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Marx's Forgotten Transformation Solution: The Transformation of Values into Prices of Production in Marx's *Grundrisse* and Maksakovsky's *The Capitalist Cycle*

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ABSTRACT

This article explains that in the *Grundrisse* Marx considered that the discontinuity in his transformation procedure was no logical inconsistency, but a necessary feature of the disproportionate transition to capitalist production dominated by the accumulation of fixed capital. Pavel Maksakovsky, a Soviet Red Professor in the 1920s, developed a theory of 'conjuncture' which probably discovered this discontinuity independently. Marx's solution to the transformation problem in *Capital III* did not emphasize this discontinuity. It was criticized by von Bortkiewicz as mathematically flawed and so logically inconsistent and false. Marx and Maksakovsky showed that the discontinuity was a necessary part of the transition from values to prices of production. This explanation has been almost totally ignored in the debate on the transformation problem.

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1. Introduction

The transformation problem of how values, quantities of socially necessary labour added in production, are transformed through competition into prices of production is the most contested area of Marxist political economy. In *Capital III* Marx showed how competition equalized profit rates as the movement of value between capitals of different compositions ensured that prices of production, not values, now formed the centre around which market prices fluctuated. In 1907 von Bortkiewicz proved that Marx's transformation procedure resulted in a disequilibrium if the transformed output prices were taken as the input prices of the next circuit of production. Marx's solution was deemed to be mathematically and so logically inconsistent as the mass of value could not equal the mass of price while the mass of profit equalled the mass of surplus value. Meghnad Desai considered that 'Marx's muddle was indefensible no matter how loyal one was' (Desai 2019, 60). He continued:

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the value price transformation problem remains fascinating, like the existence of equilibrium in Walrasian theory. A credible solution of the value price transformation problem is the Holy Grail that will prove that profits come from surplus value generated by workers and from no other source. We await a rigorous proof. (Desai 2019, 64)

Marx had already addressed exactly this point in the *Grundrisse*. Except, Marx explained, the existence of the discontinuity was not a muddle, but a necessary result of the disproportion caused by the widespread introduction of fixed capital that completed the transition to capitalism itself.

2. The *Grundrisse* and the Forgotten Transformation Solution

The *Grundrisse* written in 1857–58 formed a kind of rough draft for what was to become *Capital*. Kautsky had published parts of the *Grundrisse* in the *Neue Zeit* in 1904–05 and 1922. These sections dealt with Carey and Bastiat, where Marx discussed how profit rates vary between capitals of different compositions, and the Introduction discussed general methodological issues. The sections did not discuss the transition from values into prices of production. David Ryazanov, the director of the Marx–Engels Institute (MEI) in Moscow and organizer of the *Marx Engels Gesamtausgabe* (MEGA), re-discovered the *Grundrisse* in 1923. Lyudmila Vasina (2008) reviewed the *Grundrisse*'s tortured road to publication in the Soviet Union. Photocopies of the *Grundrisse* arrived in Moscow in 1923. The first attempt to order them was made in 1925–27 and editorial work began in 1927, with a typewritten draft completed in 1931. Vasina explained that the whole of the *Grundrisse* was published in the USSR in 1939–41 with the main edition appearing just a week after the Nazi invasion in June 1941. It was effectively lost in the mêlée. It appeared for the first time in the West in the German original in 1953. An English translation was made by Martin Nicolaus and published in 1973.

Roman Rosdolsky writing in the late 1960s in *The Making of Marx's Capital* assessed Marx's solution to the transformation problem in the *Grundrisse*. Rosdolsky noted that 'the problem of the average rate of profit was in fact already solved in the Rough Draft of 1857–58, i.e. before Marx had even set out his theory of value!' (Rosdolsky [1968] 1977, 371). Rosdolsky went on:

whereas the Ricardian school came to grief on the contradiction between the determination of value by labour and the existence of the general rate of profit, this contradiction provided the point of departure for Marx's new theory of profit. Unlike the Ricardians, he does not attempt to rescue the law of value 'from the contradictions of immediate experience by making a violent abstraction', but demonstrates, on the contrary, how, by means of the intervention of the general rate of profit, 'a market price differing from this exchange value comes into being ... on the basis of exchange-value ... or more correctly, how the law of exchange-value is realised only through its own antithesis'. One can therefore understand the satisfaction which Marx expressed about this particular achievement of his theory in a letter to Engels on 14 January 1858. (Rosdolsky [1968] 1977, 374; the speech marks are excerpts from Marx's letters to Engels)

Marx emphasized the contradictions, the disproportion, inherent in the transformation of values into prices and did not seek to escape these contradictions through

‘violent abstraction’. The disproportion was real and so logical. Nonetheless, despite this insight, Rosdolsky did not highlight what in Marx’s treatment of the transformation problem in the *Grundrisse* distinguished it from the version in *Capital III*. The extended treatment of the transformation problem in the *Grundrisse* is unmentioned elsewhere in the standard contemporary literature on the transformation problem. Meghnad Desai’s 1988 article ‘*The Transformation Problem*’ was a ‘History of the Marxian Transformation Problem’ that surveyed the issue ‘from 1885 to the present’ and placed ‘particular emphasis’ on the ‘less well known literature’ including the provision of a ‘substantial bibliography’ (Desai 1988, 295). It did not include the *Grundrisse* in its bibliography and presumably, according to Desai, neither did any of the other 82 authors referred to by him including Marx. Andrew Kliman’s 2007 *Reclaiming Marx’s Capital* referred to the *Grundrisse* but not the relevant sections on the transformation problem (Kliman 2007, 100). Marcello Musto’s 2008 *Karl Marx’s Grundrisse: Foundations of the Critique of Political Economy 150 Years Later* included an introduction by Eric Hobsbawm. Musto explained that ‘in this collection, various international experts in the field, analysed the *Grundrisse* on the one-hundred-and-fiftieth anniversary of its composition’ (Musto 2008, frontispiece). The experts did not discuss Marx’s solution to the transformation problem. Tony Burns’s 2017 article ‘*Marx, the Labour Theory of Value and the Transformation Problem*’ (Burns 2017), a more recent survey of the literature on the transformation problem, did refer to the *Grundrisse*, but not the relevant section. Alfredo Saad Filho’s 2019 book *Value and Crisis; Essays on Labour, Money and Contemporary Capitalism* is an even more recent collection of Saad Filho’s writings over several decades. It included chapters on money and the transformation problem, but again did not mention the relevant sections of the *Grundrisse*. Lefteris Tsoulfidis and Persefoni Tsaliki in their 2019 *Classical Political Economics and Modern Capitalism* provided a very comprehensive assessment of contemporary Marxian political economy which referred to the *Grundrisse* several times, but not the relevant sections on the transformation problem.

3. The Transformation Problem in the *Grundrisse*

Marx discussed the transformation problem in an extended 70-page section (373–443) in the *Grundrisse* although there are references to, and many historical examples of, the transition from values into prices throughout the work. Marx examined how changes to the proportions of fixed and circulating capital caused a redistribution of value to equalize the profit rate which disrupted the necessary reproduction relations between different capitals. The development of these contradictions leads to overproduction and crisis, ‘capital is just as much the constant positing as the suspension of *proportionate* production’ (Marx’s emphasis, Marx [1857–58] 1981, 414). The development of the productive forces to a certain technological level creates a certain necessary relationship between necessary and surplus labour ‘in which the produce is divided into one part – corresponding to raw material, machinery, necessary labour, surplus labour – and finally another which becomes capital again’ (Marx [1857–58] 1981, 444). This relatively proportionate production is disrupted by revolutions in the forces of production which ‘alters these relations, changes these relations themselves, whose foundations –

from the standpoint of capital and hence also that of realisation through exchange – always remains the relation of necessary to surplus labour, or, if you like of the different moments of objectified to living labour’ (Marx [1857–58] 1981, 444). Capital destroys the barriers to its self-development in previous modes of production but only to replace them with internal barriers of its own nature. These barriers are real not ideal:

But from the fact that capital posits every such limit as a barrier and hence gets ideally beyond it, it does not by any means follow that it has really overcome it, and, since every such barrier contradicts its character, its production moves in contradictions which are constantly overcome but just as constantly posited. (Marx [1857–58] 1981, 410)

Marx insisted that ‘we are the last to deny that *capital* contains contradictions. Our purpose, rather, is to develop them fully’ (Marx’s emphasis, Marx [1857–58] 1981, 277). These technological revolutions destroy prior necessary proportions of production as ‘becomes manifest in crisis’ (Marx [1857–58] 1981, 444) which is ‘a general depreciation of prices ... or destruction of capital’ (Marx [1857–58] 1981, 446). Simple commodity circulation or production developed historically within non-capitalist modes of production. It ended when manufactory (the category developed by Isaak Illych Rubin to describe the pre-industrial revolution capitalist division of labour ([1929] 1979, 155)) was transformed by the growth of fixed capital through the industrial revolution into a general fully capitalist mode of production. This posed a problem for the labour theory of value, as if values are assumed to equal prices of production, if surplus value is the source of all profit, then the capitalist with the lower organic composition of capital, and the lower productivity of labour and so the higher unit cost, will have a higher rate of profit than the more efficient, productive capitalist with the higher organic composition:

The profit of the larger capital, working with more machinery, therefore appears smaller than that of the smaller capital working with relatively or absolutely more living labour, precisely because the higher profit on living labour appears as smaller, when calculated on the basis of a total capital in which living labour makes up a lesser proportion of the whole, than the lower profit on living labour which makes up a larger proportion of the smaller total capital. (Marx [1857–58] 1981, 384/385)

The contradiction is solved as the growth of fixed capital and competition means that more efficient capitals with a higher organic composition of capital will capture the profits from their less efficient competitors:

The larger profit – arising from the real surplus labour within a branch of production, the really created surplus value – is pushed down to the average level by competition, and the deficit of surplus value in the other branch of business raised up to the average level by withdrawal of capitals from it, i.e. a favourable relation of demand and supply. (Marx [1857–58] 1981, 436)

Marx showed how the interchanges between the different sectoral producers were disrupted during the transition from values into prices. Marx’s model took five producers that represented the different use values categories necessary for production. The individual use values within these categories can change as there are no physical constants in a capitalist economy after the industrial revolution. The aggregate value of

100 was divided into certain necessary proportions to ensure balanced production: ‘A, B, C, D, E = 100 a producer E of workers’ necessities, 2 capitalists A and B, who produce raw materials for all the others, 1, C, who produces the machinery and 1 D who makes the surplus produce’ (Marx [1857–58] 1981, 441).

In *Capital III* Marx similarly used an aggregate of 100 rather than individual prices of actual commodities for the different sectors. Desai criticized Marx’s example as ‘no mention is made here of the physical commodity being produced’ (Desai 1988, 304). Desai complained that ‘the omission to mention the physical commodities being produced by these spheres still creates a problem’ (Desai 1988, 308) as it implicitly renders impossible Desai’s favoured physical price alternative to Marx’s social labour value theory. Although this omission was paradoxically shared by the Ricardian von Bortkiewicz ([1907] 1952) who similarly had a ‘persistent failure to specify the physical commodities being produced’ (Desai 1988, 310). Desai’s criticism represents a fundamental methodological mistake typical of Marxian political economy as it developed in the 1970s/1980s. Human industry changes the physical forms of natural materials to make them more useful. This labour process transforms the physical nature of inputs into different and so physically incommensurate outputs. Marx noted in his discussion of the circuit M-C-P-C’-M’ that:

In the general formula the product of P is regarded as a material thing different from the elements of the productive capital, as an object existing apart from the process of production and having a use-form different from that of the elements of production. This is always the case when the result of the productive process assumes the form of a thing, even when a part of the product re-enters the resumed production as one of its elements. (Marx [1885] 1956, 30)

Alfredo Saad Filho considered that Desai’s criticism of Marx’s use of the aggregate was misplaced as references to values and prices refer to different levels of abstraction (Saad Filho 2019, 109). More fundamentally, relative prices constantly change, as the nature of the product constantly changes, such that no physical measure can represent the value added in concrete production. There is no physical unit of heterogeneous means of production or consumption. The value of physical production can only be measured by a social standard external to it. The only factor common to all human production is socially necessary human labour. Desai’s insistence that changes in value must be represented in a constant physical commodity assumes away the incommensurability of physical production and so the premise for the labour theory of value. How then to reconcile the necessity of value with the divergence of values from prices of production? Discontinuously.

In the *Grundrisse* Marx showed that the transformation of values into prices of production created a crisis of disproportion. This discontinuity was necessarily present in the mathematical model of the transition. This crisis was a direct consequence of the growth of fixed capital and the development of the productive forces, ‘the destruction of value and capital which takes place in a crisis coincides with – or means the same thing as – a general growth of the *productive forces*’ (Marx’s emphasis, Marx [1857–58] 1981, 446). The key point was that the growth of fixed capital and the redistribution of value that created an average rate of profit disrupted the necessary proportions of production:

Realisation here takes place in the exchange among the capitalists ... realisation consists of each of them exchanging his own product for fractional parts of the products of the other four ... it is clear here that D and E, where E represents all commodities consumed by the workers and D all those consumed by the capitalist, would have produced too much ... that *general overproduction* would take place, not because relatively too *little* [*sic*] had been produced of the commodities consumed by the workers or too little [*sic*] of those consumed by the capitalists, but because too much of both had been produced – *not* too much for consumption, but too much to retain the correct relation between consumption and realisation; too much for realisation. (Marx's emphasis, Marx [1857–58] 1981, 442/443)

The transformation model was mathematically imperfect as the real transition from values to prices of production was imperfect. The widespread introduction of fixed capital created capitals of different organic compositions and in the process disrupted the previous necessary proportions of the incipient, undeveloped, pre-capitalist division of labour. The disruption of production due to the equalization of profit rates caused a *general crisis of overproduction, a general disproportion, or discontinuity.*

This original example of the transformation procedure in the *Grundrisse* is superior to that of *Capital III* in three key respects. It directly posited the transformation as part of a circuit of production, secondly it showed how the growth of fixed capital affected other variables, turnover time etc., and thirdly, and most importantly, it showed how the transfers necessary to produce an average rate of profit produced disproportion, overproduction, and crisis. The discontinuity identified and explained by Marx in the *Grundrisse* was absent from the version of the transformation procedure published by Engels in *Capital III*. It is possible that Engels had not read it himself. Musto speculated that:

There can be no certainty about the matter, but it is likely that not even Friedrich Engels read the *Grundrisse*. As is well known, Marx managed to complete only the first volume of *Capital* by the time of his death, and the unfinished manuscripts for the second and third volumes were selected and put together for publication by Engels. In the course of this activity, he must have examined dozens of notebooks containing preliminary drafts of *Capital*, and it is plausible to assume that, when he was putting some order into the mountain of papers, he leafed through the *Grundrisse* and concluded that it was a premature version of his friend's work – prior even to *A Contribution to the Critique of Political Economy* of 1859 – and that it could therefore not be used for his purposes. Besides, Engels never mentioned the *Grundrisse*, either in his prefaces to the two volumes of *Capital* that he saw into print or in any of his own vast collection of letters. (Musto 2008, 179)

This may explain why Engels did not include Marx's description of the disproportionality implicit in the transformation procedure in his edited version of *Capital III*.

4. Pavel Maksakovsky and *The Capitalist Cycle*

Pavel Maksakovsky was born in 1900 in the factory town of Ilevo, son and brother to metalworkers (Day 2009). In 1917 he was recruited to Bolshevik-inspired underground work, serving with distinction in the Red Army during the civil war. In 1920 a bout of typhus ended his army life, and he spent the next eight years as an instructor at party schools. Richard B. Day's compelling translation is responsible for rescuing

Maksakovsky's inciteful work *The Capitalist Cycle* from obscurity. Day's brief biography explains something about Maksakovsky's life and Day's *Introduction* situates *The Capitalist Cycle* within the philosophical and methodological underpinnings of Marxist political economy. In February 1921, the Soviet government established the Institute of Red Professors (IKP) to train party theoreticians. From 1921 to 1928 1,966 students studied at the IKP of whom 194 became Red Professors (David-Fox 1997, 165). Maksakovsky joined the faculty of 69 Red Professors (David-Fox 1997, 139) in 1925. His 1927 seminar on Marxist economic theory became *The Capitalist Cycle: An Essay on the Marxist Theory of the Cycle* (Maksakovsky [1929] 2009), posthumously published in 1929, after his death at just 28 years old. Hadas Thier's very concise and pointed review quotes A. S. Mendel'son, the leader of the seminar, who wrote that with his death 'we have lost a major Marxist theoretical force' (Thier 2013).

Maksakovsky does not refer to the *Grundrisse* in *The Capitalist Cycle*, but of course it is possible that discussions of its ideas (perhaps via I. I. Rubin) or even an opportunity to examine the draft in its various stages could have been open to him. Although speculatively it seems unlikely he had direct access to the text. Maksakovsky's sources appear to be limited to Marx's published works at the time, he takes issue with the high level of abstraction in *Capital I* and surely direct vindication from Marx for his ideas would have been an opportunity too good for him to miss?

Maksakovsky's *Capitalist Cycle* ([1929] 2009) considered that Marx solved the problem of the dynamic in 'ideal-schematic terms' and as a result Marx did not provide a 'comprehensive theory of the conjuncture' ([1929] 2009, 19). Marx assumed equilibrium in his models of reproduction and used abstraction to assess the impact of a change in each variable separately rather than as an inter-connected whole. Maksakovsky's theory of the conjuncture 'continues to take place within the framework of the abstract analytical method' ([1929] 2009, 28), but it drew 'a clear distinction' between 'taking laws in isolation in order to study them in principle – in terms of their form and content – and the way in which their activity unfolds through capitalism's real development' ([1929] 2009, 18). Marx 'provided a general solution to the problem of the dynamic of the capitalist whole. But the problem was posed only in its most general outline and was strongly influenced by the isolating force of abstraction' ([1929] 2009, 19). The conjuncture was at a lower level of abstraction as a model of the real capitalist economy. It therefore included changes to 'every category' and considered the effects of their interaction, as all of them participated 'in the formation of the conjuncture' ([1929] 2009, 44). This meant that 'crisis and the cycle are inherent in the most basic form of the law of value' ([1929] 2009, 45). Maksakovsky noted that 'the law of value is not a law of "moving equilibrium" on the part of the capitalist system's (static) fundamental elements, with equilibrium, in turn, being periodically disrupted by dynamic processes found on another plane of the capitalist whole' ([1929] 2009, 23). The economy was dynamic and disproportionate, while the conditions for equilibrium could be defined for simple reproduction; 'this basic "proportionality" was expressed in the formula $v_1+s_1=c_2$ ' (the variable capital plus the surplus value from Department I equals the constant capital from Department II), while 'for expanded reproduction, it was $v_1+s_1>c_2$ ' ([1929] 2009, 52). But this proportionality was a 'merely theoretical'

state of affairs ([1929] 2009, 53). Marx ‘established a network of lawful relations that permeate the moving system and determine the very possibility of this complex movement. Nevertheless, at this stage of the analysis, he abstracted from the inevitable disruptions of these “proportionalities”’ ([1929] 2009, 53). The real movement of the economy was necessarily crisis wracked and disproportionate.

Maksakovsky noted that Marx’s category of ‘capital in general’ assumed throughout ‘that the commodity is sold at its value’. Marx examined the forms which capital passed through in the various stages of development, but critically ‘the real conditions within which the actual process of production takes place are therefore, not analysed ... We do not examine the competition of capitals, nor the credit system ...’ (Marx [1862–63] 1968, 492–3). Marx assumed that prices equalled values to demonstrate that the economic laws of capitalist production were ultimately determined by the capitalists’ quest to maximize the surplus value they extracted in production. Even though prices never or only by accident equalled values and by the time that capitalism existed as a fully formed mode of production, the transition from values into prices of production and market prices had already occurred. The variation of price from value was a ‘veil’ (Marx [1857–58] 1981, 767) which obscured the laws of motion of the capitalist system, ‘price is therefore distinguished from value not only as the nominal from the real ... but because the latter appears as the law of the motion which the former runs through. But the two are constantly different and never balance out, or balance only coincidentally and exceptionally’ (Marx [1857–58] 1981, 137). Although ‘the value of commodities as determined by labour time is only their average value’ (Marx [1857–58] 1981, 137), without value a measure of human productive activity or exchange would be impossible. Hence Marx’s analysis abstracted from the fluctuations of prices from values to consider the essential underlying laws that determined functioning of the capitalist mode of production. Maksakovsky considered that Marx:

based his analysis on the following postulates 1) exchange of commodities according to their value; 2) unchanging values for the component parts of productive capital; 3) absence of growth in the organic composition of capital; 4) exclusion of the influence of credit (both on the reproduction process and on monetary circulation); 5) exclusion of foreign trade. (Maksakovsky [1929] 2009, 53)

Marx’s procedure abstracted from ‘the dynamic of prices, the flow of capitals, and the specific waves of market competition’ (Maksakovsky [1929] 2009, 19). This was not actual or historical, but logical, such ‘a state of moving equilibrium is merely a theoretically conceivable state of affairs, not only for capitalist production as a whole, but also for each of its individual branches at any particular time’. As a result, ‘the analysis of simple and expanded reproduction provided by Marx is not adequate for representing the real course of capitalist reproduction as it occurs at any given moment’ (Maksakovsky [1929] 2009, 53). In contrast Maksakovsky’s ‘theory of the conjuncture involves study of capitalism as it develops through the totality of its relations’ (Maksakovsky [1929] 2009, 20).

5. The Transition to Capitalist Production

Maksakovsky considered that in *Capital* Marx modelled the historical and logical transition from the simple commodity economy to capitalism. Marx noted that ‘the

concept of value precedes that of capital but requires for its pure development a mode of production founded on capital' (Marx [1857–58] 1981, 251). Marx continued:

It must be kept in mind that the new forces of production and relations of production do not develop out of *nothing*, nor drop from the sky, nor from the womb of the self-positing Idea; but from within and in antithesis to the existing development of production and the inherited, traditional relations of property. While in a completed bourgeois system every economic relation presupposes every other in its bourgeois economic form, and everything posited is thus also a presupposition. (Marx's emphasis, Marx [1857–58] 1981, 278)

Maksakovsky observed that the simple commodity economy 'is characterised by "the law of value"' which expresses 'the relationship between independent commodity producers when they are connected through the monetary form' (Maksakovsky [1929] 2009, 39). Even so, 'exchange relations themselves do not assume a universal character, but are more like "oases" scattered about in the natural economy' (Maksakovsky [1929] 2009, 38) and as a result the 'activity of the law of value is only weakly felt' (Maksakovsky [1929] 2009, 45). The simple commodity economy 'has no cyclical dynamic' (Maksakovsky [1929] 2009, 37). Thus 'the crisis only becomes real when value, still preserving its original form and significance, also grows over into capital – a new relation of production' (Maksakovsky [1929] 2009, 40). Simple commodity production developed within the natural economy wherein 'the prevailing economic motive is to convert necessary labour into another consumable form' (Maksakovsky [1929] 2009, 39). In the *Grundrisse* Marx explained:

capital does not create the objective conditions of labour. Rather, its *original formation* is that, through the historic process of the dissolution of the old mode of production, value existing as money wealth is enabled, on the one side, to *buy* the objective conditions of labour; on the other side, to exchange money for the *living* labour of the workers who have been set free. (Marx's emphasis, Marx [1857–58] 1981, 506)

In the simple commodity economy, the social division of labour is 'not yet highly developed' (Maksakovsky [1929] 2009, 39), wage labour is not general, and the distinction between Department I and Department II is immature. There is little machine production so 'any dramatic increase in labour productivity is impossible' while inter-branch competition 'is rudimentary' (Maksakovsky [1929] 2009, 39). This is the phase of economic development which ends with what Isaak Illych Rubin defined as manufactory:

During the 17th and 18th centuries, concurrently with the spread of the domestic, or decentralized system of large-scale industry, *manufactories* made their appearance. These were more or less large-scale, centralized capitalist enterprises. The manufactory differed from the domestic system in that the workers worked not alone at home, but on a single premises, which had been set up by the entrepreneur. It was distinguished from the later factory by the predominance of manual labour and the absence of any application of machinery. (Rubin's emphasis, Rubin [1929] 1979, 155)

Rubin worked alongside David Riazanov translating and preparing versions of Marx's works and works of other classical economists like Adam Smith and David Ricardo. Rubin was responsible for an authoritative version of Marx's *Contribution to the Critique of Political Economy*, which entered the MEGA. He taught at the Institute

of Red Professors (IKP) where his ideas were debated. Rubin's *Essays on Value* (Rubin [1923] 1972) were published in 1923 and his *A History of Economic Thought* ([1929] 1979) in 1926 and in an expanded edition in 1929 (Boldyrev and Kragh 2015). Whether Rubin had access to or was involved in the translation of the *Grundrisse* is apparently unknown, but it certainly seems likely he was at the very least aware of it. His argument was certainly framed in very similar terms. He noted that:

The contradictions which had torn Ricardo's theory to pieces were to be resolved only many years later by Marx through his theory of prices of production. Marx showed that in capitalist economy, as distinct from a simple commodity economy, the law of labour value does not assert itself directly, but only indirectly through the medium of a complex social process of forming the average rate of profit and prices of production. (Rubin [1929] 1979, 308)

Rubin observed that these manufactories, established by the early, still immature, division of labour, prepared the way for the development of generalized market production: 'glass factories, paper mills, iron works etc. cannot be operated on guild principles. They demand mass production; sales to a general market; monetary wealth on the part of their entrepreneur' (Marx [1857–58] 1981, 511). Rubin considered that 'the beginning of the industrial revolution is usually set at 1769' (Rubin [1929] 1979, 221). He continued:

The colossal rise in the nation's production did not reduce the poverty of its masses in the least. Machinery which was intended to save on human labour frequently gave a further push to the *deterioration* in the labourers' working conditions. Introduced at a feverish pace, it displaced hand spinners, weavers and other workers, who were threatened with either death by starvation or an existence as paupers. (Rubin's emphasis, Rubin [1929] 1979, 225)

Rubin continued: 'the machine meant the utter ruin of hand spinners and weavers, put an end to the *cottage* industries' (Rubin's emphasis, Rubin [1929] 1979, 226). The broad 'mass of *workers* suffered not simply from expensive corn, but also from the introduction of machinery, unemployment, and low wages' (Rubin's emphasis, Rubin [1929] 1979, 228). The transition to a mechanized economy completed the transition to the capitalist mode of production: '*machinery* appears, then, as the most adequate form of *fixed capital*, and fixed capital, in so far as capital's relations with itself are concerned, appears as *the most adequate form of capital* as such' (Marx's emphasis, Marx [1857–58] 1981, 694). The transition from values into prices of production coincided with the creation of capitalism itself and was crisis-wracked, ruining those dependent on the pre-capitalist division of labour.

The simple commodity economy contained the potential of crisis in the separation of the commodity between production and sale, but 'the "emergence" of capitalist production – including the law of value plus the law of surplus-value – brings real crises that appear sporadically but without lawful periodicity (an incomplete historically "unfinished" cycle)' (Maksakovsky [1929] 2009, 41). The transition from simple commodity production, where due to the lack of capital and competition prices closely reflected values, into one based on prices of production, where prices systematically diverged from values, was also the transition to developed capitalist production which 'with the law of value, the law of surplus value, and the law of the average profit –

brings periodic crises and the completed cycle' (Maksakovsky [1929] 2009, 41). It was the transition of these manufactories into machine factories that was the point when industrial capitalism began:

only when machine industry has sunk such deep roots that it becomes the dominant influence in the national industry; when, thanks to machine industry, foreign trade becomes more important than domestic trade; finally, when many industrial nations enter into competition with one another – only then do endlessly repeating cycles appear ... (Maksakovsky [1929] 2009, Marx's *Capital* cited by Maksakovsky, 42)

It was this transformation which inaugurated the circuit of M-C-M' as the dominant controlling factor in the economy: 'what does the development of machine industry mean? It meant, above all, that the organic composition of capital rises; that constant capital outweighs variable capital; and as a specific, observable expression of this fact, that fixed capital grows more rapidly than circulating capital' (Maksakovsky [1929] 2009, 43) This transformation simultaneously produced crisis: 'the price of production – value – regulated capitalist production "without interruption" *as soon as* disturbances appeared' (Maksakovsky's emphasis, Maksakovsky [1929] 2009, 43). If social capital is equated 'with its circulating part – no cycle can arise' (Maksakovsky [1929] 2009, 57). It was the revolution in the productive forces associated with the introduction of machinery and fixed capital which meant that 'the inner laws of capital – which appear merely as tendencies in the preliminary historic stages of its development – are for the first time posited as laws' (Marx [1857–58] 1981, 650).

The sequence of this transition was 'confirmed by the historical data. England – the leading capitalist country – had no experience of sporadic crises before 1825' (Maksakovsky [1929] 2009, 41). This history mirrored the logical development of value relations from the law of value which 'reflects the dialectical process whereby the relations of independent commodity producers grow over into the complex economy of capitalism in real-historical terms' (Maksakovsky [1929] 2009, 45). This process was gradual, it emerged over centuries, culminating in a rapid transition to factory production at the end of the eighteenth and beginning of the nineteenth century:

competition appears historically as the dissolution of compulsory guild membership, government regulation, internal tariffs and the like within a country, as the lifting of blockades, prohibitions, protection on the world market – because it appears historically, in short, as the negation of the limits and barriers peculiar to the stages of production preceding capital. (Marx [1857–58] 1981, 649)

These limits were barriers to capital's motion, its development and realization. This transition was real, actual and historical:

England is in this respect the model country for the other continental countries. Likewise: if the first form of industry, large scale manufacture, already presupposes dissolution of landed property, then the latter is in turn conditioned by the subordinate development of capital in its primitive (medieval) forms which has taken place in the cities, and at the same time by the effect of the flowering of manufacture and trade in other countries (thus the influence of Holland on England in the sixteenth and the first half of the seventeenth century). (Marx [1857–58] 1981, 277)

Thus 'historical evidence also verifies the view that the cycle develops gradually. Between the historical emergence of the price of production, as the immediate

regulator of the capitalist system, and the capitalist dynamic in its law governed cyclical form, there are obviously historical and logical connections' (Maksakovsky [1929] 2009, 42). During this transition period the redistribution of value between capitals of different compositions, 'the law of average profit was still emerging. The mass of profit realised by capitalists still approximated the mass of surplus value created in each branch', and so

the average rate of profit had yet to become the basic fact in the consciousness of capitalists or the measuring rod they used for assessing their own activities. This was reflected in the economics of the time – in the problems that Smith and Ricardo experienced in trying to understand this 'new' tendency. (Maksakovsky [1929] 2009, 41/42)

Competition between capitals now created an average rate of profit, 'a general rate of profit as such is possible only if the rate of profit in one branch of business is too high and in another too low; i.e. that a part of the surplus value – which corresponds to surplus labour – is transferred from one capitalist to another' (Marx [1857–58] 1981, 435). This severs the direct link between the mass of surplus value produced in a sector and the mass of profit realized in it:

with one 'hand' inter-branch competition 'creates' prices of production, converting the 'equilibrium of labour' into 'equilibrium of capitals', on the other hand, it 'gives birth' to the specific relations of market demand and supply and thus to the fluctuating movement of market prices, which is the most important feature in the movement of the cycle. (Maksakovsky [1929] 2009, 42, Maksakovsky's inverted commas)

This change in the organic composition of different capitals meant that:

It is impossible for the rates of profit on the same capital to be equal, since the relations of surplus labour are altogether different, depending on the productivity of labour and on the relation between raw materials, machinery and wages, and on the overall volume in which production takes place. (Marx [1857–58] 1981, 435)

Profit realized within a particular sector could be higher or lower than the amount of surplus value produced within it:

The larger profit – arising from the real surplus labour within a branch of production, the really created surplus value – is pushed down to the average level by competition, and the deficit of surplus value in the other branch of business raised up to the average level by withdrawal of capitals from it, i.e. a favourable relation of demand and supply. (Marx [1857–58] 1981, 436)

Capitalist 'competition therefore does not explain these laws; rather it lets them be *seen*, but does not produce them' (Marx's emphasis, Marx [1857–58] 1981, 552). The rise of industry meant that values no longer formed the equilibrium centre around which the price of commodities fluctuated. Prices of production values modified by the transfer of value to equalize profit rates now did so. This transition from the simple commodity economy to capitalism was a violent one. It upset the necessary proportions of production established in the pre-capitalist division of labour, and replaced it with a new, fully capitalist, one. Marx, Rubin and Maksakovsky demonstrated that the disjuncture implied by Marx's transformation procedure was not merely mathematical, but real. Far from the disproportion being an illogical mistake that needed to be

corrected, it accurately reflected the real transition itself. Marx's transformation model would have been wrong without it.

6. Ladislaus von Bortkiewicz

In 1907 Ladislaus von Bortkiewicz developed V. Dmitriev's maths to rediscover the discontinuity originally identified by Marx in the *Grundrisse* (Dmitriev [1902] 1974). Dmitriev had shown that assuming that inputs and outputs were physically identical and that something could be produced from nothing, then there was no need for a value explanation of surplus. If surplus appeared without equivalent, then it was possible to show how prices could be derived directly from 'the technical conditions of production' (von Bortkiewicz [1907] 1952, 9). Von Bortkiewicz noted that if Marx's output prices were taken as the input prices for the next circuit of production, then the combination of untransformed values and transformed prices of production meant that the total of value did not equal price or the total of profit did not equal surplus value as there was a disproportion between Departments I and II:

What happens now, when price-calculation ... replaces value calculation ... The sum of wages has not altered. Table II gives 110 for the variable capital in all the spheres of production taken together. The workers should therefore be able to acquire for this sum the goods produced in I and V, neither more nor less. These goods, however, now have a price of $92 + 37$, i.e. a total of 129. The workers thus must go short, or, put in another way, some of the goods made in I and V find no outlet. In this regard, therefore, the price model breaks down. (von Bortkiewicz [1907] 1952, 9)

The redistribution of value caused by the equalization of profit rates affected the structure of production so that production was disproportionate, and the conditions of simple reproduction violated. Marx's transformation procedure contained a different number of unknowns from the number of equations which conflicted with the requirements of a solution within linear algebra (Saad Filho 2019, 106). Von Bortkiewicz proved that Marx's model was only mathematically correct if by chance the composition of production was identical to that of the industry producing the commodity acting as the numeraire. As this could never be true the disequilibrium implicit in Marx's model meant it was 'inadmissible' for Marx to have excluded the transformation of the initial values themselves. Marx's model was mathematically incorrect and so internally and logically inconsistent. But the test of Marx's model is not mathematical perfection, but the imperfect real world. Von Bortkiewicz's work provided the touchstone for every subsequent refutation of Marx's value theory. Desai considered that Ian Steedman's *Marx After Sraffa* (1977) proved that 'Sraffa's system with its obvious Ricardo-Dmitriev origins was preferable to Marx's system and that surplus labour was an otiose category' (Desai 1988, 327). As there was no mathematical way to reconcile values with prices, values should be ditched alongside the whole of Marx's value analysis. The insistence that only human productive activity could produce profit must be abandoned. Desai explained that von Bortkiewicz's contribution meant that:

mathematically the tools were already fashioned for an n sector formulation of the transformation problem and Bortkiewicz took note of this in his longer essay which included fixed capital. But the importance of Dmitriev for our purpose is in the

question he raises concerning the necessity of surplus value (of labour exploitation) for the existence of profit. (Desai's emphasis, Desai 1988, 311)

Marx's model showed that the labour process transformed physical inputs and outputs rendering them incommensurate. The model balanced so that the amounts of abstract labour on the input and output side were identical. While surplus value was a property relation, a unique social relation of ownership between people. The capitalist bought labour power not labour, so that during the labour process itself property in the form of value was redistributed from the producers to the owners of the means of production. As Dmitriev's surplus was physically identical as input and output so it was directly commensurate and did not require a standard of value external to physical production. As surplus appeared without equivalent from nowhere it did away with the necessity for surplus value. As surplus could be any physical thing, it was not unique to humans and so need not be a social or property relationship. Under these assumptions value theory was necessarily superfluous. Prices or exchange values (the physical ratios in which people exchange inputs and outputs) could be determined without reference to people to create a mathematically consistent (correspondent with the laws of linear algebra) alternative to value theory. On these wholly unreal assumptions Dmitriev's model rendered Marx's theory redundant. Maksakovsky does not refer to von Bortkiewicz in *The Capitalist Cycle*, but there can be little doubt that Maksakovsky was aware of von Bortkiewicz's critique of Marx's transformation procedure. In 1922 Cholom Dvoilatski (Rodman 2010), a member of the Red Professor praesidium, associate of Preobrazhensky and Radek, and in 1926 temporary head of the editorial board of the academy's *Vestnik* journal (David-Fox 1997, 228), produced an answer to von Bortkiewicz. Dvoilatski's article 'On One "Contradiction" in the Economic System of K. Marx' was published in the journal *Under the Banner of Marxism* (Dvoilatski [1922] 2010). Dvoilatski divided the different sectors of production by use values to even out differences in the organic composition of capital, so sidestepping the disproportion implicit in Marx's transformation procedure. This was one answer, but it was scarcely a solution as it assumed away the origin of the problem.

Instead Maksakovsky resolved the contradiction by embracing it. The transformation of values into prices of production was not a problem to be 'solved'. The discontinuity anticipated by von Bortkiewicz's criticism was real, a necessary reflection of the actual historical transformation of values into prices of production. Maksakovsky modified Marx's model from one based on proportionate equilibrium production, an abstract-ideal one, into a model of the conjuncture based on the real historical relations. Maksakovsky explained that:

The first modification to be introduced is the establishment of 'pure' capitalist 'equilibrium' defined by 'proportionality' in the distribution of capitals. Because 'equilibrium' of capitals, when their organic compositions differ means disruption of the 'equilibrium' of labour, it follows that the quantitative relations between Departments I and II, together with the relations between their separate parts, must be changed. If we take the formula of expanded reproduction, the price of production in Department I will be higher than value (approximately 125 and 120), while in Department II it will be lower (approximately 125 and 133), to achieve a new 'equilibrium' will require correspondingly larger magnitude of value in Department II by comparison with I. With the original relations, Department I would make an excessive demand upon the products of II, and underproduction would be revealed or a disruption of reproduction.

This is the first modification in the analysis. (Maksakovsky [1929] 2009, 58, Maksakovsky's quotation marks)

Maksakovsky reproduced von Bortkiewicz's essential argument, but rather than being the refutation of Marx's theory, the disjuncture produced by the change in the organic composition of capital was the making of it. No longer as a theory of general equilibrium but as one of conjuncture. Chris Harman's clear summary of Maksakovsky's piece summarizes how Maksakovsky's real theory of capitalist development embraced its contradictory crisis-ridden nature (Harman 2017). Supply and demand are themselves consequent on the phases of the cycle, there are lags between sectors, while monopoly power influence prices to separate market prices from prices of production. This produces 'specifically market competition' so that 'the existing relation of "demand" and "supply" cease to reflect accurately the proportionality of social production, that direct action of the laws of equilibrium on prices is paralysed' (Maksakovsky [1929] 2009, 43). Marx 'conducted the entire analysis of real reproduction at a certain level of abstraction. He resolves the problem in terms of its principles and its content' (Maksakovsky [1929] 2009, 53). A 'general resolution of the problem, however, is not the same as a comprehensive analysis of the real course of capitalist reproduction. It is not possible to depict capitalism's pattern of development within the limitations of a smoothly rising curve' (Maksakovsky [1929] 2009, 54). Prices of production are themselves only an abstraction, they form a centre, an equilibrium point, around which market prices revolve:

The real movement is inseparable from continuous rupturing of all the 'proportionalities' of social reproduction. In reality, the latter only exist in the form of a law governed tendency and manifest themselves continuously through a system of obstacles. (Maksakovsky [1929] 2009, 54).

Maksakovsky proceeded:

By means of a purely mathematical operation, we have introduced 'equilibrium' of capitals in place of 'equilibrium' of labour. In reality, this process occurs through the far reaching activity of capitalist competition, which, at a certain stage of capitalism's history, transformed surplus value into the average profit, and correspondingly, value into the price of production. Having completed this 'historical' act, capitalist competition remains as the irreplaceable instrument of its endless 'repetition'. (Maksakovsky [1929] 2009, 56)

Maksakovsky had essentially reproduced although probably without knowing it Marx's explanation from the *Grundrisse* of the disproportional transition from values to prices of production.

7. Divergence of Market Prices from Prices of Production

Once values have been transformed into prices of production, there is no going back, values only exist in their modified and endlessly repeated form as prices of production. Prices of production, not values, now form the centre around which market prices fluctuate. The discontinuity in the transition from values into prices of production is the inevitable result of the rising organic composition of capital which disrupts the equilibrium of production: 'it is only when we introduce the moment of disruption of this

“proportionality”, by taking into account the sudden massive renewal of fixed capital, that we disclose the cyclical character of capitalist reproduction’ (Maksakovsky [1929] 2009, 81). The growth of fixed capital and the rise in the organic composition of capital creates the business cycle, and with a second disjuncture, the separation of market prices from prices of production, as Mavroudeas notes in his critical assessment of Maksakovsky’s piece (Mavroudeas 2012). During the up phase of the cycle prices rise above prices of production as demand outstrips supply. During the down phase of the cycle prices fall below prices of production as supply outstrips demand: ‘the whole reproduction process actually takes place around an axis of rising market prices that neither reflect nor correspond to change value magnitudes’ (Maksakovsky [1929] 2009, 87). It is not ‘value relations that determine the growth of individual branches during the expansion, but market prices’ (Maksakovsky [1929] 2009, 88). Maksakovsky noted:

Adjustment of the separate parts of social production to one another, and the tendency to re-establish the ‘proportions’ that are continuously being disrupted, takes place through the mechanism of capitalist competition ... At every stage of reproduction, development inevitably involves overcoming constant disproportions. The tendency towards equilibrium is never one hundred per cent realised. (Maksakovsky [1929] 2009, 56)

The ‘second step in the transition from the general theory of reproduction to the theory of the conjuncture is inclusion of the mechanism of capitalist competition’ (Maksakovsky [1929] 2009, 57). The ‘third stage of transition’ occurred when the ‘cyclical character of capitalist development’ includes ‘the role of fixed capital’ (Maksakovsky [1929] 2009, 59). The cycle developed out of the disproportion between the rate of expansion of consumer demand and of production. Consumer demand ‘fluctuates very little, being determined by the strict laws of capitalism’s relations of distribution – while, at the same time, there are no such restrictive conditions on the expanding scale of production’ (Maksakovsky [1929] 2009, 71). The production of means of production anticipates the production of means of consumption. The “proportionality” of social reproduction’ is disrupted as ‘prices that become detached from prices of production – or values’ so that ‘the period of expansion is also the period in which overproduction matures and becomes apparent in the market’ (Maksakovsky [1929] 2009, 72).

[The] whole issue (of crisis) has to do with the concrete conditions that prevail during the period of expansion, when 1) narrowing of the consumption base is accompanied by the massive character of expanded production; 2) this expansion is ‘oriented’ not upon the price of production and value, which would ensure receipt of a ‘proper’ average profit, but rather upon the elevated market price, which, instead of expressing the ‘proportions’ of social production, is associated with a unique phenomenon – that is, the impossibility of production growing at the same rate as demand when the latter is amplified by a massive renovation of capital. (Maksakovsky [1929] 2009, 66)

Maksakovsky divided ‘Department I into three groups: the first produces raw materials (mining, the branches of ferrous metallurgy, and so forth); the second produces fixed capital for Department I; the third produces fixed capital for Department II’ (Maksakovsky [1929] 2009, 74). Growth ‘of demand from Department II calls forth expansion in the third group. However, this is possible only if there is growth in the second group, which, in turn, requires growth of production in the first group’

(Maksakovsky [1929] 2009, 74/75). Maksakovsky noted that the existence of the ‘law of average profit’ means that a ‘super profit by one capitalist implies less than the average rate for others’, yet he considers ‘during the period of expansion, we have to deal with just such an irrational event’ (Maksakovsky [1929] 2009, 79). Maksakovsky allowed transfers between periods to further complicate the movement of surplus value between capitals as supply constraints during the upswing mean that ‘demand, being the other dimension of expanding production, permanently exceeds supply over the whole period of the expansion’ (Maksakovsky [1929] 2009, 82). Consequently, ‘high profits during the expansion’ are ‘the realisation of surplus value that was created, but not fully realised, at the time of the depression’ when ‘as a general rule, prices fall below the price of production due to the unfavourable realisation between demand and supply’ (Maksakovsky [1929] 2009, 80). In this way ‘market prices which have deviated from market values, equalise themselves and yield an average that conforms to market value’ (Maksakovsky [1929] 2009, 82). This was expressed through crisis when ‘the law of value now asserts itself through acute, periodic ruptures of the high conjuncture’ (Maksakovsky [1929] 2009, 92) This:

creates a unity ‘between moments that have become independent’, thus guaranteeing a new stage of development. This aspect of the crisis expresses the activity of the laws of equilibrium – of the law of value, which, through a sharp drop in prices, strictly curtails both the redundant production apparatus and the excess of commodity capital that has been created by extraordinary capitalisation on the basis of high prices that are detached from value, or from the price of production. (Maksakovsky [1929] 2009, 92)

The reintroduction of crisis as a necessary step in the development of the capitalist mode of production, and as a part of the transition from values into prices of production, explained the discontinuity expressed in Marx’s transformation procedure. The achievement of this transition from manufactory to industrial manufacturing overcomes one crisis, only to produce another, as the external limits posited by redundant modes of production overcome through the creation of prices of production are replaced by the limits generated by the functioning of the capitalist system itself.

8. Conclusion

Marx’s transformation procedure takes values or measures of human productive activity and transforms them into prices of production by redistributing value to equalize the rate of profit according to the varying composition of capitals in different sectors. Marx’s procedure reflected the actual historical discontinuous transformation of pre-capitalist values into capitalist prices of production. In the *Grundrisse* Marx noted the disproportion inherent in his transformation solution. He explained that this disproportion mirrored the real historical disproportion caused by the industrial revolution, which dissolved the necessary proportions of the pre-capitalist incipient division of labour. This occurred with the rise of fixed capital alongside the advent of industrial capitalism in the late 1700s. This disrupted the pre-industrial division of labour leading to a crisis of disproportionality. The solution to the transformation question was not to find a mathematical answer to it, but to observe as Rubin did that the transition to capitalist industry exactly led to the impoverishment and degradation of the working poor

as predicted by the model. Such a disproportion occurred in history, consequently, the mathematical discontinuity implicit in Marx's transformation procedure was historically real. It was the vindication of the procedure not the refutation of it.

The disproportion that Marx identified in the *Grundrisse* was missing from Engels's edition of *Capital III*. Von Bortkiewicz rediscovered the implicit discontinuity in the transformation procedure in *Capital III*, and considered it meant that as Marx's transformation procedure was mathematically imperfect, so it was illogical and wrong, and so pointless and redundant. Von Bortkiewicz falsely elided mathematical correctness with logical and historical truth. Von Bortkiewicz's objection provides the touchstone for the debate to this day.

Pavel Maksakovsky addressed the transformation of values into prices of production and then the transformation of prices of production into market prices in his short book *The Capitalist Cycle*. A Soviet Red Professor, the *Grundrisse* was being translated in the late 1920s in the Soviet Union concurrently with his work. Whether he knew of it, read it, or received word of its arguments second hand, perhaps via Rubin, is unknown. Nonetheless, Maksakovsky's theory of the conjuncture, and specifically his explanation of the transition from the realm of labour to the realm of capital, mirrored Marx's *Grundrisse* transformation model. Maksakovsky showed that the rapid growth of fixed capital, which was the material basis for the transformation problem, created not only divergent organic compositions of capital but disproportionality, discontinuity, and the business cycle. The transition from values to prices of production was a real disequilibrium.

The quest for Desai's Holy Grail is a journey to the unattainable out-of-reach. Imperfect reality is both more interesting and not as far away. The mathematical inconsistency expressed in Marx's explanation of the transformation of values into prices of production reflects the disproportionate nature of the actual transition. The solution to the transformation question, it transpires, is not to seek to 'solve' the contradictions of the transformation procedure. Rather it is to transform the question itself. Marx's model assumed a disjuncture between values and prices of production, and this is precisely what should be expected in the actual transition from manufactory to factory production. From being Marx's greatest weakness the disjuncture implicit in Marx's transformation procedure becomes its greatest strength.

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