

The Classics on the Division of Labour and Technical Change Revisited

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A Review article of the: *Division of Labour, Technical Change and Economic Growth*, by M.Corsi (Avebury, Aldershot, 1991), pp..ix 165. ISBN: 1 85 62 82 317 £32.50

It is generally accepted that the familiar marginalist tools of equilibrium economics are in the main ill-suited to the analysis of the disequilibrium processes through which new technologies are generated, enhanced and assimilated within economic systems. This has resulted in the development and refinement of alternative theoretical frameworks in which these dynamic processes can be more satisfactorily represented and examined. Often, the major source of inspiration for such attempts is to be found in the writings of the classical economists, and of Adam Smith in particular. Here technical progress is generally seen as one of the key factors of endogenous growth; a process limited by the extent of the market and driven by the exploitation of increasing returns and accompanied by capital accumulation. Marcella Corsi's book contributes significantly to the analysis of the process of technical progress within such a setting, notwithstanding some likely objections to the book's formal representation of the process.

Part 1 of Corsi's book contains an overview of the classical conceptualisation of technical change. The classical division of labour theory, which the author intends the later analysis to be centred, is outlined succinctly in Chapter 2. While referring briefly to other writers, the discussion here concentrates almost exclusively on the works of Adam Smith and Charles Babbage. Here Smith is portrayed in his rightful

place as an economist concerned predominately with questions of accumulation and technical change, rather than as a distant precursor of modern equilibrium and social welfare theory. The outline of Babbage's treatment of the division of labour is of particular interest, given that it has received less attention from historians of economic thought. This chapter also introduces demand factors into the discussion through a brief overview of later developments by writers, such as Young and Kaldor, of Smith's famous dictum of the division of labour being limited by the extent of the market. The intimate links between the division of labour, endogenous technical change, and economic development implied by these classical writers are reinforced in Chapter 3. The implied cumulative and self-perpetuating process of change is emphasised, together with the irreversible and essentially dynamic dimensions of the increasing returns process. The division of labour yields not only static advantages of specialisation but, more importantly, dynamic advantages through learning by experience and technological advantages.

Having outlined the classical approach, attention in the latter stages of chapter 3 is focused on the ("neoclassical") equilibrium theory approach. Here Marshall is isolated as the first economist to consider the association between division of labour and increasing returns in light of equilibrium theory. Marshall is charged with introducing "subtle modifications" to the classical treatment of increasing returns, leading to the consideration of the division of labour as a simple mechanism of static adjustment to the environment at firm level, and on the other hand, the definition of increasing returns as a reversible relation between factors of production and output, at the industry level (pp.48-49). Corsi argues that Marshall, being "aware of the problem of expressing competitive equilibrium conditions in the presence of internal economies generated by the division of labour", looked for sources of increasing returns in such phenomena which were permitted by a static framework (pp.50-51). According to Corsi, this led Marshall to exclude any economies resulting from substantial new inventions and led him also to consider "external economies as the only cause of decreasing costs of production" (p.50). Given the importance Corsi places on Marshall's role in the development of the 'equilibrium' approach, brief comment on these claims is warranted.

It is difficult to dispute Corsi's claim that the 'equilibrium' approach has paid little attention to the dynamic disequilibrium aspects of increasing returns-technical progress. Instead attention has predominately been focused on static competitive equilibrium analysis of disembodied technical progress, external economies and largely exogenously determined growth. Unquestionably, Marshall's separation of significant elements of technical change from the increasing returns process represented a significant departure from the classical view originating from Smith's analysis, and also is inconsistent with the thrust of Corsi's later analysis. However to argue that Marshall relied almost exclusively on externally sourced returns to scale so as to be consistent with "competitive equilibrium conditions" may be rather unfair on Marshall. A closer reading of both Marshall's *Principles* and methodological writings¹ would in fact suggest that Marshall was well aware of the dynamic dimensions of the increasing returns process, but was in the end unable to resolve the conflict between static (though not necessarily 'competitive') equilibrium

conditions and the increasing returns dynamics. However rather than simply resorting to the assumption of external economies, Marshall had hoped that the reconciliation would emerge from his biological analogies and the 'representative firm' concept. The appeal to external economies, along with the emphasis on "competitive equilibrium," is more accurately attributable to Pigou and his followers, and to the interpretation of Marshall's "reconciliation problem" formed by Sraffa in the cost controversies of the 1920s. In this respect it was Allyn Young (1928), more so than Sraffa (1926), who recognised the source of Marshall's difficulties in representing the increasing returns process within an equilibrium framework. The important issue here is that a clearer understanding of the precise nature of the problems alluded to in Marshall's *Principles* may have directed the analysis of increasing returns along a path closer to that championed by Corsi.

Having argued the advantages of adopting the classical conceptualisation of technical progress, Part II of the book presents a formal mathematical representation of the industrial division of labour process, with the circular causation between output and technical change emphasised. In chapter 4, two stochastic models of intra-firm division of labour are considered. These stochastic models are based on Markov processes which have the basic property that the probability of any particular future behaviour of the process, when its current state is known exactly, is not altered by additional knowledge concerning past behaviour. The models, in the tradition of contributions by Arthur (1988), represent the division of labour as a random process of selection between different options following an unpredictable path through time. The outcome of the selection process is in turn influenced by the path the process takes. Mathematically it is demonstrated, (through the emergence of the Pareto distribution), that despite the random nature of the process, regularity in the form of a steady increase of productivity does emerge. However Corsi recognises that such models fail to highlight the endogenous nature of the innovation process, a situation confronted in chapter 5 with the introduction of a production ('macro') model incorporating the interrelationships between industries.

The production model used by Corsi is constructed in two stages. The first stage involves a modification of the progress function (or learning curve) concept popularised by contributors such as Arrow (1962) and Kaldor-Mirrlees (1962), which relates average input productivity to cumulative output increases. The limiting assumption of a fixed progress elasticity exponent² which has characterised much of the usage of these functions is relaxed, and instead the process giving rise to a progress function is formally introduced in terms of a probabilistic mechanism similar to that contained in the stochastic models of the intra-firm division of labour discussed in chapter 4 of the book. The second stage of the construction of Corsi's production model involves the merging of the modified progress functions with a simple Sraffian model (no fixed capital, single technique, single product industries...). The Sraffian model is claimed by Corsi (p.100) to be the most promising theoretical model which considers industrial operations as an interrelated whole. Such a model is considered necessary in order to study the feedback relationship between productivity growth and the growth of output. Specifically, this feedback relationship is described by Corsi as "an increasing division of labour will

result in a fall in prices, this will stimulate both demand for output and consequently will lead to a subsequent increase of productivity".

Predicably, the Sraffian type model concludes that the division of labour-technical progress process results in production price variations being influenced by changes in output which occur in all industries linked by using the same means of production. Interestingly, productivity gains arising from technical innovations in the production of 'basics' flow on to the rest of the economy (production of 'non-basics') in a cumulative way. This result is likened to Kaldor's famous maxim of manufacturing being the 'engine of growth', although "the lack of direct empirical validity" of the Sraffian 'basics' versus 'non-basics' differentiation is acknowledged by Corsi (p.108).

Chapter 6 (Part 3) of Corsi's book considers the implications of the division of labour-technical change process on market structure and the behaviour of firms. The process is seen as being a weapon of competitive rivalry and, in some specific cases, leading to increased industry concentration. These implications are related in general terms to managerial and behavioural approaches to the theory of the firm. Discussion in the chapter is rather speculative in nature, and does not incorporate explicitly elements of the formal models presented in the previous two chapters. Not surprisingly, Corsi concludes discussion in this chapter by stating the final outcome of the process depends on a combination of factors and is "therefore, largely unpredictable" (p.131).

The book's major conclusions are brought together in chapter 7. Two appendices are added to provide further explanations of the mathematical derivations of formulae used in the models presented in chapters 4 and 5. While the author confesses to a "naive approach to advanced mathematical elaborations" (p.138), the reader who does not command a level of mathematical usage beyond the first year undergraduate level will struggle to follow the formal treatment in chapters 4 and 5, and certainly the attached appendices.

In general, Part 1 of Marcella Corsi's book argues a most convincing case in support of the contention that those seeking to analyse the process of technical change should turn to the classical economists, and Adam Smith in particular, for theoretical inspiration. The mathematical analysis presented in chapters 4 and 5 illustrates that the classical ideas are amenable to rigorous formal modelling. This accepted, an evaluation of the book's overall contribution requires judgements concerning the ability of its formal modelling to capture and add to an understanding of the classical insights into increasing returns-technical change endorsed in Part 1. In this respect, the book will almost certainly attract disparate evaluation, particularly in relation to the formulation of the production model developed in chapter 5 and summarised briefly above.

The first aspect of Corsi's model which is likely to be closely scrutinised is the formal representation of increasing returns-technical change through the stochastic processes outlined in chapter 4. Corsi is well aware that agreement on the 'appropriate' representation of stochastic processes is difficult to achieve and that variations to her representation of such processes are plausible. However it is unlikely that more sophisticated variations on this theme would alter the nature of

the conclusions derived in chapter 4. Other readers may argue that the increasing returns-technical change process can not be depicted or analysed independently from wider historically specific economic and social relations. However there can be little doubt that Corsi's modifications to the traditional formulation of progress functions provides a mechanism through which the links between Kaldorian style growth analysis and Adam Smith's insights can be both formalised and clarified.

Possibly the most contentious aspect of Corsi's work is the selection of a simple Sraffian framework to capture the "feedback" effects of the division of labour-technical change process. Few readers would dispute the proposition that the Sraffian framework captures many of the essential characteristics of classical economic analysis. As is well known, in Sraffa's framework the marginalist tools of demand and supply are replaced with the essentially classical notion of prices of production being determined directly by the methods of production, in a setting of "free" competition as opposed to "perfect" competition. The marginalist distribution scheme is displaced with one where distribution is a variable, and the classical dichotomy between prices and output determination is preserved. However, it is important to recall that the primary concern of Sraffa's (1960) contribution was the nature and consequences of the relationship between values and distribution. As Sraffa (1960, p.v) cautioned, in his analysis no changes in output or changes in the proportions in which different means of production are used by industry were being considered. Consequently, the analytical formulation of the Sraffian models limited the extent to which an analysis of technical change and the structural dynamics of economic systems could be considered. Moreover, as Sylos-Labini (1985) observed, it is in the sphere of the growth process, particularly in the presence of technical progress, that the extensions to Sraffa's (1960) framework have been least forthcoming.

It is not surprising therefore that Corsi's attempts to transplant the stochastic processes and progress function into a rudimentary Sraffian model is not always totally convincing or illuminating. The role of demand in the feedback process is severely curtailed as is the ability to consider explicitly the important determinants of changes in productivity performance such as the inducement to invest. The latter is particularly important given the close relationship envisaged by Adam Smith in particular amongst the classical economists as existing between the division of labour-technical change and capital accumulation. Finally, the Sraffian framework is not particularly well suited to portraying the essentially disequilibrium nature of the feedback relationship between increasing returns and output growth. In this respect, Corsi's (p.139-40) concession that a "main shortcoming" of her analysis was "the lack of consideration of the alternative mechanisms of price determination which may be considered as compatible with the division of labour" is particularly significant. It is chiefly for this reason that discussion of the firm and market structure in Part 3 of the book sits so uneasily with the analysis based on the Sraffian production model developed in the latter stages of Part 2.

In conclusion, Marcella Corsi's book may well succeed in achieving its aim of contributing to the revival of the classical division of labour theory in an attempt to provide an adequate explanation of the process of technical change. However the

choice of the Sraffian framework to play a central role in the formal representation of this aspect of classical economic analysis may be questioned.

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Notes

- 1 See in particular Marshall (1898). Marshall's awareness of the difficulties associated with representing increasing returns in a static equilibrium framework is indicated most directly in Appendix H of Principles.
- 2 A progress functions can be represented as follows:

$$I_N = I_1 N^{-b}$$

where

- N = cumulative total of units produced;
 I_N = hours of direct labour employed by the N th unit;
 I_1 = hours of direct labour employed in the production of the first unit
 b = progress elasticity

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Division of Labour means that the main process of production is split up into many simple parts and each part is taken by different workers who are specialised in the production of that specific part. ADVERTISEMENTS: Now, a day's production has become so technical and complex that different workers are put to different tasks according to their capacity and ability. One becomes specialised in the production of those goods for which he or she is best suited. Different workers perform different parts of production on the basis of their specialisation. The sexual division of labor in which the gender who is scarce in the society specializes in the most productive task is efficient only if the sex ratio is sufficiently high. For instance, through the ages, technological changes have lessened the brute physical component of labor. As a result, the absence of any significant biological advantage also calls into question the continued applicability of the biological model. Hadfield proposes a model where an individual's incentive to coordinate her human capital investments with those of a future but yet undetermined partner of the opposite sex, leads to a correlation between the 1 For recent studies about occupational segregation by gender, refer to Blau et al (1998) who analyze the trends in the US over 1970 and 1990. We find that changes in the division of labour can result both from reduced production time and from improved communication possibilities. The first shifts the division of labour towards a more generic structure, while the latter enhances specialisation. Although there exists heterogeneity, our estimates for a representative sample of Dutch establishments in the period 1990-1996 suggest that productivity gains have been the main determinant for shifts in the division of labour within most firms. @inproceedings{Borghans2005TheDO, title={The division of labour, worker organisation, and technological change}, author={Lex Borghans and Bas ter Weel}, year={2005} }. Lex Borghans, Bas ter Weel.