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*Qualitative and Quantitative Analysis in
Systematic Dialectics:
Marx vs. Hegel and Arthur vs. Smith.¹*

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Abstract

Whether capitalism is best studied using qualitative or quantitative methods is a standing issue. A key determinant in answering this is whether numerical measures can be meaningfully imposed on it epistemologically or even be said to constitute it ontologically. Reflecting on Smith's and Arthur's accounts of Hegel's influence on Marx, it is concluded that both caveats are true for capitalism. Hence, quantitative methods certainly have potential in studying it, albeit that this conclusion itself could only be arrived at through qualitative means.

¹ I am very grateful to Tony Smith, Christopher Arthur and my thesis supervisor Geert Reuten for their thoughtful and elaborate comments on earlier versions of this paper. All remaining mistakes are my own.

Introduction

The study of capitalism is first and foremost a branch of social science. As such it deals with people's behavior and their interaction. It is a standing issue whether these topics can be studied using quantitative methods. In mainstream economics this issue has long been resolved in favor of quantitative methodologies. Since Friedman's (1953) *The Methodology of Positive Economics*, mathematical models that are supposed to predict economic events rather than describe or explain them, has become mainstream economist's main tool. Heterodox economists (e.g. Coase, 1998; Chick, 1998) have responded by pointing out that such a focus on predictive mathematical models tends to obscure economics' substantive subject matter (in this context this term was first coined by Polanyi (1957)) and if taken to extremes leaves economists clueless as to the nature of the system they make predictions about (i.e. capitalism). Within Heterodox economics, it is the Marxist and, more particularly, Hegelian Marxist groups that are most focused on the description of capitalism as a system. Indeed, the assumption that capitalism is a relatively autonomous relatively self-contained system consisting of strongly interdependent and interrelated parts, is a necessary precondition for systematic dialectical methodology to be applicable at all. A focus on qualitative description of a system, however, does not necessarily preclude the use of mathematical models. Instead it should inform where, when and why the latter approach is possible and fruitful. In this paper I intend to set the stage for answering these questions for capitalism by evaluating the nature of the core categories in Marx's *Capital* from a systematic dialectical perspective.

To do this, section 1 provides an overview of Hegel's *Encyclopädie*. Next, section 2 places Marx's subject of investigation in this context. The handle this gives us on the nature of Marx's abstractions and the dialectic appropriate to them allows us to explain the various ways in which representations of Marx's systematic dialectics draw on Hegel. Section 3 next describes the implications of all this for the ontology of core capitalist categories and the potential for quantitative treatments thereof.

1. An Overview of Hegel's Encyclopädie

Hegel's main tenet is that all that can be known about the world is known in language. Things that cannot be expressed in a form of language cannot actually be known at all. The upshot of this is that the basic structures of language are the basic structures of intelligibility of the world. In other words: for the world to be represented in thought, it must be representable in language. If so, the structure of language must be isomorphic with the structure of the world's knowability (a thought also expressed by Hofstädter, 1979) and by mapping the basic systematic relationships between categories in language, the systematic of the world's intelligibility and the fundamental interrelations between everything we can claim about it, can be discovered.² Hegel provides an overview of this project in his *Encyclopädie* (1830³, 1817¹).³

This work is divided first into parts I, II and III and then into subdivisions ('Abteilungen') 1, 2 and 3. These in turn are subdivided first into sections A, B and C and usually next into subsections a, b, and c. Finally, some of the subsections are subdivided into α , β and γ . The parts, subdivisions, sections and subsections relate to each other as α) the category as it appears in total conceptual isolation, β) the category as it expresses itself in the world and γ) the reconciliation of α) the thought category with β) its expression. Thus, part I, the

² Despite Hegel's remarks to the effect that the world is created or changed through our systematic dialectical representations or reconstructions of it (e.g. Hegel 1969, 592), I take Hegel's philosophical claims to be epistemological rather than ontological in nature. Hence, my stress on intelligibility, knowability and on representation and expression of knowledge. In my opinion Hegel made those remarks, because he felt that our knowledge of the world could never surpass our ability for thought, which in turn is limited by the language(s) at our command. So, for all practical purposes ontology and epistemology may well be conflated. If there are ontological structures out there that cannot be expressed in language they cannot be expressed or known at all (yet) and until they have been made expressible, talking about them is philosophically useless. So, for Hegel ontology only matters in as far as it can be borne out epistemologically and for this reason he just doesn't distinguish between the two. As we will see in § 3 the ontological status of claims dialectically arrived at changes with Marx, for the description of capitalism requires categories that are both real and ideal (i.e. materialized abstractions).

³ Superscripts behind a publication year denote editions. The edition that was actually used is always cited first. Thus (1830³, 1817¹) means that the current text relies on the third edition of the *Encyclopädie* and that the first edition of that work was published in 1817.

Logic ('the science of the Idea in and for itself' – §18)⁴, relates to the most fundamental (structural relationships between) categories in language, i.e. it consists of categories without which the world would certainly be unintelligible, distinctionless white noise (such as Being, Becoming, the One and its Other) without however considering the application of these to the world itself. Next, part II, the philosophy of nature ('the science of the Idea in its otherness' – §18) considers how the categories in the logic are altered when one applies them to nature, that is, how they are expressed in the world. Since this involves leaving the sphere of 'thinking about thinking', this transition opens up the possibility of misrepresentation (whose occurrence is amply illustrated in the history of science – cf. e.g. Bryson, 2003), i.e. the possibility that the structure of language is not entirely isomorphic to the structure of the world (yet). In part III, the philosophy of mind, or, in Hegelian terms, the science 'of the idea that returns into itself out of its otherness' (§18), the inherent freedom of thought is reconciled with the material restrictions of nature by showing how self-conscious humanity can impact on nature to understand, create and change human society.

If we turn to the subdivisions of part I, we find it consists of 1) the doctrine of Being ('die Lehre vom Sein'), 2) the doctrine of Essence ('die Lehre vom Wesen') and 3) the doctrine of the Concept ('die Lehre vom Begriff' – §83).⁵ The first of these doctrines comprises A) Quality (§86-98), B) Quantity (§99-106) and

⁴ Henceforth all paragraph references (such as §18) are to Hegel, 1830³, 1817¹ and any citations are from the 1991 English translation by Geraets, Suchting and Harris.

⁵ All of these translations are a bit tricky. Although the German 'Lehre' is always translated as doctrine (e.g. Geraets, Suchting and Harris, 1991; Wallace, 1873; Carlson, 2003, 8; Inwood, 1992, 268), the German term is much more neutral, for it does not carry the connotation of 'indoctrination' with it at all. Instead, it is derived from 'lernen', the German for 'learning' or – sometimes – 'teaching'. The German 'Wesen' (ibid.) refers to what you might call 'essential Being', the nature of something, as well as to unidentified bodies and beings, such as the building trade (das Bauwesen) or a God the speaker does not believe in (das Überwesen). Thus 'Wesen' necessarily implies some elusiveness. This is not the case with 'Essenz'. This important distinction is lost in English. Finally, 'Begriff' is derived from the German for understanding: 'begreifen' ('to grasp' literally). In its various translations as 'concept' (e.g. Arthur, 1993, 64; Geraets, Suchting and Harris, 1991; Inwood, 1992, 58; Smith, 1993, 29) or 'notion' (e.g. Wallace, 1873) this connotation, if not lost, is at least severely downplayed, for noting or conceptualizing implies more of a dim awareness, than an *understanding* of the matter at hand. In what follows, I will adopt today's convention in the Hegel literature and use 'category' to denote concepts in general and 'concept' when referring to Hegel's 'Begriff' (2002, 45-47).

C) Measure (§107-111).⁶ All we can say at such an abstract level about the Quality of Being is that it consists of a manifold of indeterminate Ones upon which we can only externally and arbitrarily reflect, turning it into Quantity. To get rid of the arbitrariness, a Qualitative Quantum is required: Measure (Damsma, 2010 elaborates on this).

Exactly what type of categories one needs to get to grips with more determinate qualities is the subject of the doctrine of Essence. Not that any specific qualities can be invoked at such an abstract level yet, but the kind of categories required to allow for a reentrance of qualitative distinctions are identified and systematized at this level. In overview this doctrine is concerned with A) elusive, hidden Essence (how things are – §115-130), B) Appearance (§131-141) and C) Actuality (§142-159). Whilst at many occasions appearance may very well be all we got, it is only when it is mediated by some theory on Essence, that we understand the laws of self-development of the actual. So while Essence categories are applicable to objects, Essence is fundamentally elusive at the same time.

When objective, but elusive Essence is mediated by subjective thoughts on Being as a whole, in principle we have concretely applicable Concepts. Again, at the level of the Logic, the language refers to the type of category, not to any concrete embodiment of it. This final subdivision of the Logic consists of: A) Subjective Understanding (§162, §163-193), B) the Object (§162, §194-212) and C) the Idea (§162, §213-244). As such it indicates the structure by which Subjective Understanding, i.e. embodied (and thus Actualized) thought is reconciled with its Actual Object, i.e. its expressions in the Actual world. This reconciliation requires Ideas.

⁶ In this paper, categories that are dialectically important to Hegel will always be written with a capital letter, enabling the reader to see whether a word is used dialectically or not. In German, all nouns are written with a capital letter. So, this practice (although common among native English speaking Hegelians) has no warrant in German (Inwood, 1992, 6). However, since this linguistically questionable convention clarifies dialectical presentations, I will adopt it here. To avoid confusion between Hegel's moments and Marx's, Marx's will be stressed by *italicizing* them.

The general conceptual distinctions of the Logic are applicable to Hegel's philosophical system as a whole as well as to its subfields considered in themselves. Since the doctrine of Being consists of categories that are indispensable for all human understanding, the type of categories found in it best describe the Logic relative to the other two principal spheres. Considered in itself, the Logic of course displays a dialectic of 1) Being, 2) Essence and 3) Concept. Similarly, since the Philosophy of Nature relates to the way objective material things out there are represented in thought, it is best described in terms of an Essence structure, or the applied counterparts of Essence categories. When considered in itself, Nature again displays a dialectic of worldly expressions of: 1) Being (comprising Space and Time, Matter and Movement and Absolute Mechanics – §252, §253-271), 2) Essence (physics – §252, §272-336) and 3) Concept (organic physics or biology – §252, §337-376). Finally, and in the same vein, the Philosophy of Mind is supposed to resemble a structure of Concepts in that it reconciles thought with nature. As will be expected by now, its subdivisions relate to each other as: 1) Being (Subjective Spirit comprising Anthropology, Phenomenology of the Mind and Psychology – §385, §387-482), 2) Essence (society or Objective Spirit – §385, §483-552) and 3) Concept (or Absolute Spirit with philosophy as its ultimate Concept – §385, §553-577). Figure 1 summarizes and schematizes the above. As such it is essentially a condensed version of the table of contents of the *Encyclopädie*.

I.	<u>The Logic</u>
1.	<i>The Doctrine of Being</i>
	A. Quality
	B. Quantity
	C. Measure
2.	<i>The Doctrine of Essence</i>
	A. Essence (as ground of Existence)
	B. Appearance
	C. Actuality
3.	<i>The Doctrine of the Concept</i>
	A. Subjective Understanding
	B. The Object
	C. The Idea
II.	<u>The Philosophy of Nature</u>
1.	<i>Mechanics</i>
2.	<i>Physics</i>
3.	<i>Biology</i>
III.	<u>The Philosophy of Mind</u>
1.	<i>Subjective Spirit</i>
2.	<i>Objective Spirit</i>
3.	<i>Absolute Spirit</i>

Figure 1. An overview of Hegel's Encyclopädie

2. Representations of Marx's Systematic Dialectics

Representations of Marx's systematic dialectics in his *Capital* draw on the categories in the Logic in various ways. Arthur holds that Marx's representation of Capitalism roughly parallels Hegel's Logic. He writes: 'The movement from exchange to value parallels his Doctrine of Being; the doubling of money and commodities parallels the Doctrine of Essence; and capital, positing its actualization in labor and industry, as absolute form claims all the characteristics of Hegel's Concept' (Arthur, 1993, 65). Thus, Arthur views the *exchangeability* of commodities as their Quality, the ratio of exchange determined in the *bargain* as their Quantity and *value in exchange* as their Measure (Arthur, 1993, 73-77; 87).

Value is an Essential condition for commodities' exchangeability, but since it is not an inherent property of commodities, it Appears only fleetingly in the act of *exchange* unless *money* Actualizes it (which it must in the face of generalized exchange) (Arthur, 1993, 78-82; 87). Given *money* the (Concept of) *price* can be Subjectively determined quite independently of any individual bargain. Thus, money first and foremost functions as a *measure of value*. However, this value is only Objectively realized when sales actually commence, thus allowing the seller to buy the commodity s/he actually desired in the first place. This gives us the circuit of Commodity (C) – Money (M) – different Commodity (C'). Secondly then, money is a *means of circulation*. Thus, this circuit is at a constant risk of breaking down. The Idea of money is fully developed when it actualizes itself as the *end of exchange*, so that we end up with the circuit M – C – M' which determines *capital* as 'money which begets money' (Marx, 1890⁴, 1867¹, Ch. 4: 170; 1867F, 256).⁷ Thus, in its abstraction *capital* is posited as self-valorizing (Arthur, 1993, 82-84, 87).

It takes Marx only two subdivisions in a space comprising less than a fifth of *Capital I* to make the move from *exchange* to *capital* outlined above. Arthur therefore concludes that the dialectical progression in the rest of volume I and volume II and III is best represented as a dialectic of Concepts (Arthur, 2002, 47). More specifically, since according to Arthur capital can already be considered as the Idea of money, most of the dialectical progression in *Capital* must be concerned with Ideas in the Hegelian sense. These, he writes, are best represented in terms of the contrast between Universality ('*Allgemeinheit*') and Particularity ('*Besonderheit*') and its resolution in Individuality ('*Einzelheit*') (Arthur, 2002, 47). These terms supposedly represent how the three volumes of *Capital* relate to each other as well as how each volume is organized (Arthur, 2002, 48-49). Thus, the distinctions between Universality, Particularity and Individuality are applicable to *Capital* as a whole as well as to each of its subfields considered in themselves in much the same way as the general conceptual distinctions of the

⁷ Translations of *Capital* are referred to by citing the year of the first publication in German, suffixed with F (for Fowkes, translator of volume I).

Logic are applicable to Hegel's philosophical system as a whole as well as to its subfields.

However, Arthur is very critical of Hegel. He accuses him of thinking that 'the Idea creates Nature' (Arthur, 2003, 195). Clearly, if this is taken to mean that the world will automatically conform to whatever we think about it; there is no need whatsoever to do any empirical research adjusting our ideas to the world.⁸ This type of upside-down ontology *may* have *some* relevance for 'thinking about thinking', that is at the level of the Logic, but is unlikely to be applicable to Nature (at level II) or the Mind (at level III) (Arthur, 2003, 195-196). But Capitalism is an unlikely system that allows pure abstract thought (*value*) to gain material reality (as *money*). Hegel's Logic, then, is applicable to Capitalism, only because capitalism creates an inverted reality in which thought can indeed be said to preside over matter (Arthur, 1993, 64). As long as this inverted reality is considered in itself, the Idea of *capital* in general can become self-subsistent relative to *many capitals*.

But as soon as the inverted reality of capital is left and one tries to incorporate concrete people – and not just their value-expressions (such as wages and productivity) – in the system, problems arise, because people may not want to be treated as another means of production. So they may rebel (cf. Bellofiore, 2008), or not: that is a wholly contingent matter. Either way, capitalism requires quantitative expressions of the value of its produce as well as the value of its inputs (like wages and productivity) to enable it to resocialize its produce and mobilize its inputs. Thus, it creates a society, whose primary focus must be on exchange values rather than use values, leading to commodity fetishism and

⁸ Note however, that it should *not* be taken to mean this. As put, the statement caricatures Arthur's position regarding Hegel's ontology in order to convey Arthur's criticism of Hegel clearly and succinctly. Arthur does not literally claim that Hegel held that 'the Idea creates Nature', as though the Idea is just God in a philosophical guise. The point Arthur makes is rather that the former has an ontological priority over the latter. So from Arthur's point of view, there is no real dialectic in Hegel between the world and the categories describing it. One might say that Arthur portrays Hegel as holding that the world will conform more to what we think about it (i.e. the way we have categorized it) than the other way round. The need for empirical research adjusting our ideas to the world is thus limited to the world's vast array of contingencies: its fundamental determinations are immutable. I am very grateful to Tony Smith and Christopher Arthur for clarifying those subtleties.

worker alienation. These problems are similar to the problems Hegel runs into when he wants to make the transition from the Logic to the Philosophy of Nature. That is, Nature is independent of thought and hence it may ‘rebel’ against our classifications, just like labor may rebel against its treatment as a determinant of value only (Arthur, 2003, 196-197). Of course, if Nature ‘rebels’ we can only concede that our classifications were wrong, whereas a labor rebellion is more likely to result in labor being subdued again by any (contingent) means necessary. In other words, in response to a labor rebellion capitalism’s basic elements (i.e. humans) are likely to be forced back into their mold rather than the mold being adjusted to the natural behavior of its basic elements (which is the only way to go when these basic elements are electrons, quarks and the like). In short, Arthur argues that Hegel’s confusion led Marx to his correct presentation of Capitalism as an inverted reality. Thus, by staying very close to Hegel regarding his *method* of presentation, Marx actually dismissed the *content* of Hegel’s philosophical system.

Smith’s reading of *Capital* is much more favorable to Hegel. He does not grant that Hegel was unconcerned with empirical reality. On the contrary, he claims that Hegel and Hegelians as well as Marx and Marxists must appropriate their categories from elaborate empirical studies before dialectical representation can (re)commence. Marx and Marxists refer to this preliminary empirical kind of research as exploration (‘Forschung’) (Reuten, 2000, 143).⁹ So, first there is the world, second our preliminary partial categorization of it, and only when our empirical studies of a field are exhausted can we flesh out how these provisional categorizations are interrelated using systematic dialectics (Smith, 1990, 3-8). But even then, the systematic dialectician, when stuck, might need to revert to exploratory types of research in order to gain a better understanding of his

⁹ What Hegel and Hegelians call the method of the understanding (‘die Methode des Verstandes’) can be part of this exploration of concepts (cf. Hegel, 1817¹, 1830³, §259), but is much narrower in scope for it only refers to ‘a method in which the object of investigation is divided into separate things [or parts] in external relationships to each other’ (I am grateful to Tony Smith for making this point and lending me this phrase), while Marxian exploration encompasses other forms of concept formation as well (such as predicate development through mathematical modeling (cf. Hausman, 1992) and concept formation by pattern recognition, trying out analogies, etc.).

categories, and concomitantly their systematic dialectical interrelationships. So Hegel did not simply think the world would eventually conform to our ideas, but rather that, when we have done all we can to bring our ideas in agreement with reality, the ideas that can be shown to be systematically interrelated stand a greater chance of approximating the truth than those that resist efforts at systematization. Consequentially, Smith does not entirely reject Hegel's Philosophies of Nature and the Mind, although he is critical of a lot of its content. But, other than Arthur, he does not dismiss these philosophies for being constructed to fit a normal reality on the basis of an upside-down ontology applicable to the inverted reality of capitalism only.

At the same time, Smith agrees with Arthur that capitalist abstractions are rather peculiar in that they are both real and ideal (Smith, 1990, 40-41, 93-94), but in his opinion this is not the only type of abstraction susceptible to a dialectical treatment.¹⁰ Thus, whereas Arthur thinks that Hegel's Logic is useful only as a guide to the presentation of capitalism, Smith argues that the whole of Hegel's system (as laid out in his *Encyclopädie*) has some merits of its own, for example with respect to properly positioning Marx's *Capital* vis-à-vis other scientific fields. As a social theory, Marx's *Capital* presupposes subjective thought and malleable but essentially unchanging Nature and thus falls entirely on level III, the Philosophy of Mind. So, relative to science as a whole, Concept categories are applicable here (Smith, 1990, 18). Within this Philosophy however, the study of society belongs to level III-2. So, relative to other fields that study humans, be it the human mind (III-1) or human expression (III-3), Smith argues that Essence categories are most applicable. 'However within the realm of objective spirit [III-2] "civil society" is a determination on the level of ethical life (*Sittlichkeit*) [III-2-

¹⁰ Commenting on an earlier version of this paper Smith further clarified his position by pointing out that it is the uniqueness of this peculiar type of abstraction in world history that required Marx to adjust Hegel's dialectical method accordingly. So, as far as Smith is concerned, Hegel was not necessarily wrong, he was just dealing with less peculiar content (and categories describing it) than Marx was. Since these differing contents must be and are reflected in differing logical forms, any conceptual mapping of Hegel onto Marx – such as developed by Arthur – should be ruled out in principle. Of course, as explained in the main text, if most of the content of Hegel's philosophy is dismissed, Arthur's conceptual mapping is perfectly reconcilable with the statement above concerning capitalism's peculiarity and uniqueness in world history.

C] as opposed to abstract right [III-2-A] and morality [III-2-B]. As such it is a structure to which concept categories are applicable' (Smith, 1990, 18). But at the level of ethical life itself, civil society (III-2-C-b) stands over and against the family (III-2-C-a), and it is not out to harmonize the two factions if conflicts were to arise. In Hegel's opinion, the latter is the task and the *raison d'être* of the State (III-2-C-c). Moreover, categories like *value*, *money* and *price*, though central to capitalism, in the last instance have very little to do with the imperatives for human survival (for - as the Cree Indian prophecy has it - 'money can not be eaten').¹¹ So although capitalism Appears to be 'all about the money', this Appearance serves to hide and mystify the Essence of human sociality (i.e. safeguarding human survival). So, in the last instance, capitalism, as a form of civil society who's Appearance cannot be reconciled harmoniously with its Essence, is best described in terms of a structure of Essence (Smith, 1990, 18).

As far as his *mode* of representation is concerned, Smith opts for a much more general scheme than Arthur. Instead of looking for parallels between the categories in Hegel's doctrine of Essence and Marx's Capital, he presents the dialectic of Capital in terms of a movement from unity to difference to unity-in-difference. An abstract category unifies a multitude of particulars. Some stress what the particulars have in common (their unity), some what sets them apart (their difference) and some explicate both together (unity-in-difference). As one moves from unity to difference and on to unity-in-difference the structure becomes more complex and the categories employed more concrete (Smith, 1990, 5-6). Thus, these headings describe the general characteristics of *every* abstraction, not just of abstractions that belong to a certain Doctrine in the Logic. By implication, when a scheme like Smith's is adopted, whether there are clear parallels between Hegel's Logic and Marx's Capital or not, is immaterial to the mode of presentation.

Although Hegel's Philosophy of society is on the same plane as Marx's (from Smith's point of view at least), their content is very different. In contrast to Marx,

¹¹ In full, the mentioned prophecy runs: 'Only after the last tree has been cut down, only after the last river has been poisoned, only after the last fish has been caught, only then you will find that money can not be eaten.'

Hegel is hardly concerned with the material conditions of production, but rather with the articulation of α) an individual's Free Will, given that its expression is limited by β) other people's Free Will and thus is γ) a Possibility only (Hegel, 1821, §4-7; cf. Hegel, 1830³, 1817¹, §382, §487). In overview, this possibility is actualized as A) universal abstract Right (of which property right is the most prominent constituent), B) individual Morality and C) Ethical Life ('Sittlichkeit'). Hence it analyzes the political and ethical dimensions of a truly liberal society, rather than the extent to which the society we actually live in lives up to this ideal. Marx's starting point, by contrast, is his observation that capitalist specialized production, predicated on a historically given division of labor, can only work when inputs and outputs are generally exchanged in the economic domain.¹² Hence, on close inspection, the *exchange relation* appears to be the true starting point for his systematic dialectical presentation of capitalism (Arthur, 1993, 72; Smith, 1990, 67-68). Though this starting point appears to be much more historically specific than free Will, both Hegel and Marx contend that 'philosophy is its own time apprehended in thoughts' (Hegel, 1821, 15; cf. Smith, 1990, 4; cf. Smith, 2003, 187). To Marx and Marxists, it is the task of historical materialism to distinguish between 'transhistorical concepts' that belong to *all* times, and 'historically specific categories' that belong to the *theoretician's* time (in Murray's (1988) terminology these are called 'general abstractions' and 'determinate abstractions' respectively). Systematic dialectics should appropriate the latter if it is to represent 'its own time' adequately (Reuten, 2000, 141). Though Hegel and Hegelians are less outspoken about this distinction and consequentially less adamant about the proper type of categories to use, they too make use of both types of categories.

Given specialization, one's produce is bound to differ from one's means of subsistence, so people *must* enter into exchange relations and there is no guarantee

¹² I purposely use the term 'capitalist specialized production' (or specialization for short) where most people would just speak of division of labor in a Smithian (1776) sense, because theoretically there can be division of labor, predicated upon specialized laborers, without the units of production also specializing in specific products. Thus, division of labor is only a necessary, but not a sufficient condition of existence of generalized exchange.

that they would have done so on their own accord anyhow.¹³ This is why Marx's starting point allows for negative results, like exploitation, and Hegel's does not. Either way the philosophies at this level (III-2) investigate aspects of society that stand over and above individuals and potentially curtail their Freedom. With Hegel, individual actions are curtailed by the need to be at least a little considerate of other people's freedoms and rights (in order to protect your own), whereas with Marx (i.e. in capitalism) individual freedom is thwarted by the imperative to engage in exchange in order to stay alive.

3. Ontological Implications for a Quantitative Treatment of Core Capitalist Categories

On close inspection, Smith and Arthur seem to concur that Capitalist societies are characterized by structures out there that individuals are dependent upon for their survival. Hence, they have very strong incentives to mechanically play by its rules as though market forces were nothing short of forces of nature. But their convictions are based on a very different reading of both Hegel and Marx. For Smith, the seemingly inescapable nature of market forces is borne out by the fact that capitalism in the last instance is best represented as an Essence structure, while Arthur claims that *Capital* – and systematic dialectics generally – can only grasp the interrelations between the materialized abstractions characteristic of capitalism, but is otherwise incapable of making sense of real things and people. So capitalism can only work to the extent that it succeeds in materializing the abstractions it is predicated upon in the world. Because people are not

¹³ This is what distinguishes Marx not only from Hegel, but also from the economic mainstream. Both Hegel and mainstream economists contend that individuals enter into a bargain, because they feel that the goods they will have after the exchange will make them happier than the goods they originally possessed. The possibility that some enter the exchange relation with nothing to exchange but themselves or may only have command of inedible commodities is thus abstracted from. However, if either predicament is yours, you must exchange at any cost or die from starvation while trying. Thus, pretty much anyone who does not produce or otherwise commands food can only afford desire and happiness after the necessary exchanges have been made. This inexorable logic is missing from Hegel's and mainstream accounts alike.

materialized abstractions, the part they play in this process is capitalism's Achilles heel.

Smith's argument points to a strong parallel to the Philosophy of Nature (level II), because nature is the Essence structure *pur sang*. This parallel is relevant for the mere possibility of quantification. One of the reasons quantitative methods are successful in the natural sciences is that volition and subjectivity are neither present nor assumed; so that behaviors are law-like and subsuming a particular phenomenon under a law is considered satisfactory as an explanation. Since in Marx's system individual humans are dependent for their survival upon capitalist relations and concomitantly on obeying its value driven imperatives, quantitative methods are potentially just as adequate for the study of this particular mode of production as they are for the study of the natural world. According to Arthur of course systematic dialectics cannot deal with real people anyhow and must *therefore* distance itself from volition and subjectivity. So although he views capitalism mostly as a concept structure, Arthur's account implies a similar potential for the use of quantitative methods in the study of capitalism as Smith's.

Such an individual dependence on structural relationships and concomitant imperatives for survival – be it real or perceived – is absent from Hegel's system for it is entirely predicated upon the very freedom of humans that Marx immediately relegates to the margins of his system. In conclusion, survival comes first for Marx, whereas Hegel seems to contend that when Free Will is secured (in the last instance by the State), survival is immanent.

But there is more. Although numbers and mathematical formulae can describe a lot of processes in the natural world, they are externally imposed on it: they do not *constitute* nature. I am aware that such a statement flies directly in the face of scientists that claim that 'mathematics is the grammar of the book of nature' and conclude that nature is inherently (i.e. ontologically) mathematical.¹⁴ To me, this

¹⁴ From the discussion in section 1 it may seem that it also flies in the face of Hegel. After all, Quantity is one of the most basic determinations in his Logic and hence needs to be presupposed before anything else can be understood. However, since Hegel eschews ontological considerations (see footnote 2) one cannot conclude from this fact that the world is ontologically mathematical. This situation changes when abstractions (like *value*) take on a tangible material form (viz. as *money*) (cf. footnote 2).

is just as ludicrous as to conclude that a scientific field is constituted by language from the fact that the use of language adds to the field's intelligibility. Of course it does, for language has been developed as a tool to understanding the world and the categories on which set theory is based have a qualitative basis in language (see Damsma, 2010).¹⁵ Since set theoretical propositions form the basis of the foundational systems of mathematics, it would be very strange indeed if these structures would have no applications in the world. After all, the world informed language and language informed mathematical categories. So the fact that mathematical structures are applicable to the study of nature is a result of the way these structures came about. It has nothing to do with how nature is constituted.

In capitalism, by contrast, *value* must actualize itself as a certain Quantity of *money* for the mode of production to be viable. This universal monetary value permeates all entities and categories in the economic domain. Consequentially, all concrete capitalist entities and categories, like commodity, price, cost, profit, value, etcetera, can also be understood abstractly, as shares or elements in the produce of the system at large (Arthur, 1993, 64; Arthur, 2004, 79; Smith, 1990, 83-94; Smith, 1993, 22-23; Reuten and Williams, 1989, 60-65). So, this is another reason why quantitative methods have potential in the study of capitalism. Although Hegel acknowledges the necessity of money as the quantitative measure of value, he holds that man imposes this social form on things, instead of the other way round as Marx claims.¹⁶ So it is human volition that in the last instance determines exchange value (Arthur, 1988, 27, 35) through supply and demand

¹⁵ By saying that set theoretical categories have a qualitative basis in language, I do not mean to imply that mathematics is just another type of language. For one thing, it is much more rigorous than any other language and since its subject matter is 'external reflection on a multitude of distinguishable yet arbitrarily divisible elements' (Damsma, 2010), it is entirely free of qualitative considerations in a way that ordinary language can never be. As a result, it can traverse universes way beyond the reach of our imagination (such as the number of elements in $P(R)$, i.e. the power set of R), simply by consistently applying definitions and logical operations.

¹⁶ As Marx wrote: 'Men make their own history, but not of their own free will; not under circumstances they themselves have chosen but under the given and inherited circumstances with which they are directly confronted' (Marx, 1973, 146). So the individual is confronted with a material reality imposing its social form (money) on them, but historically mankind has brought this reality into existence and has the power to overturn it if a powerful enough group of people wishes to do so. As long as that does not happen, however, each individual has to yield to the value imperatives sketched out above (cf. p. 13-14).

mechanisms. Even though these mechanisms can be mathematically formulated, entering into a bargain for Hegel is an individual choice, it is not something one must do to stay alive. Hence, capitalism's laws of motion as Hegel might formulate them are less inescapable in nature than Marx's.

In short, whereas Hegel sees qualitative and quantitative reflection as reconcilable ways of *thinking* about the world around us (see Damsma, 2010 for a further explanation of this point), Marx sees the capitalist world *itself* as being both qualitatively and quantitatively constituted. So quantities are an integral part of the capitalist economy, rather than being externally imposed upon it (cf. Arthur, 1993, 64; Smith, 1990, 93-94; Smith, 1993, 22-23; Reuten and Williams, 1989, 65). It is this characteristic of capitalism that enables (mathematical) modeling methodology to be integrated with systematic dialectics all the way through, albeit with regard to the study of capitalism only (that is, amongst the systems that Marx knew of).¹⁷

Conclusion

So, are the core capitalist categories ontologically amenable to a quantitative treatment if seen from a systematic dialectical perspective? The answer is a resounding *yes*. Quantitative methods have most potential when volition and subjectivity are neither present nor assumed so that subsumption under a law can be considered satisfactory as an explanation. In Smith's opinion this is the case for the capitalist system because in the last instance it is best described in terms of Essence categories in a Hegelian sense. This type of categories relates to the world out there only and must thus abstract from volition and subjectivity.

¹⁷ This is not to say that mathematical modeling would not be *useful* in other systems, but just that they could not be integrated with them *all the way through*, for this requires abstractions to be ontologically *as well as* epistemologically quantitative. Systems for which this is not the case can only be described mathematically to the extent that suitable Measures can be found and imposed upon it. Once again, the fact that capitalist abstractions are quantitatively constituted, implies that modeling can go much further than in other systems.

According to Arthur, Hegelian systematic dialectics can only deal with abstract thought. However, the pure abstract thought of *value* in capitalism has gained material reality as *money* and therefore capitalism is the only real system it can tackle, but only as long as the presentation describes the results of the value imperatives. It cannot incorporate real people or things, but only materialized abstractions. Hence, Arthur's point of view also implies that volition and subjectivity must be abstracted from in dialectical descriptions of capitalism. So, both Smith's and Arthur's account of Marx's method, albeit on the basis of radically different readings of both Hegel and Marx, imply a huge potential for quantitative methods for the study of capitalism.

Despite these differences Smith and Arthur seem to concur that capitalist abstractions are rather peculiar in that they are both real and ideal. Again, the argument is that capitalism renders the thought of *value* tangible (as *money*) and that the concomittant value imperatives permeate all capitalist entities, relationships and processes. Hence, capitalism is largely *constituted* quantitatively. That is, not only are quantitative methods *epistemologically* useful for studying it but its core categories are also *ontologically* quantitative in ways that the categories of the natural sciences could never be.

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