

*Rethinking the Law
of the Tendency
for the
Rate of Profit to Fall*

February 17, 1998

Draft 2

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I gratefully acknowledge the careful readings and
valuable comments of Richard Wolff, Asatar Bair and Stephanie Eckman.

Abstract:

This paper's aim is to reconsider some recent debates over the Tendency for the Rate of Profit to Fall (TRPF) in light of a careful reading of *Capital*. Such a careful reading of *Capital* reveals an abundance of knowledge about the dynamics of capitalism: its dynamism alongside its vulnerability and fragility. This knowledge from *Capital* has been collectively 'forgotten' due, in part, to the recent resurgence of vulgar and neo-Ricardian economics within the left.

Within the debate over the TRPF, this collective 'forgetfulness' manifests itself in the widely heralded Okishio theorem. Though many Marxists have engaged the rhetorical claims of the proponents of the Okishio theorem, they have often taken the position that Marx's method is different from and therefore incompatible with the method of the vulgar and neo-Ricardian economists.

The vulgar and neo-Ricardian economists on the left typically reject such a position as rubbish. Many of them adopt an essentialist methodology which believes there is only one essential truth and therefore only one 'Theory' that can capture that truth. Any talk of multiple methods or multiple theories is rejected outright. Furthermore, they argue that since logical inconsistencies are absent from the Okishio theorem, it must embody that 'True Theory.'

My view is opposed to these theoretical essentialists and I side with the Marxist claim that Marx's methodology is different from that of vulgar and neo-Ricardian theorists; it therefore produces different truths. However, my understanding of Marx's method compels me to do more than simply declare its theoretical difference. My understanding is that method places great importance on Marx's concept of critique. I understand this concept of 'critique' as moving beyond simply declaring methods and truths as different. The role for Marxist critique is to delineate those differences: to create a new truth from these different and disparate truths. The TRPF is clearly evident within Marx's textual development of *Capital*. In contrast, the TRPF is absent from the literature advanced by the Okishio theorem's proponents. The role of critique is not simply to state and restate one position against another; critique instead produces an understanding of the differences in those positions.

This paper is motivated by just this spirit of critique and so I organize this paper into three main parts. In the first, I try to restate some of the more important aspects of the TRPF developed by Marx. In the following two sections, I turn toward a critique of the Okishio theorem; toward understanding why the TRPF is absent from its position. Section three shows how the Okishio theorem carries such persuasive power due to ambiguities surrounding its viability condition. Its persuasive power derived mainly from several ambiguities that surround its terminology. Its method is primarily a method of persuasion through confusion. These ambiguities condense in the so-called viability condition which allows the theorem's proponents to derive their results. The theorem's proponents have rarely justified their use of the viability condition. Even when such rare justification does arise, it has only mired the theorem in further ambiguities. Section four then examines Marx's most unique contribution to the debate over the TRPF. We see there how Marx's introduction of fixed assets and capitalist competition through revolutionizing the means of production lead to another TRPF; this one arising from the contradictory influence of technological innovation.

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1 Introduction.

Recent debates surrounding the tendency of the rate of profit to fall (TRPF) within Marxian theory have frequently ignored Marx's contributions to this issue. Many who have opposed any theory of the tendency for the rate of profit to fall have felt justified in largely ignoring Marx's own development of it. Still others have defended the TRPF but often by reinventing the wheel: taking great strides to formulate fully original responses to the arguments against the TRPF. While the need to formulate such new and original ideas is no doubt important, it is sad how few have availed themselves of the abundant and insightful writings of Marx himself on the subject.

With the resurgence of neo-Ricardian theory much of the terrain of the TRPF has shifted to Sraffian input-output analysis. While Marx certainly never encountered the linear algebra of neo-Ricardian economics, a great portion of his work is a criticism of Ricardo's political economy, the same method this linear algebra attempts to mathematize. The section of *Theories of Surplus Value* entitled "Disintegration of the Ricardian School" demonstrates both Marx's respect for Ricardian political economy and the differences he draws between his theoretical development and Ricardo's. We should find then that many of the criticisms Marx applies to Ricardo take their mathematical expression as criticisms of neo-Ricardian economics. As we will see below, these Marxian criticisms of Ricardian economics will prove devastating to those new arguments that deny Marx's TRPF.

It is past the time now that someone should begin to draw out Marx's critique of Ricardo's political economy and to demonstrate how it provides similar insights as a critique of neo-Ricardian political economy. The recent debate over the TRPF has centered around the Okishio theorem¹. While the Okishio theorem's contribution to the debate is new in its use of linear algebra, it still has many similarities to the arguments that have been made for centuries.

Since political economy first raised the concern over the TRPF, the discipline has tried to understand whether this tendency is inherent and inevitable or the result of some 'external' culprit whose influence could be minimized or even eliminated. Classical political economy asks the question: 'is the TRPF something we have to live with as a danger inherent in capitalism, or is it caused by some foreign malignant influence?' Smith answers with the former by arguing that the TRPF is brought about by the competition of capitalist enterprise. The TRPF need not concern us, Smith consoles, because "the diminution of profit is the natural effect of [competition's] prosperity" (Smith 1986, p194). We need not worry about this fall in profit because it is only the indication of how prosperous we are.

Ricardo strongly disagreed with Smith, and it is here we find the beginnings of the recent debate and the Okishio theorem. Ricardo argued that competition could not cause a fall in the rate of profit, only its equalization across enterprise. Capitalism, left to itself, would foster a rising rate of profit if only the scarcity of fertile land and the idle gain of the landlords who own such land would not stand in capitalism's way. As the rate of profit falls, says Ricardo, "the only real gainers would be the landlords" (Ricardo 1948, p75). His reasoning is based on his

¹ Though the theorem (in its latest incarnation) is nearly forty years old, I still feel justified in calling it recent in a debate that has lasted three centuries.

arguments about differential rent, suggesting that as production is extended onto marginal land of lower productivity, the landlord owners of higher productivity land would siphon off surplus rent from capitalist profit.

Ricardo thus sees both landlords and the unfortunate scarcity of natural resources as the main causes of the TRPF. He argued that we could minimize these deleterious effects by opening up free trade and eliminating landlords. Yet he still feared that once the finite limit of the earth's land were reached we would still face the dreadful moment of society's demise as the profit rate fell: the steady-state economy. Most of political economy viewed the TRPF as an unfortunate evil: a burden which society must simply bear. Whether inherent to the economy or caused by the non-economic, it was simply a dreadful example of the natural problems facing the human condition discovered by the dismal science.

Marx entered into this debate with a bang, and its reverberations still ring up to the present. In contrast to classical political economy which understood society as synonymous with capitalist society, Marx understood capitalism as an historically contingent and transient social formation. What caused discomfort for the classical political economists was a source of optimism for Marx. Marx therefore introduced a new dimension into the debate. Besides offering compelling criticism to both Smith and Ricardo on the TRPF, he also repositioned the TRPF as something to celebrate rather than dread. Marx analyzed how capitalism was only the latest social form. Just as other forms had risen to prominence and passed into history so too would capitalism. For Marx, the TRPF was only one of many symptoms of capitalism's mortality.

Marx, therefore, profoundly changes the tone of the debate over the TRPF. He rejects the classical's framing of the debate in terms of whether the TRPF is intrinsic or extrinsic to capitalism. He instead focuses on how this tendency participates in undermining capitalism and in building conditions of existence for its supersession. This is not to suggest that the TRPF unambiguously undermines capitalism. Rather the TRPF exerts contradictory forces, both undermining and sustaining capitalism. However, it is precisely the undermining tendencies that Marx sought to articulate and that bourgeois theory seeks to deny.

With this shift in the tone of the debate, it is not at all surprising that bourgeois economics would seek to deny and repress the very possibility of the TRPF, even though the TRPF was once an important object of bourgeois economic analysis. The bourgeois economists wish to paint capitalism as eternal and invincible; thus they wish to discredit the TRPF. The denial of Marx's TRPF began almost immediately after the publication of volume three in the work of von Bortkevicz leading up through Okishio to the more recent work of Roemer and Bowles.

What we should find disturbing however, is the way in which this denial of Marx's TRPF has seeped into Marxism itself. Marxists of all stripes have begun to understand capitalism as immortal. Though Marxists take seriously Marx's analysis of capitalism's hegemony, we often join in repressing his analysis of its vulnerability—society's own potential for transformation which capitalism itself has cultivated. This vulnerability of capitalism, its potential for transformation, finds expression in uncountable forms: the TRPF, Marxism itself, capitalism's concentration of the means of production and its socialization of labor, etc. All of weaknesses of capitalism are repressed in one way or another by Marxists and non-Marxists alike. Marxian theory should recover its traditional understanding of capitalism as a fragmentary and contradictory totality—moving away from its

constitution as a permanent, unitary, pre-ordained telos. For instance, some thinkers have responded to the rhetorical claims of the *Communist Manifesto* by ridiculing its historical teleology while resuscitating the teleology of capitalist permanence the *Manifesto* was intended to supplant.

Through this careful, systematic (sometimes deliberate and other times subconscious) repression of Marx's analysis of capitalism's supersession, capitalism is continually constructed, even in Marxist thought, as invincible. Some may suggest that capitalism is temporary, but its demise is, in all likelihood, on an order of millennia away (Aronson 1997). Others, equally overwhelmed by their own powerlessness before this eternal capitalism, turn their struggle against the *word* 'capitalism'—imploping us to see 'the end of capitalism' in the here and now of our everyday lives (Gibson-Graham 1996). What these denials share in common, is an understanding of capitalism's *near*-eternal being. They first question the practicality of certain strands of Marxist social transformation. Once these doubts over the practicality of some areas of social transformation are raised, they console us with the areas of social transformation that are *truly* practical. Finally, upon redefining the practical, they complete their respective discourses by suggesting that perhaps that which was unpractical was never really desirable. This world-view has gripped the left in general and even within Marxism in particular.

The denial of the TRPF has far reaching effects on the left. Marx's TRPF is not about dominant eigenvalues nor the optimization of individual capitalists; it speaks to the issue of practicality. It argues that the realm of practicality is not only a subset of our imaginations, but exceeds our imaginations too.² □ It is through Marx's introduction of his TRPF, his understanding of the impact of changing society's *Weltanschauung* that is an important part of his legacy.

The Okishio theorem is an important milestone in the stultifying discourse of capitalism's immortality. The theorem seeks to shift the terrain of the debate back to arguments over the intrinsic/extrinsic source of the TRPF and away from any discussion of the elimination of profit altogether as a form of surplus value. Okishio returns the debate to a concern over the wage-profit frontier and restores the immortality of capitalism by eliminating any discussion of its transformation from the topic of intellectual debate.

Many Marxists have engaged the rhetorical claims of the proponents of the Okishio theorem. These responses have often taken the position that Marx's method is different from and therefore incompatible with the method of the vulgar and neo-Ricardian economists (Shaikh 1977; 1982; 1984; 1987). The Okishio theorem's proponents typically reject such a position as rubbish (Steedman 1977). Many of those rejecting this argument adopt an essentialist methodology believing there is only one essential truth and therefore only one 'Theory' that can capture that 'Truth.' Any talk of a multiplicity of methods or a multiplicity of theories is rejected outright. Furthermore, they argue that since logical inconsistencies are absent from the Okishio theorem, it must embody *that* 'True' reflection of reality (Ibid).

I side with the claim that Marx's methodology is different from that of vulgar and neo-Ricardian theorists; it therefore produces different truths. However, my

²"There are more things in heaven and earth, Horatio,
Than are dreamt of in your philosophy" —Hamlet

understanding of Marx's method compels me to do more than simply declare its theoretical difference. I understand Marx's method as placing great importance on the concept of critique. I understand this concept of 'critique' as moving beyond simply declaring methods and truths as different. The role for Marxist critique is to delineate those differences, to create a new truth from these different and disparate truths. The TRPF is clearly evident within Marx's textual development of *Capital*. In contrast, the TRPF is absent from the method advanced by the Okishio theorem's proponents. The role of critique is not simply to state and restate one position against another; critique instead produces an understanding of the differences in those positions.³ Rather than the essentialist position that when faced with true contradiction theories tries to find which represents the singular truth about reality, the method employed in this paper takes these two truths and produces an understanding about why these truths are different.

Marx presents 'The Law of the Tendential Fall in the Rate of Profit' in part three of *Capital*, volume three. The first of three chapters presents the law itself while the following two chapters present first the counteracting influences and then the development's of the laws internal contradictions. The law is therefore to be understood as merely a tendency. "Counteracting influences must be at work, checking and canceling the effect of the general law and giving it simply the character of a tendency, which is why we have described the fall in the general rate of profit as a tendential fall" (v3, p339).

Despite Marx's elaborate attempts to present of the law of the tendency of the rate of profit to fall as a tendency, many ignore his discussion of counter-tendencies and internal contradictions. These theorists then construct a theoretical strawman; they set up Marx as arguing that the rate of profit must necessarily fall. We find a typical example in the work of van Parijs:

For the purposes of this article, the falling-rate-of-profit theory of crises (theory) is defined as the theory which attempts to predict and explain the occurrence of economic crises under capitalism with the help of the following three propositions: (i) the capitalist mode of production is such that the organic composition of capital necessarily rises; (ii) A rise in the [organic composition of capital] necessarily leads to a fall in the (general) rate of profit; (iii) A fall in the (general) rate of profit necessarily leads to crises .

Once the straw propositions have been erected, he demonstrates great intellectual dexterity by courageously knocking each one down. It is unclear to whom in the TRPF debate van Parijs directs his criticisms. He does not provide any references indicating who makes these rigid claims. He then ends up concluding, as did Marx,

³I am not suggesting there is a single understanding of the differences between these truths. Nor does this paper seek to unify Marxism with the latest trend in bourgeois thought which Plekanov warns against [Engels, 1976 #160]. What follows is a thoroughly Marxian understanding of the differences between the truth of Marx's TRPF and the Okishio theorem. A neoclassical or neo-Ricardian understanding could also be produced; no one has yet done this from these other perspectives.

that there is no necessary fall in the rate of profit; rather there is a tendency for the rate of profit to fall.

Yet, the outspoken opponents of Marxian economics feel they must go further than merely reasserting the conjunctural nature of the TRPF. They want guarantees that the profit rate cannot fall. They find such guarantees in the widely-celebrated Okishio theorem. Okishio claimed, against Marx, that no tendency for the rate of profit to fall could occur because of the technical innovations of capitalists. As Roemer concludes from Okishio's work,

What has been shown is that [the Okishio theorem does] more than render the effect of technical change on the rate of profit indeterminate [or as a tendency]: in fact, if technical change is introduced [only] when it is cost-reducing, the final general equilibrium effect will be to increase the rate of profit, assuming the real wage-consumption bundle of workers remains unchanged .

Or from Okishio himself, "Our conclusions are negative to Marxian Gesetz des Tendenziellen Falls der Profitrate. Unless the rate of real wages rises sufficiently, the technical innovations adopted by capitalists do not reduce the general rate of profit" (Okishio 1961, p95).

We must therefore understand the opponent's claim against this tendency as an argument of impossibility; they claim that it is not possible for capitalism, on its own, to exhibit any tendential fall in the rate of profit. While certainly the profit rate may fall at times, they argue that this is not due to capitalism itself. This is an amazingly strong claim that has rattled the intuition of many Marxists . There has been something fishy about the claim of the Okishio theorem from the start, but few have been able to pin down the problem.

Structure of Paper

Marx's discussion of the TRPF produces a knowledge of capitalism. The Okishio theorem produces a knowledge that contradicts Marx's TRPF. For some, the obvious response to this contradiction is to reject one or the other knowledges as false. Hence many simply reject one or the other knowledges without producing any understanding of the differences between these theories. In what follows I begin the process of a Marxist critique: i.e., delineating the differences between Marx's TRPF and the Okishio theorem. However, before we begin, I find it important to address a short-coming I sense in much of the literature surrounding this debate. This short-coming, I feel, is a thorough neglect of most of Marx's theory about the TRPF. A careful reading of *Capital* reveals an abundance of knowledge about the dynamics of capitalism: its dynamism alongside its vulnerability and fragility. This knowledge from *Capital* has been collectively 'forgotten' within much of the debate over the TRPF. To provide some remedy to this situation I will first review some of the insights Marx elaborates about the TRPF within section two of this paper.

Next, I will examine the Okishio theorem's place within the broad non-Marxian theoretical traditions. Here I show how the Okishio theorem finds little theoretical backing within either the neoclassical or neo-Ricardian paradigms. Through a careful analysis of the theorem's viability condition, I will demonstrate how this viability condition finds intellectual support due primarily to the various ambiguities surrounding it. Without justification, the condition the theorem advances stands at odds with most paradigms of economic theory. (For example, as

we will see, the viability condition opposes the profit maximizing behavior of neoclassical economics in favor of a strange profit rate enhancement criterion).

We will see that the debate over the Okishio theorem involves more than the usual differences between theoretical paradigms. Though it is commonplace for theorists to talk past one another, misunderstanding each other's world-view, it is less common to find a theory temporarily altering its own world-view just to discredit another theory. Yet this is the case with this intellectual critique of the TRPF. The advocates of the Okishio Theorem (;)—who throughout their work, essentialize the wills of individual human agents as the ultimate determinant of society—constitute agents differently in this debate than in all their other work. Indeed, these agent essences, are still optimizers with abundant information about their immediate situations. However, their optimizing behavior changes when the discussions of the TRPF arise. These agents stop optimizing profits or utility and instead attempt to enhance their profit rates. Is it any wonder the profit rate rises when every agent sacrifices everything within their ability to see that it does?

Section three then focuses on the common elements among Marxian, neoclassical and neo-Ricardian theories which stand united against the absurdities of the Okishio theorem and the viability condition from which it derives. Section four turns to a discussion of Marx's unique insights about the TRPF. Here Marxian theory is differentiated from neoclassical and neo-Ricardian theory and we find the original Marxian contribution to the TRPF: what I call the second TRPF. This second TRPF arises mainly from the issues involved in fixed assets, revolution in the means of production and the category of moral depreciation. Once Marx elaborates these categories, a rupture occurs between the optimizing actions of individual enterprises and the social effects of those actions. In addition, a rupture widens between the static methods of neoclassical and neo-Ricardian theory and the dynamic methods of Marx. Here the differences in method become acute. The paper ends with a brief summary and conclusion in section five.

2 A Marxian Theory of the Tendency of the Rate of Profit to Fall

The law itself

Marx's discussion of the TRPF begins with a simple demonstration of how accumulation can raise the organic composition of capital and diminish the rate of profit. We can see this impact of a rising organic composition of capital in the definition of the value rate of profit:

$$(1) \quad r = \frac{s}{c + v} = \frac{\frac{s}{v}}{\frac{c}{v} + 1}$$

From this equation, it is clear that a rise in the organic composition of capital will diminish the rate of profit unless the rate of exploitation in the numerator rises sufficiently to maintain or enhance the rate of profit. This expression allows us to view the interaction between a rising organic composition of capital and its effect on the rate of profit.

The first objection to this story is that accumulation need not raise the organic composition of capital. There are two reasons for this. First, accumulation can entail an increase in the use of labor-power along side the increase in the use of means of production. In other words, accumulation can involve an increase in variable capital as much as an increase in constant capital. While this is certainly true, there are practical limits to this possibility. For instance, there are no guarantees that the growth of the labor force will coincide with the growth of means of production. The second reason accumulation may not lead to a rising organic composition of capital lies in the measure of the means of production and the means of labor in value terms. Even if capitalist enterprises employ a greater mass of use-values in the means of production compared with the means of sustenance of labor, the magnitude of those use-values in value terms need not express itself in a rising organic composition of capital. As the conditions of production change, so do the relative expressions of value in the various means of production and means of labor.

Marx deals with the above objection and others thoroughly in the three chapters on the law of the TRPF. These objections Marx identifies as counter-tendencies which become therefore part of the law itself. These counter-tendencies provide additional support for the status of the TRPF as merely a *tendency*. I do not see these objections as points of contention, therefore, since Marx and his many critics agree that these counter-tendencies counteract the expression of the tendency itself. We should similarly agree that there is nothing in these counter-tendencies that could negate the TRPF⁴.

In contrast to the above objections, the Okishio theorem does not simply restate Marx's counter-tendencies and claim these counter-tendencies contradict and therefore disprove the TRPF. Instead, the Okishio theorem represents a more fundamental objection to the TRPF because it suggests that such accumulation cannot occur because the individual capitalists would not desire its effects and thus they

⁴We should also note here that Marx's algebra underscores the mathematical limits of the TRPF. So long as production and exploitation continue, the rate of profit cannot fall to zero, but only approach zero asymptotically. However, the lower the profit rate falls, the more the counter-tendencies discussed by Marx may create even stronger forces that keep the rate of profit above zero.

take steps to prevent its fall. Since capitalists need not accumulate, they may always 'choose' not to accumulate. They will only 'choose' to accumulate when the rate of profit will not fall. Any investment that will result in a lower rate of profit will be rejected by the various capitalist enterprises in favor of some other distribution of the surplus. We take up this objection in detail below when we consider the Okishio theorem explicitly. For now, we want to understand Marx's arguments about why capitalists accumulate and why capitalists continue to accumulate despite the possibility that the general profit rate may tend to fall. Marx makes his case even stronger by arguing that the TRPF will actually encourage capitalists to accumulate despite the way such accumulation may reinforce the TRPF.

Why accumulate?

Marx's discussion of the TRPF's place in the third volume, before Marx discusses the distribution of surplus between its various components, means that capitalists are left with little 'choice' but to accumulate at this point in the analysis. This is in contrast with the full-motion Marxian system after the completion of *Capital* volume three when surplus flows to innumerable sites of society such as landlords, banks, joint-stock owners, merchants, unproductive laborers, etc. Since Marx has not yet presented these various destinations of surplus, he wants to confine the discussion to surplus's use as accumulation and (secondarily) capitalist consumption. Marx begins his discussion of the law of the TRPF by saying:

We are deliberately putting forward this law before depicting the decomposition of profit into various categories which have become mutually autonomous. The independence of this presentation from the division of profit into various portions, which accrue to different categories of persons, shows from the start how the law in its generality is independent of that division and of the mutual relationships of the categories of profit deriving from it. Profit, as we speak of it here, is simply another name for surplus-value itself, only now depicted in relation to the total capital, instead of to the variable capital from which it derives. The fall in the rate of profit thus expresses the falling ratio between surplus-value itself and the total capital advanced; it is therefore independent of any distribution of this surplus-value we may care to make among the various categories. (v3 p320)

Marx underscores the position of this analysis within *Capital*. The discussion of the law of the TRPF enters into *Capital* before Marx's discussion of the division of surplus value into its various constituents: industrial profit, interest, rent, etc. "Since we have not investigated up till now the various components into which profit is divided,... these do not exist for us as yet" (v3 p321).

Following the distinction made by Resnick and Wolff (1987), between the fundamental and subsumed class processes (or FCP and SCP respectively), Marx's discussion of the TRPF at this point relates mostly to the FCP. The only subsumed class distribution at this point in the analysis is toward accumulation (and toward non-worker consumption). The TRPF's location in Marx's analysis occurs after his discussion of prices of production, i.e., the prices of commodities resulting from the process of productive labor applied in the process of productive capital. At this point in *Capital*, if we speak of the 'choice' of the capitalist enterprise, we only speak of a

choice between the consumption of surplus by those who do not produce, and its accumulation in the process of industrial capitalist production.

So, the first answer to the question: “why accumulate surplus?”, is that surplus is there to accumulate. Accumulation is not a necessity as van Parijs has duly demonstrated and as Marx admits. Yet accumulation does occur, and since it does, we want to create an understanding of its effects; among those effects we find accumulation impacting in contradictory ways on the fundamental class process and the rate of profit. Among those contradictory effects, we find the TRPF.

The productivity of labor implies that labor can produce more than it requires for its reproduction: surplus. Under capitalism this takes the form of producing more value than is required for simple reproduction of the workers or surplus value. Some tend to treat this surplus as merely the consumption bundle of the capitalist: the individual who personifies the capitalist class process. Yet even those most gluttonous among capitalists are incapable of consuming all the objects of surplus labor produced within a capitalist social formation. If it is said, Marx argues, “that the capitalists have only to exchange their commodities among themselves and consume them, then the whole character of capitalist production is forgotten, and it is forgotten that what is involved is the valorization of capital, not its consumption” (v3 p366). Moreover, as this productivity of labor grows, the ability of capitalists to consume the surplus becomes that much more difficult. Therefore, abstinence from accumulation cannot serve as a permanent ‘solution’ to the productivity of labor.

Once we admit that surplus exists and that nothing can guarantee its ostentatious consumption by its appropriators, we begin to grasp the possibility of accumulation. Yet the mere possibility of accumulation will not bring accumulation about. Marx details several reasons that accumulation takes place.

First, accumulation serves as a constituent of demand so that surplus value can be realized. If no enterprise buys the commodities expressing the surplus value of a given period of production for either consumption or for accumulation, then capitalism faces a condition of overproduction. Since capitalist enterprises produce surplus value, they must continually seek out new markets for their commodities. Once enterprises reach certain limits in selling use-values for the personal consumption of themselves and other surplus appropriators, they turn their sights on convincing each other to expand production. They find new uses for their commodities and seek to convince their existing customers to increase the existing uses of the commodities. When the various enterprises fail on these counts, the economy experiences overproduction. While overproduction is typical under capitalism, it is typically—at least eventually—followed by a process of renewed accumulation, yielding greater levels of production.

Second, it is a defining moment of capitalism, a cultural or ideological constituent, that capitalism accumulates. It is therefore one among many of the conditions of existence of the capitalist class process. This cultural constituent manifests itself in the myopic focus on economic growth and in measuring social well-being by the magnitude of output prices (GDP) produced in a year. Therefore, while it’s certainly possible for production to avoid accumulation, such permanently non-accumulating production begins to look much less like *capitalist* production and is therefore outside the analysis of *Capital*.

Finally, Marx finds a compelling reason for an individual capitalist to accumulate in the possibility of increasing its own profits—implying that the capitalist enterprise does not concern itself solely with maintaining the social average profit *rate*. Marx presents the following numeric example in volume three:

$$\text{I. } 4_c + 2_v + 2_s; \text{ Costs} = 6, \text{ profit rate} = 33\frac{1}{3} \text{ percent}$$

$$\text{II. } 15_c + 3_v + 3_s; \text{ Costs} = 18, \text{ profit rate} = 16\frac{2}{3} \text{ percent}$$

Here this enterprise accumulated the value of 11 constant capital and one additional value of variable capital and increased surplus value by one unit. He follows this numeric example with the following assessment: “The absolute magnitude of profit, its total mass, would thus have grown by 50 per cent, despite the enormous decline in the ratio between this mass of profit and the total capital advanced, i.e., despite the enormous decline in the general rate of profit” (v3 p324). Accumulation of C and V therefore allows capitalists to amass profits and they ‘choose’ to amass profits even if the social average rate of profit falls (or even if their own rate of profit falls relative to the social average). I will discuss in greater detail the distinction between profit and profit rates in section two.

From the preceding discussion we can see why capitalist enterprises contemplate and indeed accumulate surplus—even if they believe their accumulation may lead to a fall in the rate of profit. However, Marxian theory makes an even stronger statement: arguing that the possibility of a decline in the rate of profit actually motivates the accumulation and concentration of capital as well as conditioning the revolutionizing of the means of production. We find here why Marx argues that competition did not merely cause the fall in the rate of profit, but the fall in the rate of profit caused competition. It is the beneficial private effects of a capitalist enterprise accumulating and concentrating capital or introducing new techniques that causes the socially deleterious effect of a fall in the rate of profit. Simultaneously, the prospect of a fall in the rate of profit leads to the accumulation and concentration of capital and the introduction of new production techniques.

Marx talks of a growing concentration of capital into larger capitalist enterprises and a socializing of labor “so that the mass of surplus-value and hence profit which they appropriate grows along with and despite the fall in the rate of profit. The reasons that concentrate massive armies of workers under the command of individual capitalists are precisely the same reasons as also swell the amount of fixed capital employed” (v3 p326). These reasons are a motivating force for capitalist competition. Marx here eludes to the defense against the life or death effects of the fall in the rate of profit that brings about this concentration and a swelling of the fixed capital employed. This is the first time Marx mentions fixed-capital’s influence on the TRPF, just nine pages into part three. He repeatedly talks about fixed capital throughout these chapters and its role in the TRPF.

The Revolutionizing of the Means of Production and Fixed Capital

Marx identifies another process of competition that contributes to another tendency for the rate of profit to fall. Within the competition of capitalist enterprises, each seeks surplus-profits by continuously implementing new methods of production that lower the enterprise’s own cost of production. This

revolutionizing of the means of production typically involves the acquisition of new machinery and other fixed capital.

Of course, both accumulation and revolutionizing the means of production have contradictory influences on both competition and the rise or fall in the rate of profit. As Marx makes clear, the constant revolution in the means of production can exert contradictory forces on the rate of profit: pulling up the rate of profit through higher rates of exploitation and pulling down the rate of profit through moral depreciation.

The value of fixed capital and its depreciation (i.e., the imparting of fixed capital's value onto new commodities) is directly affected by the process of accumulation and the complementary process of technological innovation. When a capitalist introduces a new piece of machinery to the production process before any competitors, this enterprise may lower the per unit cost of its own production for the moment. Yet the competition over technological advancement in the fixed assets of machines increases the industries costs by depreciating fixed assets more quickly thus lowering the general rate of profit. Marx discusses these effects of innovation on fixed capital in *Capital* volume two:

To the same extent as the value and durability of the fixed capital applied develops with the development of the capitalist mode of production, so also does the life of industry and industrial capital in each particular investment develop, extending to several years, say an average of ten years. If the development of fixed capital extends this life, on the one hand, it is cut short on the other by the constant revolutionizing of the means of production; they constantly have to be replaced, because of their moral depreciation, long before they are physically exhausted... The result is that the cycle of related turnovers, extending over a number of years, within which the capital is confined by its fixed component, is one of the material foundations for the periodic cycle in which business passes through successive periods of stagnation, moderate activity, over excitement and crisis. (v2 p264)

This is another related yet separate tendency of the rate of profit to fall. The competition among capitalists to be the first to technically innovate causes the depreciation of capital among the followers of the innovation. Marx calls this influence *moral depreciation* due to its intangible and often unanticipated effects. The first enterprise in the industry to innovate does not experience this decline in the profit rate because the innovating enterprise is ahead of the social average productivity of labor. But, the other enterprises in the industry will feel the brunt of this innovation in the increased rate that fixed capital's value passes into their products. Marx first introduces this TRPF in chapter 12 of volume one when he discusses relative surplus value and again in chapter 10 of volume three when he discusses the search for surplus-profits. However, this second TRPF requires the understanding provided across all three volumes to fully grasp its importance.

Leaving aside the effects of fixed asset depreciation, the concentration of both fixed capital and circulating capital alongside variable both provides a defense against the fall in the rate of profit and contributes to its fall. Accumulating surplus through either an increase in the scale of techniques or through the implementation of new techniques diminishes the social average rate of profit.

However it provides the enterprise with a growing concentration of capital a greater mass of profit. The greater mass of profit attenuates the dangers caused by the lower rate. A large concentrated capital worries much less about the rate of profit than a small independent producer⁵

The competition among the various capitals over technological innovation and over the accumulation in the form of new or expanded techniques represent actually two different tendencies for the rate of profit to fall. We see that both of these tendencies are a result of competition even as competition is created by these tendencies. To avoid the deleterious effects of the TRPF, capitalist enterprises engage in willful behavior which brings about the TRPF.

Capitalist accumulation has contradictory effects. Capitalists accumulate in order to secure the conditions of their existence: i.e., to increase the mass of surplus value they appropriate. This accumulation occurs after the production and appropriation of surplus value in the form of profit and this profit allows production and appropriation to begin again at a larger social scale. The worrisome consideration for capitalism is that, though the rate of profit might tend to fall, its fall will not necessarily reverse the process of accumulation. From the above discussion, we can see that the TRPF might even accelerate the process of accumulation as capitalist enterprises compete to grow their way out of the deleterious effects of this TRPF.

Why does the profit rate matter?

Why should anyone (economists, Marxists, capitalists) care about a falling rate of profit if the mass of profits is rising? A neoclassical economist might suggest that a falling rate of profit simply does not matter as long as the mass of profits (the objective of capitalists) rises. After all, says the neoclassical economists, this is simply a trade-off accepted by the capitalist: a lower-rate for a higher mass of profits. Trade-offs, the neoclassical economist will tell us, are what economics is all about.

Previous economists, not knowing how to explain the law of the falling rate of profit, invoked the rising mass of profit, the growth in its absolute amount... as a kind of consolation, but this was... based on mere commonplaces and imagined possibilities (v3 p330).

⁵Marx's reasoning for the concentration of capital might seem odd to someone accustomed to the logic of a neoclassical economist. The neoclassical economist argues that concentration and the scale of capital only occurs because of constant or increasing returns to scale. Marxist economic theory demonstrates that the concentration of capital can come about because of decreasing returns to scale as enterprises struggle to appropriate a larger mass of surplus even under conditions of a diminished rate of profit.

Marx responds:

Compensation for the fall in the rate by an increase in the mass of profit is possible only for the total social capital and for the big capitalists who are already established. New and independently operating additional capital finds no compensatory conditions of this kind ready made; it must first acquire them, and so it is the fall in the profit rate that provokes the competitive struggle (v3 p365).

Although it may be the case that one or another capitalist enterprise is indifferent to the fall in the rate or profit, there are several reasons that the profit rate matters to other enterprises or to capitalist society's reproduction. Below, I discuss three of the many reasons why a falling rate of profit matters.

First, large capital pursuing a greater mass of profits can force down the rate of profit and push smaller capital out of business—leading to lower rates of profit along with diminished mass of social profit or surplus-value. A falling rate of profit is a problem for capitalism and for some individual capitalists; it is not necessary that large enterprises show compassion for the smaller capitalist enterprises. It is a problem because of the distinction between social and individual effects. Though it may not affect certain individual capitalist enterprises it will nevertheless have effects on other enterprises and on the structure of capitalist exploitation. Some of these effects are discussed in the following paragraphs.

Second, Marx argues that a decline in the general rate of profit raises the minimum required capital one must set in motion. There are certain minimum expenditures out of surplus that any capitalist enterprise must make to secure its conditions of existence. As the rate of profit falls, the magnitude of capital needed to appropriate the required minimum surplus rises. For example, imagine the state requires a distribution of \$100 annually to operate a productive enterprise. If the general rate of profit is 10%, an enterprise can meet this requirement with capital advanced of \$1,000. If the rate of profit falls to 5%, \$1,000 will be an insufficient capital investment. The minimum capital set in motion will now rise to \$2,000 for an enterprise to meet this subsumed class obligation. Many distributions of surplus take the form of this minimum amount. Again, we see that as the rate of profit falls, capitalist enterprises will be driven to accumulate a greater mass of capital.

The devastating impact of the TRPF on small enterprises has far reaching consequences. To the extent that capitalism gains legitimacy through the ideal of the petty bourgeois or ancient enterprise of Locke and Jefferson, the TRPF creates a legitimation crisis. A decline in the rate of profit damages smaller, younger and less concentrated enterprises. It hurts the ideology of the small entrepreneur.

Finally, the rate of profit matters because as it falls, the rewards to productive investment decline and capitalists seek the valorization of their private capital through various swindles or speculations that fail to valorize the social capital—fail to increase the total social value (wealth)—instead fighting over the dying carcass of productive capital. The fall in the rate of profit forces capitalists “onto adventurous paths: speculation, credit swindles, share swindles, crises” (v3 p359). If the rate of profit falls enough, a cunning capitalist may find a greater return in swindles or unproductive investment than in industrial capital valorization.

Marx's development of the TRPF is very involved and provides a rich and dynamic understanding of capitalism. Among the many determinants Marx discusses for the rate of profit, we find: the productivity of labor; the rate of exploitation; the depreciation of fixed capital; the rate of turn-over of capital; and so on. Marx makes clear from his discussion of the TRPF that capitalism is a complex object of analysis. Capitalism can be better understood if we embrace that complexity rather than hiding from it. I will return to the issue of embracing complexity, but first I turn to the arguments advanced by present-day vulgar economists and demonstrate why their inability to face this complexity has led them astray.

3. A Critical Assessment of the Okishio Theorem

In point of fact, the vulgar economist does nothing more than translate the peculiar notions of the competition-enslaved capitalist into an ostensibly more theoretical and generalized language, and attempts to demonstrate the validity of these notions.

—Marx (v3 p338)

The Okishio Theorem has had a profound impact on the Marxian tradition in the last few decades. It has leveraged such great influence by playing on certain ambiguities in its language and counting on an unfamiliarity among Marxists with the methods of neoclassical and neo-Ricardian economics. The proof is certainly *valid* but its antecedents are so bizarre that it should be widely viewed as inconsequential. Instead of falling on deaf ears, some have suggested that the theorem “is so devastating that it deprives all arguments (pro and contra [TRPF])... of their relevance” (van Parijs 1980, p9). Such hyperbole is typical of the dogmatic yet often persuasive rhetoric of the theorem’s proponents.

The effectiveness of this rhetoric has relied on ambiguities constructed primarily around two areas: 1) its behavioral criterion, the so-called viability condition and 2) the failure to understand Marxian theories elaboration of individual actions and social cost. In this section we will take up the first ambiguity which relates primarily to a confusion of Marxian, neoclassical and neo-Ricardian theories. The next section will consider the second confusion relating to a failure to understand Marx’s critique of bourgeois theory.

In addition to the confusion over the behavioral criterion, confusion has arisen over a number of other issues. Both proponents and opponents of Okishio’s theorem have conflated such things as classical verses neoclassical profits; technical implementation (or accumulation) verses technological innovation; enterprise verses industry; and financial versus productive investment.

Moreover, a total disregard for Marx’s own work on the TRPF has led to even more confusion over the meaning and place of the TRPF within the Marxian, neo-Ricardian and neoclassical traditions. Since Marx’s own work is largely ignored, textual support for the strawman arguments set up by the advocates of the Okishio theorem are rare. One of those rare occurrences is within Okishio’s own work. However, despite Okishio’s attempts to support his depiction of the TRPF with citations from Marx, he frequently attributes neoclassical meanings to Marx’s Marxian terms.

In addition to the indiscriminate ascription of neoclassical meanings to Marx’s terminology there has also been an indiscriminate mixture of neo-Ricardian and neoclassical theories. Participants in the debate have inadvertently ascribed neo-Ricardian meanings to neoclassical terms and vice versa. As a result, we have not experienced a clarity of knowledge as claimed by the proponents of the Okishio theorem, rather an obfuscation of the various theoretical discourses involved.

The infinitely rotating circuit of capital

One aspect of the confusion within the Okishio school is revealed in light of Marx’s discussion of the various circuits of capital in *Capital* (v2, p154). Marx lays

out one circuit of capital: $M - C < \overset{L}{m_p} \dots P \dots C' - M'$ and suggests that this is only one way to enter into an analysis of capital. Rather than beginning and ending with capital in its money form, another way might be to begin with production and end with production. This, Marx felt, was Ricardo's method and it is also apparent in the method of the neo-Ricardians today. They begin with the technical conditions of production which yields commodities. Those commodities then circulate at specific prices (at production determined exchange ratios) presumably transforming into money capital and back to the means of production and means of labor: ready to begin production anew. These different circuits simply represent alternative theoretical entrances into the analysis of capital. To quote Marx,

In a constantly rotating orbit, every point is simultaneously a starting-point and a point of return. If we interrupt the rotating, then not every starting-point is a point of return. Thus we have seen that not only does every particular circuit (implicitly) presuppose the others, but also that the repetition of the circuit in one form includes the motions which have to take place in the other forms of the circuit. Thus the entire distinction presents itself as merely one of form a merely subjective distinction that exists only for the observer (v2 p180).

Some of the confusion over the Okishio theorem arises from taking one circuit as an absolute or objective circuit, $P - P$: criticizing all others who begin or end at another point. Yet if the proponents or opponents of the Okishio theorem continued their analysis of the circuit past one rotation, the errors in the Okishio theorem would become painfully clear. Undoubtedly some have taken that step of analyzing the next period of the circuit and retreated back to the safety of the $P - P$ circuit.

To explain further, the neo-Ricardian approach (like the Ricardian approach) begins with the conditions of production (P , the input-output matrix). These conditions of production determine everything else: prices, surplus, profit rate. Once the conditions are specified and the circuit is set in motion, output commodities are produced and exchanged with other commodities at the solved for price vector: $C - M - C$ (though the role of money is downplayed). Some of those commodities are presumably the inputs into the same production processes which bring us full circle back to the starting point, P . The important question to consider for the TRPF is what happens to the other commodities: those commodities not needed to reproduce the original scale of social production. As mentioned above, the Ricardian approach frequently considers those commodities as merely consumption for the capitalist. Or the neo-Ricardians fail to consider the use of the surplus at all; the issue is simply absent from the Ricardian essentialist circuit of capital. However, since those same commodities—that express the surplus labor performed within the completed circuit of capital—will serve both as consumption and accumulation, the very surplus reshapes the process of production. Production not only determines everything as the Ricardians claim, but everything also determines production. We will see again how this failure to understand the circuit of capital from its various points of entry blinded the Okishio school from seeing the other aspects of their own theoretical system.

Below, I will summarize a basic proof of the theorem and then discuss the numerous ambiguities that accompany the proof, beginning with the viability

condition and again returning to the issue of the circuit of capital. Much of the remainder of this section deals with the issue of the Okishio theorem on its own terrain, within the confines of neoclassical and neo-Ricardian theory. Before I try to disentangle the terms within the debate, we will find it useful to review a commonly cited proof of the Okishio Theorem (Bowles 1981). There are certainly other proofs that try to extend its validity or simply try to illustrate its effectiveness. However, these other proofs all contain similar flaws so for our purposes, the critique that follows applies to those other proofs as well.

The proof of the Okishio theorem involves a typical input-output system as developed by Leontief, Sraffa and others. Additional ‘simplifying’ assumptions are made explicitly: no scarce non-produced means of production; each industry produces a single product with circulating capital; all goods are produced within the same rate of turnover; and the real wage is constant.⁶

Finally, the theorem assumes that a capitalist enterprise will only adopt a new technique if it lowers the per unit costs of production at the current prices:

$$(2) \quad p_j^{old} - \sum_{i=1}^n p_i^{old} m_{ij}^{new} (1 + r^{old}) > 0 \quad (\text{the viability condition})$$

(i.e, the only viable technique is one which raises the enterprise’s rate of profit above the current general rate of profit at the current prices). The remainder of the proof is trivial. Given these assumptions and the viability condition, the proof demonstrates that the rate of profit can only rise as a result of the uncoordinated actions of individual industrial enterprises. We will now focus our attention on this viability condition to understand what it does and does not say.

Various writers on both sides of the debate state the viability condition in different ways. Stated simply, the viability condition is a condition that reduces the behavior of capitalists to a profit rate maximization (or profit rate maintenance/enhancement) problem⁷. Most thinkers who approach the debate agree at least in mathematical terms that this is an appropriate behavioral condition. However, the literature is full of verbal stand-in phrases treated as synonyms—though they are clearly not. Throughout this literature, one finds theorists using phrases such as cost-minimization and profit maximization to explain the behavior of capitalists, which, though they express a behavioral criterion and might add profundity to proponents’ claims, have little to do with Okishio’s behavioral criterion: the viability condition.

⁶The assumption of a constant real wage is instituted to attempt to analytically separate the effects of wage effects on the rate of profit from purely technical change or accumulation effects.

⁷Strictly speaking the viability condition does not imply profit rate maximization. Rather, it requires capitalists to disregard any technique that lowers the capitalists’ own rate of profit at existing prices. It does not impel a capitalist to implement techniques that increase the rate of profit the way a strict profit rate maximization criteria would. This is a subtle point that only further divorces the viability condition from any other body of economic literature outside the Okishio debate. See Appendix B for further elaboration of the distinction between profit rate maximization and profit rate enhancement (or maintenance)

The Okishio theorem rests on the presumption that capitalists do everything they can to maintain or enhance their rate of profit. They sacrifice everything to always maintain their own rate of profit even if it means sacrificing a greater mass of profits⁸. This criterion subsequently leads to a maintenance of the general rate rather than merely maintenance of the private rate of profit. The theorem is practically a tautology which very likely contributes to the smugness and dismay of its proponents when confronting their critics.

However as we will see the Okishio system collapses together two objects, profit mass and profit rate, to turn the Okishio theorem from an inconsequential curiosity into a proof worthy of the power it has wielded. Once we restore these concepts to their autonomous status, little of the theorem's importance remains.

A closer examination of viability

This viability condition argues that a capitalist enterprise will only implement techniques that enhance or maintain its profit *rate* at the existing prices. Okishio certainly does not find any justification for this criterion in Marx. The condition eliminates the antagonisms between and within enterprises that Marx sought to underscore when he spoke of the enterprise that seeks a greater mass of profits even at the expense of a lower profit rate (i.e., the antagonism that the capitalist cannot realize these two objectives simultaneously) . While, in Marx's view, the objectives of capitalists include maintenance or enhancement of the rate of profits, no single capitalist enterprise can afford to take steps to maintain its own rate of profit nor the general rate of profit at any cost without jeopardizing its own reproduction. Profit rate maintenance/enhancement certainly enters into the behavioral constituents of the capitalist enterprise—into its choice of technique—but it cannot dominate over all other considerations (e.g., the mass of profits, the realization of value, its own rate of profit). How then can the Okishio theorem's proponents justify such a criterion?

The Okishio theorem's proponents do not find justification for this behavioral criterion outside of the Marxist tradition either. Neoclassical economics has steadfastly held to maximization of profit mass as the single criterion that should dominate over all others. Some neoclassical economists have argued for utility maximization for the owners or managers of an enterprise, but no one, that I am aware of, has argued for a maximization (or maintenance or enhancement) of profit *rate* criterion.

Neo-Ricardian literature outside of the Okishio debate has had less to say about behavioral assumptions. The topic is taken up briefly by Sraffa (1960 p81) in his final chapter where he considers how changes in the distribution of surplus between capital and labor will affect decisions about the choice of technique. To make his critique of neoclassical economics as strong as possible, he simply accepts

⁸Cullenberg suggests that Marx was one of the first to understand and delineate the distinction between the mass and the rate of profit (Cullenberg 1994 p108). If the Okishio debate is any indication, it might suggest Marx was also the last to clearly make that distinction.

the neoclassical view and adopts profit mass maximization as the appropriate behavioral criterion⁹.

Where then does the Okishio school find this profit rate maintenance (enhancement) criterion? It seems as though the proponents of the Okishio theorem, whether neoclassical or neo-Ricardian, have dropped their usual assumption of profit maximization simply for the purpose of proving the Okishio theorem and thus discrediting Marx. They have assumed, only in considering the TRPF, that capitalists are entirely indifferent to their own mass of profit: they care only about their own profit rate. Why then do these champions of microfoundations (Roemer, Bowles, Parijs), put forth a condition of profit *rate* enhancement with little or no justification when all of neoclassical economics assumes profit mass maximization? They provide virtually no explanation for their atypical assumption leaving themselves in the theoretical realm they themselves dismiss as functionalist (aka non-microfounded).

Roemer goes so far as to refer to these assumptions, including the viability condition, as typical. He argues that the Okishio theorem demonstrates, "that the *usual* competitive assumptions do not produce such a theory [of the tendency of the rate of profit to fall]" . The claim that this is all a part of the *usual* competitive assumptions draws attention away from this extremely *unusual* condition for the implementation of technique: the viability condition.

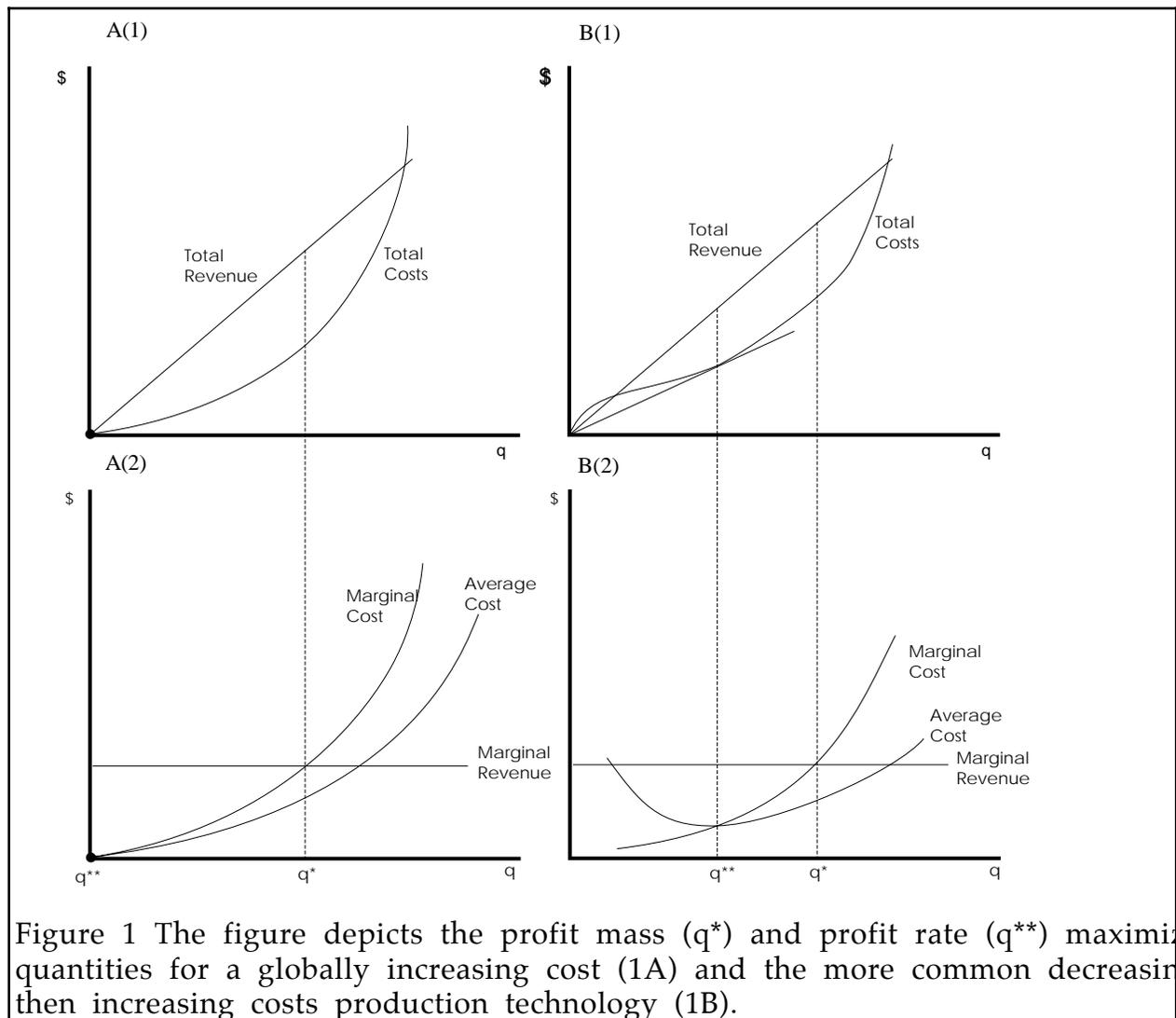
Distinguishing Profit Mass Maximization from Profit Rate Maximization

Before proceeding, we should be clear why this viability condition is so unusual. To this end, I will deploy some basic neoclassical concepts familiar to anyone who has completed a graduate course in microeconomics. In these courses graduate students are called upon to compute endless optimization results. A crucial

⁹Much of the debate from neo-Ricardians has attributed cost per unit minimization to Sraffa. Sraffa's brevity may be one factor that contributes some confusion to the debate and it will help us to take a closer look at the problem. In the preface to his famous book (Sraffa 1960), Sraffa discusses several important theoretical assumptions (or lack thereof) introduced into the book

Anyone accustomed to think in terms of the equilibrium of demand and supply may be inclined, on reading these pages, to suppose that the argument rests on a tacit assumption of constant returns in all industries... In fact however, no such assumption is made. No changes in output and (at any rate in Parts I and II) no changes in the proportions in which different means of production are used by an industry are considered... This investigation is concerned exclusively with such properties of an economic system as do not depend on changes in the scale of production or in the proportions of 'factors' (Sraffa 1960, v).

In the final chapter of the book (part III, ch 12), when Sraffa does take up the issue of changes in the proportion of the factors he continues to hold to the assumption of a constant quantity of output. The preface explains to the reader that Sraffa's system in chapter 12 holds output constant. It therefore is not based on a cost per unit minimization as many have read it, but on quantity constrained cost minimization. Because we are concerned specifically with accumulation, we have left the realm of issues considered by Sraffa where the output remains constant. We will see shortly why this distinction is so important to the Okishio theorem.



question in any optimization problem is: what is the criterion of optimality? (though the question is too seldom asked). Without an optimality criterion, it is impossible to perform the optimization. Neoclassical production theory invariably fixes on total profit as the criterion of maximization.

This is, of course, a very different criterion than a profit rate maximization. Figure 1A and Figure 1B each depict a different production situation with the corresponding total cost, total revenue, marginal cost, marginal revenue and average cost curves. Figure 1A depicts a situation of globally increasing costs. Figure 1B depicts the more standard assumption of decreasing and then increasing costs.

If a perfectly competitive enterprise faces globally increasing costs, the profit maximizing level of output will be at q^* (where $MR=MC$), while the profit *rate* maximizing level of output will be in the limit as q goes to zero (where $MC=AC$)¹⁰.

¹⁰If we recall that profit rate maximization is identical to cost per unit minimization, then we can find the profit rate maximizing level of output by drawing the minimum sloped ray from the origin that still reaches the cost curve. This tangency is the profit rate maximizing (cost per unit minimizing) level of output. This will also correspond to the minimum average cost on the graph 1B(ii).

This implies that at the profit *rate* maximizing level of output, revenue, the mass of profits and costs all go to zero in the limit. Profits and profit rate are inextricably linked by the production function and the conditions of demand so that a capitalist enterprise cannot implement a technique with both the maximal rate of profit and the maximal mass of profit simultaneously, even if it is its will.

So far we have considered an extreme case with globally increasing costs. Again, Figure 1B demonstrates a general divergence of profit and profit rate maximization with the more common assumption of decreasing and then increasing costs. The profit maximizing level of output is only coincidentally equal to the profit rate maximizing level of output¹¹.

We should take careful note at this point to ensure we all understand what the general divergence of profit rate and profit mass maximization imply in terms of the Sraffian input-output system employed in the Okishio debate. It implies nothing about the viability condition if we are comfortable with the assumption of profit *rate* maximization; it remains true that an enterprise will only implement a technique if it raises the rate of profit above the general rate. However, if we make the more accepted traditional assumption of profit mass maximization we must modify the viability condition as in Expression Three (3):

$$(3) \quad p_j^{old} - \sum_{i=1}^n p_i^{old} m_{ij}^{new} (1 + r^{old}) \gtrless 0 \quad (\text{the new viability condition})$$

Here we have replaced the strictness of the inequality with an indeterminacy to indicate that a profit maximizing technical implementation may occur above, below or at the current general rate of profit. In other words, we have no reason to exclude techniques which raise the quantity of every magnitude in the technique's vector expression (m_j). In other words, the cost per unit may rise for a particular commodity because the added revenues from selling a greater quantity of output more than compensate the capitalist for the rising cost of producing each unit of output resulting in a larger mass of profits, but a higher cost per unit and thus a lower profit rate.

Both of these conditions—profit maximization and profit rate maximization—have a corresponding duality condition which compounds the ambiguity and confusion. Profit *rate* maximization is identical to cost per unit minimization (see Appendix A). Profit maximization finds a dual counterpart in quantity constrained cost minimization. Within the exalted language about the “high level of analysis”¹² within the Okishio debate, we find abundant use of

For a demonstration that profit rate maximization is identical to cost per unit minimization see Appendix A.

¹¹Now we must remember that the continuous and differentiable nature of the production functions in neoclassical theory are very different than the discrete production functions of neo-Ricardian theory. But the point here is to understand that, in general, profit mass maximization and profit rate maximization lead to different solutions.

¹²For instance Roemer says of those who engage in the same confusion as he, that they are “on the same analytical level” (1979, p380)

ambiguous phrases. Instead of precisely identifying profit rate enhancement as the behavioral criterion, the language that surrounds the debate over the TRPF and the Okishio theorem typically refers to Expression Two (2) above as a viability, profitability or cost minimization condition, but it is none of these (it is a profit rate enhancement condition). Table 1 provides a rough summary of some of the language used by the various proponents of the Okishio theorem.

Now let us turn to an examination of some of these ‘euphemisms’ to see what they might imply. First, *viability condition* reveals little about the behavioral assumptions of the model. It is difficult to understand how the devotion of a capitalist to enhancing the social rate of profit, even at the loss of a greater mass of profits, makes the capitalist more viable. The mass of profits provides a capitalist enterprise with the pecuniary and legal means to secure its conditions of existence within a capitalist social formation. Any enterprise indifferent to this mass of profits would surely undermine its own livelihood. Second, a few authors use the term profitability, which sounds as if it refers to profit mass rather than profit rate maximization. It is ambiguous enough and sufficiently vague to direct attention away from the theoretical confusion over profit mass and profit rate. Finally, cost minimization fails to make clear whether the theorist is considering cost per unit minimization, quantity constrained cost minimization or simply straight cost minimization.¹³ The ambiguity created by these stand-in phrases has elevated the theorem to a position of profound stature.

	Roemer	Bowles	Van Parijs	Samuelson	Okishio
viability	•	•	•	•	•
cost min	•				•
profitability		•			•
profit max	•	•	•	•	•
super profits		•			

Table 1: Euphemisms used for the profit rate (cost per unit) maintenance/enhancement criterion.

Considering Constant Returns to Scale

The above analysis of the divergence of the profit rate from the profit mass criterion may suggest to some that an assumption of constant returns to scale implicitly rescues the viability condition because it implies that profit and profit *rate* maximizing outputs are again identical according to the graphs of Figure 1. Indeed, some have suggested that a CRS assumption is implicit within the theorem and its various proofs .

Leaving aside the issue of whether or not an assumption of CRS is made or not or whether explicit or implicit, a dilemma still remains. The assumption of constant returns to scale only makes the two criterion (profit mass and profit rate maximization) identical when deciding on the scale of production. An enterprise is still able to implement a new technique which, though yielding a lower rate of

¹³Taken literally, cost minimization under the standard neoclassical assumptions implies zero output and in the long-run revenue and profits all equal to zero.

profit, yields a greater mass of profit. The only way to remove any possibility of a qualitative change in production (as opposed to a change in scale), demand must be infinitely elastic at the industry level to allow the enterprise to increase the scale of production without shifting to an entirely new and qualitatively different technique (one whose rate of profit is lower at the current or expected prices). Even if profit-rate maximization coincides with the point of profit mass maximization, one cannot simply assume that profit-rate maximization was the criterion all along. Below, I will discuss the issue of CRS further under the heading *Rescuing the Okishio Theorem*.

Justifying Viability

Despite the questionable nature of the behavioral criterion employed in the Okishio theorem, few of its advocates show even a slight sense of responsibility for justifying this assumption that is foreign to other so called microfoundational approaches. One of the only Okishio theorem advocates who even attempts to justify this bizarre behavioral criterion is van Parijs . In justifying the profit rate enhancement criterion, van Parijs argues that if a capitalist “has extra capital at his disposal he would instead expand his production with the old technique, or invest elsewhere in the economy at the general rate of profit, or at least buy safe financial assets which will give him the equilibrium rate of interest” (Ibid, p11).

From this rare justification of the ‘viability’ condition, we can glean several points of ambiguity and confusion on the part of van Parijs as well as gain insight into the thinking of the other theorists who were not so forthright. First, he suggests that any capitalist with extra capital can always fall back on expansion of production in his existing technique or invest elsewhere in the economy at the general rate of profit. This amounts to assuming constant returns to scale in at least one industry and an infinite elasticity of demand at that industry level. Yet despite van Parijs’ careful (what he calls rational) exposition of his model, he somehow fails to make explicit those assumptions.

Next he claims that any capitalist has the option to buy a financial instrument at the equilibrium rate of interest instead of making a direct investment. Yet his model has no financial sector and therefore has no theory about where those financial returns arise. As we shall see below (p25), the claim of retreat to a financial sector serves the same function as an industry whose returns are constant and demand is infinitely elastic. Despite these sorry attempts to justify this wholly inappropriate behavioral criterion, the sad fact remains that van Parijs serves as our example here primarily because he was one of the only Okishio theorem advocates who felt compelled to justify such a strange assumption.

Rescuing the Okishio Theorem

From the above considerations, we can begin to ask the question: what conditions does the Okishio theorem require to rescue the viability condition: to make profit rate enhancement identical to profit mass maximization? As mentioned above, two conditions combined could contribute to this end; neither are generally plausible. The first, constant returns to scale, we have already considered, but it cannot collapse together profit maximization and profit rate enhancement on its own. Combined with another assumption, perhaps the most absurd ever suggested, the assumption of CRS can guarantee an identical solution to a profit and

profit rate optimization problem. This second assumption is that of infinite price elasticities of demand *at the industry level* for at least one single-product industry.

The logic that follows from these assumptions is simple. In a production system with constant returns to scale, the conditions of production alone determine relative prices. Demand alone determines the quantity outputs of those industries. If one of the industries within this economy is unconstrained by demand (i.e., it faces an infinite price elasticity of demand over all quantities), any and all enterprises are free to accumulate capital within the unconstrained industry, thereby guaranteeing a minimum rate of profit while increasing the mass of profits. CRS in all the other industries guarantees a ready and unconstrained supply of inputs for the demand unconstrained industry without any change in relative prices or the rate of profit. Along side these assumptions we also require a growth rate of the labor force equal to the growth rate of the production system. Together, these wild assumptions fulfill van Parijs' justification of the viability criterion. The opportunity cost of investment is frozen at the rate of return on this imaginary industry.

It is interesting to consider some of the ultimate implications of this world where the viability condition applies to optimization of the mass as well as the rate of profit: a world characterized by CRS and an infinite price elasticity of demand in at least one industry. Under these assumptions, capitalism not only looks forward to maintaining its rate of profit (a very happy story), but can also anticipate a mass of profits, and mass of use-values, which grow to infinity with time. A concept of capitalism constructed with these assumptions promises a world of plenty to all (or at least some) of the earth's inhabitants: an end to scarcity. This concept of capitalism is precisely the concept which Marx seeks to dispel within the third part of *Capital* volume three. Capitalism cannot end scarcity because it is motivated by entirely different ends.

Without this fantasy economy, accumulation cannot continually occur that simultaneously allows an enterprise to increase its mass of profits yet maintain or enhance its rate of profits: i.e., the viability condition cannot be satisfied simultaneously with a maximization of profit. The rate of profit can fall independently of the will of each of the capitalists to maintain an increasing scale of production with at least the current rate of profit. To reiterate: with increasing production costs, a capitalist enterprise interested in increasing its mass of profits may implement a technique where all of the per unit inputs rise, thus increasing the cost per unit and decreasing the profit rate. In such a case, one can simply invert the proof of the Okishio theorem and thus show that under such profit maximizing behavior, the general rate of profit will fall. If we consider that such a decrease in the profit rate is intertwined with an increase in demand resulting from capitalist accumulation in other industries, we can easily understand why the technique would be implemented: it contributes to the 'viability' of the enterprise.

As we will see, an enterprise facing CRS production, yet constrained by demand, may accumulate by creating new markets—choosing to produce a new product under a new technique of production. These new commodities simultaneously change the dimension of the input-output matrix adding a row and a column while altering the production techniques of all of its buyers (if it becomes a basic commodity). Nothing can be generally said about the direction of the rate of profit in such an instance. This newly implemented technique does not have an old price for the new commodity on which to base expectations. Though the product is

not necessarily new in the sense of an invention, it may have never been involved within the process of commodity production and exchange. On the other hand, it may be an entirely new invention too. In these cases, there is no current price for the output which can serve as a benchmark for the implementation of the new technique; the enterprise is largely in the dark.

Additional confusion over the TRPF

We might defend the Okishio theorem's viability condition based on the understanding that no enterprise would implement a technique that decreased its rate of profit below the general rate because the option always exists to invest at the general rate. We could call this understanding of the viability condition the opportunity cost condition. This term better describes the phenomenon, because the opportunity cost viability condition suggests that no enterprise would implement a technique at lower than the general rate of profit because its opportunity cost is the general rate of profit: i.e., no enterprise would invest in a project yielding 3% if the bond market's prevailing yield was 5%.

This interpretation of the viability condition forgets that in neoclassical theory, the choice of technique constitutes the general rate of profit as much as the general rate of profit constitutes the technique. The general rate of profit is affected by the techniques that makes up the input-output matrix. One cannot claim that the techniques chosen will coincide with the general rate of profit because the general rate of profit will not be determined until the techniques are chosen. The bond market's yield is thus shaped by the yield of the project which the purchase of the bond facilitates.

As discussed above, the neo-Ricardian linear model has no financial markets. Okishio theorem advocates must arbitrarily introduce into standard neo-Ricardian theory, an intermediary agent who creates a financial market. She willingly purchases all of the social surplus and also promises to continue paying the current rate of return to investors. However, in the neo-Ricardian linear model, all enterprises have equal access to all industries so there is neither an apparatus nor a need for financial intermediation. Adding a financial agent who receives and then doles out surplus value to enterprises only serves to confuse the issue: one still needs to explain why this agent purchases all of the surplus use-values of society and where this agent derives the surplus values to compensate investors at the previous rate of return.

This financial agent plays the same role as the industry that faces an infinite price elasticity of demand discussed above. She provides a sector of retreat for any enterprise with capital value to accumulate but no project capable of yielding at least the general rate of profit. Once we acknowledge that such financial intermediaries cannot save these enterprises, we are again left with only a set of unimplemented techniques that can be added to our current techniques: all with lower profit rates than the social average. The opportunity cost of capital under these circumstance is not the old general rate of profit, but the next best rate of return over cost available to the enterprise.

This means that for the capitalists to forgo the investment in their next best projects is to lose the potential return on that project. For example, imagine a neo-Ricardian enterprise that has realized \$1 million in surplus value on an investment of \$20 million (or 5% return). This enterprise will likely continue the same lucrative production technique as before, but now it has an additional surplus to invest as

well. Since it is a typical neo-Ricardian enterprise, all of society's projects are available for investment. It will choose that project which it believes will allow it to realize the highest rate of return on that investment. The rate of return on the next project may be only 3%. The opportunity cost of hoarding this surplus value rather than investing it is 3%: not 5% as the Okishio theorem's proponents imagine.

From the above discussion, we can see how the viability condition has led to no end of confusion over the TRPF and the Okishio theorem. However, the viability condition is complexly intertwined with a laundry list of other ambiguities and confusions surrounding the development of the Okishio theorem. We now take a closer look at some of these other issues.

Technical Implementation v. Technological Innovation

The application of this so called viability criterion in choosing techniques reveals another ambiguity embedded in the discussion of the Okishio theorem: the issue of technical innovation. To draw a clearer understanding of the TRPF, it is important at this juncture to differentiate innovation from implementation. In line with the linear algebra employed in the debate, it will help the reader to think of technology as a set of known production column vectors that describe all of the recipes (techniques) for producing all known products. *Technical implementation* is therefore the choice of a technique from among this set of techniques contained in the technology set of vectors. In contrast, we can understand *technological innovation* as a transformation of the technology set: as an addition to the technological set for example. Technological innovation need not coincide with technical implementation. Technical implementation can occur without technological innovation, and we can witness technological innovation without a corresponding technical implementation.

Using the phrase technical innovation as many in the Okishio school do, collapses these two concepts together and further mires any understanding of the TRPF. In the opening of his section on the TRPF, Marx describes a case of capital accumulation, which means that techniques are implemented from the current technological set without the need for any technological innovation (an expansion of the set).

The implementation of a technique through accumulation may involve one or several of the following four changes in technique.

- 1) Technical implementation could involve merely a change in scale, combining the same inputs in the same proportions to yield a different mass of output. CRS implies that such a technical implementation maintains all inputs in the same proportion to the output as well (though can obviously be increasing, constant or decreasing).
- 2) Technical implementation could be a change in the relative proportion of the inputs, with or without a change in scale.
- 3) Technical implementation can involve a discrete and qualitative change in the inputs combined to form the same output at the same or a different mass; this is the form of technical implementation more closely associated with the neo-Ricardian framework.

- 4) A final form of technical implementation involves the employment of a previously unused set of inputs, to yield a previously unproduced commodity output. This does not necessarily correspond to a new product, only a new commodity. One finds this last form of technical implementation in outsourcing for example. An enterprise producing a commodity through combining an intermediately produced product within a vertically integrated productive enterprise, outsources, or purchases the intermediate product from an independent supplier who now seeks its own equalized share in profit on the newly dis-integrated commodity. An enterprise producing personal computers might outsource its logic boards, eliminating the components of the logic board from its production process while adding a completed logic board to its set of inputs. Within a Sraffian framework, a new row is added to the input-output matrix complemented by a new column representing the new outsource industry of logic board commodity production.

Different motivations shape the behaviors of a capitalist enterprise when engaging in technical implementation as opposed to technological innovation. Through isolating technological innovation, we may make some sense of the profit enhancement criterion. We will see this more fully when we look for the viability criterion in Marx. But first, I will elaborate on the problems of imagining the profit rate enhancement criterion in the case of the choice over technical implementation: specifically on the issue of substitution of techniques or adding to techniques.

Substitution v. Accumulation

Yet another ambiguity apparent in the exposition of the Okishio theorem lies in the difference between substitution of techniques and accumulation. Substitution implies a replacement of one technique of production with another. This might occur in the case of a simultaneous technological innovation and technical implementation. In the case of accumulation of capital, the issue is not one of replacing one technique with another but adding a technique to the existing techniques (or expanding an existing process). Let us look again at the viability condition from Expression Two (2) above:

$$(2) \quad \lambda_j^{old} - \sum_{i=1}^n p_i^{old} m_{ij}^{new} (1 + r^{old}) > 0 \quad (\text{the viability condition})$$

Bowles develops this condition as a strict inequality. While we could make some sense of this in the case of a substitution of techniques, it makes no sense in the case of an accumulation of capital. For if a capitalist enterprise wanted to maintain its own current private rate of profit, it could do so by adding a technique whose rate of return at the current prices was equal to the current rate of return. Instead Bowles suggests that this would not be 'viable.' In other words, Bowles is apparently considering only a condition of substitution. That the Okishio school could read Marx's discussion of the TRPF and completely ignore accumulation is troubling. Even within a strictly neoclassical theory, once accumulation is considered, there is absolutely no reason to make this viability condition a strict inequality. The introduction of a strict inequality is some measure of the confusion of the Okishio theorem's proponents.

Accumulation for profit's sake

With this richer understanding of the possibilities for technical implementation disentangled from the possibilities of technological innovation, we can reexamine the Okishio theorem. A capitalist enterprise seeking to maximize its profits will implement a technique with the most potential for profitability (highest *rate* of profit) with its initial capital¹⁴. As surplus is produced, some of this surplus can be applied toward accumulation. The enterprise acquires additional means of production measured by a greater magnitude of value. The enterprise looks to apply this new capital to the available project (aka technique) with the highest rate of return. Simply extending the original technique at the same rate of profit (say 6%) may not be possible if the technique is subject to decreasing returns to scale. A project formerly viewed as undesirable, because its rate of profit (e.g., 5%) was below those already implemented, now becomes desirable. Though current expectations indicate a lower rate of profit on the new project for the enterprise, the technique will still be implemented because of its potential to raise the mass of profits for the enterprise. If a general rate of profit is to prevail under the new accumulated capital, prices of all commodities will adjust to bring the rate of profit in all industries into conformity with the new techniques. Again this demonstrates that a profit maximizing enterprise will not necessarily meet the Okishio viability condition. The new general rate of profit will be below the previous general rate of profit after the implementation of the new technique.

Some may recognize the above description of a choice of technique as Keynes' diminishing marginal efficiency of capital (DMEC). I see no harm in thinking about Marx's contribution in those terms. Although Marx did not attach such a definitive term to the concept, its appearance within the chapters on the TRPF is unmistakable. Large capitalist enterprises, Marx argues, accumulate additional capital because they care more about the *mass* of profits than the *rate*. At first they care about both the mass and the rate (i.e. they order their techniques so that they implement the technique with the highest rate of profit first), but as more capital value becomes available, they implement techniques which lower their overall rate of profit: not because they want to lower the rate of profit, but because they want to increase the mass of surplus value realized. They cannot in general both raise the mass of profits and maintain or raise the rate of profit. The capitalist would prefer to put the newly accumulated capital into a technique with a higher rate of profit, thus raising their overall rate of return. But such a technique is not typically available. The enterprise would always prefer to accumulate capital at a higher rather than lower rate of return because obviously, any mass of capital invested generates a greater mass of capital at a higher rate of return than a lower rate of return. This concept of DMEC is an idea common not only to Marx, but to Keynes, and neoclassical theory. DMEC is therefore a concept that runs across theoretical paradigms even if it is understood differently within each of these paradigms.

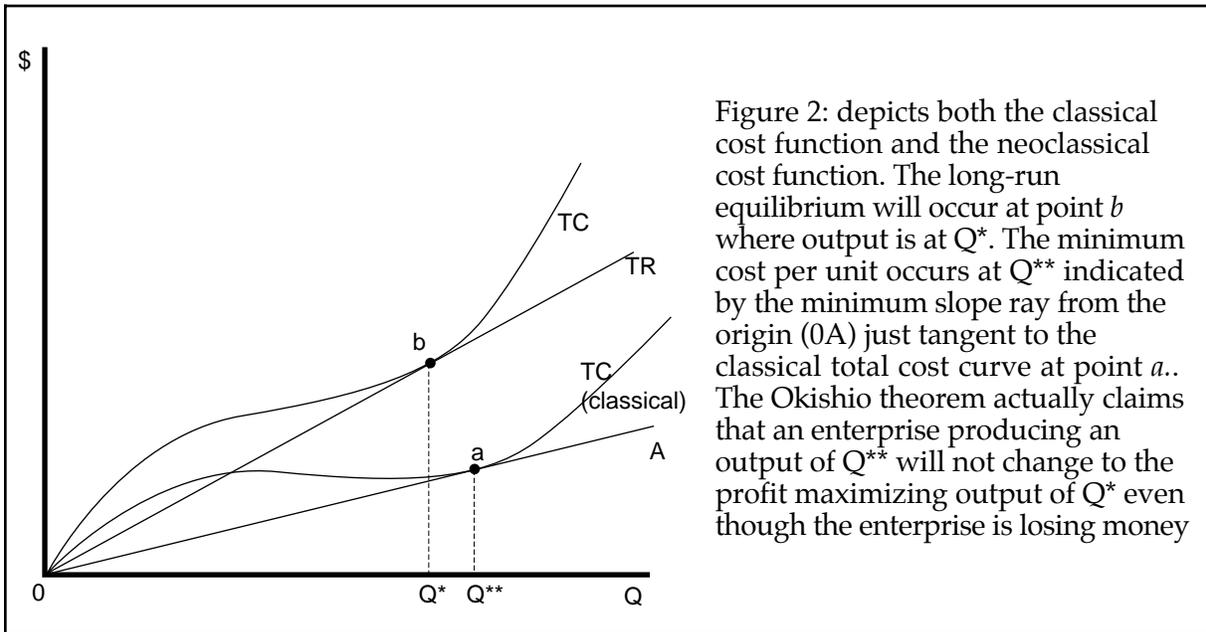
Neoclassical economics's awareness of this form of the TRPF is evident in the work of Irving Fisher. Perhaps Fisher's most influential work, *The Theory of*

¹⁴Profitability here means both mass and rate because with any given value of investment will yield the highest mass of profit when invested in the technique with the highest rate of return.

Interest, occupies much of the same position within neoclassical theory as Marx's TRPF occupies within Marxian economics. While Fisher's work is directed at the theory of interest and Marx's is concerned with the theory of industrial profit, these terms occupy analogous positions within their respective theories. Despite the other differences in terminology, this extensive quote from Fisher should demonstrate the similarity of Marx's TRPF with the neoclassical tendency for the interest rate to fall.

...The increased productivity of capital will entail a decreased price, or value per unit, of the products of that capital. And in addition there may be an increase in the expense of producing the capital, if, for instance it is reproducible only under the laws of diminishing returns or increasing costs. Evidently it does not follow that the net return on capital-value will be permanently increased. In short, the expenses of production, on the one hand, and the price of the product of the capital multiplied by the increased product itself, on the other hand, will tend to adjust themselves to each other and to the rate of interest. But this rate of interest, according to my philosophy, instead of being permanently raised, will be ultimately lowered, for to double the productivity of capital will mean ultimately a much larger income to society than before, and this larger income tends to lower the rates of impatience of those who own it. So long as the rate of interest does not fall to correspond with the lower rates of impatience there will continue to be profit in reproducing the productive capital until adjustment is attained—whether by the decrease in the price of the products or by increase in the cost of the capital, or both, does not matter. In any case, this adjustment must be by lowering and not by raising the rate of interest, for the rate of interest cannot be raised if the rates of impatience are not raised, and the rates of impatience cannot be raised if, as is assumed, the income stream is increased in size without being altered in other respects .

Integral to Fisher's understanding of the tendency for the rate of interest to fall is his conception of the investment opportunity principle (IOP). Just as in Marx's argument that accumulation forces capitalists to accept a lower rate of profit even as the mass rises, the IOP suggests that as enterprises employ greater quantities of capital, they do so at a lower rate of return over cost. Remarkably, for Fisher any rise in the rate of return from accumulation implies an irrationality or mistake on the part of the entrepreneur because it means that at a lower level of capital accumulation the entrepreneur skipped over projects with higher rates of return over cost (or misjudged the expected return on a project) to implement a project with a comparatively lower rate of return over cost. Fisher acknowledges that technological innovation could forestall the fall in the rate of interest by drastically increasing outputs over inputs, but eventually as those outputs become inputs through accumulation the rate of interest will fall from the interaction of two forces: rates of impatience of individuals in the consumption/saving decision interacting with the diminishing rate of return over cost—producing a lower rate of interest. Fisher does leave open the possibility for the rate of impatience to shift, but that would be a change in the parameters of the model outside the scope of the



discussion, and it certainly would not negate Fisher's Tendency for the Rate of Interest to Fall.

Fisher's work, published at the turn of the century, still forms the cornerstone of neoclassical interest theory. In light of his work, I am dismayed by those involved in the Okishio debate who argue Marx's failures arose from his neglect of proper microfoundational methods¹⁵. If a microfoundational approach inevitably disproves the tendency of the rate of profit to fall, why does it exhibit the opposite outcome in the hands of Fisher? Why would those who see neoclassical techniques as superior not direct their disagreement over the TRPF at Fisher rather than Marx, so that they could involve themselves in a debate with others using the 'proper' theoretical terms? If they had done so, we might now have a clearer understanding of the disagreement over this tendency. Instead we have ambiguity and confusion.

Classical v neoclassical terms

The Okishio debate leads us to another ambiguous use of concepts in the conflation of classical profits and neoclassical profits. Classical profits is synonymous with the contemporary term accounting profits, while neoclassical profits coincides with the term economic profits. The profit rate measured in the neo-Ricardian (Sraffian) system is the accounting or classical profit rate while neoclassical economic theory employs its own concept of neoclassical profits. By economic profits, neoclassical theory understands the profit of the enterprise minus the return on the enterprise's next best alternative (e.g., the interest rate). The long-run competitive equilibrium is where price equals the neoclassical cost of production or where the mass of profits and profit rate are both zero.

Within the neoclassical long-run equilibrium for profit mass maximizing enterprises, we find not only marginal cost equal to price (the condition for profit mass maximization), but also that marginal cost equals average cost (the conditions for profit rate maximization). This long-run equilibrium outcome therefore seems

¹⁵See for example, Bowles 1981.

to coincides with both the profit mass maximizing as well as the profit rate maximizing quantity of output. It would seem, at first glance, that we have found a situation in which the viability condition is again valid: long-run equilibrium. Long-run equilibrium thus raises the possibility of another case (in addition to CRS combined with infinite elasticity of industry demand) where profit maximization coincides with the solution for profit rate maximization.

However, this is an example of the confusion that can arise when the general rate of profit is included among the costs of production.¹⁶ We must remember, that the costs expressed in the Sraffian (aka neo-Ricardian) system are classical costs, not neoclassical costs. The minimum cost per unit (maximum profit rate) will always be lower (higher) for the Sraffian systems than for the neoclassical system¹⁷. The limiting case, when the minimum cost per unit is identical in both the classical and neoclassical situations, is excluded by assumption in the Sraffian system because Sraffa assumes a production surplus (and therefore positive classical profits).

In constructing the neoclassical cost function from the classical cost function, the neoclassical economist multiplies the classical cost function by $1+i$, where i equals the opportunity cost of capital. The opportunity cost of capital is generally understood as the rate of interest or in the classical terms used here, the general rate of profit. However, the identity of the opportunity cost of capital (i) and the general rate of interest (r) is an equilibrium condition and will not hold out of equilibrium. It is true only for the last marginal investment in equilibrium. The next marginal investment (as in the case of accumulation) will have a different (typically lower) opportunity cost of capital than the old rate of interest or general rate of profit. The end of the production circuit (for neoclassical theory $C - C'$ where $C' > C$, meaning there is a Sraffian surplus) implies a new round of auctioneering, a whole new price vector, new (presumably higher) levels of output and a new (often lower) general rate of profit.

The preceding discussion means that the techniques constituting the Sraffian production matrix cannot be the techniques which maximize the classical rate of profit (whether considering the short-run or the long-run). To restate this result: except in unusual circumstance (CRS combined with infinite price elasticity of demand for the industry), the techniques that minimize the classical cost per unit are not the same as the techniques chosen by profit maximizing enterprises. If an enterprise does maximize its rate of profit (classical or neoclassical) it will force itself in general to forgo a mass of profits. Over time and as techniques change, we will expect the dominant eigenvalue associated with the Sraffian production matrix to both rise and fall due to the deliberate production decisions of profit mass maximizing capitalists. This implies that the rate of profit will also rise and fall.

The Okishio theorem proponents do not see the TRPF because the theorem amounts to the following exercise: assuming a constant or rising marginal efficiency

¹⁶Shaikh (1977) criticizes this confusion early in the Okishio debate. Fisher also attacks the notion of waiting as cost in his appendix to chapter 20 (Fisher 1907).

¹⁷Since we create the neoclassical cost function by multiplying the classical cost function by $1+i$ where a viable $i > 0$ (i.e., $(1+i) C_{\text{classical}} = C_{\text{neoclassical}}$) $\therefore C_{\text{classical}} < C_{\text{neoclassical}}$

of capital (aka internal rate of return; aka rate of return over cost), can the rate of profit decline? The theorem thus assumes away any conditions contrary to the proof, and without any explanation. This understanding of the Okishio theorem amounts to arguing that the profit rate cannot fall below the interest rate. As we have already seen above, this uncritically lumps these two concepts together, classical and neoclassical profits.

The proponents of the Okishio theorem have managed to stumble their way to a proof of nothing of consequence. They argue that the profit rate will not fall below the interest rate, as if the interest rate can dictate an internal rate of return on productive capital. If one distinguishes between profit rate and interest rate as neoclassical theory does, one cannot simply argue that the profit rate will not fall because it is determined by the interest rate. Instead, one has to take the next step and ask if the argument about the tendency for the rate of profit to fall now has a counterpart theory for the tendency of the rate of interest to fall as Fisher has already done. Fisher's answer is 'yes' because it must be remembered that whether we are within Marxian theory, the Sraffian theory or Fisherian theory, the choice of techniques makes the rate of profit (interest) at the same time that the rate of profit (interest) makes the choice of technique.

The capitalist enterprise therefore chooses a level of output where the derivative of the neoclassical cost function, its marginal cost, equals the marginal revenue or price of the output. Though this appears in Figure 2 to meet the condition for the profit rate maximizing level of output ($MC=AC$), it is not identical to the classical profit rate maximizing behavior. Moreover, the only way the long-run profit maximizing level of profit coincides with the profit-rate maximizing outcome occurs when classical profits and therefore the classical profit rate falls to zero. We therefore solidify the modified viability condition from Expression Three (3) above as the more appropriate viability condition (meaning nothing can be said a priori about the relationship between a new technique's rate of return over cost and the current general rate of profit). Only when the classical (accounting) rate of profit falls to zero can we reinvoke Expression Two (2) as the viability condition because only when the general rate of profit falls to zero will an enterprise avoid production at negative rates of return.¹⁸

Another important issue to consider is the distinction between the general rate of profit and the opportunity cost of capital. As suggested above, these are equal in equilibrium. The realization of surplus in the form of profit, combined with the process of capitalist accumulation, breaks the bond between the general rate of profit and the opportunity cost of capital. Instead of using the general rate of profit (or the rate of interest) as a proxy for the opportunity cost of capital, the capitalist enterprise must turn toward the next best investment in the enterprise's ordering of projects. The rate of return over costs on that project is the new opportunity cost of capital. It will cost our sample enterprise the return on this next investment if it avoids accumulation to prevent the fall in the rate of profit.

¹⁸In Marx's terms, this would happen only when workers ceased to perform surplus labor (see Expression One (1)). Marxian economics finds this limiting case an interesting one and would agree that the TRPF would cease to exert any influence because the law of the TRPF is a capitalist law. When no more surplus labor is performed we are no longer analyzing capitalism.

The alternative to productive investment—of distributing the enterprise's surplus to its own hoard—is too costly for any one enterprise to undertake¹⁹. Moreover, such behavior will only reinforce the TRPF because the rate of profit is measured against the money value of all capital whether hoarded or employed. If the size of the fallow portion of capital grows, the denominator in the rate of profit grows too with no corresponding rise in the numerator as with accumulation. Thus not accumulating, simply taking capital out of production, is not a solution to the TRPF.

In this section I have demonstrated how the Okishio theorem confuses profit mass with profit rate to prove the TRPF inconsistent with 'rational' behavior. This confusion has arose in various ways through various thinkers. Some simply use the term profit without any awareness of the two distinct aspects of profit: mass and rate. Others recognize the distinction between the two but fail to consider the changes in scale and scope that accumulation entails. Some reify financial markets as if finance has a rate of return completely independent of industrial rates of return. Others collapsed the term profit used in two different theoretical paradigms (classical and neoclassical) into the same signified object. Whatever the mistakes of these proponents of the Okishio theorem, we now clearly understand their missteps. These misunderstandings clearly divorce the Okishio theorem from any connection to neoclassical or neo-Ricardian theory. The viability condition is opposed to the neoclassical, neo-Ricardian and Marxian theories from which it might claim to arise. It is only confusion across these theories that has led to its prominent position in the debates over the TRPF.

The third section of the present paper dealt primarily with the common aspects of neoclassical, neo-Ricardian and Marxian theory that stand opposed to the Okishio theorem. In the next section I turn to some differences between Marxian theory and these other theories. In what follows we will see how Marxian theory advances another tendency for the rate of profit to fall unknown in either neoclassical or neo-Ricardian theories. Whereas the tendency discussed in this section relates to the contradictory effects of accumulation, the next section deals with the contradictory effects of the revolutionizing of the means of production (i.e., technological innovation).

¹⁹This is not to say that hoard behavior does not exist; only that the desire to avoid a fall in the general rate of profit is not a plausible motivation.

4. A Marxian Critique of the Okishio Theorem

Viability originates in Marx?

Some (Roemer 1981; Okishio 1960) attribute the viability condition to Marx himself. They suggest that Marx believed that capitalists focus solely on the maximization of profit rate to the exclusion of all else. One oft quoted passage from Marx provides perhaps the sole justification for this view:

No capitalist voluntarily applies a new method of production, no matter how much more productive it may be or how much it might raise the rate of surplus-value, if it reduces the rate of profit. But every new method of production of this kind makes commodities cheaper. At first, therefore, he can sell them above their price of production, perhaps above their value. He pockets the difference between their costs of production and the market price of the other commodities, which are produced at higher production costs. This is possible because the average socially necessary labour-time required to produce these latter commodities is greater than the labour-time required with the new method of production (v3 p373).

The Okishio school reads Marx here as saying that capitalists care solely about the rate of profit, or perhaps solely about their own private rate of profit. It understands this quote as establishing this criterion of profit rate maintenance/enhancement for all decisions and for all times and places. They cannot understand Marx's approach to theory as conjunctural because their own statements are meant to apply to all places and all times. If they really believe that Marx views capitalists as one-dimensional profit rate maximizers, the critics of the law of TRPF should instead ridicule Marx's bizarre reduction of capitalist behavior to profit rate maximization instead of indulging in strange algebraic proofs. Yet such an assertion about Marx's method is unsustainable.

This quote of Marx comes at the end of his long elaboration of the TRPF. At this point Marx has moved away from the terrain I covered earlier (section 3) that is so damaging to the Okishio theorem. He is no longer elaborating the damaging effects manifested through a fall in the profit rate brought on by the accumulation of capital and the amassing of profits. Nor is he speaking explicitly of accumulation, but rather the implementation of new higher productivity techniques. I began a discussion of this 'other' TRPF in section two, (p10) but the importance of this textual evidence in the Okishio debate warrants a return to the topic here. It is this second TRPF where we see Marx's most original contribution to the tendency of the rate of profit to fall. It is here that Marx distinguishes his theory from bourgeois theories of the TRPF.

In section two we saw how capitalist enterprises, in addition to accumulating, also use their surplus to transform technology and the methods of production. In this competitive pursuit, an antagonism arises between the private interests of a particular enterprise and the social effects of that enterprise's actions. Instead of accumulation as the force behind the TRPF discussed above, Marx refers here to

another competitive force: revolution in the means of production (the implementation of new techniques and the transformation of technology in our terminology used here). The motivation here does not lie merely in the larger mass of profits as above, but with the implementation of new techniques producing both higher rates of profit alongside higher masses of profits for the innovating enterprise. With this second TRPF, we return to a terrain more familiar to some of the Okishio theorem's proponents because it once again becomes reasonable to consider the viability condition as a behavioral criterion (even in its strict inequality case). At this point, no doubt, the proponents feel confident of Marx's mistakes.

However, as before, the mistakes are not Marx's mistakes, but arise from the failure of the theorem's proponents to perform a careful reading of *Capital*. At least two oversights on the part of the Okishio theorem's proponents led them to their misguided dismissal of *this* TRPF. The first is in their treatment of fixed capital, and the second oversight is in their treatment of competition among enterprises and their sense of the scale of capitalist production.

We can find an example of the oversights surrounding fixed capital in Roemer where his treatment of the issue of fixed capital is fairly representative of Marx's opponents. As with his other articles on the TRPF, Roemer invokes the (flawed) viability condition of Expression Two (2) above. However, to the extent that the article finds its justification for the viability condition in this second TRPF, he may find sufficient justification to make his case. After all, if the intent of capitalists is to substitute a new technique intended to raise productivity than that technique should satisfy Expression Two (2) (all other things equal). Surely Roemer's work on the Okishio theorem disproves this second TRPF at least.

Roemer first presents a case where fixed capital is infinitely-lived.²⁰ He then extends the model to depreciating capital using a von Neumann linear production system. Bidard has extended Roemer's analysis through Sraffian analysis of joint production. Both Bidard and Roemer share the same short-comings regarding TRPF discussed earlier (e.g., the failure to separate accumulation from substitution). However, they bring a misunderstanding into the consideration of introducing a new method of production as well. Each treats the depreciation of fixed capital as independent of technological advancement. This treatment disregards Marx's important elaboration of the detrimental effects of technological innovation on the

²⁰He might as well add the assumption of production through perpetual motion machines while he takes such liberties with his assumptions.

life and value of fixed capital assets: moral depreciation.²¹

Moral Depreciation

Moral depreciation introduces another element that can lead to the TRPF. Though the introduction of new production techniques can raise the rate of exploitation and therefore increase the realization of surplus value within any enterprise, these new techniques actually lead to an acceleration in the depreciation of fixed assets. Both profit mass and profit rate can fall together due to moral depreciation. Such a possibility may seem counter-intuitive to the celebrants of the capitalist enterprise. The profit rate is a ratio of net revenues (surplus value realized) to the total capital advanced:

$$(4) \quad \frac{\text{Revenue} - \text{Cost}}{\text{Capital Advanced}}$$

If moral depreciation leads to a decline in the denominator that will mean a rise in the rate of profit. However, this forgets that the only way for the denominator to decline is for the numerator to decline first. The depreciation of the fixed assets first appear as an increase in the costs of production. This increase in the costs of production can diminish net revenue (profit) to such an extent that it can actually turn negative. Then we must consider not only a very small profit rate for the enterprise but even a negative profit rate.

Moreover, the moral depreciation of fixed assets involves the replacement of those assets with new fixed capital. The denominator of our profit rate expression will not necessarily fall even as the costs of production associated with moral depreciation falls rapidly. As the fixed capital assets associated with the old technology depreciate more rapidly because of the introduction of new technologies, new fixed capital assets enter into the denominator to bring on the latest advance in technique.

Finally, though certain industries are more prone to technological innovation (and thus moral depreciation) than others, the equalization in the rate of profit implies that capitalist enterprises share the detrimental effects of moral depreciation in one sector across all sectors of production. All sectors of industry will suffer declines in the rate of profit brought on by revolutionized means of production in only one industry. Once again, it is important to underscore the contradiction of revolutionized means of production. On one hand, the introduction of new higher productivity techniques may raise the rate of exploitation of labor, tending to increase the rate of profit. On the other hand the

²¹As with accumulation, moral depreciation introduces a concept beyond the scope of Sraffian or von Neumann systems of fixed assets. Moral depreciation arises from changes in techniques of production. Sraffa's method of calculating depreciation demonstrates a generalization of the standard annuity approach. However, it assumes an identical production method in perpetuity and therefore does not deal with the moral depreciation that arises from a change in method (a revolutionizing of the means of production). In other words, the current turnover of capital is a cross-sectional sample of production over time. Changes in technology or in technique (which are not considered by Sraffa at this stage of his book) would add a whole new dimension to depreciation and the valuation of fixed assets. This new dimension cannot be dealt with in static models because like accumulation it is an inherently dynamic phenomenon (see Sraffa 1960, chapter 10).

introduction of new methods of production accelerates the depreciation of fixed assets along with the acquisition of new fixed assets and leads to a decline in both the mass and the rate of profit. The outcome of these two contradictory processes will depend on the conjuncture of all the other processes overdetermining the capitalist class process.

The Okishio school might respond by saying that we can disregard the harmful effects associated with the introduction of a new technique because the innovating enterprise would already consider those effects when choosing the new technique by applying the viability condition. While this is certainly a reasonable assertion, it brings us to the second oversight in the past Okishio literature's use of the Sraffian mathematical apparatus. The proponents of the Okishio theorem treat the vectors composing the technical matrix as individual enterprises. This is inconsistent with their claims of modeling a competitive market economy. Why should we assume that one and only one enterprise comprises each industry? Competitive market capitalism typically involves multiple enterprises competing within each industry—sometimes reaching hundreds or thousands of enterprises.

Marx's Heterogeneous Industry

To model such a competitive industry, we need to consider an industry as an aggregation of many competitive capitalist enterprises. Sraffa's apparatus lends itself well to such a model if we simply consider each enterprise as deploying a different column vector technique. In our present consideration of fixed assets, each enterprise actually consists of two different vectors: a vector of inputs, and a vector of outputs for the principle commodity and the outputs of variously dated fixed assets for continued use in the production process or for sale as scrap. The k th industry can be derived from the set of all enterprises in the k th industry by simply summing the corresponding input and output vectors of each enterprise.

This formulation of an industry allows us to introduce Marx's concept of intra-industry competition because it exhibits the same conditions expressed by Marx (v1 p436). While convergence toward an equilibrium general rate of profit is possible on the industry level, each individual enterprise within the industry will only realize the general rate of profit if its own costs equal the industry average costs. An enterprise with higher than average costs will face a lower than industry rate of return while an enterprise with lower than average costs will realize a higher rate of return than the general rate of profit. Any enterprise has a strong motivation to increase its productivity of labor, its intensity of labor or the length of its own working day. If through the introduction of new machinery, it can diminish its per unit costs of production, it can realize what Marx calls surplus-profits from its intra-industry competitors even after the new general rate of profit reaches equilibrium.

As I already admit, such a new technique (a production innovation) will likely meet the very restrictive viability condition in Expression Two (2). However, what effect will it have on the costs faced by the rest of the enterprises in the industry? The introduction of revolutionary new machinery accelerates the moral depreciation of fixed assets throughout the industry. Just as we saw in the case of changes in quantity output, the Sraffian system has not been adapted to deal with the effects of moral depreciation (see footnote 21). In Sraffa's treatment of fixed assets, he only considers tangible and predictable depreciation. The depreciation of fixed assets is simply calculated within the system of simultaneous equations. There is nothing wrong with this computation as long as one acknowledges it cannot

address a changing fixed asset composition. It instead assumes a unity between the current turn-over's fixed asset composition and the fixed asset composition for the entire relevant future.

In contrast, Marxian theory requires an apparatus that can consider the motion of fixed asset composition and depreciation. I will not introduce such an apparatus here, but the important thing to understand is that any technical change that shortens the competitive life of fixed assets in other enterprises, must increase the moral depreciation. In Marxian terminology, it accelerates the rate at which the embodied abstract labor passes from the fixed asset commodity into the finished product. Thus, the costs of production for the other enterprises in the industry actually rises from the introduction of the new machinery. While the innovating enterprise clearly considers such effects on its own cost structure, little should compel it to consider such effects on its competitors. What its competitors lose in moral depreciation, it gains through surplus-profits. By introducing a new higher productivity technique, the enterprise gains in two respects. It first gains by decreasing its own costs below the average (for example). Secondly, it gains by raising industry's average cost of production. While the private decision maker raises its own rate of profit (meeting the Okishio viability condition in one sense), it can still diminish the industry rate of profit (failing to meet the Okishio viability condition in the sense in which the theorem employs the viability condition). When this occurs, the inversion of the Okishio theorem again provides us with the ready-made proof that the general rate of profit must fall.

The proponents of the Okishio theorem get around this by adhering to the familiar neoclassical idea of the representative firm. Rather than regard each enterprise in an industry as distinct—facing its own historically contingent production decision—the enterprises in an industry are lumped together so that they behave as one cohesive unit. Every enterprise produces with fixed capital assets of identical composition in relation to the vintage of those assets. Any decision to change the composition of fixed assets is simultaneously made by all enterprises in an industry. For both neoclassical and neo-Ricardian theory this is understood as the inevitable result of long-run equilibrium. However, it is far from inevitable as it carries with it an implicit assumption that the rate of technological innovation is sufficiently slow to allow all enterprises to converge on one fixed asset composition. Once all enterprises adopt a production technique and the long-run arrives, the opportunity arises for a new technological innovation and subsequent technical implementation. The dynamic process described in these theories requires that all enterprises synchronize their fixed capital purchases and depreciation schedules and that no technological innovation reach implementation during any long-run equilibrium adjustment.

A Marxian understanding of competition contrasts sharply with these classical and neoclassical conceptions. Marx develops the category of capitalist competition as including revolution of the means of production. Marx posits a tendency for a general profit rate across industries, but not within an industry. The pace of revolution in the means of production and the varied composition of the vintage of fixed capital ensure that profit rates cannot equalize within an industry. This disparity of the positions of the various enterprises also undermines the hidden neoclassical assertion of a monolithic, unified industry characterized by a single homogenous representative enterprise.

As competition over technical innovation becomes wide-spread, its effects become pervasive. While innovation raises the productivity of labor, its influence on the depreciation of fixed assets socially can overpower its impact on labor productivity. On balance, this continuous revolution in the means of production can contribute to a TRPF rather than leading to a rise in the rate of profit as Roemer and Bidard insist. Capitalists may even recognize the madness of their competition yet each is paralyzed to remedy the situation. This provides another example of the destructive effects of capitalist competition frequently glossed over by its apologists.

5. Conclusion and Summary.

Placing the Okishio Theorem within a more appropriate context.

As we saw in the last two sections, the Okishio theorem's rhetorical power derives primarily from the pervasive ambiguity within its concepts as well as a confusion on the part of its proponents and opponents alike. Neither Marx nor I make any claims that the profit rate will in fact fall. Marx has meticulously covered many counter-tendencies and internal contradictions that both undermine and reinforce the TRPF. Despite the status of the TRPF as 'merely a tendency,' claims made by the proponents of the Okishio theorem are clearly unwarranted.

To the extent that the theorem has any validity, it lies in the fact that if the viability condition holds for the industry the general rate of profit will rise. However, there is nothing in the behavior of capitalists or in the physical, cultural, political and economic conditions of capitalist production that can guarantee changes in production techniques will occur only within the constraints of the viability condition. Within the process of accumulation Marx addresses in (what I identify as) the first TRPF, the implementation of techniques will typically fail to meet the viability condition for enterprises grasping to maximize their profit mass. In agreement with neoclassical and neo-Ricardian theories, there are no doubt very special circumstances when capitalist accumulation will lead the disparate behavior of individual capitalist enterprises to cause the viability condition to hold for the whole industry. But, to the extent that those special circumstances deserve attention at all, they should simply be added to the list of counter-tendencies enumerated by Marx himself.

The rhetorical power of the Okishio theorem lies in the mistaken premise that the profit mass maximizing techniques will correspond to the minimum cost per unit technique in any input-output system (or at least the weaker presumption that, a capitalist enterprise will change a technique only if it lowers the cost per unit of production within the industry). There is nothing in the explicit assumptions of the theorem which should necessitate such a conclusion except the viability condition itself. Yet the viability condition is not a condition of profit mass maximization, but profit rate enhancement. If we do not accept this absurd condition, there remains no persuasive power left in the theorem.

Though I have clearly demonstrated that the Okishio theorem's influence has been thoroughly overblown, some will dismiss this paper out of hand. Still others may claim that it was only under these very special conditions that the theorem was ever meant to apply. Yet if that is all the theorem 'ever meant,' then the celebration it fueled is far out of line with its implications. To call the Okishio theorem a law of the rising rate of profit is simply ridiculous.

The debate ignited by the Okishio theorem over the last few decades has surely constituted a distraction from Marx's contribution to the TRPF. As this distraction is set aside we can begin the process of re-articulating Marxian economics in a more productive way.

Micro-determinism

Some of the proponents of the Okishio theorem tried to argue that Marxian theory's 'mistaken' advancement of the tendency of the rate of profit to fall derived

from its failure to employ micro-foundations or what Marxian theory calls micro-determinism. In one sense they are correct. The denial of the TRPF and the broad acceptance of the Okishio theorem is certainly caught up in a pre-theoretical ideology of human essentialism.²² Their belief that society is merely the expression of the wills of its individual members led the Okishio proponents through a sort of theoretical gymnastics to demonstrate that which they had presumed from the start.

The *different* truths produced by Marx and by Okishio are not merely the typical outcome of *different* modes of thought: neoclassical/neo-Ricardian and Marxian. Behind these different truths lies a more interesting story. The Okishio theorem arises not from a particular theoretical paradigm such as neoclassical or neo-Ricardian, but from a mutant hybrid of the two. Once this mutant had served its purpose in discrediting Marxism and retelling the story of capitalist immortality, it was left without a home.

As the above analysis has made clear, we can understand the Okishio theorem as the condensation of numerous theoretical ambiguities. The persuasive power of the theorem requires the confusion of many categories: static versus dynamic; profit rate and profit mass; classical profits and neoclassical profits; technical implementation versus technological innovation; enterprise and industry; and so on. These ambiguities condense in the theorem's viability condition and in its confusion over private choice criterion and social effects.

No one would claim responsibility for this hideous creature. What use would a neo-Ricardian or a neoclassical have for a theory of profit rate enhancement through industry-wide cooperation? What would become of neoclassical claims of technical efficiency in production? A whole new generation of neoclassical economists would need to go to work to come up with the proofs that profit-rate enhancement enterprises created efficiency just like the profit maximizing firms. Assuming these proofs materialize, what would that say about the previous efficiency claims derived from profit mass maximization? Would it mean that any behavioral criterion leads to efficiency? If so, perhaps it would imply that any absence of a behavioral criterion would also be efficient. This is not a fruitful path for neoclassical theory to take. The neo-Ricardians have no particular use for this theory either. If they seek to critique neoclassical theories of distribution in theory with a theory of profit-rate maximization they will only deepen the divide they must cross to gain a voice in mainstream economics. Everyone will wonder whether their insights regarding income distribution derive from simply an absurd behavioral criterion. The theory surrounding the Okishio theorem is no doubt a theory without a home.

The Okishio theorem advocates produced a new theory of human behavior whose sole purpose was to discredit the work of Marx and the Marxian tradition. That they enjoyed such success is troubling. Their success, on the one hand, demonstrates the way the ideology of human essentialism so thoroughly pervades

²²I say pre-theoretical because it is the pre-conceptions of humanism that micro-determinist theorists brought to their work and not the neo-Ricardian and neoclassical theories they employed which led them to draw such misguided conclusions. The Okishio theorem is not a truth produced by a particular theory but "the peculiar notions of the competition-enslaved capitalist [translated into an] ostensibly more theoretical and generalized language" (v3, p338).

our understanding of the world.²³ On the other hand, the success enjoyed by the Okishio theory can also be viewed as the result of its affirmation of the dominance of bourgeois ideology. It told bourgeois economists, in particular, exactly what they wanted to hear. It told us all that capitalism was an immortal social form. It told the critics of capitalism that capitalism is invincible and eternal.

Mainstream theory's critical engagement with Marxian theory is very rare. The Okishio theorem's failure to deal critically with Marxism is typical of mainstream opposition to Marxism. Often the strategy of mainstream economics is to ignore Marxism entirely. When that fails and some engagement proves unavoidable, the reaction becomes one of demonstrating how mainstream theory has a theoretical conclusion that conflicts with Marxian theory. The conclusion then is that Marxian theory must be false. The Okishio theorem likewise fails to engage Marx's theory of the TRPF. Rather than engaging Marx's exposition of capitalist accumulation and capitalism's continual revolution of the means of production, the theorem imagines a world where such processes simply do not matter. Nowhere do those opposed to the TRPF explain why these processes are inconsequential; it is simply asserted. Had they engaged Marxian theory directly they would have found the flaws in their own logic. They would have confronted the ambiguities embedded in their language. They might have found other roads to attack the TRPF.

Instead, the theorem simply casts aside the TRPF without critically engaging it. The failure of the Okishio theorem's proponents parallels the failure of other non-critical theorists. For instance, of Feuerbach, Engels says "He was incapable of disposing of Hegel critically but simply threw him aside as useless, while [Feuerbach] himself achieved nothing positive beyond a turgid religion of love and a meager impotent morality in contrast with the encyclopedic wealth of the Hegelian system" . Like Feuerbach, the Okishio theorem's proponents simply throw aside Marx and the TRPF, they do not even try to understand it . Their hucksterism has given them their fifteen minutes, but it will eventually be measured against the "encyclopedic wealth" of Marxian theory.

The importance of critical theory is in drawing out the distinctions between various theories. A critical understanding is one that makes sense out of the differences in the various truths produced by various theories. Among Marx's many contributions, we often lose sight of his mastery of this critical method. Marx did not simply produce a different truth, but provided an understanding of why *his* truth deviated from the truths of other theoretical paradigms (Hegelian, Ricardian, vulgar, etc.). The failure of the Okishio theorem proponents to produce such an understanding has led them down theoretical dead-ends.

²³It is an unfortunate possibility that the most persuasive element in this essay may prove to be the demonstration that Fisher also had a theory of the tendency for the rate of profit to fall. Many Marxists and non-Marxists alike may conclude that if neoclassical theory predicts a fall in the rate of profit then it must be true. Though I hope the argument will serve such persuasive ends, it is also sad that we so often adopt the idea that truth can be adjudicated by neoclassical theory alone—that truth cannot arise from Marxian theory without the independent confirmation from bourgeois theory. There is extreme danger in Marxian theory seeking confirmation of its truths within a theory whose clear objective is to undermine Marxian theories of political economy.

While human essentialism is absent from Marx's method, it is ridiculous to claim Marx had no understanding of the role of individual capitalists within the process of capital. Roemer himself says of Marx's method in the TRPF chapters of *Capital*, "it must be admitted [the argument] is microeconomic" (Roemer 1979, p379). Indeed it is, but it is also macroeconomic. In a word, it is anti-essentialist. As we have seen in particular, Marx's use of the circuit of capital is a device to show how the many determinations are themselves determined. The exchange of commodities for money shapes the exchange of money for commodities. Those processes shape the process of production. The process of production, in particular the production of surplus, now shapes a renewed exchange of commodities for money. Surplus implies that the same exchange cannot take place as the earlier exchange before production—commodities have been transformed. There is a greater mass of commodities expressed in a greater value than before. One cannot simply presume a simple repetition of the process again and again. To do so would be not to use Marx's method, but the method of static analysis—of metaphysics.

The Okishio theorem views production as a process repeated endlessly inside itself. The surplus has no consequences on production (or at least no consequences detrimental to capitalism) because the process can be reproduced again and again in an identical manner. If the rate of profit falls any enterprise can simply return to the previous levels of production before accumulating surplus. In contrast, Marx understood the circuit of capital as a process that was always in motion. Any iteration of that process is necessarily different from any other. The conditions of existence for capital are always changing and so too is the circuit of capital itself.

$$(1) \quad r = \frac{s}{c + v} = \frac{\frac{s}{v}}{\frac{c}{v} + 1}$$

We should return briefly to Marx's argument about accumulation illustrated with Expression One (1). If the organic composition of capital rises while the rate of exploitation remains constant or fails to rise sufficiently, then the rate of profit will fall. There is no disputing this simple algebraic exposition. Now that we understand the fallacious foundations of the viability condition, there is no longer any reason to argue that capitalist enterprises would systematically avoid such declines in the rate of profit. A typical enterprise will find an infinite number of changes in technique that are both attractive yet may tend to lower the rate of profit.

In fact, a capitalist enterprise may accumulate surplus to offset the detrimental effects of a falling rate of profit. It will revolutionize the means of production once it finds its own balance sheet supports such a move despite the devastating effects of moral depreciation on the profit mass and profit rates of its competitors. The Okishio theorem has been a misguided and mistaken distraction that has occupied Marxian economics for too long.

Appendix A: The identity of Profit Rate Maximization and Cost per Unit Minimization.

In the two columns below we derive the first order conditions for the dual problem of cost per unit minimization and profit rate maximization. The final expressions show the identity of profit rate maximization and cost per unit minimization.

Profit rate maximization:

$$\max_{q_i} \frac{\pi}{C} = \frac{p_j q_{(j)} - \sum_{i=1}^n p_i q_i}{\sum_{i=1}^n p_i q_i} = \frac{p_j q_{(j)}(q_i)}{\sum_{i=1}^n p_i q_i} - 1$$

Cost per unit minimization:

$$\min_{q_i} \frac{C_j}{q_{(j)}} = \sum_{i=1}^n \frac{p_i q_i}{q_{(j)}}$$

First Order Conditions

$$\frac{\left(\sum_{i=1}^n p_i q_i \right) p_j \frac{\partial q_{(j)}}{\partial q_i} - p_j q_{(j)} p_i}{\left(\sum_{i=1}^n p_i q_i \right)^2} = 0 \quad \forall i$$

$$\Rightarrow \left(\sum_{i=1}^n p_i q_i \right) \frac{\partial q_{(j)}}{\partial q_i} = q_{(j)} p_i \quad \forall i$$

$$\left. \frac{\sum_{i=1}^n p_i q_i}{q_{(j)}} = \frac{p_i}{\frac{\partial q_{(j)}}{\partial q_i}} \quad \forall i \right\}$$

$$\frac{q_{(j)} p_i - \left(\sum_{i=1}^n p_i q_i \right) \frac{\partial q_{(j)}}{\partial q_i}}{q_{(j)}^2} = 0 \quad \forall i$$

$$\Rightarrow \left(\sum_{i=1}^n p_i q_i \right) \frac{\partial q_{(j)}}{\partial q_i} = q_{(j)} p_i \quad \forall i$$

$$\equiv \left. \frac{\sum_{i=1}^n p_i q_i}{q_{(j)}} = \frac{p_i}{\frac{\partial q_{(j)}}{\partial q_i}} \quad \forall i \right\}$$

The first order condition for both profit rate maximization and cost per unit minimization is that the marginal cost (right side) equals the average cost (left side).

Appendix B: On the relationship of optimization and enhancement (maintenance).

Here we see the viability condition's relationship to the profit rate. The viability condition is directly connected with profit rate and not profit mass criteria.

The viability condition is identical to the cost per unit minimization (or maintenance or enhancement) or the profit *rate* maximization (or maintenance or enhancement) conditions.

$$\max_{q_i} \frac{\pi}{C} = r = \frac{p_j q_{(j)} - \sum_{i=1}^n p_i q_i}{\sum_{i=1}^n p_i q_i} = \frac{p_j q_{(j)}}{\sum_{i=1}^n p_i q_i} - 1$$

$$\Rightarrow 1 + r = \frac{p_j q_{(j)}}{\sum_{i=1}^n p_i q_i}$$

$$\Rightarrow p_j = (1 + r) \sum_{i=1}^n p_i \frac{q_i}{q_{(j)}}$$

\Rightarrow repeatedly implementing (and substituting) all such techniques where $p_j - (1 + r) \sum_{i=1}^n p_i \frac{q_i}{q_{(j)}} > 0$ until all techniques where $p_j - (1 + r) \sum_{i=1}^n p_i \frac{q_i}{q_{(j)}} > 0$ are exhausted will maximize the profit rate.

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