NOTE

A comparison of the stochastic approach to the transformation problem with Marx's original assumptions

Kenji Mori[1]

Abstract

The stochastic solution provided by Prof. Schefold proposes, by allowing variables to be random, three conditions which should be sufficient for the solution to the transformation problem. These three assumptions are not only added to Marx's original (implicit or explicit) assumptions, but they also change some essential part of his original argument. This paper will take up in particular two examples of major alteration arranged by the stochastic approach.

Keywords Transformation problem · Stochastic approach · Marx · Money form · Machinery

JEL Classification B1 · B3 · B4

1 Assumptions in the stochastic solution

The problem which was originally set by Marx and has been called since then "Transformation Problem" consists in how to prove the following double invariance: for any output, the total value equals total price, and total surplus value equals total profit. As Schefold (2014) confirmed, a complete, i.e. *general* solution to the transformation problem turned out to be impossible after a long debate since Böhm-Bawerk's criticism. That means that a consistent "solution" could be given only by providing new reasonable assumptions in addition to or instead of the original ones made explicitly or implicitly by Marx himself.

The stochastic solution provided by Prof. Schefold showed that by allowing variables to be random, the following three conditions are sufficient for the double invariance stated above (Schefold 2019, 26).

✉ Kenji Mori
kenji.mori.b6@tohoku.ac.jp

[1] Graduate School of Economics and Management, Tohoku University, 27-1 Kawauchi, Aoba-ku, Sendai 980-8576, Japan

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1. The eigenvalues $\mu_2, \ldots, \mu_n$ converge to zero for n going to infinity.
2. The vectors of numeraire and of labour are random and independent (i.e. $cov(\mathbf{m}, \mathbf{v}) = 0$ or $cov(y, l) = 0$).
3. The surplus vector and the labour vector are random and independent (i.e. $cov(\mathbf{s}, \mathbf{v}) = 0$).

These three new assumptions are, as we will show, not only *added* to Marx's original (implicit or explicit) assumptions, but they also *change* some essential part of his original argument. In the following, we will take up particularly two examples of major alteration arranged by the stochastic approach.

2 Money-form

The problem Engels' prize competition set was how to explain an equal average rate of profit not only without a violation of the law of value (Wertgesetz), but on the very basis of it (Marx 1956, 19). Engels demanded thus the law of value as the assumption each valid solution must be subject to. Marx's law of value includes obviously besides the determination of value by abstract labour, also the development of value forms, i.e. from the simple form up to the money form. In the money form, in Marx's opinion, the position of the general equivalent is monopolized by gold.

"Gradually it began to serve, within varying limits, as universal equivalent. So soon as it monopolises this position in the expression of value for the world of commodities, it becomes the money commodity". Therefore, "Gold and silver are not by nature money, but money consists by its nature of gold and silver." (Marx 1954, 75, 92).

This statement implies that the price standard, therefore numeraire, is a fixed commodity (vector), say e.g. $\mathbf{y} = (1, 0, \ldots, 0)$, and not random. According to this Marxian law of value (form), the inner product of numeraire vector and labour vector ($\mathbf{yl}$ or $\mathbf{mv}$) need not be reduced to $n\bar{m}\bar{v}$ and may not vanish even if $n\bar{v}$ can be proven or assumed to vanish. Apart from the fact that the assumption of components of $\mathbf{v}$ (i.e. deviation of labour input coefficients from the standard composition) to be i.i.d., therefore, to have the uniform expected value would not be made by Marx. If $\mathbf{mv}$ does not vanish, the (ex post) wage curve cannot be linear and the desired invariance of P and M cannot follow.

3 Principle of multiples

Another substantial arrangement is the assumption of identical and independent distribution of input coefficients in each sector (row). Marx regarded the "principle of multiples" (Marx 1982, 1964) as one of the most characteristic features of the "machinery system (Maschinensystem)". As is well known, he conducted a notebook full of detailed research on machinery in the manuscripts of 1861-63 by

referring to contemporary technology literature by A. Ure, J.H.M. von Poppe and Ch. Babbage. There, he took up this idea and adopt it later in his *Capital* Volume 1, where the "principle" is explained as follows:

"The division of labour, as carried out in Manufacture, not only simplifies and multiplies the qualitatively different parts of the social collective labourer, but also creates a fixed mathematical relation or ratio which regulates the quantitative extent of those parts … When once the most fitting proportion has been experimentally established for the numbers of the detailed labourers in the various groups when producing on a given scale, that scale can be extended only by employing a multiple of each particular group." (Marx 1954, 327).

The "machinery system" as division of labour of machinery took over the principle of multiples from the division of labour of workers and creates a fixed proportion among instruments of labour which is strictly determined by a "technical necessity (technische Notwendigkeit)" (Marx 1954, 365). According to Marx's understanding about the principle of multiples, therefore, the machinery system would be appropriately understood as a "mathematically fixed" vector of physical and labour inputs around which particular cases may be perturbed randomly. This must be then also true for the "socially necessary" production process, which is only relevant for the value determination. Marx could indeed agree to treat inputs in each industry as random variables but would not think of an identical and independent distribution for all inputs. It is obviously not possible to adapt the law of large numbers if the variables are not i.i.d.

This short comment is intended to be constative and not (yet) evaluative. It only attempts to explicitly show some substantial points of departure of Prof. Schefold's stochastic approach from Marx's original assumption system. It can be, however, already surely said that this departure deserves thorough evaluations because it is no doubt novel and consistently thought out.

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