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# *C.E. Ferguson and the Neoclassical Theory of Capital: A Matter of Faith*

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ABSTRACT *In 1969 the American neoclassical economist C.E. Ferguson wrote that reliance on neoclassical aggregate production and distribution theory is a 'matter of faith' to be sorted out (he says 'answered') by econometricians. Ferguson was criticized on both sides of the debate for invoking this religious metaphor. Using the methodological framework of A.J. Cohen & G.C. Harcourt (2005, Introduction: capital theory controversy: scarcity, production, equilibrium, and time, in: A. Cohen, G.C. Harcourt & C. Bliss (Eds) Capital Theory, 3 Vols. Northampton, MA: Edward Elgar), this paper argues that faith plays a recurring role in all capital controversies and especially in modern theories of growth that rely wholesale on the aggregate production function. Ferguson's faith proves to be much more insightful than previously recognized.*

## 1. Introduction

This essay explores the work of the American neoclassical economist C.E. Ferguson in relation to the history of the Cambridge debates on capital theory. Ferguson wrote on a variety of subjects from the late 1950s through the early 1970s[1] but is best known for having said that reliance on neoclassical aggregate production and distribution theory is a 'matter of faith' to be sorted out (he says 'answered') by econometricians. In Ferguson we find one of the original arguments regarding the role of empirically validating standard neoclassical postulates in the face of reswitching and reverse capital deepening paradoxes. What Ferguson may have meant by 'faith' is discussed below; however, what is clear is that many had a field day with the religious metaphor (Robinson, 1970a; Harcourt, 1970; Ferguson & Nell, 1972; Pasinetti, 1977) and Ferguson (1971a, p. 250) himself subsequently called it 'that ill-begotten clause.' This suggests a certain degree of chagrin

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[1]Ferguson was born in Nashville, Arkansas in 1928 and died in 1972 in College Station, Texas. He was educated at Hendrix College (Arkansas, BA 1949) and the University of North Carolina (MA 1951; PhD 1957). He held positions at Duke University (1957–67), Michigan State University (1967–68), and Texas A&M (1968–72). His Presidency of the Southern Economics Association (SEA) was cut short due to his death; his never delivered Presidential Address was posthumously published in Ferguson (1972).

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regarding this choice of words, which recent evidence from the Robert Solow Papers at Duke University attests.

C.E. Ferguson played a significant role in the history of capital theory when neoclassical theory, in light of the presence of reswitching and capital reversals, was in the early phase of the Cambridge Capital Controversies. Ferguson was one of many neoclassical theorists trying to provide some explanation and/or rationale for a theory that was seriously compromised. The paradoxes in capital theory, brought to light in the 1966 *Quarterly Journal of Economics* Symposium on Reswitching, had shaken neoclassical orthodoxy to the core. These early defenses of neoclassical theory invoked 'faith' in the empirical robustness of simple (one-commodity) neoclassical models. Ferguson's invocations were steadfast, heartfelt, and unapologetically neoclassical. He had a significant impact on the debates, especially in the American camp, by reinforcing the correctness of the neoclassical vision. His belief in the correctness of surrogate aggregate models never wavered. Ferguson died in early 1972 at the dawn of the second phase of the Cambridge Controversies, where intertemporal and/or temporary general equilibrium models arose that eschewed homogenous capital as well as any uniform rate of return on the supply price of each heterogeneous capital good. Ferguson did not seriously consider these modern intertemporal/temporary equilibrium heterogeneous capital models because of his untimely death; hence, his faith remains in the context of the one-commodity or malleable-capital model.

Cohen & Harcourt (2005) contend that economic theories in general, and capital theories in particular, have often relied on professions of faith in the development of their respective theoretical paradigms. In terms of the neoclassical paradigm, this faith initially took the form of continued belief in the robustness of certain neoclassical parables evidenced in one-commodity models (Cohen, 1989; Cohen & Harcourt, 2005).[2] Ferguson's story allows us to explore this thesis concerning the role of faith in early defenses of neoclassical theory during the Cambridge Controversies.

The remainder of this essay is organized as follows. Section 2 discusses briefly some methodological aspects of the Cambridge controversies and questions of faith in economic theory along the lines of the *vision : ideology* dynamic developed in Cohen & Harcourt (2005). Section 3 elaborates on the different phases of the Cambridge Controversies and shows that Ferguson wholly belongs to the first. Section 4 presents a taxonomy of the pillars of faith that the different players the various capital critiques have invoked in the history of economic thought. Section 5 presents heretofore unpublished correspondence from the Robert Solow Papers and considers the question of faith in general and in Ferguson's own development. Section 6 concludes.

[2]The one-commodity model defines a range of simple models: the Classical corn model of Ricardo as well as two-sector or multi-sector equal production conditions models, such as the surrogate function (Samuelson, 1962), the putty-clay model (Bliss, 1968), the Meccano sets (Swan, 1956), and Mrs. Robinson's (1970a) leets. Sraffa's standard system, although a multi-commodity model proper, is from the one-commodity (corn) model in Ricardo's 1815 *Essay on Profits* (Sraffa & Dobb, 1951).

## 2. The Cambridge Capital Controversies: Methodological Comments

Capital theory has long been the subject of debate and controversy. According to Cohen & Harcourt (2005, pp. xlviii–l), the Cambridge Controversies were actually one of three distinct capital controversies in the late 19th and 20th centuries. The first occurred in the late 19th–early 20th century in debates between Böhm-Bawerk, J.B. Clark, Irving Fisher, and Thorstein Veblen. The second took place during the 1930s in debates between Frank Knight, Friedrich von Hayek, and Nicolas Kaldor. Finally, there was the Cambridge Capital Controversies running from the 1950s to the 1970s.

The Cambridge Controversies show the possibility that there exist exceptions to simple neoclassical parables in more general (multi-commodity) models, and that this cannot be ruled out *a priori*. Cohen & Harcourt (2005, p. xxxi) identify three fundamental neoclassical parables.

(1) An inverse, monotonic relation between quantity of capital and rate of interest.
(2) Return on capital grounded in technical properties of diminishing marginal productivity of capital and/or roundabout production.
(3) Distribution of income between capitalists and laborers is a function of relative scarcity and marginal products.

Reswitching, where one technique is chosen at two or more different rates of profit, violates parables 2 and 3; and the presence of capital reversing, a direct relation between the rate of profit and the quantity of capital, violates parables 1 and 2. The main point of contention is the *importance* of the paradoxes. For a critic of neoclassical theory, their existence and the inability to extend simple models betrays a fundamental logical and theoretical deficiency in the model itself. For the neoclassical economist, the logical properties of the model are nowhere as important as its predictability. Simple neoclassical models that purport to have tremendous predictive power rather than robustness are considered the cutting-edge of high-brow theorizing. Purported empirical verification takes methodological precedence over logical consistency such that evidenced logical inconsistency in and of itself is not sufficient to overturn theory.

That there is a clash of paradigms in the Kuhnian sense was recognized early on by Ferguson (1972) himself. The subtitle of his posthumously published Presidential Address to the Southern Economic Association was 'A Tale of Two Paradigms.' Dow (1980) first employed the Kuhnian clash of paradigms analysis to the Cambridge Controversies. She used the Kuhnian concepts of 'normal science' and 'extraordinary science' and argued that because the parameters of the debate were conducted mainly within technical models, technical solutions and remedies were advanced and larger theoretical issues were avoided such that 'the exercise had in effect changed from one of extraordinary science to one of normal science' (Dow, 1980, p. 376). The methodological challenge for Post Keynesian critics of neoclassical theory was taken up by Cohen (1984), who identifies the competing methodology of each respective paradigm. The neoclassicals adopt the 'received view' methodology where the 'hallmark of scientific activity is the construction of theoretical models . . . capable of generating testable predictions' (Cohen, 1984, p. 615). Not only is prediction paramount, but predictive accuracy is the most important criterion for good theory. The realism of the assumptions is of minor concern compared with the critical importance given to predictions, which when confirmed or non-falsified are said to 'explain' the phenomenon studied. This extends to the realism of the theory itself, especially given the overtly mathematically driven modeling, where mathematical solutions often possess little economic merit. By contrast Cohen calls Post Keynesian methodology the 'growth of knowledge view.' It has the very different starting point that scientific theory must go beyond prediction and provide explanatory causal mechanisms for the phenomenon studied. Here, logical structure and consistency remain paramount, and the fruitfulness of future theoretical developments engaged with empirical 'reality' is asserted as methodologically primal (Cohen, 1984, pp. 623–625).

Cohen & Harcourt (2005) use this methodological structure to frame questions around the *vision* : *ideology* dynamic.[3] Citing Schumpeter,[4] they argue that an economic theory's vision is intimately bound with ideology, that ideological underpinnings reinforce the vision, and that the two evolve together constituting the mechanisms through which theorists conceptualize and interpret economic phenomena. We can identify at least four characteristics of the neoclassical vision—the ubiquity of scarcity; individual choice and non-satiation; substitutability in consumption and production;[5] and the diminishing margin at the level of value (utility) and physical production (productivity).

Modern neoclassical theorists conceptualize the problem under consideration through such a lens. It rarely occurs to them that these fundamental pillars of neoclassical orthodoxy are appropriate only within the neoclassical context.[6] It rarely

[3]We do not at all suggest that the *vision : ideology* dynamic is limited to neoclassical theory; alternative theories also have their own visions and ideologies. See Heilbroner (1988, Ch. 8).

[4]'Analytical work begins with material provided by our vision, and this vision is ideological almost by definition. It embodies the picture of things as we see them. And wherever there is any possible motive for wishing to see them in a given rather than another light, the way in which we see things can hardly be distinguished from the way in which we wish to see them' (Schumpeter, quoted in Cohen & Harcourt, 2005, p. xlv). Dobb (1973) also discusses ideology in detail, as evidenced by the subtitle of this work, 'Ideology and Economic Theory.'

[5]It is recognized that fixed-proportion Leontief-type value and production systems do play a significant role in many areas of neoclassical theorizing; so too does linear programming and activity analysis. But smooth substitutability in both consumption and production remains of fundamental heuristic value, both theoretically and pedagogically.

[6]This speaks to the need for a thorough rethinking of the basic principles of economics. Far too often introductory textbooks present orthodox theory under the guise of being the only theoretical structure possible, when in truth it is one of several alternative explanatory theories. Hence, it becomes important to stress the existence of a plurality of theoretical perspectives, at the introductory principles level, so as to debunk the erroneous impression that economics is exclusively a behavioral science that stresses 'economic rationality'

occurs to them that alternative theorizing regarding the objective economic phenomena studied may be possible. The neoclassical vision is set in stone. This type of determinism is captured well by Mongiovi (1999, p. 7) in expressing the sentiments in Garegnani (1970):

> The principle of factor substitution originated not from the observation of empirical regularities but is a process of deduction from axioms presumed by early marginalists to be plausible. The notion of price-elastic factor and commodity demand functions has so deeply penetrated the economic intuition of our age that to doubt their existence seems to contradict the obvious. But of course these functions have never been, and can never be, directly observed. If these relations were as obvious to common senses as they are now so widely deemed to be, we might wonder how the science of political economy could have gone on without them for nearly two hundred years – how they could have escaped the notice of such astute and careful intellects as Smith, Ricardo, and Marx.

This certainly is not a static process, and new developments and controversies can shape in varying degrees the *vision : ideology* dynamic.[7]

Cohen & Harcourt (2005) identify two points where ideology enters neoclassical theory—the need for an ethical justification of profit/interest, and the practice of sustaining faith in the results from simple one-commodity models that support the neoclassical vision.[8] In simple one-commodity neoclassical models, especially of the Clark-Ramsey variety, this 'ethical' distribution is expressed through the marginal concept quite nicely. However, when more general models are considered, well-known problems arise for economic models of any variety, neoclassical or otherwise (see Cohen, 1989; Cohen & Harcourt, 2005, pp. xli–xlv). For neoclassical theory, multi-sector models of heterogeneous

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(read optimizing behavior in the face of constraints) as an inherent trait of human nature, as well as the 'objective' call for unfettered 'free' trade and a limited role of government according to doctrine of *laissez-faire*. Notable exceptions to this unfortunate trend do exist (Keene, 2001; Hunt & Sherman, 1982; Bober, 2001). Colander (2010) is one of the few introductory mainstream texts openly discussing alternative paradigms, although these discussions are mostly limited to marginal and ancillary summary treatment at the end of chapters. The need to develop alternative pedagogical approaches at the introductory level was the explicit purpose of Robinson & Eatwell (1973). Harcourt & Kerr (2009, p. 186) refer to this project as 'the light that failed'—not because of its theoretical approach, but rather because of its cumbersome and difficult pedagogical style (see also King & Millmow, 2003).

[7]This does not however mean that it necessarily will; certainly the future is uncertain as regards the ultimate impact such developments will have on theorizing. Take, for example, Dow's (1980) observation that the influence on neoclassical orthodoxy with the development of imperfect competition theory in the 1920s and 1930s was much more profound that those of the Cambridge Capital Controversies.

[8]Ferguson engaged in both 'points of entry.' His 1951 Master's Thesis considered the question of excess profits taxation. It was published in the *Southern Economic Journal* (Ferguson, 1952). The question of excess profits taxation speaks to the heart of an 'ethical' distribution of profit.

capital face the problems of capital reversing and reswitching; at the very least, the possibility of such perverse phenomena cannot be ruled out *a priori*.[9]

The ethical foundation for justifying profit/interest became explicit in J.B. Clark's theory of distribution, where remuneration was posited as a function of marginal productivity to production.[10] To reinforce this 'ethical' nature of income distribution in capitalism, despite the presence of perversities in more general models, defenders of neoclassical theory placed faith in the robustness of their simple neoclassical parables. It is this underlying and present faith, one can argue, that accounts for the continued dominance of aggregate neoclassical models of production and growth, despite all that has been written regarding the tenuous nature (at best!) of aggregate models at fundamental conceptual and methodological levels.[11] Indeed, by Bliss's (2005, pp. xxiv–xxv) own admission, the frontiers of neoclassical capital theory, or what he calls 'mainstream theorizing,' have returned wholesale to highly suspect models of aggregate capital. He identifies four lines of such research.

(1) Shift from general equilibrium ('high dimension') models to one-commodity models.
(2) Adoption of Ramsey-style dynamic-optimization of the savings rate over Keynesian/Harrodian fixed saving propensity.
(3) Adoption of the single representative agent as opposed a multiplicity of consumers.
(4) The 'joining' of endogenous and exogenous notions of technological progress.

Here, faith in the one-commodity world reigns supreme; clearly the Cambridge Controversies had little or no impact on the neoclassical vision of an economy. This, we argue, is a curious example of how Ferguson's faith may actually have been more insightful than previously recognized by either side in the debate.

[9]In terms of Classical models along the lines of Sraffa, exceptions to the inverse wage–profit relation arise in multiple-commodity models (see Cohen, 1989, p. 231).

[10]Many Post-Keynesians argue that the 'ethical' foundation for profit speaks to the reactionary origin of neoclassical theory regarding the threat of Marxian and other socialist thinkers who accepted Ricardo's labor theory of value as well as Marx's exploitation theory of profits. Certainly this is the case of Sraffa in his unpublished Lecture Notes on the Advanced Theory of Value of 1928–31 (Sraffa Papers, D2/4). But the removal of exploitation, in tandem with the emerging idea that profit was the legitimate result from capitalistic savings, began in the post-Ricardian period prior to Marx—this is seen especially in Mill's ([1824] (1965), p. 22) defense of the right of the capitalist against the sentiments and writings of Hodgskin ([1825] 1962) and Thompson ([1824] 1962) calling for the right of workers to the whole product of labor. The author thanks an anonymous referee for this insight.

[11]The resurgence of the Cobb-Douglas and aggregate neoclassical production functions generally is a particularly glaring example of this. See the Symposium on the Aggregate Production Function in the summer 2005 issue of the *Eastern Economic Journal*, and Carter (2011a).

## 3. Phases in the Neoclassical Defense

By the time of the 1966 Symposium in the *Quarterly Journal of Economics* the above implications of reswitching and capital reversals were accepted across the board. From this point on neoclassical economists began searching for an effective response to these criticisms. Tracing the history of the neoclassical defense of the Cambridge Criticism evidences two distinct phases—the first associated with defending the heuristic value of the aggregate capital concept, paradoxes notwithstanding, and the second with abandonment of aggregate capital itself and movement into inter-temporal and temporary general equilibrium analyses and models. The dividing line between the two phases concerns the notion of equilibrium, which had become quite entrenched with the publication of Bliss (1975), as articulated by Garegnani (1990).[12] For Garegnani neoclassical capital theory begins with 'Walras's Inconsistency,' defined as the inability in Walras's general equilibrium system of equations to reconcile the homogeneous fund of saving with the heterogeneity of physical capital goods. The theory of capital, argues Garegnani (1990, p. 3), tries to answer this question, where 'only one of two ways out of the inconsistency can be conceived.' Either we change the notion of capital from Walrasian heterogeneity into capital conceived as a homogeneous quantity; or we change in the notion of equilibrium, keeping the notion of capital heterogeneity. All three historical controversies in capital theory focused attention on the first 'way out.' The second 'way out,' by changing the notion of equilibrium, is associated almost completely with the second phase of the Cambridge controversies.

### *3.1. The First Phase of the Neoclassical Defense: Aggregate Capital Models Retained*

In the early phase of the late 1960s and early 1970s, neoclassical capital theorists launched a two-prong defense. First, they held that reswitching results can be further marginalized and seen as unimportant in more complicated aggregate models. Second, they held that it is an empirical question after all. One defense reinforced the other and both were consistent with neoclassical methodology stressing the need for predictability.

The question of whether or not the capital theory paradoxes can be verified starts in the original 1966 *QJE* Symposium with Bruno *et al.* (1966)[13] and Samuelson (1966).[14] Ferguson is one of the strongest advocates for the empirical verifiability of neoclassical aggregate capital parables (especially Ferguson, 1969). At the same

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[12]Lazzarini (2010) also discusses this idea of two phases in the neoclassical response, but he cites Bliss (1970) as marking that turning point.

[13]'There is an open empirical question as to whether or not reswitching is likely to be observed in an actual economy for reasonable changes in the interest rate' (Bruno *et al.*, 1966, p. 545, n. 2)

[14]'Reswitching, whatever its empirical likelihood, does alert us to several vital possibilities' (Samuelson, 1966, p. 582).

time empirical verification arguments were being advanced, defenders of neoclassical theory were scrambling to find an alternative theoretical response.

Brown (1969), developing a line of analysis first introduced in Hicks (1965), introduced the concept of 'capital intensity uniqueness' (CIU). The basic thrust of this idea is to distinguish 'substitution effects' from 'composition effects' such that if the former dominates up to a threshold value, the case for reswitching is further qualified. This notion was interpreted in different ways by Ferguson & Allen (1970), Sato (1974) and Gallaway & Shukla (1974).[15] The basic idea behind CIU is summed up nicely in Ferguson (1969, p. 258), who cites an earlier draft of Brown (1969): '[I]f there is "enough" substitutability in the economy, either between factors of production or between commodities in demand, neoclassical theory emerges unscathed. Otherwise not.'

Hence, what Ferguson & Allen (1970, p. 109) call 'Mrs. Robinson's Paradox' would be to production and distribution theory what Giffen's Paradox was to the theory of demand.[16] And it is here we see movement to a Kuhnian normal science interpretation of the problem. The logical possibility of reswitching is acknowledged; however, it is deemed to be a problem of measurement rather than theory, purported 'empirical verification' takes precedence over logical consistency.[17] In recent years there has been a rekindled interest in the question of the empirical relevance of paradoxes in capital theory (see Zambelli, 2004;[18] Han & Schefold, 2006[19]).

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[15]See Carter (2011b) for a more thorough development of this aspect in the neoclassical defense.

[16]The analogy with Giffen's paradox is especially explicit in Stiglitz (1974, p. 896).

[17]See Carter (2011b) for an account of Robinson's later position on capital theory. It is shown that her change corresponds precisely at the time she began her debate with Ferguson (1971a) in the *Canadian Journal of Economics* and reviewed Ferguson's book (1971b) for the *Economic Journal*. See also the recent book by Harcourt & Kerr (2009).

[18]Strictly speaking, Zambelli (2004) is not empirical in that it does not consider actual data but rather is a simulation experiment that considers the probability of paradoxes in those simulations. He concludes that while the likelihood of reswitching is low (nine cases out of 21,000; see Table 4, p. 113), the presence of capital reversals are significant, with only 40% of the simulations evidencing the 'well-behaved' inverse relation between the value of capital and the profit rate (see Table 2, p. 112).

[19]Han & Schefold (2006) is an empirical study in the strict sense of the term. Theirs is an empirical test of reswitching and 'returns of processes' as well as reverse capital deepening for nine OECD countries from the period of 1968 to 1990 using 32 input–output tables for 36 sectors. They consider 4,389 switchpoints for 496 wage–profit envelops derived from the data, and find that in 4,229 cases (over 96% of the time) the standard neoclassical results of an inverse relationship between the capital–labor ratio and the profit–wage ratio are evidenced. The authors argue that this result is 'ambiguous' in that even at 4%, the empirical evidence against neoclassical results remains statistically significant:

> [The] results obtained so far are ambiguous and likely to lead to conflicting interpretations. More than 96% of cases of an unequivocal fall in the intensity of capital with the wage rate will be regarded as a confirmation by many

### *3.2. The Second Phase of the Neoclassical Defense: Intertemporal and Temporary Equilibrium*

Beginning around 1973, general equilibrium economists argued that defending neoclassical models using the aggregate capital notion was doomed to failure. The empirical defense was falling out of favor as the neo-Walrasian intertemporal/temporary general equilibrium framework came to dominance. As Kurz & Salvadori (1995, p. 451) note:

> Other advocates of the neoclassical approach were conscious of how *defective the attempts to avoid reswitching and capital reversing or to play down their importance using the 'empirical' route were*. Since the phenomenon was irrefutable it had to be absorbed and shown to be compatible with more sophisticated versions of the theory, that is, those on the 'frontier of knowledge'. (cf. Hahn, 1975, p. 363; emphasis added)

Hahn (1975, 1982), Bliss (1975), and Blaug (1974) advanced the thesis that the aggregate capital concept itself was bogus and that high-brow neoclassical theory had no need for it.[20] It must be made clear that the heterogeneous capital models have been in existence since Walras, but such models were under the radar throughout the early defenses of neoclassical theory. It was not until 1975 that we can really say that these models came to dominance, as dissatisfaction with aggregate neoclassical models came to a head (for an earlier dating, see Lazzarini, 2010). Basing themselves in the work of Malinvaud (1953), Arrow & Debreu (1954), and Debreu (1959), the modern neo-Walrasian intertemporal/temporary equilibrium framework argued that the problem of capital required recognizing both the heterogeneity of capital goods as well as heterogeneity of rates of returns to the various capital stocks. The original Walrasian framework was returned to, but this time absent Walras's assumption of an equal rate of return to the heterogeneous stocks of capital. The basic model developed in the mid-1970s had the two fundamental characteristics of an intertemporal environment and non-equality of the rate of return.[21]

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> neoclassical authors, while their opponents will state that the logical problems of the theory remain unsolved and have received empirical support. (Han & Schefold, 2006, p. 758)

[20]Hahn (1975, 1989) especially is critical of textbooks, especially in the United States, espousing the aggregate capital concept: 'Much of [Joan Robinson's] criticism was directed against the textbooks. I believe the American economists have done almost as much harm as Joan did in certain cases, with their ghastly little textbooks. The textbooks are the worst thing that happened to modern economics' (Hahn, 1989, p. 897). In the 1960s, Ferguson was one of a handful of prominent textbook writers, some editions of which went with collaboration even into the 1980s.

[21]The definitive statement of this appears in Bliss (1975), but Hahn (1972, 1975, 1982) also played a fundamental role. See Lazzarini (2010) for a thorough account of this second phase in the neoclassical defense.

### *3.3 The Current State of the Debate*

Strictly speaking, the ‘answer’ to the Cambridge capital controversies remains that of an intertemporal and temporary general equilibrium model eschewing a uniform rate of return on the supply price for each heterogeneous capital good. However, as made clear in Bliss’s (2005) comment quoted above, neoclassical theory has returned to simple models that employ aggregate production functions of the Clark–Ramsey variety. These modern models are usually in Cobb–Douglas form, but sometimes also expressed in CES form. Since the natural logarithm of both the Cobb–Douglas and the CES are additively simple and relative income shares are often assumed constant, models that use these functional forms have a built-in affinity with marginal productivity assumptions, and this affinity is often mistakenly taken as evidence of the empirical robustness of these simple models.[22]

## 4. Faith and the theory of capital

Cohen (1989) and Cohen & Harcourt (2005) claim that all types of economic theory have a *vision : ideology* dynamic. This dynamic frames the way economic phenomena are conceptualized and understood. As regards simple neoclassical theory, this *vision : ideology* dynamic comes out in the construction of an inverse demand curve for the factor ‘capital’ possible in one-commodity models. This *vision : ideology* dynamic is reinforced by faith, defined as the belief that the results (parables) that result from simple (one-commodity) models are robust in that they can be extended to the more general multi-commodity case.

This ideological entry point into neoclassical theory concretely manifests around the ethical justification of profit, and sustaining and maintaining faith in simple models and neoclassical parables. Cohen & Harcourt (2005, p. xlviii) elaborate on the latter: ‘The second entry point for ideology is the faith professed by many capital controversy combatants that disequilibrium dynamics will converge to equilibrium outcomes, or their faith in the underlying visions when one-commodity results are not robust.’ The latter type of ‘faith’ mentioned here is an assumed extension of the simple (one commodity) models of distribution to more complicated cases, even in the face of contrary evidence.[23] Each of the three distinct periods of capital controversy has associated issues of faith among participants in the debate. From Cohen & Harcourt (2005, pp. xlviii–li) the

[22]A recent critic of the resurgence of the Cobb-Douglas in modern growth models is Sylos Labini (1995, pp. 497–498), who argues that the constant returns to scale assumption is itself and ‘act of faith’: ‘[O]n the basis of an act of faith in the marginalist theory of distribution, the constraint $\alpha + \beta = 1$ was introduced, sometimes implicitly, and the value of $\beta$ was even introduced exogenously. The result is that neither the values of $\alpha$ and $\beta$ nor the so-called “residual factor” can be considered theoretically significant.’ See also note 12 above.

[23]The other ‘faith’ in the convergent properties of the dynamized version of the theory despite tendency towards disequilibria is not relevant for the present discussion.

faith of various combatants in the different capital controversies of the late 19th to 20th centuries can be seen in Table 1.

Table 1 makes clear that the notion of faith is not unique to Ferguson or to the Cambridge Controversies. This is an important point because it puts Ferguson's professions into sharp relief—his explicit invocation of 'faith' was perhaps less about naïveté and may instead be construed as an effort towards clarity and above all honesty as regards a defense of neoclassical theory in the throes of serious crisis. In her review of his book, Robinson (1970b, p. 336) keenly discerned this aspect of Ferguson's work: 'A clear uncompromising statement of the principles of neoclassical economics will be very useful to their opponents. (I doubt whether their supporters will welcome it as much).' Robinson's parenthetical remark is borne out by the Solow–Ferguson correspondence of 1971 (see below and Carter, 2011b).

## 5. Ferguson: From Faith to Paradigm

Ferguson (1969) spends the majority of the Preface to his book discussing these questions, and it is here we find the famous 'faith' comment:

> In the initial draft [chapter 12 on aggregate distribution] formally ended with the multi-sector model of technological progress and relative factor shares. Since the exposition of neoclassical aggregate theory ... depended entirely upon the assumption of J.B. Clark real homogenous capital, I added an appendix on Samuelson's 'Parable and realism in capital theory' in order to show that the results of neoclassical analysis could be obtained from fixed-proportions, heterogeneous capital models.[24] Shortly after this was completed the 'Symposium on capital theory' appeared in the *Quarterly Journal of Economics*; and it then became quite apparent that the Cambridge Criticisms, as I call it, must be accorded more careful consideration. As it now stands, the last half of chapter 12 is given over to an exposition of the Cambridge Criticism of neoclassical theory. Its validity is unquestionable, but its importance is an empirical or an econometric matter that depends upon the amount of substitutability there is in the system. *Until the econometricians have the answer for us, placing reliance upon neoclassical economic theory is a matter of faith.* I personally have the faith; but at present the best I can do to convince others is to invoke the weight of Samuelson's authority. (Ferguson, 1969, p. xv; emphasis added)

We have already noted that Ferguson was emphatic that the proving ground for neoclassical theory lies not in the logical consistency of its tenets but rather in its

[24]This appendix and the 'initial draft' we conjecture probably look a lot like the argument in Ferguson (1967). In Robinson's review of Ferguson's book, the above-referenced 'initial draft' was addressed in the following manner: 'Professor Ferguson tells us that he had almost completed the draft of this book, relying upon Professor Samuelson's surrogate production function to shelter him from what he calls Cambridge Criticism, when the "reswitching" controversy altered him to the fact that this defense is not as impenetrable as he had believed' (Robinson, 1970b, p. 336). Despite journeys both to Duke and Texas A&M in the hopes of finding this material, Ferguson's own unpublished material has not been found and is presumed lost; hence this can only remain a conjecture.

**Table 1**. Different 'faiths' of different players in the various capital critiques

| Capital controversy | |
|---|---|
| Late 19th–Early 20th Century | **J.B. Clark's faith**: Recognizes that dynamic implications of his malleable capital model violate comparative static assumptions consistent with marginal productivity theory but remains insistent on the dominance of static forces. |
| | **Eugene Böhm-Bawerk's faith**: '[Retention] of faith in the one-commodity result of an inverse monotonic relation between the interest rate and the capital intensity, roundaboutness and productivity' (Cohen & Harcourt, 2005, p. xlix). |
| | **Irving Fisher's faith**: Assumption that general equilibrium will adequately reflect partial equilibria and results derived from partial equilibrium models can be generalized, although he does not in fact consider the general equilibrium implications of a rise in prices on capital intensity and the rate of return. |
| 1930s | **Friedreich von Hayek's faith**: Retention of faith in basic one-commodity models of the period-of-production Austrian variant and assumption that decreases in the rate of profit prompt more 'roundaboutness' in production methods, thus increasing the capital intensity despite acknowledging that it cannot be done in more general models. |
| | **Nicolas Kaldor's faith:** Faith that capital is essentially a factor of production the return on which is a function of scarcity and marginal productivity. |
| | **Frank Knight's faith**: Faith that capital is a 'permanent timeless homogenous fund of value which is embodied in "factors of production"' (Cohen & Harcourt, 2005, p. l). |
| Cambridge Capital Controversies (1950s–1970s) | **Paul Samuelson's faith**: Faith that marginal productivity theory is akin to laws of physics: 'Until the laws of thermodynamics are repealed, I shall continue to ... believe in production functions...' Samuelson, 1966, p. 444). |
| | **C.E. Ferguson's faith**: Faith that robustness of marginal productivity theory can be empirically validated: 'Until the econometricians have the answer for us, placing reliance upon neoclassical economic theory is a matter of faith' (Ferguson, 1969, p. xv). |

empirical usefulness. Many authors have cited Ferguson this score. In his 1969 book, Ferguson first and forcefully advanced such an empirically oriented justification:

> The crucial point to emphasize is that the validity of neoclassical theory is an *empirical*, not a *theoretical*, question. At the time of this writing, there have been some, but limited advances toward the construction of statistical models by means of which the empirical validity of neoclassical theory may be assessed. (Ferguson, 1969, p. 258)
>
> The question that confronts us in not whether the Cambridge Criticism is theoretically valid. It is. Rather, the question is an empirical or an econometric one: is there *sufficient substitutability* within the system to establish the neoclassical results? (Ferguson, 1969, p. 266; emphasis added)

It is precisely along these 'empirical' lines that both Blaug and Bronfenbrenner locate Ferguson's notion of 'faith.' Blaug (1974, pp. 41–42) defends Ferguson from the ridicule that was heaped on him for the infamous 'faith' comment:

> There is . . . nothing absurd in Ferguson's . . . famous declaration of 'faith' in neoclassical parables until such a time that 'the econometricians have the answer for us' . . . The history of both the physical and the social sciences is replete with such examples of 'faith,' that is, a determination to ignore logical anomalies in a theory until they are shown to be empirically important, rather than leave whole areas of intellectual endeavor devoid of any theoretical framework.

Bronfenbrenner (1975, p. 3) argues a similar line, referring to Ferguson's notion of 'faith' as 'a generally misinterpreted passage of his *Neoclassical Theory*' (Bronfenbrenner 1975, p. 3). Going further, he states:

> Ferguson's profession of faith is denigrated by his critics. It is *not* faith in conventional wisdom as such, or in such great men as J.B. Clark, Alfred Marshall, or A.C. Pigou. It is faith in 'casual empiricism' until its results are disconfirmed . . . The evidence against capital-reversal and double-switching and in favor of the conventional wisdom seems largely empirical, like that against the 'Giffen paradox' of a rising demand curve in consumption theory, or like that against elasticity pessimism' and 'immiserizing growth' in international trade. (Bronfenbrenner, 1975)

On February 10, 1971, Ferguson sent Solow a draft of his response to Robinson's (1970a) review of his book and her (1971) *Canadian Journal of Economics* article. Solow wrote a detailed response to Ferguson's initial draft; indeed, Solow's influence on the published version is significant when one compares it with the original version Ferguson sent to Solow (which is extant in the Solow Papers).[25] On the question of 'faith,' Solow remarks: 'Obviously, I agree with you about the empirical utility of aggregate analogies. *I just wish you had called it a working hypothesis rather than a "faith."* But this note should make it quite unambiguous. (Solow to Ferguson, February 22, 1971; emphasis added)

[25]Solow's influential comments were not lost on Ferguson, who acknowledges both Solow and Bronfenbrenner in the final published version (Ferguson, 1971a, pp. 250, 251 n8).

Ferguson took this advice. In the final published version of his response to Robinson, he writes:

> [N]eoclassical theory deals with macroeconomic aggregates, usually by constructing the aggregate theory by analogy with the corresponding microeconomic concepts. Whether or not this is useful is an empirical question to which I believe an empirical answer can be given. This is the 'faith' I have, but which is not shared by Mrs. Robinson. *Perhaps it would be better to say that the aggregate analogies provide working hypotheses for econometricians.* (Ferguson, 1971a, pp. 251–252; emphasis added)

Indeed, Ferguson lamented the ridicule heaped on him by the 'faith' statement. In the published response to Robinson he states that:

> I should like to address a few comments to [Robinson's] review [of Ferguson's book] in the hope of establishing some ground for mutual communication. As a caveat, I should add that 'I still have the faith', although that *ill-begotten clause* did not convey adequately what I have faith in. (Ferguson, 1971a, p. 250; emphasis added)

That infamous 'ill-begotten clause' continues to haunt Ferguson's legacy, as noted by Solow in recent correspondence (December, 26 2007) to the present writer: 'He has taken an undeserved beating, mainly on account of that one ill-judged remark about "faith".'

What Ferguson may have meant by 'faith', and why he chose this particular phrase, may perhaps be revealed in the concluding chapter of the dissertation written by Ferguson's last dissertation student, Heather Slemmer (1971). Contextualized within the debate of the social rate of return between Solow (1967, 1970) and Pasinetti (1969, 1970), Slemmer presents the idea that the heart of the difference between the two Cambridges hails from two distinct and competing paradigms of thought. As noted previously, Ferguson (1972) uses this in his Southern Economics Association Presidential Address. Slemmer writes that:

> Paradigms are like gestalts. A scientist views the world from one paradigm or he sees it entirely from another paradigm. No one theory ever solved all possible problems, instead the paradigm specifies which problems are admissible ... Since a paradigm cannot be proved or disproved, but only preferred above others
>
> > '...The man who embraces a new paradigm at an early stage must often do so in defiance of the evidence provided by problem-solving. He must, that is, *have faith* that the new paradigm will succeed with the many large problems that confront it, knowing only that the older paradigm has failed with a few. *A decision of that kind can only be made on faith*.' (Kuhn, 1964, p. 158)
>
> It is something akin to this that seems to have occurred in the Cambridge-US disagreement and the Pasinetti-Solow exchange. Certainly they seem to talk through each other and each refuses to accept the assumptions of the other, so that neither side can be proven right. (Slemmer, 1971, pp. 148–149; emphasis added)

Here we have powerful evidence, buried deep in the dissertation of the last PhD student he supervised, that Ferguson drew the term 'faith' directly from Kuhn's

*The Structure of Scientific Revolutions*, yet Ferguson himself never made direct reference to Kuhn's work.

## 6. Conclusion

The present essay attempts to support the thesis of Cohen & Harcourt (2005) that questions of faith remain a vital part of the *vision : ideology* dynamic in any economic theory. The neoclassical emphasis on model predictability over logical consistency allows for the belief in neoclassical parables inherent in its vision to be both sustained and maintained. In the early phase of the Cambridge Controversies, Ferguson and his colleagues were actively searching for an answer to the questions posed that would allow neoclassical theory to remain intact. A line of defense was advanced that eschewed logical rejection of neoclassical theory; instead, exceptions to the problem were sought out and empirical likelihood and predictability was emphasized in accordance with neoclassical methodology. This required *faith*, defined as a belief (assertion) that the neoclassical parables emergent from simple (one-commodity) models were robust.

In fact, this defense of empirical verification over logical consistency is actually a negative defense, in that evidenced logical inconsistency in and of itself does not overturn theory. This is made quite explicit in Ferguson's (1969) Preface with his claim that the econometrician will ultimately provide the answer of whether the theory can be disproved. The analogy of paradoxes in capital theory as the production-distribution dual of the Giffen good was another effort to refocus the debate to question, in this case making it one of measurement and index number. This all allowed the neoclassicals to frame the debate as a question of normal science over extraordinary science. But in fact this defense is a bit disingenuous. Social sciences are not hard sciences and thus cannot be rejected or accepted by experimentation; logical consistency in describing objective economic phenomena must be asserted as methodologically primal.

The five or so years following the 1966 *QJE* Symposium were trying times for neoclassical theory. Ferguson articulated in writing what many of his neoclassical colleagues were thinking and feeling. Yet his open, honest, and unequivocal profession of faith came back and slapped him in the face, something that he was aware of before his death. In his response to Solow's admonition for using the term 'faith,' Ferguson writes:

> I think that I have always taken a candid appraisal of my own abilities. This has resulted in the following: (1) I am not inventive in the sense that you and Paul [Samuelson] are; (2) I am the best expositor or writer in the profession. While (1) remains true, (2) has been proven false . . . I now must be the *worst* expositor. I am going into sackcloth and ashes to atone for this. (Ferguson to Solow, February 25, 1971; emphasis in original)

Ferguson, however, was too hard on himself. Perhaps this reflected the heat he was getting from critics on both sides of the debate. This becomes all the more tragic for Ferguson given that neoclassical theory has come full circle (see Bliss, 2005), and modern theory has once again come to rely on simple one-commodity models—in a word, faith. In addition, the question of the empirical likelihood of paradoxes in capital theory has once again received attention (see Zambelli, 2004; Han & Schefold, 2006). A return to modes of thinking associated with the early defenses in capital theory shows that Ferguson's contributions (specifically around the notion of faith) need to be reassessed. The aggregate capital modeling that characterizes modern theories of growth must be forced to openly reckon with the pillars of faith that Ferguson invoked at the foundations of that approach. Scientific rigor and honesty demands no less.

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