Figure-3), starting low but going beyond all other sectors towards the end of the 1990s. During the 1980s service-II, which includes dwelling and business services apart from "community, social and personal services"; the last category includes education and health services, grew neck and neck with Service-I only to fall behind afterwards. Growth of manufacturing also accelerated along with GDP during the decade.



Source: www.mospi.nic.in/data, sectoral shares at 2003-04 prices.



Source: Table-1.

During the 1990s growth rates of all the sectors fluctuated much more than they did during the previous decade and this is clearly visible even from 5-year moving averages too. It is also clear that fluctuations have been the greatest for the manufacturing sector and the least for Service-I. It happened in spite of a great spurt in manufacturing's growth in early 1990s; that shows the churning the sector went through after reform. In the latter part of the 1990s the sector's growth rate dropped and shot up again early in the next decade. During this decade the growth trend of service-II was much below that of service-I, only there was a jump in 1996-97 caused by implementation of pay commission award[3].

Table-1: GDP-Shares of Major Sectors and Sub-sectors; current prices, percentages

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Sector	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2012-13
Agriculture, etc.	35.4	30.9	29.0	26.3	23.0	18.8	18.2	17.5
Manufacturing	16.2	16.0	16.2	17.3	15.3	15.4	14.8	14.1
Industry	24.3	25.7	26.5	27.4	26.0	28.1	27.2	26.2
Trade, hotels, etc.	11.6	12.9	12.7	13.9	14.5	16.7	17.3	17.2
Transport&Communication	4.4	5.4	6.1	6.8	7.6	8.2	7.3	7.5
Communication	0.6	0.6	0.9	1.4	1.5	1.6	1.1	1.1
Banking & Insurance	3.0	3.4	3.9	5.4	5.4	5.4	5.7	5.9
Service I	19.1	21.6	22.7	26.1	27.6	30.4	30.2	30.6
Dwellings, Business	8.2	8.5	8.4	7.4	8.7	9.1	10.4	11.4
CSPS	12.8	13.0	13.2	12.5	14.7	13.5	14.0	14.3
PAD	5.1	5.6	5.9	5.4	6.5	5.6	6.1	6.0
Service II	21.0	21.5	21.5	19.9	23.4	22.7	24.4	25.7

Note: Sectoral shares do not add up to 100 due to rounding-up error. CSPS = community, social and personal services. Its major components are education, health and PAD (EHPAD). Source: www.mospi.nic.in/data

The major story for the first decade of the new millennium is that manufacturing's growth rate picked up from a couple of points below that of GDP at the start and went past the rising GDP growth rate by the mid-decade. However, manufacturing could not make up for the loss of GDP share in the previous decade. Service-I again remained above all other sectors. An important development of the new decade is coming to prominence of composite business services (not shown separately). It is mainly based on this service that growth of service-II picked up after falling quite a bit; nevertheless, the sector's growth trend remained below that of GDP, which also picked up.

To round up the above discussion of GVA growth trends we note first of all that service-I is apparently the leading sector of the Indian economy. Its growth curve has remained above those of industry and manufacturing by far over most of the three decades since 1978-79. The same cannot be said of service-II. In terms of sectoral shares in GDP expressed as percentage points, agriculture has lost 17 points over three decades since 1980-81(Table-1). Service-I has gained 11 of these points and the rest has been equally shared by industry and service-II. Manufacturing actually lost two points! Here we must pause to reflect on the question: Demand for service-I is basically derived from demand for goods, basically manufactured goods; and then how come service-I so consistently grew so much faster than manufacturing? Particularly, distributive trade accounts for more than half of GVA in service-I and demand for this service is entirely derived demand. Claiming that trade is the engine of growth of manufacturing is putting the cart before the horse. Does changing relative price of output have something to do with the overriding growth of service-I (Datta, 2019)? Let us look at the trends of sectoral outputs in real terms.

III. Trends in Output Growth

Since gross output (henceforth we simply use "output" to mean "gross output") of a sector is what comes out of the sectoral production process to cater to final demand as well as intermediate input demand from other sectors, output of manufacturing is aggregate final demand for manufactures plus intermediate consumption demand coming from non-manufacturing sectors net of imports of manufactures. The input-output transactions tables(IOTTs) provide the relevant information, only they need to be aggregated and deflated appropriately to convert to a constant price base.

Table-2 presents output estimates at constant prices for the Indian economy. The table and also Figure-4 show growth trends of outputs of manufactures and service-I as almost convergent[4]. The convergence of output trends stands in sharp contrast to GVA trends that diverge, as we have seen from growth rates and relative shares. In fact, most of the components of service-I are very closely connected with M-sector production; so much so that it is sometimes difficult to segregate them from the M-sector's process[5]. This is the basic logic

why they used to be called material services in the Material Products System of erstwhile socialist countries. Very close growth paths of manufactures and service-I are reflected in their exponential trends. The best-fit log-linear curves to the output data give the coefficients of time (the compound growth factors) as shown at the bottom of Table-2. Even for the period of fastest growth of services (1993-94 to 2007-08), due to the "Service Revolution" ushered in by IT-enabled services, the growth of output of manufacturing did not lag behind very much; but during the next quinquennium manufacturing's growth surpassed that of services. The findings are contrary to the widespread perception of stagnation of the sector in general, and the puzzles of an unresponsive manufacturing to the comprehensive product market reforms of the early 1990s in particular (Gupta, et al., 2009; Srinivasan, 2009).

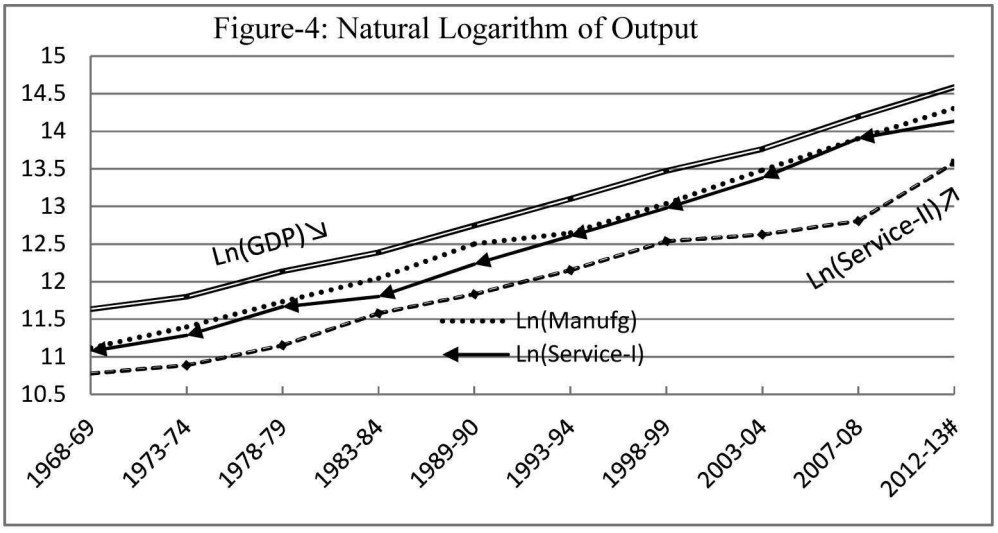
Table-2: Gross Output of Selected Sectors and GDP at factor cost Rs. Crores; at 1993-94 Prices

Table-2: Gross Output of Selected Sectors and GDP at factor cost
Rs. Crores; at 1993-94 Prices

	Manufactures	Serv-I	Serv-II	Serv-I+Serv-II	GDP
1978-79	124951	116667	69843	186510	399855
1983-84	170519	133533	106964	240497	489296
1989-90	268970	205995	137990	343985	651032
1993-94	311571	298378	189965	488343	830557
1998-99	459254	433052	278779	711831	1114885
2003-04	715174	647226	304509	951735	1436499
20007-08	1088581	1094589	364729	1459318	2083810
2012-13*	1629212	1372026	789541*	2161567	2958506
Estimate of Growth Coefficient from log-linear regression					
1978 to 1999	1.067	1.071	1.069	1.070	1.053
1978 to 2008	1.075	1.081	1.059	1.073	1.058
1978 to 2013	1.078	1.081	1.066	1.076	1.061
1993 to 2008	1.093	1.095	1.045	1.079	1.066
1993 to 2013	1.093	1.084	1.063	1.077	1.069

**Estimates for 2012-13, based on Supply and Use Table, are not fully comparable with those of the previous years, which are obtained from IOTTs.*

Note: *Output excludes intra-sectoral intermediate input uses.*



Source: Table-2.

It is interesting as an aside that the index of industrial production (IIP), which includes mining and electricity but gives about 80 percent weight to manufacturing and lacks in coverage for reasons including non-response of producing units, is found to be remarkably consistent with the above manufacturing output trend. After conversion to 1993-94 base the indices become as shown in Table-3. Back of the envelope calculations show the closeness of trends.

Table-3: Index of Industrial Production

Table-3: Index of Industrial Production							
Year	1983-84	1989-90	1993-94	1998-99	2003-04	2007-08	2012-13
IIP	52	86	100	149	197	338	412
Source: RBI, 2018, p.68							

Source: RBI, 2018, p.68

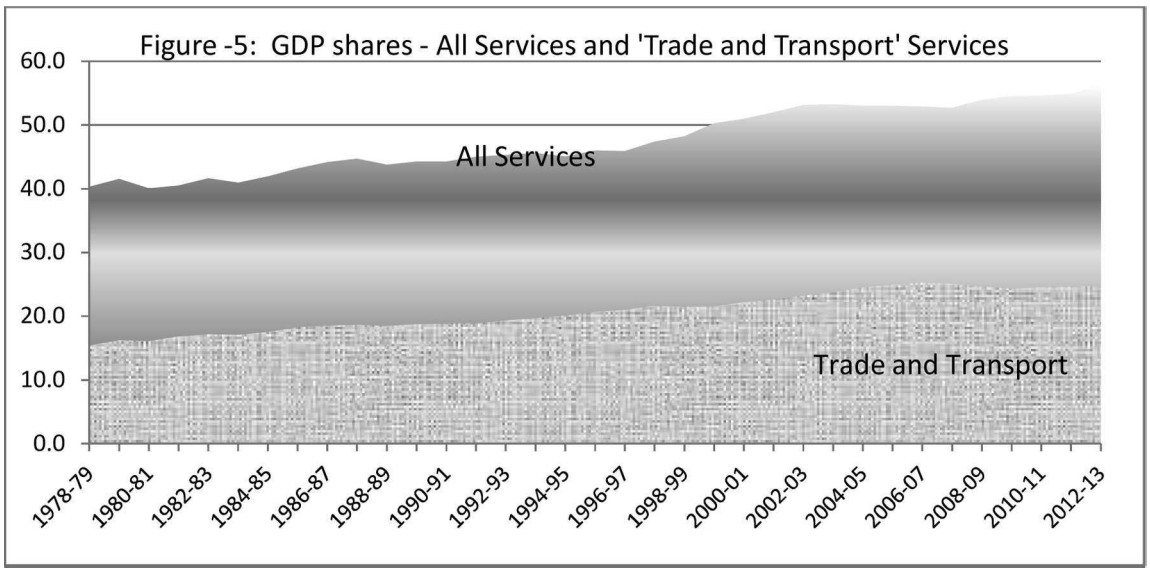
Service-II provides a contrast with a growth rate about two percentage points slower than that of service-I since 1978-79[6]. An interesting observation here is that India's "service revolution" was in full force since mid-1990s with fast growth of information technology related services, as we have already commented on. These services are mostly classified with business services and included in service-II. Two points need to be noted here. First, the rapid growth phase of these services needs to be viewed in the context of the very low base from which it spurted so that even after fast growth for a decade and a half "computer related services" accounted for just more than three percent of GDP (at constant prices) in 2007-08 (GOI, 2010, pp.15 & 161). Second, this phase of fast growth only compensated for

the stagnation, or even decline (though not in nominal terms), of EHPAD since mid-1990s. As a result service-II as a whole managed to grow just at about the same pace as GDP (Table-4.) over the three decades since 1978-79[7].

To sum up, the most notable finding is the contrast between growth rates of GVA and output of the manufacturing sector. Output growth is equal to that of the fastest growing subsector, i.e., service-I, while GVA growth is slower than that of GDP, as is evident from the trend of relative share of the sector(Table-1). This divergence in growth rates of output and value added highlights the fact that it may be seriously misleading to treat sectoral value added as a representation of sectoral output, as is very often done, particularly in productivity analysis. Further, in studying inter-sectoral relations it should be more appropriate to study the relation between outputs rather than value added when there is reason to suspect that relative prices change significantly. In the following discussion we develop a simple framework to throw light on what one may expect the relationship to be between trade and transport services on the one hand and manufacturing or the GDP on the other in the course of development.

IV. Trade and Transport Services

We have noted that in terms of GVA, service-I has been the fastest growing sector of the Indian economy over several decades. This sector is constituted of three groups of activities: 'trade, 'transport and communications', hotels and restaurants' and 'banking, insurance and finance'. For convenience, henceforth we refer to them simply as trade, transport and finance respectively. Trade and transport are required mainly for distribution of goods, though a part of transport services has direct final use for travels and other purposes. In IOTTs, the part of the services used for distribution of goods to, or used directly by, final users is taken as final service; and the rest, used for distribution of intermediate inputs, is taken as intermediate service. For finance also the same norm is applied for classification between intermediate and final uses. But the norm should not distract us from the fact that even the demand for the above final service is mostly derived demand. As we have seen above, service-I is the more dynamic part of the overall services sector while trade and transport explain roughly four-fifths of the GVA in service-I. How do we understand this phenomenon of rapid growth of trade and transport services?



V.Derived Demand for Distributive Services

Demand for distributive trade is wholly a derived demand arising from demand for goods[8]. Also, transport is intimately related to trade, so a very large part of the demand for transport services is derived demand too. A similar point can be made regarding demand for financial services also. This means that the growth of the above services is linked to the growth of other activities; most prominently, manufacturing. Here we proceed with our arguments in terms of trade and transport services; these services are unavoidable for distribution of goods, be it for intermediate or final use. Keeping the intimate functional link between trade and transport services in mind, in the following discussion we will consider the two services as integrated in their distributive function and call this integrated service the TT service. In order to highlight the link of this integrated service with the structure of production of goods, we exclude from our model the part of transport service that is dissociated from distributive trade and demanded for its own sake, like transport for travels. So, we can view the integrated TT service. as final service (T_F) to the extent it is used to distribute goods to final users; and, as intermediate service (T_I) when it is used to distribute intermediate inputs; This is how it is done in IOTTs. The value of intermediate TT-service gets incorporated into the producer's price of relevant goods; but the final TT-service is paid for by final users only, the charge getting reflected in the purchaser's price.

The structural change in an economy is the manifestation of uneven growth of different sectors. Typically, while agriculture declines relatively due to Engel effect, industry along with services expands. An important part of manufacturing's growth is caused by expansion in scale and scope to meet consumer's choices. We may call it the spread effect. A very

obvious example is carbonated soft drinks companies diversifying to "new age" soft drinks like bottled water, tea-based ones, etc. Similarly, milk diaries diversified from packaged milk to several milk products. Example can be multiplied. But there is a simultaneous process of achieving depth in the sense that in the course of economic development gradually more and more sophisticated parts of a basically round-about production process become integrated with domestic production as links in a chain constituting a complete process; lengthening of these links adds to the depth[9]. The idea here is that the different sub-processes are often not vertically integrated; in fact, de-verticalization is often a conscious strategy for achieving efficiency in modern times (Yousuf, 2004). With sophistication of technology in general the finished goods are increasingly the cumulative outcome of operations of a lengthening chain of sub-processes[10]. This may well have implications for TT intensities of production. The point may be explained in terms of the following structured argument.

VI. A model of Industrialization with Induced TT Service

Case-I: Rudimentary Manufacturing and Derived Demand

We first consider an economy under autarky, where final products come from agriculture and rudimentary manufacturing[11]. We will abstract from price changes; so we can take all the prices to be unity with suitable definition of units of quantity. Let us denote the output of agriculture by A and that of rudimentary manufacturing, which only processes minerals and does not take manufactured intermediate input, by M; we will introduce advanced manufacturing at a later stage. Let us assume that A is produced without any intermediate input while M takes intermediate inputs from mining and TT services, but not agriculture. Let B be the output of mining, produced without any intermediate input but used wholly as intermediate input in manufacturing[12]. The only service produced in the economy is TT service; it does not take any intermediate input, so that its output T and is its value added too. The input-output structure is represented by Table-4. Its different columns show inputs used by producing sectors and types of uses with the final column showing total use or output. The rows corresponding to sectors show use of the relevant sector's produce, while the last row shows factor payments, or value added. Note that output of TT service is represented by a uniform margin ($\hat{o} > 0$) on goods handled:

T = Sum of intermediate and final uses = $B\,\tau + (A+M)\tau$. … (1)

It can be seen from the 'TT service' row in table 7.1. Output is also the value added of the sector as, by assumption, the service does not use any intermediate input[1].

Gross Domestic Product (Y) = Aggregate value added = Aggregate final uses. From the column of final use in Table-4: $Y = (A+M)(1+\tau)$ … (2)

From (1) and (2), the share of TT-service in GDP = $(A+M+B)\tau / (A+M)(1+\tau)$

Or, $T/Y = [1 + B/(A+M)]\,\tau/(1+\tau)$ … (3)

Table-4: Flow of input and output with Single-stage Manufacturing

Table-4: Flow of input and output with Single-stage Manufacturing							
	Agri-culture	Mining	Manu-facturing	TT-service	Intermediate Use (total)	Final Use	Output
Agriculture	0	0	0	0	0	A	A
Mining	0	0	B	0	B	0	B
Manufacturijg	0	0	0	0	0	M	M
TT service	0	0	Bτ	0	Bτ	(A+M)τ	T
Intermediate Use (Column total)	0	0	B(1+τ)	0	B(1+τ)	(A+M)(1+τ) = **GDP** (*Y*)	
Factor payments = Value added	A	B	M-B(1+τ)	T = (A+M+B)τ			

Clearly, *for case-I*, final trade share, $T_F/Y = \tau/(1+\tau)$ … (3a)

And intermediate trade share, $T_I/Y = [B/(A+M)]\,\tau/(1+\tau)$ … (3b)

So, for therudimentary economy, $T_I/T_F = [B/(A+M)]$ … (4)

One may now introduce dynamics into the model in a simple way. One stylized fact about economic development is that manufacturing production grows much faster than agriculture in a developing economy (LDC). Accordingly, let us suppose, A and M grow smoothly at rates $\acute{a}$ and $\grave{\imath}$ respectively $(\grave{\imath} > \acute{a})$.

Then, at time 't', $A_t = a.e^{\alpha t}$ … (5)

and, $M_t = m.e^{\mu t} = V.B_t\,(1+\tau), \quad V > 1.$ … (6)

Where, V is the constant factor by which the value of intermediate input $B_t(1+\tau)$ is multiplied in transformation into output M_t^1. So, $(V-1)$ is the factor for value-added in the rudimentary manufacturing process. We do not need to specify the production functions

beyond the maintained assumption of a constant intermediate input coefficient in manufacturing, as we presume industrialization and focus on the induced demand for TT service.

Clearly, from (5) and (6),

$a = A_0$ and $m = M_0 = V.B_0 (1+\tau)$. Or, $B_0 = m / V(1+\tau) = b$ (for symmetry of notation).

It follows immediately from (6),

$B_t = [m / V. (1+\tau)].e^{\mu t} = b.e^{\mu t}$, [clearly, $b<m$] … (6.1)

Now, value-added (same as output, T,) in TT services is the sum of value-added in intermediate TT (T_I) and final TT (T_F) services. So, T may be written in terms of a uniform TT-margin as:

$T_t = [T_F + T_I] = (A_t + M_t) \tau + B_t\tau = (a.e^{\alpha t} + m.e^{\mu t}) \tau + be^{\mu t} \tau$ … (7)

A_t and M_t are the final uses of A and M respectively while B_t is the intermediate use of minerals, all at producer's prices; we must add the TT service charge to get GDP, which is the aggregate final demand (at purchaser's prices) : $Y_t = (ae^{\alpha t} + me^{\mu t})(1 + \tau)$ … (8)

[See the final use column of Table-4.]

So, TT share in GDP, $[T_t / Y_t]$ is $\chi_t = \{(ae^{\alpha t} + me^{\mu t}) \tau + be^{\mu t}\tau\} / (ae^{\alpha t} + me^{\mu t})(1 + \tau)$

$= \{\tau / (1+\tau)\} + [b / (a.e^{(\alpha - \mu) t} + m)].\{\tau / (1+\tau)\}$ … (9)

[(9) may be compared with (3).]

The first and the second terms in (9) stand for final and intermediate TT ratios in GDP respectively. It is clear that the final TT service is a constant proportion of GDP Further, the trade components ratio (i.e., the trade ratio between the intermediate and final services) is given by: $T_I / T_F = b / (a.e^{(\alpha - \mu) t} + m)$ … (10),

where $(\alpha - \mu) < 0$;

Clearly, the ratio rises over time. The limiting value for a rudimentary economy is $b/m < 1$. So, the TT share in GDP), χ_t, rises over time due to intermediate trade. This growth of the trade share is entirely explained by the spread effect caused by relative growth (spread) of manufacturing production vis-à-vis agricultural production, as manufacturing only involves intermediate trade in the model.[This simplifying assumption can be justified by the observations from all the IOTTs for the Indian economy that intermediate trade and transport coefficients (i.e., use per unit of output) for agriculture are much smaller than those for manufacturing.]

Case-II: Advanced Manufacturing and TT service

In the course of development, as we have mentioned above, much of manufacturing evolves into multi-link chains; in that sense the depth of manufacturing increases. Let us introduce one higher stage manufacturing**,** at this stage manufacturing uses a proportion, λ ($0<\lambda<1$), of the output of rudimentary manufacturing (M) as input; the output of this higher stage being denoted by N. Thus, when two stages operate, total final output (which excludes intra-sectoral use) of manufacturing is $[(1-\lambda)M + N]$. The input-output structure now is as follows:

Table-5: Flow of Input and Output with Multi-stage Manufacturing

	Agri-culture	Mining	Manufac-turing-I	Manufac-turing-II	TT-service	Intermediate Use	Final Use	Output
Agriculture	0	0	0		0	0	A	A
Mining	0	0	B		0	B	0	B
Manufactr-I	0	0	0	λM	0	λM	$(1-\lambda)M$	M
Manufactr-II	0	0	0	0	0	0	N	N
TT-service	0	0	$B\tau$	$\lambda M\tau$	0	$(B+\lambda M)\tau$	$[A+(1-\lambda)M + N]\tau$	T^*
Total Intm. Use = Column sum	0	0	$B(1+\tau)$	$\lambda M(1+\tau)$	0	$(B+\lambda M)(1+\tau)$	$[A+(1-\lambda)M + N](1+\tau)$ = **GDP**	
Payments to factors = Value added	A	B	$M-B(1+\tau)$	$N-\lambda M(1+\tau)$	T^*			

[* $T = (A+B+M+N)\tau$]

Gross domestic product (Y) = aggregate final use (check relevant column ofTable-5) = $(A+(1-\lambda)M + N)\ (1+\tau)$

Share of TT-service in GDP, $T/Y = (A+ B+ M+N)\tau\ /\ (A+ (1-\lambda)M + N)\ (1+\tau)$

$= [1 +(B +\lambda M)\ /(A + (1-\lambda)M + N)]\ \tau\ /\ (1+\tau)$ … (11)

It can be checked from the final use column of Table-7.2: $T_F/Y = \tau\ /(1+\tau)$ … (11.1)

and, $T_I/Y = [(B +\lambda M)\ /(A + (1-\lambda)M + N)]\ \tau\ /\ (1+\tau)$ … (11.2)

Or, $T_I / T_F = [(B + \lambda M) / (A + (1-\lambda)M + N)]$ … (12)

The advanced manufacturing uses λM and associated TT service as input for further processing resulting in output N. Let $W(> 1)$ be the factor by which intermediate input is multiplied at this stage. So, output is: $N = W \lambda M(1+\tau)$ … (13)

Substituting in (12), $T_I / T_F = (B + \lambda M) / [(A + M) + \lambda M\{W(1+\tau) - 1\}]$ … (12.1)

(12.1) may compare with (4). The final-TT share in GDP being the same in the two cases, the difference is purely for intermediate-TT share. (12.1) adds λM to the numerator and $\{W(1+\tau) - 1\}$ times λM to the denominator of (4).

Introducing growth over time, as before,we can write:

$N_t = W \lambda M_t(1+\tau) = W \lambda me^{\mu t}(1+\tau) = ne^{\mu t}$ ... (13.1)

[Writing $n = W\lambda m(1+\tau)$]

The growth of manufacturing production now is caused not only by expansion in scale and scope, as in case-I, but also by processing of manufactured products in the higher stage, adding depth to manufacturing. This also enhances intermediate TT to the extent of $\lambda M\tau$. So, total intermediate TT services now is: $T_{I.t} = (\lambda M_t + B_t)\tau$, and aggregate value-added in TT service is: $T_t = (A_t + B_t + M_t + N_t)\tau = (ae^{\alpha t} + ne^{\mu t})\tau + (b + m)e^{\mu t}.\tau$ ... ' (14)

Now GDP is: $Y_t = (ae^{\alpha s} + (1-\lambda)me^{\mu s} + ne^{\mu t})(1 + \tau)$ … (15)

Taking the ratio of (14) and (15), TT service as a ratio to GDP is:

$T_t/Y_t = \chi_t = \{\tau / (1+ \tau)\} + [(b + \lambda m)e^{\mu t} / (ae^{\alpha t} + (1-\lambda)me^{\mu t} + ne^{\mu t})]\{\tau / (1+ \tau)\}$,
which further reduces to:

$$\chi_t = \tau / (1+ \tau) [1 + (b + \lambda m) / (ae^{(\alpha - \mu) t} + m + \lambda m\{W(1 + \tau) - 1\})] \quad \ldots \quad (16)$$

So, the trade ratio, $T_I / T_F = (b + \lambda m) / (ae^{(\alpha - \mu) t} + m + \lambda m\{W(1 + \tau) - 1\})$ … (17)
[This ratio may be checked against (12)]

We intend to compare (10) with (17), i.e., trade ratios in stage-I and stage-II, to check how the ratio has changed. In (17) the numerator is that of (10) plus λm, while the denominator is higher by $\{W(1 + \tau) - 1\}$ times λm. What should be the value of the expression within braces? [We can try to be objective by looking at information given by the IOTTS. Datta (2019b) shows that aggregate intermediate inputcoefficient of the manufacturing sector has remained fairly stable at 0.7 over the last four decades[1]. This observation may be a basis

for a guestimate of W**,** which is the transformation factor on aggregate input. On the above basis we take the ratio of aggregate output to intermediate input for manufacturing to be 1.5. Similarly, the ratio between aggregate TT-input to aggregate material inputs in all the sectors turns out to be less than one-third; this indicates an upper-side estimate of $(1 + \tau)$ to be 4/3.] So, a fair estimate of $\{W(1 + \tau) - 1\}$, generally,should not exceed unity for our present concern; which means (17) adds roughly the same quantity to the numerator and the denominator of (10).

Let us consider theexpression for trade ratio (T_I / T_F) in stage-I, $b / (a.e^{(\alpha - \mu) t} + m)$, given by (10). We find the value (at factor cost) of agricultural output to be almost at par with that of manufactures in 1978-79[2]. So, taking t=0 at that point, we have $a = m$. Further, going by equation (6.1), $b = m/V(1+\tau)$;taking $V = 3/2$ (the same as W) and $(1 + \tau) = 4/3$, as determined above, b is half of m, i.e., one-fourth the denominator in (10).] Based on this consideration, T_I / T_F**,**at $t = 0$**,** is around ¼ in the present construct[3].

Clearly, by adding the same positive quantity, roughly λm**,**to the numerator and the denominator, (17) takes a jump over (10) due to addition of depth to manufacturing; and magnitude of this jump is positively related to λ. In fact, in the limiting case, as t tends to infinity, with$m = 2b$, addition of a new stage of manufacturing enhances the intermediate trade ratio. So, keeping in mind thatour analysis in only indicative, we conclude: a *rise indepth of manufacturingcauses the trade ratio* (T_I / T_F)*to shift up*. Since the final trade share in GDP is a constant, our analysis implies a rising overall trade share in GDP due to both the spread and the depth effects of a growing manufacturing sector[4]. Are there off-sets to this trend? We need further considerations.

VII. Further Considerations on the Trade Components Ratio

Abstraction from reality in the above arguments is obvious. The trade components ratio (T_I / T_F) given by equation (10) considers only the spread effect while expression (17) brings into focus our basic idea of growing depth of manufacturing. Abstraction from agricultural inputs manufacturing does not seem to affect the trend of the trade ratio very much because from the point of view of our model it does not really matter if inputs come from agriculture or mining.[19] Similarly, our abstraction from final-product services, like community, social and personal services (CSP), also does not seem to seriously affect the dynamics of trade share, as the services are not much related to either intermediate or final trade.

Probably the most glaring omissions from the model are the sectors – construction and utilities. These activities take intermediate inputs no less intensively than the manufacturing sector itself, though the sectors distribute their products without the intermediation of traders; so the relevant demand for the TT service is wholly intermediate demand[20]. We omitted the

activities from our model as they do not generate the depth-effect. The implication of the exclusions for our model is that the intermediate demand for manufactured inputs from the excluded sectors has to be viewed, in the context of our model, as final demand for manufactures causing spread effect[21].So, we preferred the simplicity of working with manufacturing only with the above consideration in mind.

There may be several other causes acting to qualify the conclusion of the model. Thus, intermediate TT may be restrained by vertical integration and boosted by de-verticalization. Variation of TT margins across activities and over time[22] may bring complications into the straightforward account given above. Thus, how the relative shares of intermediate and final TT services will behave in the course of economic growth will inevitably depend on a host of developments apart from the growing spread and depth of manufacturing; but that does not detract from the importance of the two effects – the spread effect and, specifically, the depth effect of manufacturing – for the trade ratio[23].

VIII. The Trade Ratio, Sectoral Interrelations and the Demand Structure

We have already noted that trade and transport subsectors taken together (roughly, what we have called TT-serviceplus direct use of transport) have increased rapidly relative tomany other sectors in terms of sectoral GDP. At current prices, the relative share of the group in GDP has increased from 16 percent in 1980-81 to almost 25 percent in 2012-13. Over the same period the relative share of the subsector 'banking, insurance and finance' has almost doubled from 3 percent. This, of course, does not project a true picture of real growth, which is distorted by relative price movements (Datta, 2019a). A better picture of real growth is given by that of sectoral gross output at constant prices (the trickiness of measurement of volume of services notwithstanding), shown in Table-2. It emerges that the growth of service-I has been of the same order of magnitude as that of manufacturing over the three decades since the turn of the 1970s, as one would expect from the logic of the model presented here.

We obtained estimates of the trade components ratio (T_I / T_F) from the IOTTs. The trend of the ratio shows definite sign of increase. As the observations show some fluctuations, we consideraverage of observations from two consecutive IOTTs; the ratio increases from 0.725 (average from 1968-69 and 1973-74 IOTTs) to 0.943 (from 2003-04 and 2007-08 IOTTs). If we take only distributive trade, then the corresponding increase is found to be of the same order of magnitude, from 0.760 to 0.975. While this finding seems to be in perfect tune with our analysis of the dynamics of the TT service, our analysis based on equation (10) suggested a much smaller ratio (around one-fourth) as we abstracted from intermediate trade in several activities. Further, the assumptions of a uniform trade margin, a closed economy and all that militates against reality. Nevertheless, as an academic curiosity, we computed the ratio of intermediate use of TT service in manufacturing and the rest of the service[24] from the IOTTs. Following the logic of treating all intermediate TT services in activities that we have

abstracted from as final service, this ratio should be of interest in the context of equations (10) and (17). The average of the ratios for 1973-74 and 1978-79 is 0.239. It increases to 0.254 in 1993-94 and again, the average of the ratios in 2003-04 and 2007-08 is higher still, 0.281. These observations are in perfect tune with our analysis[25].

Readings from the IOTTs, after conversion to constant prices, show that manufacturing sector's self intermediate input coefficient almost steadily increased from 0.275 in 1968-69 to 0.367 in 2007-08 (see Datta, 2019b). The observation is consistent with the hypothesis of increasing depth of manufacturing production. The above observations highlight the key role of manufactures in generating demand for TT-service (and more broadly, service-I) in the increasingly roundabout production processes. A natural interest (though not directly related) here is: how did the weight of manufactures and, more broadly, products of different sectors, in final demand (not output, which is the sum of intermediate and final demands) evolve over time? Table-7.3 presents the information taken from the IOTTs after conversion to the price base of 1993-94[26]. It shows that manufacturing's weight has almost doubled in four decades since the turn of the 1960s. Service-I also has raised its weight, somewhat to a lesser extent, as one might expect due to the predominant intermediate input use of the sector's output and the depth effect discussed above. Weight increments have been possible due to the decline in the weight of agriculture.

Table-6: Sectoral Shares in Aggregate Final Use (at 1993-94 Prices)

Table-6: Sectoral Shares in Aggregate Final Use (at 1993-94 Prices)							
	1968-9	1978-9	1989-0	1993-4	2003-4	2007-8	2012-13*
Agriculture	0.356	0.315	0.270	0.265	0.169	0.133	0.077
Mining@	-0.004	-0.015	-0.020	-0.021	-0.041	-0.043	
Manufacturing	0.163	0.209	0.278	0.244	0.304	0.311	0.355
Consruction	0.161	0.148	0.117	0.112	0.140	0.144	
EGW	0.003	0.005	0.009	0.007	0.008	0.010	
Transport, etc.	0.056	0.048	0.052	0.066	0.077	0.095	
Trade, etc.	0.084	0.119	0.106	0.113	0.120	0.117	
Banking, etc.	0.006	0.008	0.007	0.012	0.022	0.022	
Service-I	0.150	0.180	0.170	0.196	0.235	0.264	0.236*
EHPAD	0.140	0.126	0.115	0.105	0.086	0.075	
O. Serv.	0.031	0.032	0.059	0.091	0.099	0.106	
Service-II	0.170	0.158	0.174	0.197	0.185	0.181	0.224*

*2012-13 figures are not comparable with those from previous IOTTs, because those are based on Use-table and include product taxes. Also, due to reclassification, service-I and service-II are somewhat different in the Use table compared to the earlier IOTTs. @ Negative figures indicate large import of mainly petroleum crude, used as intermediate input. *Source*: IOTTs for the Indian economy published by the CSO, New Delhi.

IX.Summary and Conclusion

The paper analyzes the dynamics of the most prominent intermediate service – distributive trade and related transport, clubbed together as TT-service. The basic premise is: this service is not demanded for its own sake, the demand is derived from that for goods. We have often talked of service-I inter-changeably with TT-service as the latter constitutes three-fourths or more of the broader sector in recent times and demand for rest of service-I also is largely derived demand. Demand for transport or financial services made by final users is quite significant, but that too comes largely from demand for final goods though shown separately in national accounts.

We have focused on deepening of links in the interconnected manufacturing process, what we have called the depth effect. This process should work to enhance the relative importance of intermediate TT service and raise the trade components ratio (T_I/T_F). The whole gamut of influences determining of the GDP-share of Service-I is a complex and dynamic process, and we have not ventured into any quantitative exercise other than what can be read directly from the IOTTs. Our explanations are centered on the key role of the manufacturing sector in creating demand for intermediate and final TT service. This role is boosted by other sectors to which it is the key supplier of intermediate inputs, most prominently constructions.

Our model highlights that the share of TT service in GDP is driven by its two components: the intermediate trade ratio (T_I/Y), which is the dynamic part and the final trade ratio (T_F/Y), which is expected to be rather stable. The intermediate trade is influenced by the growing spread and rising depth of basically manufacturing. This derived nature of TT service, and more generally demand for service-I, makes it imperative that the phenomenal growth of value added in service-I of the Indian economy, leaving the goods sector (primary and secondary) way behind (discussed below), needs to be viewed with caution. As a related curiosity, we have examined the movement of relative weights of different sectors in aggregate final use. The finding is that manufacturing is the most dominant sector and service-I, being closely interrelated, has expanded roughly in tune with it.

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Notes :

[1]Refers to GDP at factor cost at 2004-05 prices.

[2] A drastic fall in GDP depresses the 5-year moving average for five years and the trough of the trend need not be in the year of lowest performance.

[3]Rakshit (2007) has made this point.

[4] Output estimates for the two sectors happen to be very close but this point is not important for our present consideration. It may be noted that we can obtain output estimates only from the IOTTs after taking into account intra-industry transactions; so, we present data only for the years for which the IOTTs are available.

[5] Trade service is very often a subsidiary product of a manufacturing process. This is reflected in the Supply Table (2012-13) published by the CSO.

[6] Fitting an exponential curve to the output path of service-II may not be very enlightening; we did it just to get a proximate compound annual growth rate imposed on the data.

[7] The other very rapidly growing service since the turn of the1980s is "communications" which is classified with service-I in the present study.

[8] That, of course, does not mean that the service is wholly an intermediate service; IOTTs show part of the service, which is related to the distribution of final goods, as final use of the service.

[9] The classic example given by BohmBawerk (1923) is worthy of note. "I am short-sighted, and wish to have a pair of spectacles. For this I require ground and polished glasses, and a steel framework. But all that nature offers towards that end is silicious iron ore. …. I must take the silicious earth and fuel, and build furnaces for smelting and glass from the silicious earth; the glass thus obtained has to be carefully purified worked, and cooled by a series of processes; finally, the glass thus prepared

– again by means of ingenious instruments carefully constructed beforehand

– is ground and polished into the lens fit for short-sighted eyes. Similarly, I must smelt the ore in the blast furnace, change the raw iron into steel, and make the frame therefrom …. Thus, by an exceedingly roundabout way, the end is attained."

[10] An example may not be very far to seek. A country may gradually make more and more sophisticated parts of an automobile or aircraft, to run an assembly plant taking inputs largely from home manufactures; thus adding to the depth of production at home. India, in fact, has been going through such a process.

[11]Our objective is limited to highlighting the interrelations relevant to derived demand for TT service only. So, we do not raise complex questions of agricultural productivity and openness of the economy in the context of an integrated model. For enlightened discussion of these questions the reader is referred to Murphy et al. (1989) and Matsuyama (1992).

[12] For simplicity, we abstract from final services like education, health, etc., that use very little TT service, as our objective is to highlight the role of the key sector (manufacturing) in creating demand for directly linked TT services.

[13]In the present model agriculture and mining also do not use intermediate inputs, so their outputs are the respective sector

's value added too.

[14] An implication of this assumption is that intermediate trade as a proportion of output of the manufacturing sector is constant.

[15] It means70 percent of the value of output is accounted for by intermediate inputs and the ratio did not change much in the course of growing sophistication of manufacturing.

[16] Based on the IOTT for the year.

[17] In reality, we do not expect the figure to be matched by actual observation as we have excluded several activities from our hypothetical economy, restricting the GDP. Further, we have assumed a uniform trade margin under autarky; all the assumptions being abstractions from reality.

[18] Some authors have talked of a reverse causality, which in our view is putting the cart before the horse.

[19] Packaged milk is an interesting example of spread of rudimentary manufacturing. In the absence of processing, milk would be considered a final product of animal husbandry (grouped with agriculture) and it would be distributed largely without the intermediation of traders. The new stage of processing has led to enormous value addition in trade and transport of milk and its products. It is a case of spread of manufacturing.

[20] The same point can be made of transport, which sector uses a lot of intermediate input in the form of oil, which we have ignored.

[21]Treatment of the construction sector in services in the Reserve Bank of India classification is in tune with our model. See Reserve Bank of India, 2018.

[22] Emergence of e-commerce must be affecting the organization and margins of TT services.

[23]Datta (2001) studies the trend of distributive trade services (separately from transport) over 1950-51 to 1996-97. The study concludes that the final trade ratio over the period has been roughly constant while the intermediate trade ratio increased very significantly and steadily over the period both because of what we have called in the present study spread and depth effects (p.86). This is perfectly in tune with our model's conclusion.

[24] The rest of TT service includes direct demand for Transport that is, by definition, outside TT service.

[25] If we compare directly, without taking averages, the ratio has increased from 0.234 in 1978-79 to 0.304 in 2007-08.

[26] We may note here that the weights are significantly different from those obtained at current prices because relative prices have changed quite significantly against manufactures and in favour of service-II.

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Effect of Income Tax Progressivity on the Middle Class: An Analytical Study

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Abstract

This paper analytically relates progressivity of income tax with two fundamentally different metrics, the well-known Lorenz ordering and the bipolarization ordering put forth in Chakravarty (2099, 2015).

Keywords: middle class; progressive taxation; income inequality; income bipolarization.

JEL Classification Codes: D63, D71.

1. Introduction

It has been observed that inequality in India in income, consumption, expenditure and wealth dimensions of measurement have demonstrated an increasing trend since the launch of economic reforms. (See, for example, Chancel and Piketty, 2017 and review of the book ' India: Social Development Report 2018, edited by T. Haque and D.N. Reddy, Council for Social Development/Oxford University Press, published in Hindu Business Line, on June 20, 2019. Data sources: All India household expenditure survey conducted by the National Sample Survey Organization, India Human Development Survey since 2005 and the National Sample Survey Organization decennial All India Debt and Investment survey.) For wealth inequality this has been confirmed by the Forbes' India Rich List. In the US in the period starting in the late 1970s a substantial increase in income inequality has been noted. (See, among others, Piketty, 2014; Atkinson, 2015 and Milanovic, 2016.)

High inequality means concentration of high incomes in the hands of few and is likely to compress the size of the middle class. For instance, the share of the middle 40% income group in the national income of India reduced from 40% in 2000 to 30% during 2013-14. Likewise, in the US a growing concern was about the shrinkage of the middle class in the recent period. (See, Birdsall et al., 2000; Pew Research Center, 2015, 2017 and Fortune, 2018.)

A large and rich middle class of a society contributes to the well-being of a society in many ways, particularly, in terms of higher education level and better health status, so that the middle class emerges as a key provider of skilled labor. A rich middle class makes a considerable contribution to the country's tax revenue and infrastructure.

'…The best political economy is formed by citizens of the middle class, and that those states are likely to be well-administered, in which the middle class is large' (Aristotle, -350). The importance of the size of the middle class has been emphasized in several contributions, including, Wolfson(1994), Wang and Tsui(2000), Easterly(2001) Banerjee and Duflo(2008), Bossert and Schworm(2008), Chakravarty and D'Ambrosio(2010), Foster and Wolfson (2010) and Duclos and Taptue(2015).

In contrast, a society possessing a small middle class and many persons away from the middle income group may give rise to a constrained relationship between the individuals belonging to the subgroups on the two sides of the middle income group which at long last may lead to social unrest and civil war. A small and weak middle class generates weak systems and hence non-continual growth (Birdsall, 2007). High incomes stemming from high economic growth provide higher chances for better systems and state capacity which successively may weaken chances for conflict (McBride, Milante and Skaperdas, 2011) [1].

Since the 1990s the size of the middle class has been closely related to the notion of bipolarization by social scientists. An income distribution that is more spread out from the middle, so that there are fewer individuals in the middle position than in the two extreme positions, is known as more bipolarized (see Wolfson, 1994). This is as well referred to as 'two-peaks' or 'two-components' hypothesis (Quah, 1996).

In a highly interesting recent contribution, Carbonell-Nicolau and Llavador (2020) provided a normative justification for tax progressivity that relies on principles of equity and depolarization. Their 'paper considers the notion of bipolarization put forth in Chakravarty(2009,2015) which is based on an incomplete preorder…..Chakravarty's ordering serves our needs in that it allows for comparisons of distributions with different medians'(Carbonell-Nicolau and Llavador, 2020, p.3). The objective of this paper is to analyze the Carbonell-Nicolau-Llavador result in greater details.

The paper is organized as follows. After introducing the basics and preliminaries in the next section, we briefly define the middle class in Section 3. Section 4 presents the formal framework and Section 5 concludes.

II. The Middle Class

For a population of size $n \in N^n$, an income distribution is represented by a vector $x = (x_1, x_2, ..., x_n)$, where each x_i is positive and N is the set of positive integers. Furthermore, incomes are assumed to be non-decreasingly ordered, that is, $x_1 \leq x_2 \leq x_3 \leq .... \leq x_n$ .Let D^n stand for the set of all income distributions. The set of all

possible income distributions is given by $D = \bigcup_{n \in N} D^n$. For any $x \in D^n$, we write $m(x)$ (or, simply m) for the median of x. Formally, if n is odd, $m(x)$ is simply the $\left(\frac{n+1}{2}\right)^{th}$ observation in x. On the other hand, if n is even, the median is defined as the arithmetic mean of the $\left(\frac{n}{2}\right)^{th}$ and the $\left(\frac{n}{2}+1\right)^{th}$ observations in x. Thus, while in the former situation the median is an observation in the distribution, in the latter situation it may not be.

In order to illustrate this, let the income distribution in a 5-person community be $(2,5,8,9,10)$. Then the median of this distribution is 8. Now, suppose for a 6-person society the distribution is $(2,3,,5,8,9,10)$. The median in this case $\frac{5+8}{2} = 6.5$.

The two alternative approaches that have been suggested in the literature for defining the middle class are respectively the income space-based and population space-based approaches. While the former defines the middle class in terms of a particular income range, the latter views it with respect to the income range covered by a given percentage of the population. For instance, Thurow (1984) followed the former suggestion and used the range $(75-125)\%$ of the median income to define the middle class. Levy (1987) adopted the latter formulation and defined the middle class as that subgroup of the population whose size lies between 20 percent and 80 percent of the entire population. A general formulation of the middle class that follows the former recommendation is the population proportion whose incomes belong to an interval of the form $(am = s_1, bm = s_2)$, where $0 < a < 1$ and $b > 1$ are constants. For a continuous type income distribution with cumulative income distribution F, $F(s_2) - F(s_1)$ represents the middle class and decline of middle class is indicated by a reduction in the population size whose incomes are in the interval (s_1, s_2). This is shown in figure 1(see Chakravarty, 2015).

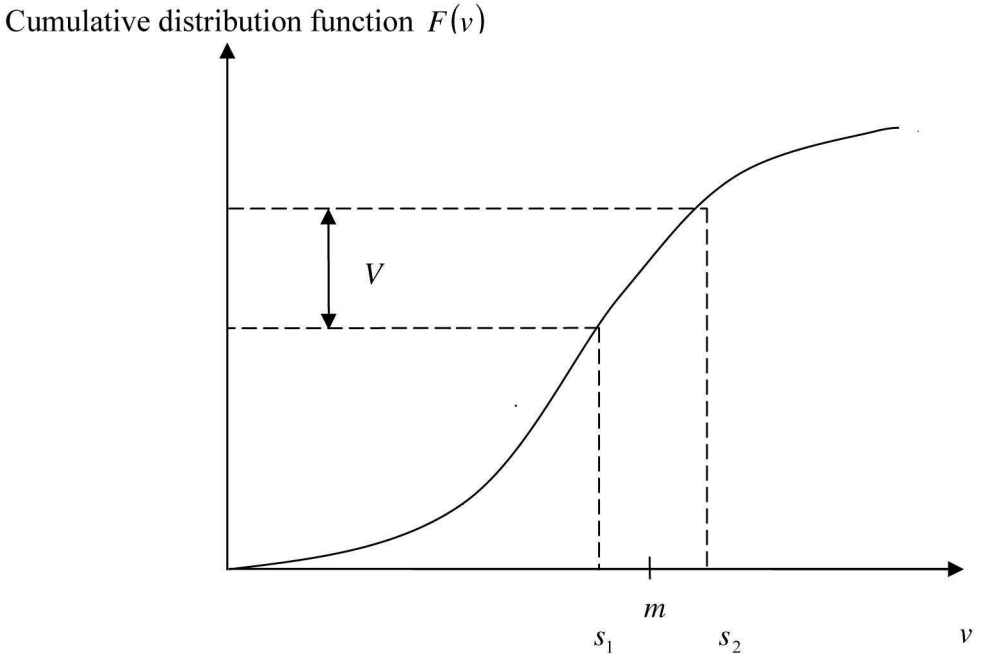

Figure 1: The Middle Class

To illustrate the formulations, let us consider the income distribution $(2,3,,5,8,9,10)$. The Thurow definition states that the middle class corresponds to the population subgroup in the range $(0.75\times 6.5 - 1.25\times 6.5) = (4.875 - 8.125)$. Thus, only the third and fourth persons constitute the middle class. According to the Levy definition, the subgroup with the income distribution $(3,5,8)$ constitutes the middle class.

III. Postulates for a Bipolarization Indicator

Intrinsic to the concept of bipolarization are the postulates 'increased spread' and 'increased bipolarity'. According to increased spread, polarization increases under movements of income from the middle position to the tails of the distribution. Since such a movement increases the spread of the distribution, the characteristic is referred to as increased spread. Hence, the spread of the distribution has a monotonically increasing relationship with bipolarization. Increased bipolarity requires increasingness of polarization under a bunching of incomes below or above the median. Equivalently, we say that polarization should go up if there is a reduction in the gap between any two incomes, above or below the median. Hence polarization incorporates an inequity-like component and an equity-like component. These two aspects may be regarded as alienation and identification factors of polarization[1].

To exemplify these postulates, consider the income distribution $x=(2,5,8,9,10)$ so that $m(x)=8$. We obtain the income profiles $x'=(1.5,,5,8,9,10)$ and $x''=(2,,5,8,9,11)$ from the original profiles by reducing and increasing the minimum and maximum incomes respectively by 0.5 and 1. In each case the spread of the distribution increases making each of them more polarized than x. Evidently, we can also combine the two spread increasing movements to arrive at the profile $x'''=(1.5,,5,8,9,11)$ so that x''' is more polarized than each of x' and x''. Note that a spread increasing movement increases inequality.

Next, $\bar{x}=(3,4,8,9,10)$ and $\hat{x}=(2,5,8,9.2,9.8)$ are obtained from x respectively by a (progressive) transfer of 1 unit of income from person 2 to person 1 and a (progressive) transfer of size 0.2 from person 5 to person 4. Thus, while is transformed into a by clustering of incomes below the median, the transformation involves a clustering above the median. In each case polarization goes up. The two transformations can be combined to generate the distribution , which is more polarized than and . Evidently, the increased bipolarity principle criterion increases equality.

While increased spread and increased bipolarity are treated as major ingredients of bipolarization, other features of an indicator of bipolarization are anonymity, the Daltonian population principle, scale invariance and continuity. Anonymity demands that any characteristic other than incomes is irrelevant. This postulate enables us to define a polarization evaluator directly on ordered profiles, as has been done. The Daltonian population principle claims that a polarization indicator should remain unchanged under replications of population. This property is helpful for intersociety polarization comparison. According to scale invariance, a polarization statistic remains unaltered under equi-proportionate changes in incomes. Continuity, a technical postulate, does not make the indicator over responsive to minor observational errors on incomes.

To state the postulates formally, we need some preliminaries.

Definition 1: For all $n\in N$, $x,y\in D^n$, x is said to be derived from y by a simple increment if $y_j+\theta=x_j$ for some j and $x_i=y_i$ for all $i\neq j$, where $\theta>0$.

In the above definition the distributions x and y are identical accept that only the j^{th} person's income in y has gone up by an amount θ and his income in x is the increased amount $y_j+\theta$. This transformation is denoted by the inequality $x\geq y$.

Definition2: For all $n \in N, x, y \in D^n$, x is said to obtained from y by a Pigou –Dalton progressive transfer ,which is denoted by xTy , if for some pair (i, j) and $\theta > 0$,

$$x_i = y_i + \theta \leq x_j ,$$

$$x_j = y_j - \theta ,$$

and $x_k = y_k$ for all $k \neq i, j$.

In words, we deduce x from y by a transfer of θ units of income from a rich person j to a poor person i . This is equivalent to the statement that y is derived from x by a regressive transfer. Since incomes are assumed to be ordered, the two transformations considered in the above definitions are rank preserving.

A bipolarization index P is a real valued function defined on D .Formally, $P : D \to R^1$, where R^1 is the real line. For any $n \in N, x \in D^n$, $P(x)$ determines the level of polarization associated with x . Let $\bar{n} = \frac{n+1}{2}$. For any $n \in N, x \in D^n$, we write x_- and x_+ for the sub-vectors of x that include x_i for $x_i < m(x)$ and $x_i > m(x)$, respectively. That is, for any $n \in N, x \in D^n$, $x = (x_-, x_+)$ if n is even and $x = (x_-, m(x), x_+)$ if n is odd. Thus, for $x = (2,5,8,9,10)$, $x_- = (2,5)$ and $x_+ = (9,10)$.

Following Chakravarty(2009, 2015), we now formally state the axioms for a polarization index P .

Increased Spread (IS) : For all $x, y \in D$, where $m(x) = m(y)$, if x and y are related through anyone of the following cases: (i) $\hat{x}_+ = \hat{y}_+$, $\hat{y}_- \geq \hat{x}_-$, (ii) $\hat{x}_- = \hat{y}_-$, $\hat{x}_+ \geq \hat{y}_+$, (iii) $\hat{y}_- \geq \hat{x}_-$, $\hat{x}_+ \geq \hat{y}_+$, then $P(x) > P(y)$.

Increased Bipolarity (IB): For all $x, y \in D$, where $m(x) = m(y)$, if x and y are related through anyone of the following cases: (i) $\hat{x}_- T \hat{y}_-$, $\hat{x}_+ = \hat{y}_+$, (ii) $\hat{x}_+ T \hat{y}_+$, $\hat{x}_- = \hat{y}_-$, (iii) $\hat{x}_- T \hat{y}_-$, $\hat{x}_+ T \hat{y}_+$, then $P(x) > P(y)$.

Anonymity (AN): The polarization index $P : D \to R^1$ remains invariant under any reordering of incomes.

Daltonian Population Principle (PP): The polarization index $P : D \to R^1$ is population replication invariant.

Scale Invariance (SI): The polarization index $P : D \to R^1$ is homogenous of degree zero.

Continuity (CN): For all $n \in N$, P is a continuous function on D^n.

An example of a bipolarization index that verifies the above postulates is

$$P_C(x) = \left(\frac{1}{mn} \sum_{i=1}^{n} |m - x_i|^r \right)^{\frac{1}{r}}, \qquad (1)$$

where $0 < r < 1$ is a parameter. The sign restriction $0 < r < 1$ is necessary and sufficient for P_C to fulfill IS and IB. For $r = 1$, P_C is the relative mean deviation about the median, which, although meets IS, violates IB. If for an income distribution x, $\sum_{x_i \le m} (m - x_i) = \sum_{x_i \ge m} (x_i - m)$ holds, then from policy point of view, for $r = 1$, $\frac{mnP_C(x)}{2}$ determines the total amount of money needed to be transferred from all the persons with incomes above the median income to all the persons with incomes below the median income so that polarization for the post-transfer distribution becomes 0. Therefore, in this particular case, $\frac{mnP_C(x)}{2}$ may be regarded as the cost of polarization. Alternatively, this is the total amount of money that becomes necessary to bring all the persons with incomes below the median income at the median income itself. This can be verified using the example $x = (2,5,8,11,14)$.

In order to make a systematic comparison between inequality and polarization, we consider an arbitrary inequality index $I : D \to R^1$. It should satisfy the Dantonian population principle, anonymity and scale invariance conditions. It should reduce under a Pigou-Dalton progressive transfer. A standard example of an inequality index of the desired type is the well-known Gini index defined as

$$I_G(x) = \frac{1}{2n^2 \mu} \sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|, \qquad (2)$$

where μ is the mean income. Given that incomes are non-decreasingly ordered, we can rewrite

I_G as

$$I_G(x) = 1 - \frac{1}{n^2 \mu} \sum_{i=1}^{n} [2(n-i)+1] x_i . \qquad (3)$$

To understand the difference between the two notions of measurement more explicitly, consider the distribution $x = (2,5,8,11,14)$ so that $m = \mu = 8$. The profile $y = (2,5,8,12,13)$ is derived from x by a redistribution of incomes between persons 4 and 5. We note that

$$I_G(x) = \frac{30}{100} > I_G(y) = \frac{29}{100} .$$

Next, for $r = 0.5$,

$$P_C(x) = \frac{2}{40}\left(\sqrt{6} + \sqrt{3}\right) = \frac{8.2}{40} < P_C(y) = \frac{1}{40}\left(\sqrt{6} + \sqrt{3} + 2 + \sqrt{5}\right) = \frac{8.3}{40} .$$

Thus, while inequality has gone down, polarization has gone up.

IV. Lorenz and Bipolarization Quasi-Orderings

For any income distribution $x \in D^n$, the Lorenz curve of $x \in D^n$ is the plot of $L\left(x, \frac{j}{n}\right) = \frac{\sum_{i=1}^{j} x_i}{n\mu(x)}$, the proportion of total income possessed by the bottom j proportion of the population, $0 \le j \le 1$. The closer is the curve to the line of equality, the more equal the distribution is(see figure 2). Twice the area enclosed between the Lorenz curve and the line of equality becomes the well-known Gini index.

Of two income distributions $x, y \in D^n$, y is said to be Lorenz superior to x, what we write $y \ge_{LS} x$, if the Lorenz curve of y is nowhere below that of x and is inside in some places (at least) (see Sen., 1973). Formally, $\frac{\sum_{i=1}^{j} x_i}{n\mu(x)} \le \frac{\sum_{i=1}^{j} y_i}{n\mu(y)}$ for all $j = 1,2,...,n$, with $>$ for at least $1 \le j < n$. In figure 2, both $x^1 \ge_{LS} x^3$ and $x^2 \ge_{LS} x^3$ hold, but neither $x^1 \ge_{LS} x^2$ nor $x^2 \ge_{LS} x^1$ holds. Hence, $\ge_{LS}$ is an incomplete, irreflexive relation, although it is transitive. That is why, it is also referred to as a quasi-ordering.

For the distributions $x=(2,5,8,11,14)$ and $y=(2,5,8,12,13)$, $y \geq_{LS} x$ holds since we have $\frac{\sum_{i=1}^{j} x_i}{n\mu(x)} = \frac{\sum_{i=1}^{j} y_i}{n\mu(y)}$ for j=1,2, 3 and $\frac{\sum_{i=1}^{j} x_i}{n\mu(x)} < \frac{\sum_{i=1}^{j} y_i}{n\mu(y)}$ for j=4. At the terminal point j=5, the two sums coincide. Now, let $z=(1,6,8,12,13)$. It is easy to verify that neither $z \geq_{LS} x$ nor $x \geq_{LS} z$ is true, although $y \geq_{LS} z$ is verified.

The following result has been demonstrated by Foster (1985).

Proposition: Let $x, y \in D^n$ be arbitrary. Then the following statements are equivalent:

$(i)\, y \geq_{LS} x$.

$(ii)\, I(y) < I(x)$ for all inequality indices $I : D^n \rightarrow R^1$ that fulfill anonymity, the Pigou-Dalton transfer principle and scale invariance.

In words, y is Lorenz superior to x if and only if y is regarded as less unequal then x by all anonymous, scale invariant inequality indices that satisfy the Pigou-Dalton transfer principle.

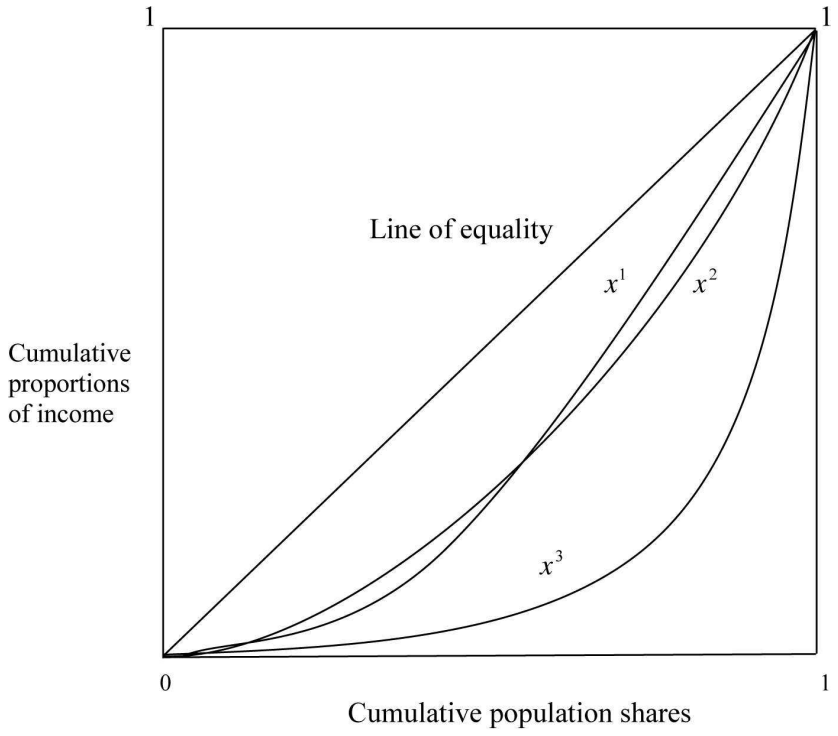

Figure 2: Lorenz curve and Lorenz Superiority

The bipolarization curve of an income distribution is obtained by plotting the normalized value of the distance between the income share enjoyed by any population proportion and the corresponding share that it would enjoy if everybody possesses the median income against the population proportion. Formally, for any $x \in D^n$, assuming that n is odd, the ordinate of the bipolarization curve of x at the population proportion $\frac{j}{n}$, where $1 \le j < \overline{n}$, is given by $B\left(x, \frac{j}{n}\right) = \frac{1}{nm} \sum_{j \le i < \overline{n}} (m - x_i)$, where $\overline{n} = \frac{n+1}{2}$. The corresponding ordinate, for incomes are not below the median, is given by $\frac{1}{nm} \sum_{\overline{n} \le i \le j} (x_i - m)$. A similar construction follows when n is even. Thus, while for a Lorenz curve the mean is the reference income, for a bipolarization curve the reference income is the median.

If the income distribution is equal, the curve coincides with the horizontal axis, the axis that represents the cumulative population proportions. For a bipolarization curve, this is the line of equality. The closer is the curve toward the horizontal axis, the less is polarization. For an unequal income distribution, the curve decreases over $\left[0, \frac{\overline{n}}{n}\right)$, whereas it increases over $\left(\frac{\overline{n}}{n}, 1\right]$. At the population proportion $\frac{\overline{n}}{n}$, it coincides with the horizontal axis.(See Chakravarty, 2009,2015.)

For the distribution $x = (2,5,8,11,14)$, the curve is a plot of the values $\frac{(8-2)+(8-5)}{5 \times 8} = \frac{9}{40}$, $\frac{3}{40}$, 0, $\frac{3}{40}$ and $\frac{9}{40}$ against $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$ and 1 respectively. For the distribution $(2,3,5,8,9,10)$, the curve is obtained by plotting the values $\frac{9.5}{6 \times 6.5} = \frac{9.5}{39}$, $\frac{5}{39}$, $\frac{1.5}{39}, \frac{1.5}{39}$, $\frac{4}{39}$ and $\frac{7.5}{40}$ against $\frac{1}{6}, \frac{2}{6}, \frac{3}{6}, \frac{4}{6}, \frac{5}{6}$ and 1 respectively. The curve is completed by extrapolating it linearly from the ordinate $\frac{1.5}{39}$ corresponding to the population proportion $\frac{3}{6}$ to the horizontal axis

and then extrapolating it linearly to the ordinate $\frac{1.5}{39}$ that corresponds to the population proportion $\frac{4}{6}$.

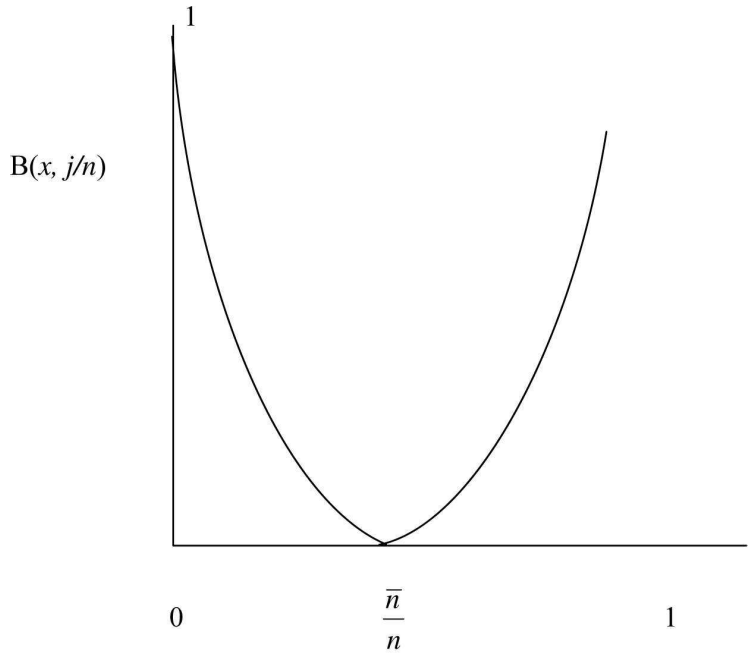

Figure 3: Bipolarization curve

Of two income distributions $x, y \in D^n$, y is said to be depolarization superior to x , what we write $y \geq_{DPS} x$, if the bipolarization curve of y is nowhere above that of x and is below in some places (at least) (see Chakravarty, 2009, 2015). That is, $y \geq_{DPS} x$ means that $B\left(y, \frac{j}{n}\right) \leq B\left(x, \frac{j}{n}\right)$ for all $1 \leq j < n$, with strict inequality for at least one j .

V. Income Tax Progressivity, Lorenz and Bipolarization Quasi-Orderings

A strong normative justification for progressivity of income taxation is equality. A tax schedule T is a real valued continuous function of incomes. Formally, $T : D^1 \rightarrow R^1$ .For

any $x \in D^n$, let $T(x)$ denote the vector of taxes associated with x so that $x - T(x)$ comes to be the resulting post-tax income distribution. More specifically, for any income x_i, $T(x_i)$ is the corresponding tax and $x_i - T(x_i)$ is the post-tax income, $1 \le i \le n$. A tax schedule is said to be average rate progressive if it demonstrates increasing average tax rate, that is, $\frac{T(z)}{z}$ is increasing in z. Under differentiability of the tax function this condition means that marginal tax rate is higher than average tax rate. A tax schedule is said to be incentive preserving if the post-tax income is a non-decreasing function of the pre-tax income. Thus, a person who is earning more does not have a less post-tax income than someone who is earning less. An incentive preserving tax schedule does not alter the pre-tax ranking of the tax payers in the post-tax profile.

To illustrate this, consider the income distribution $u = (5,10,15,20,30)$ and $T(u) = (1,2.5,5,8,15)$ so that the means of the pre-and post-tax distributions are respectively 16 and 9.7. For this example, $\frac{T(u_1)}{u_1} = \frac{1}{5} < \frac{T(u_2)}{u_2} = \frac{2.5}{10} < \frac{T(u_3)}{u_3} = \frac{5}{15} < \frac{T(u_4)}{u_4} = \frac{8}{20} < \frac{T(u_5)}{u_5} = \frac{15}{30}$. Hence the tax function is average rate progressive. Evidently, this tax schedule is incentive preserving as well.

Now, consider the distribution $v = \frac{16}{9.7}(u - T(u)) = \frac{16}{9.7}(4,7.5,10,12,15)$. The pos-tax distribution $(u - T(u))$ and its transformed counterpart v have the same mean 16. Since the Lorenz curve is scale invariant, $L\left(v, \frac{j}{n}\right) = L\left((u - T(u)), \frac{j}{n}\right)$ for all $0 \le j \le n$. That is, the Lorenz curves of $(u - T(u))$ and v coincide. Now,

$L\left(v, \frac{1}{5}\right) = \frac{6.4}{80} > \frac{5}{80} = L\left(u, \frac{1}{5}\right)$, $L\left(v, \frac{2}{5}\right) = \frac{18.4}{80} > \frac{15}{80} = L\left(u, \frac{2}{5}\right)$,

$L\left(v, \frac{3}{5}\right) = \frac{34.4}{80} > \frac{30}{80} = L\left(u, \frac{3}{5}\right)$, $L\left(v, \frac{4}{5}\right) = \frac{37.6}{80} > \frac{35}{80} = L\left(u, \frac{4}{5}\right)$ and $L(v,1) = L(u,1) = 1$.

Hence $L\left(v,\frac{j}{5}\right) > L\left(u,\frac{j}{5}\right)$ for all $1 \le j \le 4$. That is, the distribution v (hence the pos-tax distribution) becomes Lorenz superior to the pre-tax distribution.

This example may be regarded as an illustration of the following theorem.

Theorem 1(Eichhorn, Funke and Richter, 1984): For any $x \in D^n$, the following statements are equivalent:

(i) The tax schedule T is average rate progressive and incentive preserving.

$(ii)\ (x - T(x)) \geq_{LS} x$.

In words, average rate progressivity and incentive preservation of a tax scheme is necessary and sufficient for the post-tax distribution to be Lorenz superior to the pre-tax distribution. Equivalently, we say that these two conditions on the tax function ensure inequality reduction.(See also Fellman, 1976; Jakobsson, 1976 and Chakravarty and Moyes, 2003 .)

Observe that the medians of the distributions $u = (5,10,15,20,30)$ and $u - T(u) = (4,7.5,10,12,15)$ are respectively 15 and 10. Since the bipolarization curve is scale invariant, the bipolarization curves of $u - T(u) = (4,7.5,10,12,15)$ and $\bar{v} = \frac{15}{10}(u - T(u)) = (6,11.25,15,18,22.5)$ coincide. Formally, $B\left(\bar{v},\frac{j}{n}\right) = B\left((u - T(u)),\frac{j}{n}\right)$ for all $0 \le j \le n$. Now,

$$B\left(\bar{v},\frac{1}{5}\right) = \frac{12.75}{75} < \frac{15}{75} = B\left(u,\frac{1}{5}\right), B\left(\bar{v},\frac{2}{5}\right) = \frac{3.75}{50} < \frac{5}{50} = B\left(u,\frac{2}{5}\right), B\left(\bar{v},\frac{3}{5}\right) = 0 = B\left(u,\frac{3}{5}\right),$$

$B\left(\bar{v},\frac{4}{5}\right) = \frac{3}{50} < \frac{5}{50} = B\left(u,\frac{4}{5}\right)$ and $B(\bar{v},1) = \frac{10.5}{50} < \frac{20}{50} = B(u,1)$. Hence the post-tax distribution is depolarization superior to the pre-tax distribution.

The following innovative result of Carbonell-Nicolau and Llavador(2020) demonstrates this in a formal framework.

Theorem 2 (Carbonell-Nicolau and Llavador, 2020):: For any $x \in D^n$, the following statements are equivalent:

(i) The tax schedule T is average rate progressive and incentive preserving.

$(ii)\ (x - T(x)) \geq_{DPS} x$.

This theorem establishes that a post-tax income distribution is depolarization superior to its pre-tax counterpart if and only the underlying tax schedule is average rate progressive and incentive preserving.

We may now combine Proposition 1, Theorems 1 and 2 and Theorem 2.3 of Chakravarty(2015) to arrive at the following:

Theorem 3: For any $x \in D^n$, the following statements are equivalent:

(i) The tax schedule T is average rate progressive and incentive preserving.

$(ii)\ (x - T(x)) \geq_{LS} x$.

$(iii)\ (x - T(x)) \geq_{DPS} x$.

$(iv) I((x - T(x))) < I(x)$ for all inequality indices $I : D^n \to R^1$ that fulfill anonymity, the Pigou-Dalton transfer principle and scale invariance.

$(v) P((x - T(x))) < P(x)$ for all bipolarization indices $P : D^n \to R^1$ that fulfill anonymity, scale invariance , the increasing spread and increasing bipolarity postulates.

Theorem 3 clearly demonstrates that an average rate progressive, incentive preserving tax scheme is inequality reducing if and only if it is polarization reducing. The intuitive reasoning behind this result is that depolarization in this case involves a tradeoff between spread reduction and equity increase. Equity increase increases polarization, but spread reduction decreases polarization. In this case the tradeoff balances out in favor of spread reduction and polarization reduces. This ensures that the position of the middle class improves under an average rate progressive, incentive preserving tax scheme.

VI. Concluding Remarks

The indices of polarization we have considered in this paper are of relative type; they remain unaltered under an equal proportionate change in all incomes. This contrasts with the notion of absolute polarization invariance, which requires polarization indices to stay unchanged when equal absolute changes in all incomes take place(see Chakravarty, Majumder and Roy, .2007) Each of these two invariance notions reflects a particular value judgment and debatable to some extent. For instance, while a proportionate increase in all incomes widens their absolute gaps, an absolute reduction in all incomes increases ratios among them. Often policy makers do not prefer such extreme positions. Bossert and Pfingsten (1990) suggested a compromise notion of invariance, intermediate inequality invariance, that contains relative and absolute concepts as polar cases.(For its merits and demits, alternative and variations, see Chakravarty, 2015.)

Given incentive preservation, while for relative inequality reduction increasingness of average tax liability is necessary and sufficient; for absolute inequality reduction the analogous condition is minimal progressivity, increasingness of tax liability with income. (See Moyes, 1988. See also Chakravarty and Moyes, 2003.) It may be worthwhile to note that incentive preservation does not imply minimal progressivity. To see this, consider the pre-tax distribution $(2,10,20)$ whose corresponding post-tax distribution is $(1,1,12)$ so that the tax vector is $(1,9,8)$. The underlying tax function is definitely incentive preserving but not minimally progressive.

For a tax schedule to be intermediate inequality reducing, the unique conditions on the tax function were developed by Pfingsten (1986). Chakravarty and D'Ambrosio(2010) adopted the Bossert-Pfingsten suggested an intermediate invariance concept and identified the class of intermediate polarization indices whose orderings of alternative income distributions agree with the rankings generated by the corresponding intermediate polarization curves. It will be worthwhile to identify the class of tax functions that shows consistency between the Pfingsten (1986) condition and the Chakravarty-D'Ambrosio intermediate polarization ordering. We leave this as a future research program.

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Notes :

It may be noted here that the classical economists were concerned with the increase in wealth in the society and its distribution across class subgroups, which was regarded as a source of conflict (Robbins, 1939). For further discussion, see Dasgupta (1985).

In the literature bipolarization is distinguished from multi polar polarization which does not capture the size of the middle class (see Esteban and Ray, 1994; Duclos, Esteban and Ray,2004; Montalvo and Reynal-Querol,2005; and Chakravarty and Maharaj, 2011). For a detailed comparisons, see Chakravarty(2009, 2015) and Esteban and Ray(2012).

If in $P_C(x)$ given by (1), we replace the median income m by the mean income μ, then the resulting inequality index reduces under a progressive income transfer for all $r > 1$.This inequality index becomes the coefficient of variation and the relative mean deviation about the mean for $r = 2$ and $r = 1$ respectively. As $r \to \infty$, it approaches the relative Rawlsian (1971) maximin inequality index.

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Inequality in Education: Aspects of Opportunities and Processes in India+

Debdas Banerjee[1]

It is indeed a great privilege for me to address this august gathering. I am grateful to the members of the *Parishad* for giving me this opportunity. This presentation is part of a larger study undertook as Senior Fellow and submitted to ICSSR. The detailed statistical results including those on higher educationand cooperative federalism are not reproduced here.Instead, we highlight the analytical framework to examine the key factors explaining inequality. What I wish to stress is that the public policies by way of ignoring the 'process aspects' of inequality have been proliferating various asymmetries in the system of education.

I. Introduction

Education can impart skills of three types, namely,first, academic skills that get directly measured through maths and literacy; second, generic or life skills that generally include critical and creative thinking, behavioural and computing skills; and,third, technical skills directly associated with one's profession. The basic academic and generic skills are arranged in the primary education systems, while the secondary education systems can provide more advanced academic and generic skills, as well as some technical skills. Tertiary education systems, on the other hand, are meant for all three types, of a higher order.

Two critical concernsin contemporary educational development in India are (a) growing inter-personal as well as inter-regional inequalities (measured in terms of years of schooling); and, (b) dwindling average quality of learning outcomes. Thus,some are beneficiaries of a few 'pockets' of better learning, while the overwhelming 'rest' are losers in the labour market.And, thesystem fails to accumulate 'cultural capital'.

Inequality in education contributes the most to overall inequality, followed by inequality in life expectancy, and incomeinequality in India (UNDP, various years). Educational inequality measured in terms of years of schooling, of course, is a partial reflection of overall inequalityas it ignoresdifferential*quality* of teaching-learning outcomes across institutions.Further, if gross attendance ratio (GAR) (as measured in NSSO surveys) at any level of education was considered, inequality index goes further north.

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The critical question from the equity point of view is: 'Equality of what?' The relevance of human capability formation for freedom suggests the need for innovative lines of investigation dealing with the development of cognitive and constructive powers (Sen, 2009, p. 234). This is a fundamental paradigmatic shift from the *means* of living to the *actual opportunities* a person has away from the notional *equality* of opportunities, which the *Right of Children to Free and Compulsory Education Act, 2009* (henceforth, RTE Act) assures. Equity does not mean equality of capability that the society aims at, as AmartyaSen argues. The focus of the capability approach is that "can the person actually do these things or not?" (Sen, 2009, p. 307). Further, "An institution or a policy may well be defended not on the grounds that it enhances capability equality, but for the reason that it expands the capabilities of all, even if there is no distributional gain" (Sen, 2009, p. 298). It is a momentous distinction to be recognized in the making of public policy beyond mere concerns about *efficiency*.

Since education has positive *externalities* (or, spill overs), Pareto efficiency condition is inapplicable. However, there may have the social choice dilemma in allocating public resources, first, between 'expanding out' and 'expanding up'. Second, it is the dilemma between allocations in educational sector and other competing social sectors, such as, public health and poverty alleviation from the concern for efficiency, or for equity and social justice.

However, the aims of equity do not always come to terms with efficiency. In education, the term *equity* encompasses a wide variety of educational models, programs, and strategies that may be considered fair, but not necessarily equal. On the other hand, *efficiency* refers to output in relation to inputs. Unlike other commodities where production function approach — i.e. so much of inputs, in quantity or value terms result in quantifiable output — is applicable, schooling is a cumulative process by which cognitive skills are learned by a heterogeneous group. According to Kenneth Arrow, "In education … the problem of efficiency is more *what we should be efficient about* [emphasis – DB] than whether we should be efficient" (Arrow, 1993, p. 7). Asymmetric information in education is exceptionally high and, thus, the market mechanism is inimical to equality of opportunities. The capital market for students (to financing education by borrowing) "does exist to some extent, but it is far from perfect" (Arrow, 1993, p. 9). The correct trade-off between equity and efficiency objectives depends upon the strategic planning of the government to correct certain distributional issues, which is not about 'why equality?' but about 'equality of what?'.

The RTE Act while has codified opportunities for all the school-age children, transformation of the opportunities to capabilities varies between children, between different communities, and between children with varying cognitive abilities due to socioeconomic disparities in childhood (Noble, Houston, Kan, & Sowell, 2012). Therefore, different people can have widely varying opportunities to convert general resources into capabilities. The common hypothesis is that educational inequality is directly proportional to income inequality.

To our dismay, state-wise dropout rates at various levels of school education is not explained by the poverty ratio (i.e. percentage of population below poverty line in 2011-12) in the states, in cross-section analysis. Also, state-wise distribution of *mean years of schooling* (MYS) is not found to have a strong correlation with either monthly per capita consumer expenditure (MPCE), or the distribution of monthly income (Ministry of Rural Development, 2011). While income distribution is found to be most unequal among the states, MYS in Chhattisgarh is higher than in either Bihar, Rajasthan, or Madhya Pradesh. In 15 of the states, households having monthly income of less than [1] 5,000 (of highest earning household member) constitute 70-80 per cent of the total number of households in the rural areas. Yet, the range of variation in MYS (rural) across these states is wide; with Bihar and Rajasthan at the lower end, as against Kerala, Tamil Nadu and Uttarakhand at the upper end.

We have also compared a different set of data on the likely association between income poverty and education at the district-level. The *NITI Aayog* in 2017 identified as many as 115 most backward districts in India for the purpose of special attention by GoI. It has ranked these districts in terms of poverty, and their corresponding ranks in health, education, and infrastructure. The correlation between ranks in poverty and education, respectively, however, draws a flak (coefficient = - 0.00410). In brief, had there been a reliable correlation of poverty ratio or income inequality with MYS, in different states, the conclusion was straightforward. However, the situation is found to be different, and thus needs a different paradigm of analysis.

II. Fiscal spending as statutory opportunities

As regard the economics of education, Mark Blaug comments on the concept of rate of returns to human capital:

> We can measure private and social returns to educational investment but since we cannot specify, much less measure, the externalities generated by educated individuals, not to mention the consumption benefits of education, the 'social' rate of return to education is a bogus label. But even if the externalities of education were nil, it would still be true that we have been unable to separate the productivity from the screening functions of schooling and hence cannot even say what the social rate of return to education actually means. Is it cognitive knowledge or effective behavioural traits that make educated workers valuable to employers? (Blaug, 1989, p. 332).

So far as the demand pattern of basic education is concerned, it is different as of a public good than when it is a private good. Another problem related to this is that of finding the equilibrium supply of education. A situation of oversupply or undersupply of public provision can happen quite frequently. Stiglitz attempts to find the equilibrium level of

education in private, mixed public-private school systems, and public-school systems, viewing education separately as a public consumption good, a private capita1 good, a private consumption good, and a source of information about individual's abilities, respectively. And, the conclusion is that the determination of the equilibrium level of education is not likely to be at the 'efficient' level in private, mixed public-private systems, and public education systems (Stiglitz, 1974, p. 384). The equilibrium level of expenditure on education is likely to differ markedly depending on the institutional arrangement for its provision — public, mixed private-public, or purely private — but in none of these cases is the level of expenditure necessarily Pareto optimal. In fact, the source of the problem is the estimation of demand. Education is a strategic issue in a country like India and cannot be delinked from the employment policy, to a great extent. When the labour market prospect is dull, it is difficult to anticipate whether the demand-, or the supply-side factors would be decisive.

Based on the understanding that there is a distinction between the statutory *opportunity* that a person has (out of certain inputs supply) and the *process* that transforms statutory into *actual* opportunity, given the person's personal and social circumstances (Sen, 2000), let us propose that:

Years of schooling (of *i*-th individual) = $f(I_{hh}, I_{ins}, w_i, u)$;

where, I_{hh} = Individual/household's investments on education; I_{ins} = Institutional investments on education (for school infrastructure, pupil-teacher ratio, school and teacher characteristics, etc.); w_i = *i*-th individual/household's initial endowments (such as, income, household assets, intellectual property of the household, social status where the neurobiological pathways through which socioeconomic disadvantage shapes cognitive and socio-emotional development, etc); and, u = *'residual'* factors. 'u' includes such factors as household economic characteristics, child characteristics, prices related to schooling, teacher absenteeism, skills learned (or learning outcome), short-, and long-term stability (or, instability) in the labour market, government policies regarding education in respective states, and the spectrum of available 'choices' to individual/household (freedom of choice of school, English language learning, vocational education, etc.).

'I_{hh}' and 'I_{ins}' are two distinctively different but complementary domains of decision-making. Although institutional investment can provide the educational or training facilities, only individual's efforts and investments will make it possible for them to take advantage of them. "Unless the two kinds of investments match there can be only empty, or over-crowded classrooms and under-, or over-subscribed training programs" (Majumdar, 1983, p. 28). The 'mismatch' between 'I_{hh}' and 'I_{ins}' is expected to be explained by 'w_i'. If it does not, 'u' would do. Investment decision of each and every individual/household are not based on the

same 'set' of considerations, and many of the factors are not even quantifiable. Investments by the 'institutional domain' may have differential impact on individual/household depending on how strong or weak are the effects of the 'residual' factors. Further, when other three variables at work fail to fully explain the variations in the years of schooling, like the 'Solow residual', '*u*' becomes instrumental to explaining interpersonal variations in years of schooling. Despite free elementary education in government school and free mid-day meal, GER lower-than 100 per cent may find a great deal of explanation in the residual factors, i.e. '*u*'. Another reason of 'I_{hh}' and 'I_{ins}' not expected to have a *perfect* statistical correlation is the 'time-horizon' aspect of *complementarity* of domains. Individual investment decision is one generational, while institutional investments in education are transgenerational; institution has to add on existing facilities for several generations of students (Majumdar, 1983).

Finally, when education is a 'public good' (*non-rivalrous* and *non-excludable*), 'w_i' becomes insignificant in the determination of years of schooling. In general, school education is a 'Merit good' (limited in supply, *rivalrous*, i.e.admissions of some in a school reduces availability of seats to others, so *excludable*, prone to rejections by those unwilling to pay, and have *externalities*). Thus, 'w_i' plays an important role in accessibility.

Institutional investments ('I_{ins}')

One of the crucial determinants of growing educational inequality is the dwindling share of the Centre's share to total public expenditure in school education, while the backward states are struggling with revenue mobilisations given their burdens of the social sectors (*Table 1*). The subject 'education' though originally allotted by the Constitution to the exclusive State field, by the Constitution (42nd Amendment) Act, 1976 it was transferred from the State-List to the Concurrent List. Further, the operational part of RTE Act began during the 9th Plan period with sharing the costs between the centre and the states in the ratio of 85:15. Subsequently, the states have been sharing an increasing burden of the total expenditure. Since 2015-16, the funding pattern revised to 60:40 between the centre and the states, except the eight North-Eastern States and other three states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand where the basis of sharing is 90:10.

Table 1 **Financing education, sector-wise: states and the centre, by sectors**

Sector of education	2012-13 (actual)				2013-14 (revised estimates))				2014-15 (budget estimate)			
	States'sectoralExp. (%)	Centre'ssectoralExp. (%)	States' share to Total public Exp. (%)	Centre's share to Total public Exp. (%)	States'sectoralExp. (%)	Centre'ssectoralExp. (%)	States' share to Total public Exp. (%)	Centre's share to Total public Exp. (%)	States'sectoralExp. (%)	Centre'ssectoralExp. (%)	States' share to Total public Exp. (%)	Centre's share to Total public Exp. (%)
Elementary	43.5	42.7	76.0	24.0	42.3	42.2	76.6	23.4	46.6	40.5	78.1	21.9
Secondary	28.8	11.0	89.0	11.0	29.0	10.7	89.8	10.2	28.5	11.5	88.5	11.5
University& higher education	15.7	21.0	69.9	30.1	16.5	22.3	70.7	29.3	14.3	22.1	66.7	33.3
Adult education	0.2	0.5	50.5	49.5	0.2	0.5	54.0	46.0	0.2	0.5	61.2	38.8
Technical	11.9	24.8	59.7	40.3	12.0	24.3	61.8	38.2	10.4	25.4	56.1	43.9
Total (Education)	100.0	100.0	75.6	24.4	100.0	100.0	76.6	23.4	100.0	100.0	75.6	24.4

Source and *notes*: Computed from (MHRD, 2017). The State's share and Centre's share in a sector, in any particular year, add up to '100'.

Ever since India approached the long-awaited milestone of 25 per cent GER (for 18-23 years) in higher education the priority been distinctively shifting from 'Expanding out' to 'Expanding up'. However, to note, half-of-the numbers of states are still languishing much below 25 per cent GER in higher education. The country that began with more-than 100 per cent GER in Class I since adopting *SarvaShikshaAbhiyan* (SSA) by the turn of the century ends up with 75 per cent or more 'missing' from the system by the time the boys and girls are 18 years old. It is also important to note that GER in Class I started to decline after reaching its peak of 115.5 per cent in 2010-11.

So far as the Centre's funding is considered, more-than-half of the total GoI expenditure on primary education are financed by the Primary Education *Cess* collections by GoI, during the period from 2004-05 to 2016-17 (Ministry of Finance, 2018). In any particular financial year, say, in 2015-16, total revenue collection of GoI as Education Cess was [1] 47,182.52 crores (Ministry of Finance, 2017), which constituted not-less-than 70 per cent of the budgeted (Revised estimate) expenditure of Ministry of Human Resource Development (MHRD) on school and higher education in the year. Moreover, though primary together with secondary education, rather than higher education, plays greater role in targeting poverty, it is the latter that receives disproportionate share of the fiscal resources. As such, the budgetary allocation to the MHRD in the Union Budget has been declining. It was 6.15 per cent in 2014-15 and steadily declined to 3.48 per cent in 2018-19 (Budget estimate, BE). It would

be even lower if the huge additional allocation in 2018-19 over that in 2017-18 to the Higher Education Financing Agency (HEFA) was deducted from the total allocations.

Sector-wise, the disproportionality in government expenditure as a ratio of total expenditure on education in India is distinctly noticeable (*Table 2*). In pre-primary, it marginally exceeds one per cent, which is exceptionally low when compared with some other distinguished countries in educational development. Moreover, this sector is overwhelmingly left to the *anganwadi* centres, which aim to take care of both the health and preschool non-formal education, under the Ministry of Women and Child Development (MWCD). And, in doing so under a different administrative setup, it fairly fails to work as an effective agency for preschool education, apart from preliminary preparedness in language and communication. The core content of orientations in other cognitive areas remain neglected.

Table 2 **Sector-wise government expenditure on education, average of 2009 to 2015 (%)**

Country	Pre-primary	Primary	Secondary	Tertiary	Total
Denmark	13.1	24.8	34.3	28.0	100.1
Finland	8.3	19.3	42.2	30.0	99.8
South Korea	4.6	31.4	38.6	17.8	92.4
Singapore		21.0	23.3	35.7	80.0
Sweden	13.4	23.3	31.0	27.0	94.8
Switzerland	3.8	28.9	39.5	25.9	98.0
USA	6.4	31.4	34.5	27.1	99.4
India	1.3	26.8	38.5	33.6	100.2

Source and *note*: (UNESCO Institute of Statistics) [data extracted on 05 Jun 2017]. Total in the last column may not add up to 100 because of rounding-off of figures and variation in inclusion/exclusion in the tertiary sector in different countries.

Primary education receives about 27 per cent despite the sector's overwhelming importance in aggregate enrolments in the education system. Further, enrolment ratio declines remarkably at the secondary level, yet about 38 per cent of the total educational expenditure of the government are allocated to the sector. Rest of the expenditure, i.e. about 34 per cent are allocated to the tertiary sector. In other words, the fatter tertiary sector is thriving on two 'rickety' legs, turning the system incompetent in the long run.

Further, the distribution of per student government expenditure is extraordinarily tilted in favour of 'expanding up' (*Table 3*). The government expenditure per student at the secondary level is about 1.59 times more than that at the primary level in India. It more or less follows the pattern in some other educationally developed countries, excluding South Korea, Switzerland and Sweden. However, the expenditure is exceptionally high in the Indian tertiary education, i.e. about 6.2 times more than that in the primary.

Table 3 **Annual average government expenditure per student (constant PPP $), by sector, in relation to primary education (average of 2009 to 2015)**

Country	GII global rank in 'Human capital & Research'	Primary (ISCED Level-1)	Secondary (ISCED Level-2 & 3)	Tertiary (ISCED Level- 5 to 8)
Finland	1	1	1.65	1.82
Singapore	2	1	1.50	2.74
South Korea	3	1	1.07	0.54
Denmark	4	1	1.24	2.02
Sweden	5	1	1.18	1.63
Switzerland	6	1	1.08	1.83
USA	14	1	1.12	1.05
		1		
India	63	1	1.59	6.21

Sources and *notes*: (UNESCO Institute of Statistics) [data extracted on 05 Jun 2017]; and, the global ranking of the country in 'Human Capital and Research', according to(Dutta, Lanvin, & Wunsch-Vincent, 2016).GII stands for *Global Innovation Index*. Government expenditure per student (in PPP$) includes total public expenditure (current and capital expenditure on education by local, regional and central governments, household contributions are excluded) per pupil or student in the specified level of education, expressed in international dollars (current) adjusted in terms of purchasing power parity (PPP).

The significance of the said *ratios* is read *vis-à-vis* some of the world's most advanced countries in education as well as accumulation of human resources. For instance, in Finland (ranked 1st in *Global Innovation Index*, GII), the corresponding proportions are 1 (primary) : 1.65 (secondary) : 1.82 (tertiary). Similar ratios are evident in some other countries, which are at the top of the of GII rankings. In South Korea, per student government expenditure in the tertiary sector had been lower than in any of the other two sectors. Yet, the country has occupied the 3rd position in GII. The *causality* though remained unexplored, as compared to many other countries of outstanding merits in educational development, India stands apart in privatisation as measured by the yardstick of enrolments in private *vis-à-vis* public sector (*Table 4*). Incidentally, privatisation in non-Merit good tertiary education is relatively low in India.

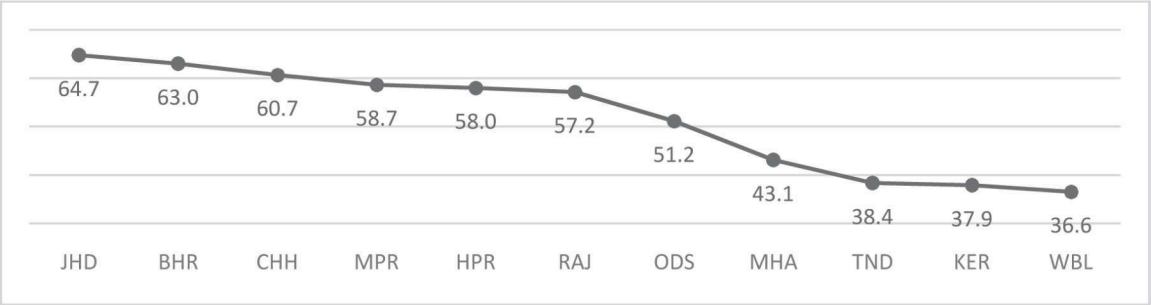
***Table 4 Relative weight of private educational institutions in a few countries, all*toppers in OECD's PISA ranking and above-the-rank of USA**

Country	Percentage of enrolment in private institutions out of the aggregate, in 2015						
	Early childhood education	Primary education	Secondary education	Lower secondary	Upper secondary	Post-secondary non-tertiary education	Tertiary education
China	52.5	7.0	10.6	11.0	10.3	30.1	13.5
Finland	9.1	1.7	14.6	4.9	19.4	17.6	39.6
India	74.4	34.8	50.2	41.5	59.3	67.3	57.9
South Korea	83.8	1.6	31.2	17.9	43.1	NA	80.3

Source and notes: (UNESCO Institute of Statistics) *[data extracted on 07 Feb 2018]*.PISA is the OECD's Programme for International Student Assessment. Every three years it tests 15-year-old students from all over the world in reading, mathematics and science. The tests are designed to gauge how well the students master key subjects in order to be prepared for real-life situations in the adult world.

The national *average* pattern of financing different sectors of education does not truly reflect the pattern in the major states. The central allocations are comparatively larger on higher education, while the state priority, in varying degrees, is the school education. Elementary education in less prosperous Jharkhand, Bihar and Chhattisgarh, respectively, received more than 60 per cent of Education Budget (Revenue account), on an average, during 2012-13 to 2014-15, while states such as West Bengal (36.6 per cent), Kerala (37.9 per cent), and Tamil Nadu (38.4 per cent) had been lagging much behind (*Figure 1*). The states where relative importance of the government and aided schools are low, proportionally smaller budgetary allocation to elementary education is somewhat understandable. However, the real burden of the underdeveloped and densely inhabited states, in general, is evident in low per student government expenditure, which was, on an average, about half-of-that in the high MYS states. Privatisation, thus, has become a compulsion unless political forces in the states are opposed to it, or the central government come forward in a big way to rescue school education in these states, in particular. The radical transformation in Delhi during the last couples of years, making the government schools serious competitors of private schools, both in terms of quality outcomes and student enrolments, without raising private costs has set an example of how to fight the maladies.

Figure 1 **Revenue account expenditure on elementary education as a proportion of total education budget, average of 2012-13 to 2014-15, in selected states (%)**



Source: Compiled from(MHRD, 2017A).

Rise in private costs, restricting opportunities

Although the RTE Act has made primary education a 'Merit good' sector, post-RTE private expenditure by a student have increased (NSSO, 2016). Awkwardly, among the sectors, the increase is found to be highest in primary education, followed by upper primary, during 2007-08 to 2014. Further, in the rural, average private expenditure per student in primary education increased at a rate that is about 2.4 times higher than that in the urban (*Table 5*). It may so happen that the (average) increase in private costs was due to the increasing relative 'weight' of enrolments in unaided schools. However, still overwhelmingly large majority of students enrol in the government and aided schools.

Table 5 **Rise in average private expenditure (at current prices) per student, during 2007-08 to 2014, all-India (%)**

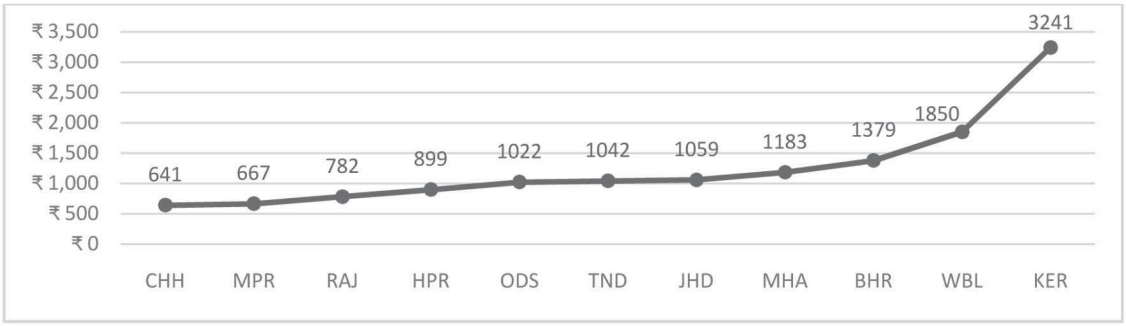
Level of attendance	Rural (%)	Urban (%)	Rural *plus* Urban (%)
Primary	240	178	226
Upper Primary	137	168	158
Secondary and Higher secondary	134	134	131
above Higher secondary	106	104	100

Source: Computed from(NSSO, 2016).

Besides, the growth of private schools in primary education has been more in the urban areas than in the rural, while increase in costs was comparatively higher in the rural. There is though significant inter-state variation. In economic as well as socially backward Chhattisgarh private costs of primary education in government school are about five times lower than that in Kerala, and so on (*Figure 2*). Utmost *negative* impact of dwindling fiscal resources is felt on *pupil-teacher* ratio (PTR), thereby, on teaching-learning outcomes. The

common understanding that privatization would lead to better learning outcomes is, however, found to be a misnomer. As compared to some of the top-ranking countries in PISA, that is, OECD's Programme for International Student Assessment, (India withdrew from this global measurement system in 2009 when it was ranked 72nd out of 74 countries), there has been 'unmatched' privatization in school as well as tertiary education in India, but without corresponding learning outcomes measured in terms of MYS, rank in *Global Innovation Index* (GII), employers' assessment of employability of the graduates, and similar others.

Figure 2 **Government school in primary education: Average educational expenditure (₹) incurred by a student in the current academic session (rural *plus* urban), in 2014**



Source: Compiled from(NSSO, 2016).

On the whole, high dropouts at the primary and secondary levels result in persistent inequality in education as well as in the labour market. As regard the general level of education of the Indian workforce (rural *plus* urban) 33.2 per cent are not literate, 32 per cent literates and up to primary level of schooling, 13.8 per cent middle, 9.3 per cent secondary, 5.7 per cent higher secondary, 0.8 per cent diploma/certificate course, 3.9 per cent graduate, 1.1 per cent postgraduate and above (i.e. altogether 20.8 per cent are having secondary and above level of education), in 2009-10(NSSO, 2013).

While Human Development Index (HDI) does not show much variation and range in different states, the sub-index for education shows considerable variation in India (Suryanarayana, Agrawal, & Seeta Prabhu, 2011). In another study to investigate the possible impacts of education, it is found that government performance in Kerala topped the list of states, followed at a distance by Tamil Nadu and Maharashtra, with the states of the Hindi heartland at the bottom (Mayer, 2001). The message is that the government performance is strongly correlated with human development.

III. Process aspect of opportunities

The schools across the states are working under different policy environments, notwithstanding the national policy framework of the GoI. One has to inquire, in this perspective, why GAR

in Elementary education in all-India (rural *plus* urban) does not show improvement between 2007 and 2014, despite improvements in the supply of several types of inputs. In fact, GAR dropped distinctly in classes I-V (NSSO, 2016; NSSO, 2010).

So far as the learning is concerned, the children from underprivileged tribal communities in the remote countryside at the bottom, right up to the educationally privileged Tier-I urban households have been sharing the common school curriculum, but without identical school facilities. The discipline of social choice theory, the modern form of which was founded by Kenneth Arrow, is concerned with the rational basis of aggregation procedures of individual information leading to social judgements and public decisions in choosing between social alternatives. The outcomes of the social choice procedure "take the form of ranking different states of affair from a 'social point of view', in the light of the assessments of the people involved" (Sen, 2009, p. 95).

The act of reversing the 'ranking', that is, positioning individuals over collective, may be labelled as 'methodological individualism' by many critics. According to Sen, "Perhaps the misconstruction in this critique arises from its willingness to distinguish adequately between the individual characteristics that are used in the capability approach and the social influences that operate on them" (Sen, 2009, p. 245). A person's ability to take part in the life of the society is what matters to both the individual and the collective. In brief, alternative social policies would entail alternative capabilities which individuals would have. Social choice must be aiming to secure basic capability for all. If an individual fall short of the 'basic capability' the social policies need to address that. A person's advantage in terms of opportunities is judged to be lower than that of another if she has less capability — less *real* opportunity — to achieve those things that she has reason to value (Sen, 2009). The concept of capability is thus linked closely to *comprehensive* opportunities.

The dropout of about half-of-the cohort enrolled in class I within the threshold of 'compulsory education' is undoubtedly worrying for human development in the country. The 'lack of interest' in studies has come out as the main reason for dropping out among almost a quarter of the dropped out girls in the rural areas, in the age group of 6-17 years, according to NFHS-4 (Ministry of Health and Family Welfare, GoI, 2015-16). Further, the survey conducted by NSSO (2016) reported that 'not interested in education' as the top most reason for dropping out of about 25 per cent male and 16 per cent of the dropped out females in the all-India rural areas. 'High cost of education' was the second-most frequently cited reason by the dropouts. We have tried to figure out some of the *processes* those are inimical to keeping back the less privileged children in the system.

Choice of school

First, the choice of school in most of the localities, especially in the rural areas, is

limited to either one government or aided school. If that one fails to deliver, there is no other option left for the economically weaker section (EWS) children than to continue in the accessible school. Second, if at all there was a private unaided school in the neighbourhood its high costs made it practically inaccessible to EWS, no matter whether the *rules* allow a certain percentage of them to get admission in the school. Therefore, the government schools are to perform. Otherwise, justice would be denied to a large section of the population.

It is important to note that Primary Education Cess collected between 2004-05 and 2016-17 was ₹ 1,93,828 crores, in aggregate (Ministry of Finance, 2018). The Cess is credited to *PrarambhikShikshaKosh* (PSK) and is used to meet parts of expenditure on *SarvaShikshaAbhiyan* (SSA) and mid-day meal (MDM) scheme. However, the utilization of PSK for SSA during the said period was ₹ 1,20,239crores, and for MDM ₹ 58,503 crores, leaving substantial funds unutilized. On the other hand, during 2014-2018, hundreds of government/aided schools in the most backward areas closed down and/or merged with some other schools (located far away from home) in the name of 'rationalisation' in states such as Rajasthan, Maharashtra, Jharkhand, and Chhattisgarh, consequently paving the way for rather involuntary dropouts, particularly among the girls.

There is the compulsion for the private unaided schools, under section 12(1)(c) of the RTE Act, to admit children belonging to weaker sections in the neighbourhood in class I or below to the extent of at least 25 per cent of the strength of that class and provide free and compulsory elementary education till its completion. Under the SSA norms, the states/UTs have to notify the costs per child to pay the private schools, on behalf of the children admitted under the said section of the RTE Act. The private unaided schools are supposed to get reimbursements according to the per child cost notified by the respective state/UT. Subsequently, the expenditure incurred by the state/UT is supported under SSA for classes I to VIII, subject to a limit of 20 per cent of the overall SSA budget approved for the respective state/UT. How far the provision has been a 'real' opportunity for the EWS is revealed in the latest statements of the MHRD in the LokSabha (MHRD, 2018a; MHRD, 2018b). Many of the states have not even issued notifications regarding admissions under the RTE Act. In the rest, corresponding figures reveal the indifferent attitude of the governments towards the *processes* of choice.

Early childhood education and care

By analysing data in NSSO (2016) and ASER (various years) it is found that early childhood education, first, has a positive impact on the attendance ratio in the subsequent levels of school education. The emotional development of the children and to bring them outside the family environment at an early age are equally, if not more, important to retaining them into a regular or routinized system of formal education. Second, the state-wise

assessments of skills in reading and arithmetic of the rural students done by ASER show a positive relationship between preschool education and the learning outcomes, especially, in the primary classes. Third, the 'repetition rate', by grade is found to be considerably higher in states where preschool education is markedly underdeveloped.

Choice of English language learning

Teaching of English is compulsory in classes I to XII in 13 states and four UTs. In another 15 states and three UTs, teaching of the language is compulsory for a short duration only, at different levels of education (MHRD, 2014). In many countries, large numbers of children are taught and take tests in languages that they do not speak at home, hindering the early acquisition of critically important reading and writing skills(UNESCO, February 2016). International and regional assessments confirm that when home and school languages differ there is an adverse impact on test scores. Language, ethnicity and poverty can interact to produce an extremely high risk of being left far behind. Recent evidence claims that at least six years of mother tongue instruction — increasing to eight years in less well-resourced conditions — is needed to sustain improved learning in later grades (*Ibid*).

One may depend on counting the proportion of persons expressing choice in favour of English as the first/second language and apply the majoritarian rule. However, capabilities are disparate, and hence non-commensurable. According to Sen, "indeed, if counting one set of real numbers is all we could do for reasoning about what to choose, then there would not be many choices that we could sensibly and intelligently make" (Sen, 2009, p. 240).We certainly do not have adequate societal statistics on how many students prefer English as the second language in their curriculum because no such survey has ever been undertaken. Thus, subjective application of the 'majority rule' can be thoroughly inconsistent because of an arbitrary aggregation of diverse information from diverse individuals or groups of individuals.

There are, however,data available on English language learning outcomes, given other parameters of school inputs more or less the same for the 'set' of learners, including the contact hours for teaching the language, which is scheduled as one period of 30 to 40 minutes a day, like that for other subjects. Notwithstanding, to make the base of comparison more precise, additional qualitative data were required but not available on whether the proficiency of the English teachers, the regional language teachers, or the arithmetic teachers are all on a par with one another. As regards the outcome, English language learning has been failing almost uniformly. The private schools are no exceptions (ASER 2016). The sample survey shows that less than 60 per cent of the youth in the age group of 14-18 years have the ability to read English sentences in all-India (ASER, 2018), and so on.

There might be other reasons, yet in the absence of a systematic survey on the matter, the preliminary conclusion would not perhaps go overboard that the pressure of English

learning as a second language dissuades a large section of the children from going to schools, the bulk majority of whom are enrolled in government or aided schools. How much the pupils or, for that matter, the country would lose if English learning was made an *optional* for those who find it difficult to cope up with an alien language that is neither present in their daily lives nor for reasoning?

Similar situation is found in, say, California where 85 per cent of the English learner (EL) students speak Spanish. The review of 25 years of dropout research done by the California Dropout Research Project identify EL students as more likely to drop out than students belonging to other status groups (Rumberger & Lim, 2008). One has to probe the children and their parents who have little motivation to learn English, in India. It needs to be appreciated that *not* all of the children enrolling in class-I are looking forward to undertake long-term investments for obtainingjobs in the upper-end of the market. Rather, greater numbers of the school-going children leave the education system in order to join the 'army' of tail-end jobs in agriculture, non-farm, manufacturing, and services sector. It needs to be appreciated that a large number of migrant Indians working in the Gulf or Middle-East are only conversant with Hindi or Malayalam. Of course, those who aim for higher education, for them learning English is an added advantage. So, for the 'cluster', whose *expected* years of schooling is higher than-the-average there ought to have the opportunity of learning English in school, from whatever level it may be. Let us remindRabindranath Tagore's own initiatives and experiments almost a century ago in *Shantiniketan*(West Bengal, India). Tagore explained at length that the teaching becomes more communicative and interactive through the child's native language (Tagore, 1906; 1989). The capacity to cogitate and to imagine are two most enabling forces. According to Tagore, language training, especially, English occupies substantial amount of time of school learning. Entering into the language itself is a prolonged process. Yet, at the end of the day, the students are found to be incapable to think, search, and act independently (*Ibid*).

Given the circumstances, it would be appropriate to make English language learning an *optional* subject, up to the grade at which there occurs significant scale of dropouts. The students ought to be given the choice of additional language learning, depending on the local conditions as well as the public funds allocated to the school for the appointment of trained language teachers. For example, the schools located in the backward regions/communities, unlike in the high-income Tier-I, or Tier-II cities, may offer the choice to the pupils regarding language learning. This is essentially *decentralization* of elementary education, the provision of which are codified in the RTE Act.

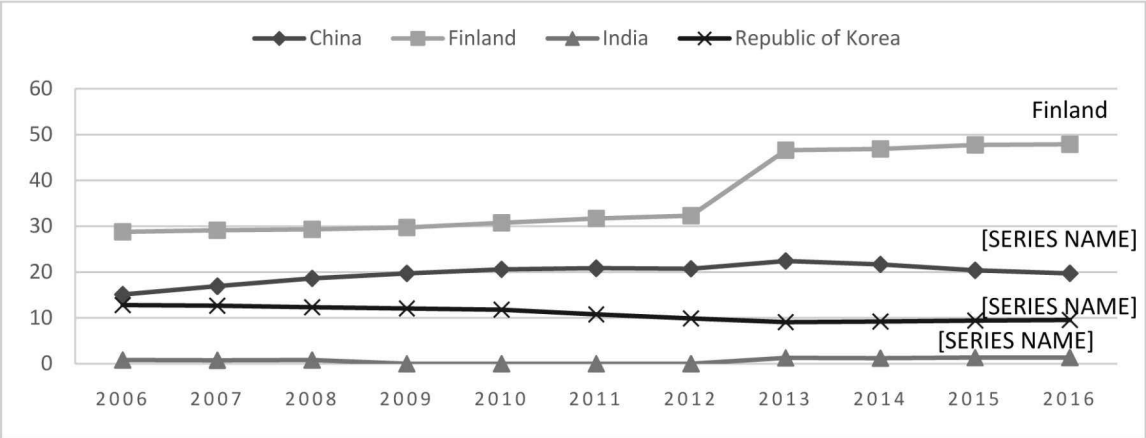
Choice of special education

Unlike in the 'West' as well as the late-developed countries in the South-East and East Asia,

almost half-of-the class I cohort in India drop out by the end of elementary level in many of the regions and join informal workforce. The non-agricultural informal sector has been engaging a growing number of youths aged 15-24 years; more so in the rural than in the urban areas (ILO, 2018b). According to the ILO Report, the level of education is one of the key factors affecting the level of informality. Globally, when the level of education increases, the level of informality decreases; those who have completed secondary and tertiary education are less likely to be in informal employment compared to workers who have either no education or completed primary education (*Ibid*). The Report observes that training and skills development are essential contributing factors for the transition to the formal economy, as they can improve the competencies and employability of the workforce.

As compared to the developed educational systems, such asChina, Finland, and South Korea, India lags far behind in skills development (*Figure 3*). For instance, in Finland, a high-income, very high in human development rankings as well as top ranking country by the index of educational achievements, about half-of-the students get enrolled in vocational programmes, out of the country's total in secondary education. Further, more than 70 per cent of the students in upper secondary education are in various vocational programmes. The rapidly grown China follows Finland in terms of proportion of school enrolments in vocational stream. School-level vocational programme is also significant in high-income economy and highly placed in PISA ranking, South Korea. These countries are examples of the kind of restructuring that creates *capabilities* through education. As regard public-private divide, Finland and China relied very heavily on public educational institutions to deliver the good, while South Korea has been following a mixed system at post-primary levels.

***Figure 3*Percentage of all students in *secondary* education enrolled in vocational programmes, both sexes: Trends in China, Finland, India and South Korea, between 2006 and 2016**



Source: Based on data extracted from UNESCO, UIS.Stat on 07 Mar 2019.

Lessons from other educationally developed as well as high HDI countries tell us that to strengthen the *process* aspect of freedom (in the specific context of capabilities building) we must undertake the following reforms: *First*, the national/state school curriculum must have the flexibilities to incorporate the local conditions. *Second*, the local authority or the school should have the required autonomy to modify the curriculum. *Third*, the school-level dropout rate being unusually high the eight years of compulsory education following the RTE Act may be reviewed in the right perspective. In order to reduce educational inequality and make the productive force of the country educated, a shorter duration of elementary education is necessary. So long as the ability to enjoy the right to education remain unequal the universality of rights cannot be operationalised. The duration of primary education needs to be reduced to six years. The (lower) secondary school may begin at class VII and continue for three years (i.e. classes VII to IX), and having the liberal opportunity of choices for general education and vocational studies. Some skills come from general education, but specific occupational skills are also needed. *Fourth*, to make the latter arrangements effective, the national level examination or any other eliminatory examination needs to be postponed till the end of the lower-secondary level. *Fifth*, the students opting for vocational education must have equal, or even preferential opportunity to study in technological institutions for the bachelor's degrees. This measure would popularize the stream at the school level, and simultaneously help redistributing the disproportional (in relation to infrastructural facilities) flow (of students) to general higher education that has been allegedly affecting the quality of higher education, to a large extent. *Finally*, while implementing the policy of decentralisation of the school education system, the fiscal health of the low-MYS states ought to be addressed by the Centre using, perhaps, the instruments available to the Finance Commission of India.

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DECODING COMPLEXITIES IN HEALTHCARE MARKET: THE NEW HORIZONS OF RESEARCH IN HEALTH[1] ECONOMICS

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Abstract

The healthcare markets in developing countries have been in a rapidly transiting phase in recent decades bringing forth new challenges for contemporary research on health economics. Without adequate social protection and appropriate regulatory arrangements, there is significant risk of producing a failed and distorted market and, consequently, a new set of vulnerabilities, inequalities, and health related poverty. The creation of appropriate institutional arrangements has lagged far behind the marketization process in most of these countries leading to uncontrolled proliferation of private providers. The complex Indian scenario epitomizes the transition where the private providers have assumed the dominant role in both inpatient and outpatient care markets after the economic liberalization initiatives in 1990s. On the one hand, this marketization process has generated new opportunities for innovations in health care and substantial expansion of consumers' choice set; on the other, a large part of population are at serious risk of falling under the poverty line due to spiraling out of pocket spending on health care. The complex scenario has opened up new avenues in research related to health economics.

JEL Classification: I11, I13, I14

Key words: Marketization, health equity, regulation, health poverty

I. Introduction

Since the publication of Arrow's seminal work on uncertainty and the welfare economics of medical care (Arrow, 1963), analysis and discourse on healthcare market has taken a serious line of thought in economics. It is now universally accepted that healthcare is a unique service that requires stretching beyond traditional economic theories, since there are vast differences between healthcare markets and the competitive market models due to uniqueness of actual healthcare market. The most important distinguishing feature, which makes if different from the 'goods' used for demonstration in standard economic textbooks, is that health care is not consumed for its own sake but for the positive contribution it is expected to make to an individual's health. In other words, as Arrow noted 'medical services, apart from

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preventive services, afford satisfaction only in the event ofillnesses, adeparture from the normal state of affairs'. The departure is further confirmed by the specialty of the demand for healthcare services, which is 'irregular and unpredictable unlike food or clothing'. The unpredictability in illness means that consumers' responseis driven by exogenous shocks and not by one's own preferences, implying the necessity of a structural change in the analysis of demand in the context of healthcare market. Under such conditions, information becomes a very important element; in a sense, purchase of medical care becomes almost equivalent to purchasing information from a skilled provider, since consumers' abilities to acquire and process information on their own illness are limited.

The uniqueness in healthcare market triggered the expansion of Arrow's analytical structures in the following decades and, with several path-breaking researches on information market, the modern basis for health economics is further consolidated. For example, information asymmetry between sellers and buyers of healthcare has been explored to explain the market failure in the context of the insurance as well as of the healthcare market and consequent spiraling cost of medical care in developed market economies. Adverse selection in the medical insurance market, an offspring of asymmetric information between the insurers and the insured persons, has become a point of interest among the researchers to explain the failure of insurance market to provide a socially desirable solution. Similarly, various versions of the concept of Suppliers-induced-demand (SID) - that doctors, as agents for their patients, can use their power from having 'better information' to inappropriately engage in demand-shifting or inducement activities often against the interest of the patients–is extensively used by the new generation of health economists to explain the malfunctioning market.

There are parallel developmentsthat markfew of the key cornerstones of the discipline – economic evaluation of new health interventions - in terms of changes in diagnostic technology, treatment procedure, or introduction of new drugs – has been one of them. Estimation of health benefits of an intervention, in terms of QALYs or DALYs, have become a common parlance among the new generation of health economists. One step further in the same direction was development of health technology assessment (HTA) procedures, which is aimed mainly at informing decision making regarding health technologies by using cost-benefit analysis. The concepts are based on the fundamental question of economics, i.e., what would be the best way to use scarce resources?

Undoubtedly, health economics as a discipline has advanced with spectacular speed covering a vast range of research dimensions. However, the progress largely remains lopsided as the theories and their applications – as given above - remained conspicuously focused more on health care and less on health, bounded by the issues and challenges typically experienced in the healthcare markets of the developed nations. According to one leading economist:

> Importantly however the vast majority of what passes formally for health economics is by and large health care economics, and health care economics of the developed world, at that. Something like 70 percent of the world's health economists are based in the US. There is nothing either equitable or efficient about that distribution (Mooney, 2009).

Dominance of western economists in this area and their focus on the health system of their own countries, therefore, has kept the research agenda limited to issues faced mostly bythe westernhealth systems, which are quite in sharp contrast with those of the developing world. The contrast is visible in health financing system, epidemiological profile, demographic structure, culture and in socio-economic perspectives that are often remarkably different in the low-income countries.

The health economics in developing world, therefore, needs a new approach, that would be able to raise relevant questions typically associated with the resource setting in the counties of this world and generate scientific evidences to address the questions. Unfortunately Indian response is weak so far primarily due to the fact that the Indian universities do not offer enough scope for training in this discipline despite high demand for research in health economics in the country.Encouragingly, high level of interest is visible among the young public health students and professionals to build career in this area or, in more general terms, in health system research. Given this pressure of demand, it is expected that it will soon be accepted as an attractive alternative in research and education among Indian academia.

The purpose of this paper is to inform the young researchers of economics about this relatively new branch of the subject and stimulate their interest for exploring interesting research issues in health sector. The next section briefly presents the common issues currently being addressed by health markets in developing countries. Section III highlights selected key issues that characterize the Indian healthcare marketfollowed by some indications on relatively less-trodden areas of research in the context of India's health economy (Section IV). Conclusions are drawn in the last section (Section V).

II. Healthcare markets in developing countries

Traditionally, many health policy analysts and policy makers in low- and middle-income countries like to view healthcare as a special case of non-marketable commodities, guided by the principles of 'patient's need is more important than economics'. Yet, market relationships have become pervasive in the health systems of these countries highlighting the need for recognizing and engaging with the market. Many countries have pluralistic health systems with large informal markets in which providers of health-related goods and services vary widely in terms of their practice settings, their type of knowledge and associated training, and their relationship with the legal and regulatory system (Bloom and Standing, 2008). The

spread of health-related markets has created both opportunities and challenges for improving the performance of health systems in these countries.

Marketization has brought in several opportunities to developing countries, especially in terms of increasing availability of improved technology for diagnosis and treatment, new drugs, and innovative procedures. The glowing face of markets, however, is counterbalanced by a set of adverse consequences primarily due to market failure.For example, increasing commodification of health care is an unavoidable result of marketization process which has serious equity implications, especially in low- and medium-income countries in Asia and Africa that have highly heterogeneous consumer base with unequal ability to pay. The global evidences suggest that the transition to a marketized system of health care, without adequate social protection and appropriate regulatory arrangements, underpins a significant risk of producing a new set of vulnerabilities, inequalities, and health related poverty. For example, lack of financial protection for the costs of health care, a common trait of the developing world, implies that a large number of people are pushed below the poverty line each year by out of pocket payments for health care and many more will not seek care because they lack the necessary funds. Similarly, in the 75 countries that account for more than 95 percent of maternal and child deaths, the median percentage of births attended by a skilled health worker is only 62 percent, and women from low-income households are much less likely to receive it than are women with higher paying capacity (Mills, 2014).

It is important to note that strong and rapidly changing institutional conditions surrounding the health markets are extremely important to encourage good performance by market actors as well as to counterbalance the adverse effects of market failure. Unfortunately, the creation of appropriate institutional arrangements has lagged far behind the marketization process in most of the developing countries.For example, formal institutions, such as legal and regulatory structures, property rights, and insurance lawsoften fail to keep pace with the speed of market spread leading to pervasion of an uncontrolled health market.

III. India's healthcare complexities: Key issues

Until 1990s Indian health care sector was guided by a vision of a universal, vertically integrated, tax-based and publicly provided health care system, and operated through a vast network of primary, secondary and tertiary health facilities across the country. However, the vision failed to translate into reality and gradually turned into a 'utopian appeal' primarily due to inadequate public investment in health (less than 1 percent of GDP), coupled with typical inefficiencies in financing, provision, organization, and regulation by the public sector (Kanjilal and Mazumdar, 2010). The public health services were free but mostly unavailable; the users and providers of these services had very limited options in following or advising

treatment procedures, obtaining or prescribing drugs and diagnostic tests, even when they were available.

The dismal scenario in health service deliverywent into a quick transition whena parallel process of marketization set off in 1990s with a new economic regime pushing neo-liberal policies, leading to rapid proliferation of private sector in Indian health market. The traditional public sector based service delivery model is being replaced by a new regime and modern clinical procedures, new medical technologies and new drugs leading to huge expansion of consumers' choice set. With market forces in full swing, economics rather than ideology guide the changing structure, pattern and complexities of the healthcare market. From the demand side, an expanding middle class with more disposable income to purchase medical power fuels the process. A robust health care industry, which is estimated to be growing at double digit, is now in place with a new wave of opportunities.

The increasing share of private sector is quite evident in case of inpatient care (i.e., hospitalized cases) market. Data from four rounds of national morbidity and healthcare utilizations conducted by the National Sample Survey Organization (NSSO) during 1986–2014 (42nd round in 1986-87, 52nd round in 1995-96, 60th round in 2004, and 71st round in 2014) reveal that for curative care requiring hospitalization, the share of private hospitals – in terms of percentage of hospitalized cases – increased from 40 percent in 1986 to about 68 percent in 2014 for the urban users and to 58 percent for the rural users. Increasing dominance of the private sector in this market is also characterized by a vibrant growth in tertiary and super-specialty care that has facilitated entry of corporate houses, venture capital and a spate of mergers and acquisitions leading to a partial 'corporatization' of the market.

The impact of increasing dominance of private players in the inpatient market on common users of hospital care is quite significant. Historically, India lacks a strong safety net of any social protection or risk-pooling mechanism. As a consequence, almost all of the private cost of treatment is borne by the users at the point of service delivery making India one of the few countries where the share of out-of-pocket health spending (OOPS) in total health expenditure is extremely high (about 61 percentof total health expenditure (NHSRC, 2018)). As expected, the burden of OOPS is disproportionately higher in private hospitals compared to their government counterparts; for example, according to NSSO 71st round (2014), on average a hospitalized case (except birth delivery) would have required a user of a private hospital to spend INR25850 which is about four timesmore than a user of a public hospital would have spent (INR6120).

Clearly, high OOPS has its own mark on household economy. Out-of-pocket spending on health can add to the poverty head-count and the depth of poverty by diverting household spending from non-health budget items. Given that the share of private hospitals has further

increased and the cost of treatment has multiplied since 2014, the market poses a significant, and sometimes catastrophic, impact on the economy of a large number of Indian households. The numbers of households falling below poverty line (BPL) due to inpatient care, as found in a paper (Berman et al, 2010), is astoundingly high (2.46 million or 1.3% of households) implying that at least one household in a hundred is silently marching towards poverty every year due to inpatient care. Most of these households are expected to be the users of private hospitals.

The disproportionately high cost of inpatient care in private hospitals may be attributed to two major reasons: (1) due to huge asymmetric information and the absence of an effective regulatory mechanism, the control of the private hospitals over prices as well as on the utilization remains conspicuously strong, and (2) increasing corporatization and consequent 'branding' initiatives have unleashed a competition among hospitals to buy latest capital-intensive technology and build more hospitable infrastructure that do not always justify the benefits – a process which is called as 'medical arms race' by some health policy analysts – pushing the price up at a galloping rate. Not only the rising cost has aggravated the impoverishing impacts of private inpatient care but also it has raised the barrier for many who remain untreated because private price is prohibitive and the demand for public care is too competitive.

The present paper primarily focuses on the inpatient care market. However, for a more comprehensive understanding, it is also important to briefly point out the basic features of the outpatient market (i.e., curative care for which hospitalization is not necessary) and its transformation. Historically, the Indian outpatient care market has always been dominated by the private sector. The scenario did not change much in recent years. NSSO data shows that about 80 percent of ailing persons (non-hospitalized) were treated by the private providers in 1985-86 which remained almost as high (more than 70 percent - 72 percent in rural and 79 percent in urban areas) in 2014. Researchers and policy makers alike concur that a large section of these providers belongs to a category of village doctors who practice modern medicine (allopathic) without any recognized formal training or license. This section of medical practitioners is often identified as Rural Medical Practitioners (RMPs), "informal", "unqualified", "less than fully qualified (LTFQ)" providers, or simply "quacks". The high presence of these providers is quite consistent with similar scenario in developing countries, since in low income countries, one of the most striking aspects of health care marketization is the proliferation and reinforcement of informal market in primary curative care, creating a largely unregulated and officially unauthorized parallel structure.

What explains their growing market power? The strength or market power of the RMPs is derived from two forces: (1) market or price factors, and (2) institutional factors. The price factors are more visible and well researched; evidently, people save money and

time when they visit a RMP (instead of visiting a public health centre) because RMPs offer acheaper option to the rural people. However, no less important are the 'institutional' factors, mostly arising out of the informal structure of the RMP-people connection which helps reduce the transaction cost on both sides and wrap it with strong trust bondage (Sudhinaraset et al., 2013).

IV. New horizons in research

Given the above scenario, what should be the focus area of a young Indian researcher in health economics? The above analysis clearly highlights the acute need for more research-based evidences on different aspects of health markets to decode its complexities and to help design informed policy. The primary purpose of these research initiatives would be to help the policy makers design policies to counterbalance the adverse effects of the marketization process through appropriate state interventions. A set of few selected high-focus research areas in Indian context, related to health economics, are listed below with brief introduction.

(1) It is now universally recognized that primary health care, especially preventive care for communicable diseases and maternal and child health care, family planning, basic child nutrition care, etc. should be treated as public goods with high potential of externalities and, hence, should be financed and organized by the public sector with or without support from the non-government actors. However, the transition to marketized care logically highlights an important question: what should be the role of the state in such complex transformation especially of the curative care market? The options are: either itdownsizes its role as a provider andchannelizes its resources to compensate the consumers for the welfare loss due to market failure, or, it tries to regain the lost position by increasing subsidies and focusing exclusively on better governance in public health care facilities. The former option would imply a more active and strategic role of the public sector as a market actor who wouldprovide institutional oversight and social protection (by sponsoring and subsidizing medical insurance), while the second would force the government to play more of the traditional role of a welfare state with reformed governance (Kanjilal and Mazumdar, 2010) .

The issue has become more significant in recent years. The increasing prominence of channeling central subsidies through medical insurance model is quite evident after the launch of Prime Minister's *Jan ArogyaYojna* – the state funded national medical insurance scheme - through *Ayushman*Bharat programme, which clearly indicates that the government intends to play more active role as financier and less as provider in curative care. In other words, it is expected that the government subsidies through the new insurance model would help poor people access the private hospitalsand further consolidate the dominance of private providers in the market.

Given this contextual transformation, the need for addressing some relevant research questions can hardly be overstated. For example, to what extent does the new insurance model counterbalance the impoverishing effect of health care? What is the possibility that it triggers healthcare costs spiraling up and increases the financial risk instead of reducing it? Clearly, a strong agenda of research in health economics is required to address these questions.

(2) Equity in health and health care have been one of the prioritized research agenda to health economists, with increasing commitment to the serving the needs of the poor and underprivileged being central to health policy documents. The quantitative tools to measure health equity put together by a World Bank team (O'Donnell et al, 2008) has encouragedmore quantitative research on this topic among the economists in developing counties. There is, however, a great scope for raising equity questions on diverse issues in Indian context, especially with a focus on social determinants of health. For example, despite an encouraging picture of increasing uptake of Maternal and Child Health (MCH) care services by poor households in the last two decades and consequent improving health outcomes, it is still not clear to what extent the initiatives have mitigated the health inequalities across different parameters. It is also a concern that there are several special zones or pockets in the country where the health services are traditionally weak and the health outcomes are worse than other parts of the country. The specialty of these pockets manifest in a large number of populations who are historically out-streamed (or, under-served) due to (1) climatic and geographical vulnerability (e.g., Sundarban), (2) nature of their occupation or geographical location (e.g., tea plantation or mining), (3) socially marginalized section (e.g., tribal population), (4) urban slums, and so on. The question is:to what extent the MCH care needs of these special groups are being addressed by the recent initiatives? What are the bottlenecks which may constrain the effectiveness of these innovations? And, so on.

Among many equity questions, effect of climatic shocks, especially the catastrophic events - such as flood, cyclonic storms, or earthquakes – on health and health care distribution among the affected population has been gaining importance in recent years. In addition to the immediate effects of these climatic shocks, there are long run effects on nutrition and health status, especially of the affected children. This requires a complex analytical framework since climatic shocks may also create social and economic disruptions and resultant change in health-related practices (e.g., it may prompt out-migration of productive male labour force affecting health seeking behavior of the rest of the family), thereby affecting children's health.

The inequity in financing health care is another concern. The literature has ample evidences on application of various quantitative tools to measure the regressiveness of financing (e.g., Kakwani index). However, much less evidences are available on benefit incidences of public subsidies in health. In other words, it is desirable that the public investment in health care should have strong pro-poor bias in terms of flow of its benefits; the question is: to what extent this bias is maintained across the Indian states? The question is important since there has been unprecedented increase in public investment in India, especially on MCH care, in the last two decades and we hardly have any evidence on the distribution of benefit incidences generated by these resources.

(3) As mentioned earlier, the overwhelming dominance of RMPs in outpatient care market highlights the need for innovative research to analyze the market. Clearly, the standard economic tools are grossly inadequate to decode the complex nature of the linkages in rural health market in this context. For example, the apparent irrationality of over-dependence on the RMPs by a large section of rural population (despite their high potential to do harms during course of their treatment) may only be explained by concepts of institutional economics (e.g., trust) and behavioral economics (e.g., bounded rationality). Surprisingly, the interest on this subject is hardly visible among the mainstream economics in Indian universities.

(4) Research on institutions related to market is inadequate. This is especially true for regulatory structures to control the market. It is important to assess the performance of existing regulatory structure and evaluate the costs of a poor regulatory mechanism in India. For example, what is the cost of poor quality of care in different levels of care (primary, secondary and tertiary) that may be persistent due to weak or no regulation? Similarly, the degree of imperfect agency relationship between the hospitals and patients may be focused to provide a solution to growing provider-induced demand and irrational treatment.

(5) Economic evaluation or impact evaluation for new health programmes or technological interventions in public health is a highly valued exercise by the health economists in developing countries. The number of studies in Indian context has been steadily increasing. However, more rigour is required to create a strong body of evidences in this area. Since rigorous evaluations, such as experimental studies based on randomized trials, are expensive, the young researchers may use more non-experimental but scientific methods (e.g., Difference-in-difference, matching scores, etc.) for research.

V. Conclusion

Healthcare in the Indian health market is becoming increasingly complex and has emerged as one of the most important social and economic issues in our country. The rapid transformation of the market is being driven principally by changing economic forces. Changing epidemiological pattern (for example, increasing incidence of non-communicable diseases) and political economy of healthcare (for example, growing power and interest of domestic and multinational corporate sector in hospital and pharmaceutical market) are fuelling this transformation. The governments (central and state) are seriously redefining their role and response in this rapidly changing scenario. Clearly, the degree of effectiveness of the state policies to maximize social welfare gains depends on the availability and acceptability of high-quality scientific evidences that are generated to inform the policy process. The role of relevant research on health economics is extremely crucial in this context.

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