Tokyo Keizai University Faculty of Economics

Discussion Paper Series

No. 001

Reconsidering Marx's Theory of Turnover under Uncertain Circulation: Japanese Marxian and Unoist Approaches

Yoshihisa Iwata
Tokyo Keizai University

December 24, 2025

東京経済大学経済学会

Tokyo Keizai University Economics Association
Kokubunji, Japan

Tokyo Keizai University Faculty of Economics Discussion Paper Publication Regulations

Date of Enactment: September 24, 2025

Article 1 (Purpose of Publication)
The purpose of issuing the Faculty of Economics Discussion Papers is to promptly disseminate research results produced by members of the Tokyo Keizai University Economics Association and to promote the revitalization of discussions within the domestic and international academic community.

Article 2 (Eligibility of Authors)
1. Authors are classified into the following categories:
(1) Members of the Tokyo Keizai University Economics Association (regular members and special members) (hereinafter referred to as "Author A").
(2) Persons other than those listed in the preceding item (hereinafter referred to as "Author B").
2. Author A may publish their own individual research results, joint research results with other Author As, or joint research results with Author Bs.
3. Author B may publish research results only when co-authoring with Author A.
4. The publication of a discussion paper shall be determined based on the application or recommendation of at least one regular member of the Tokyo Keizai University Economics Association.

Article 3 (Content for Publication)
The content to be included in the discussion papers shall broadly encompass research outputs by eligible authors, such as academic papers, research notes, materials, book reviews, and similar works.

Article 4 (Copyright)
The copyrights for works such as the papers published in the Discussion Paper Series shall revert to the author, and the Tokyo Keizai University Economics Association shall retain an edit copyright. Also, the author shall be able to entrust exercise of the copyright to the Tokyo Keizai University Economics Association. Even such a case shall not interfere with the author exercising the rights.

Article 5 (Administration)
The administration related to the publication of the Faculty of Economics Discussion Papers shall be carried out by the Editorial Committee of the Journal of Tokyo Keizai University: Economics.

Article 6 (Revision and Abolition)
Any revision or abolition of these regulations shall be decided by the Tokyo Keizai University Economics Association.

Reconsidering Marx’s Theory of Turnover under Uncertain Circulation: Japanese Marxian and Unoist Approaches

Yoshihisa Iwata[1]

December 24, 2025

Abstract

Turnover consists of production and circulation processes. Although circulation interrupts the accrual of value in production, industrial capital can continue production by advancing additional capital, as Marx described in Chapter 15 of Volume II of Capital. He described money that is set free and lies idle during turnover in detail.

However, this paper argues, first, that industrial capital can eliminate set-free money by combining more than two production processes, as shown by Japanese Marxian economists. Second, by introducing uncertainty with variance into the circulation time, this paper shows that monetary reserve is essential for turnover. Third, as a consequence, idle money is unevenly distributed among industrial capitals. Some capitals persistently hold excess idle money, while others face shortages that threaten continuous production. This dispersion provides a foundation for further research on phenomena such as the emergence of credit.

JEL Classification: B51, E11

Keywords: turnover of capital, idle money, uncertain circulation, Marxian economics, Unoist approach

[1] Department of Economics, Tokyo Keizai University, Tokyo, Japan. iwata_12@tku.ac.jp

Introduction

Volume II of *Capital* plays an important role in understanding the movement of individual capital and the capitalist economy as a whole, yet the literature on it is far less extensive than that on Volumes I and III. Chapter 15 shows that additional money capital must be advanced to continue production during the circulation time, and that money is periodically set free during turnover. However, by examining turnover beyond a purely textual interpretation of *Capital*, this paper argues that set-free money can be eliminated under an alternative production method, while the necessity of monetary reserves reappears once uncertain circulation is considered.

In recent work, there have been two strands in the analysis of turnover in Chapter 15. One examines the influence of turnover time on the rate of profit and accumulation (Marx 2019; Passarella and Baron 2015; De Marco 2022, 2023). Passarella and Baron (2015) propose a compact method for representing the joint effects of capital composition and turnover within a single equation, and argue that finance can shorten the turnover time of industrial capital in the long run, thereby raising the periodic rate of profit. However, under the conditions of continuous production discussed in Chapter 15, changes in the turnover time affect the periodic rate of profit primarily through the required initial advance of capital. Moreover, this literature tends to treat circulation as a process that shortens over time, thereby overlooking its inherently uncertain character—namely, that circulation may become longer or shorter at any given point in time.

Another strand of literature focuses on money that is set free during turnover (Saros 2008; Liang and Tang 2024). By formalizing Marx's examples in mathematical models, these studies examine changes in the amount of set-free money. They argue that such changes generate aggregate economic fluctuations and idle money among individual capitals, which

may provide a foundation for credit. However, with regard to fluctuations, since different capitals set money free at different times, such fluctuations can be leveled off at the aggregate level.

More importantly, some Marxian economists in Japan have shown that industrial capital can eliminate set-free money itself by combining multiple processes. Furthermore, Saros (2008) and Liang and Tang (2024) also focus exclusively on predictable production processes and overlook the significance of idle money arising from circulation.

Nevertheless, the absence of set-free money in production does not imply the absence of idle money over the entire turnover. Once uncertainty in circulation is introduced into Marx's presupposition, idle money necessarily reappears. Modern Unoist scholars, who seek to reconstruct *Capital* in a logically consistent manner, emphasize the distinctive features of uncertain circulation and analyze the various behaviors and operations of industrial capital that emerge in response to it (Shibasaki and Ehara 2022). Building on this line of research, this paper introduces uncertainty of circulation into the analysis of capital turnover. Importantly, under conditions of uncertainty, the appropriate amount of monetary reserves of industrial capital cannot be determined objectively in advance, whereas set-free money without uncertainty is technically predictable in advance. Although Marx himself referred to uncertainty in circulation as a "salto mortale" (Marx 1976: 200), he often abstracted from it by assuming "normal business conditions." Furthermore, this paper argues that uncertain circulation leads to the prolonged deviation of monetary reserves among industrial capitals. Under this deviation, some capitals hold excess idle money, while others are short of monetary reserves. The prolonged deviation brings about various operations of industrial capitals in circulation.

While such deviations imply several possible uses of excess idle money—such as commercial credit, commercial capital, and banking capital—this paper focuses on turnover and uncertain circulation and leaves these issues for future research.

The remainder of the paper is organized as follows. Section 2 examines interrupted and continuous production as discussed by Marx, together with the other method proposed by Japanese Marxian economists, and compares these three methods. Section 3 introduces uncertain circulation into the analysis of turnover and demonstrates the theoretical significance of monetary reserves under uncertain circulation. This section constitutes the core of the paper. Section 4 concludes.

2. Turnover of capital and idle money

2.1 Premises of turnover in Marx's *Capital*

Marx analyzed turnover as consisting of production and circulation in Volume II of *Capital*. In several places, he discussed how shortening the circulation time leads to a reduction in total turnover time (e.g. Marx 1973: 659; Marx 1978, Chapter 14). However, after introducing the concept of continuous production through the advance of additional capital in Chapter 15 of Volume II, his focus shifted to how the circulation time affects the required advance of capital (Marx 1978: 358).

In Chapter 15, Marx introduced several explicit assumptions that differ from the general formula of capital, M–C–M′. These assumptions simplify the analysis. Following Saros (2008: 195), we regroup these assumptions into three categories (2.1.A–C).

2.1.A. Basic assumption on turnover

A-1. Production is continuous (Marx 1978, 334)

A-2. No fixed capital is assumed (ibid.: 354)

A-3. All production time is working time (ibid.: 334)

A-4. Surplus value is set aside (ibid.: 334)

A-5. The same amount of capital is advanced weekly (ibid.: 334)

"Continuous" production means not only that production is uninterrupted, but also that it continues on the same scale. Abstracting from fixed capital means excluding its replacement period. Marx himself notes that production continues "on the given basis of fixed capital" (ibid.: 335). Modern Unoist scholars have pointed out that, although fixed capital is abstracted from the analysis, it nevertheless underlies the necessity of continuous production.

2.1.B. Abstracting from credit

B-1. Money is gold (ibid.: 213)

B-2. No credit relations exist (ibid.: 336)

B-3. In the first turnover period, production is funded entirely by the capitalist's own capital (ibid.: 336)

These assumptions concern the required amount of initial capital advance. Marx explicitly relaxed these assumptions when he later analyzed credit relations (ibid.: 357).

2.1.C. On the circulation, especially the sales

C-1 Normal business conditions are assumed (ibid.: 109, 335)

C-2 Circulation time consists only of selling; there is no buying time (ibid.: 326)

Changes in circulation time arise solely from changes in selling time. The assumption of "normal business conditions" makes it possible to work with an average circulation time.

2.1.D. The timing of buying and selling

Marx assumed that capital advanced for production is successive, whereas commodity capital is realized at a stroke (Marx 1978: 334; Lapavitsas 2017: 157). On this basis, Marx discussed the periodic appearance of set-free money during turnover. However, this assumption lacks generality (Itoh and Lapavitsas 1999: 68).

Conversely, it may be assumed that capital for production is advanced at a stroke, while commodity capital is realized successively. To generalize Marx's assumption, it is useful to classify these combinations into four types, as shown in Table 1.

Table 1. Classification of Production Advances and Circulation Realization

		Advance for Production	
		successively	at a stroke
Realization in circulation	at a stroke	(1)	(3)
	successively	(2)	(4)

Marx assumed only case (1). Once the assumption is modified, the manner in which idle money appears also changes. For example, if money realized successively is advanced successively into production, idle money becomes smaller (case (2)). In particular, if the amounts advanced in production and realized in circulation coincide at any time, idle money does not appear at all. By contrast, in cases (3) and (4), set-free money can also be observed in ways different from Marx's description, except in special numerical cases. In the following subsection, we adopt case (1) in line with Marx's original framework[2].

[2] Overlapping continuous production method effectively reduces case (1) to case (2); See Section 2.2.D below.

2.2 Literature in Japan on turnover

2.2.A Overview

This section mainly introduces research on turnover developed in Japan[3], while also engaging with its theoretical implications. It then shifts the focus from production to uncertain circulation.

Marx initially assumed an alternation between production and circulation. He later proposed continuous production through the advance of additional capital, which allows production to continue during circulation but generates set-free money at certain stages of turnover. These two methods have been discussed in the English-language literature, including Saros (2008) and Liang and Tang (2024).

However, Japanese Marxian economists proposed a third method, in which industrial capital can eliminate idle money by operating multiple production processes in parallel[4]. This method represents a radical extension of Marx's framework. To clarify its significance, we compare the following three methods:

– *Interrupted production method*, in which production and circulation proceed alternately.

– *Unilateral continuous production method*, in which production continues through the advance of additional capital, as analyzed by Marx.

– *Overlapping (parallel) continuous production method*, in which production continues by combining more than two processes without generating set-free money.

To compare these methods, we assume a production period of five weeks and a circulation time of two weeks. A year consists of 50 weeks. Capital advanced for production is assumed to be successive—100 units per week—and the value of commodities is realized

[3] Much of this discussion draws on the Japanese-language literature.

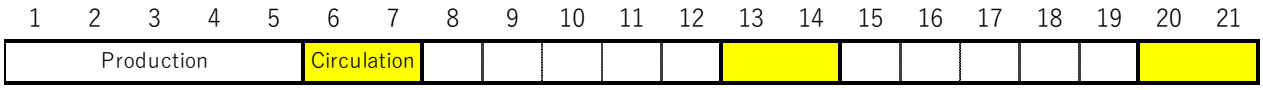
[4] This method was proposed as early as the late 1940s.

at a stroke at the end of the circulation time. We also present the analysis in a generalized form, letting the production period be w^p, the circulation time w^c, total turnover time $w^t = w^p + w^c$, and weekly capital advance α.

2.2.B Interrupted production method

This method is not continuous. Production stops once the production process ends and resumes only after circulation is completed. Under this method, fixed capital would remain idle during circulation. Figure 1 illustrates this method.

Figure 1. Interrupted Production Method



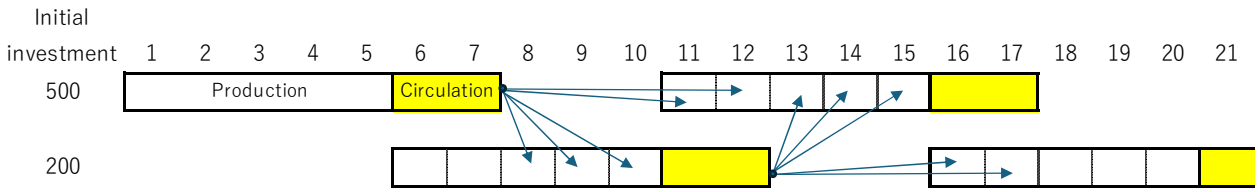
At the initial stage, industrial capital must advance 500 units of money. Production stops at the end of one production period. At the end of circulation, 500 units are realized. Of this amount, 100 units are advanced into the next production period, while the remaining 400 units are set free. Part of this money remains idle for a while: idle amounts of 400, 300, 200, and 100 units appear at times 8, 9, 10, and 11, respectively, measured at the end of each period. Idle money fluctuates with a seven-week cycle.

In generalized form, the required initial advance of capital is $\alpha \cdot w^t$. The annual value produced (excluding profit) is $50\alpha \cdot \frac{w^p}{w^p+w^c}$, and the annual number of turnovers of the initially advanced capital is $\frac{50}{w^p+w^c}$. The average amount of money capital at the end of each period is $\frac{\sum_{k=1}^{w^p} k}{w^p+w^c}$. Idle money fluctuates with a $(w^p + w^c)$-week cycle.

2.2.C Unilateral continuous production method

Marx analyzed this method in detail. Figure 2 illustrates the process.

Figure 2. Unilateral Continuous Production Method (1)



At the initial stage, in addition to 500 units, industrial capital must advance an additional 200 units to continue production during circulation. At the end of circulation, 500 units are realized. Of this amount, 100 units are advanced immediately into production, while the remaining 400 units are set free. Idle money appears and gradually decreases following the same pattern as in the interrupted production method, but fluctuates periodically with a five-week cycle, since this method is not interrupted.

The term “unilateral” becomes clear when Figure 2 is rewritten as Figure 3.

Figure 3. Unilateral Continuous Production Method (2)

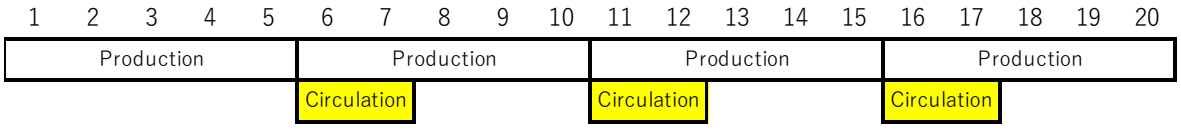


Figure 3 shows a unilateral production process continuing, accompanied by intermittent circulation processes.

In generalized form, the required initial advance of capital is $\alpha \cdot (w^p + w^c)$, which is larger than in the interrupted production method. The annual value produced (excluding profit) is 50α, and the annual number of turnovers of the initially advanced capital[5] is $\frac{50}{w^p+w^c}$, which is the same as in the interrupted production method. The average amount of money capital at the end of each period is $\frac{\sum_{k=1}^{w^p} k}{w^p} = \frac{w^p(w^p+1)}{2}$, which is larger than in the interrupted production method[6]. Idle money fluctuates with a w^p-week cycle.

Comparing the two methods, the unilateral continuous production method requires a larger initial capital and produces more. Nevertheless, the number of turnovers of the initially advanced capital is the same in both methods. This result follows from abstracting from fixed capital. If fixed capital is taken into account, the unilateral continuous production method is more effective than the interrupted production method.

If credit is introduced into the unilateral continuous production method, it can reduce the required initial advance of capital, thereby increasing the number of turnovers of the initially advanced capital. However, credit can no longer increase the volume of production or shorten the turnover period, because turnover time is determined by the production period of a unit of output under the assumption of continuous production. This point is clearly illustrated in Figure 3.

---

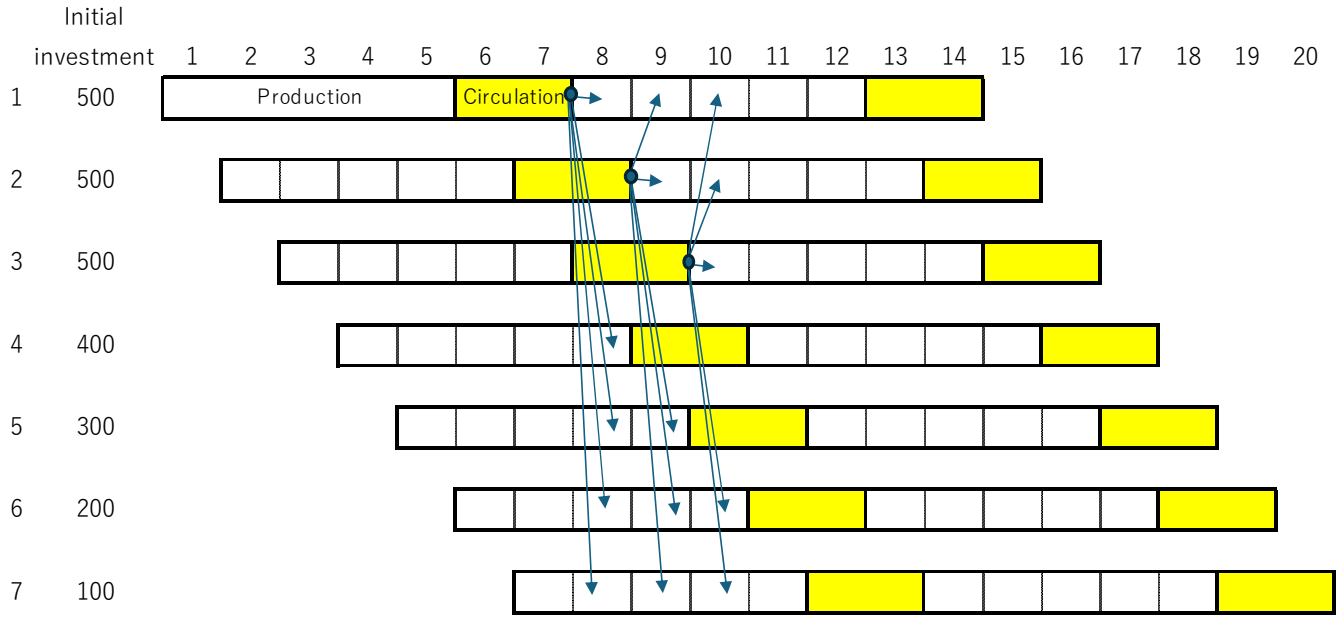
[5] The number is useful for profitability when profit is taken into consideration. Marxian economics in Japan usually considers turnover time to be that of circulating capital in continuous production from the perspective of production structure, such as circulating and fixed capital. In that case, the annual number of turnovers is $\frac{50}{w^p}$.

[6] Marx also referred to the increase of idle money ("the capital advanced that exists as a money reserve") in the unilateral continuous production method (Marx 1978: 341)

2.2.D Overlapping (parallel) continuous production method

This method is not discussed by Marx. Here, multiple production processes are combined. Their number equals the sum of the production and circulation times. Figure 4 illustrates this method.

Figure 4. Overlapping Continuous Production Method



Each arrow in Figure 4 represents an allocation of 100 monetary units to a production process. All money realized at the end of circulation is immediately allocated to production without becoming idle. For example, 500 units realized at the end of time 7 are allocated to processes 1, 4, 5, 6, and 7. This method effectively reduces case (1) in Table 1 into case (2) and equalizes sales revenues and production outlays at each period.

In generalized form, the required initial advance of capital is $\alpha \cdot w^p \cdot (w^p + 1)/2 + \alpha \cdot w^p \cdot w^c$. The annual value produced (excluding profit)[7] is $50\alpha \cdot w^p$, and the annual

[7]The calculation excludes the initial periods, that is, it applies after all processes start.

number of turnovers of the initially advanced capital is $\frac{50}{(w^p+1)/2+w^c}$, which exceeds that of unilateral continuous production when $w^p > w^c + 1$.

Table 2 summarizes the key values for the three methods.

Table 2. Comparison of the Three Methods

	required initial advance of capital	annual number of turnovers of initially advanced capital	Average idle money	Turnover time of circulating capital
Interrupted production method	$50\alpha \cdot \frac{w^p}{w^p + w^c}$	$\frac{50}{w^p + w^c}$	$\frac{w^p \cdot (w^p + 1)}{2 \cdot (w^p + w^c)}$	$w^p + w^c$
Unilateral continuous production method	50α	$\frac{50}{w^p + w^c}$	$\frac{w^p \cdot (w^p + 1)}{2 \cdot w^p}$	w^p
Overlapping continuous production method	$\alpha \cdot w^p \cdot (w^p + 1)/2 + \alpha \cdot w^p \cdot w^c$	$\frac{50}{\{(w^p + 1)/2 + w^c\}}$	0	w^p

To sum up, if fixed capital is abstracted from, the interrupted and the unilateral continuous productions exhibit the same efficiency when measured by the number of turnovers of initially advanced capital. By contrast, given fixed capital, the unilateral continuous production becomes more efficient. In both cases, money is set free and remains idle intermittently. By contrast, the overlapping continuous production method combining can eliminate idle money. Thus, set-free money emphasized in existing research loses its theoretical significance.

Certainly, Marx's focus in Chapter 15 must be understood in light of his assumption that only one production process operates at any given time on the basis of a given fixed capital. Under this assumption, the unilateral continuous production method is indeed the most relevant.

Nevertheless, once this assumption is relaxed, the overlapping continuous production method can become the standard method within a sector, insofar as it minimizes the amount of capital required for continuous production. Even if technical constraints prevent the complete elimination of idle money, set-free money arising in production remains theoretically predictable and manageable.

This section therefore concludes by reconsidering the significance attributed to set-free money in the existing literature. Once this point is clarified, it becomes apparent that the source of idle money must instead be sought in circulation.

3. Idle money from uncertain circulation

3.1. Introduction of uncertainty into circulation time

This section develops the central argument of the paper by reformulating the concept of idle money under uncertain circulation. As noted in the introduction, Marx was aware of uncertain circulation. He also recognized the necessity of holding monetary reserves, noting that "[i]f the process C′–M′ extends beyond its normal duration, then the commodity capital is abnormally delayed in its transformation into the money form" (Marx 1978: 165). Even under normal business conditions, the circulation times of individual commodities may deviate from the average. Introducing deviations from the average circulation time allows uncertain circulation to be conceptualized.

Such uncertainty gives rise to a contradiction within the turnover of industrial capital. If industrial capital adjusts production strictly in line with sales, production will be interrupted irregularly. Marx referred to this case in his discussion of Chinese handicraftsmen (Marx 1978: 182). By contrast, when the existence of fixed capital is presupposed, industrial capital must maintain production at a constant pace, which requires regular production outlays on

materials and wages. A contradiction therefore emerges between certain production and uncertain, unpredictable circulation, since it is never assured that necessary money will be obtained in time through the realization of commodity value. To cope with this contradiction, industrial capital must hold monetary reserves to cover temporary delays in sales. Such reserves absorb unexpected fluctuations in revenue and enable production to proceed at a constant pace.

3.2 Difficulty with monetary reserves

A crucial difficulty is that industrial capital cannot determine the appropriate amount of monetary reserves required to cope with unpredictable fluctuations in sales revenue. This difficulty is fundamentally different from the problem of set-free money in production as assumed by Marx, Saros (2008), and Liang and Tang (2024).

Schematically, monetary reserves held to address uncertain circulation can be distinguished from excess idle money: the former represents a necessary amount, while the latter exceeds that requirement. However, uncertainty in circulation renders this distinction inherently unclear. If industrial capital holds large monetary reserves, it can avoid shortages of liquidity, but at the cost of inefficient capital use. Conversely, if it holds only a small reserve, capital is used more efficiently, but production becomes vulnerable to temporary shortfalls in money. There is therefore no objective criterion by which to distinguish necessary reserves from excess idle money. Depending on fluctuations in selling time, money capital held by industrial capital may at times appear excessive and at other times insufficient. This difficulty reflects the underlying contradiction between certain production and uncertain circulation.

This difficulty may be partially mitigated by depreciation funds and accumulation funds for fixed capital (Marx 1978: 164–165)[8]. However, these funds cannot eliminate the problem entirely. First, at this level of abstraction, the turnover of fixed capital remains excluded from the analysis. Second, in practice, depreciation and accumulation funds have predetermined purposes and are not always available to address unforeseen shortages in circulation, even if parts of them may be temporarily allocated as monetary reserves (Marx 1978: 165). Third, from the standpoint of the overall theoretical framework, since these funds typically lie idle over long periods, it is more appropriate to invest them in long-term loans or securities, which yield higher interest or returns, rather than to hold them as cash. In any case, the problem of determining the appropriate level of monetary reserves persists under uncertain circulation.

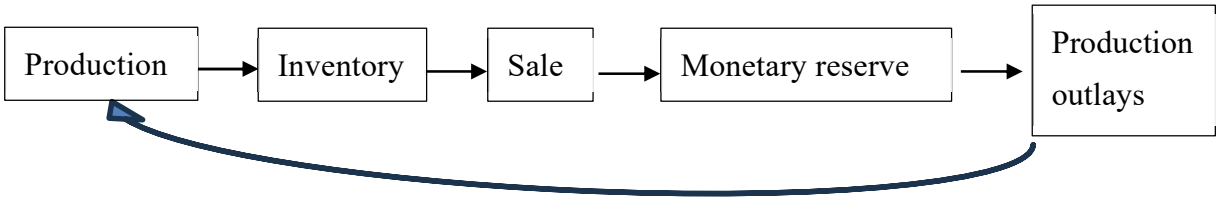
3.3 Adding variance to average circulation time

To analyze uncertain circulation more abstractly, let us assume that production outlays per unit of time are constant. Average sales per unit of time are also constant[9], but actual sales at any given moment are unpredictable and independent of past sales. The relationship between production and sales is illustrated in Figure 5.

[8] Marx referred to three or four types of money (Marx 1978: 164–165, Lapavitsas 2017: 131; Itoh and Lapavitsas 1999: 66–67): set-free money during turnover, monetary reserves for unexpected disturbances in circulation, and depreciation and accumulation funds.

[9] This assumption is justified by the overlapping (parallel) continuous production method

Figure 5. Circulation Process of Industrial Capital



We define the following variables.

P denotes the value of products produced per unit of time and is assumed to be constant.

S_t denotes the value of products sold per unit of time at the time *t*.

R_t denotes monetary reserve at the time t, and R_0 denotes the initial monetary reserve.

Since production is certain, P is time-invariant. Following Marx, profit is abstracted from, so the entire amount P is expended on materials and wages in each period. Marx assumed a fixed circulation time. Once uncertainty is introduced, sales per unit of time must instead be represented as a time-varying series S_t. In other words, Marx assumed the special case in which the circulation time has an average and zero variance, whereas this paper generalizes the circulation time to include positive variance.

The monetary reserve R_t evolves according to

$R_t = R_{t-1} + S_t - P = R_0 + \sum_{k=0}^{t}(S_k - P)$.

When S_t fluctuates unpredictably, so does the difference $P - S_t$, which has a mean of zero and positive variance. If $S_t - P > 0$, the monetary reserve increases; if $S_t - P < 0$, it decreases. As long as $R_t > 0$, industrial capital can continue production. The problem is therefore to determine an initial monetary reserve R_0 such that $R_t > 0$ holds for all t, which is evidently a difficult task.

3.4 Dispersion of idle money among industrial capitals

Although $S_t - P$ fluctuates irregularly around zero, its cumulative sum $\sum_{k=0}^{t}(S_k - P)$ need not do so. The latter follows a random walk. Accordingly, R_t represents a random walk starting from the initial reserve R_0.

In general, a random walk does not necessarily return to its starting point and may remain far from it for extended periods. In other words, some series fluctuate around the initial level at irregular intervals, while others diverge for long durations. Moreover, since the variance of a random walk increases over time, different series tend to disperse widely from one another[10].

When monetary reserves follow such a process, some industrial capitals experience persistent shortages or excesses of money capital, whereas others fluctuate only within certain bounds.

Although, in hindsight, such deviations may appear to persist over prolonged periods, individual capitalists cannot rely on their continuation given the uncertainty in circulation. Excess idle money may turn into shortages, just as shortages may turn into excess. Consequently, even when an industrial capital holds a large monetary reserve that appears excess, the reserve may in fact be insufficient.

Thus, the difference between set-free money[11] in turnover with only certain processes and monetary reserves under uncertain circulation becomes clear. Set-free money appears and disappears periodically and can be predicted in advance. It lies idle for a certain time but does not become excessive. By contrast, monetary reserves under uncertain circulation may be

[10] The appendix illustrates this deviation.

[11] Of course, this set-free money exists in Marx's assumption, but it does not in the overlapping multiple production method.

either insufficient or excessive, and no objective criterion exists by which to determine the appropriate amount in advance.

Modern Unoist scholars focus precisely on this problem of uncertain reserves. Unlike set-free money in *Capital*, industrial capital does not know when such reserves will be required. Excess idle money can therefore be utilized only for limited periods in circulation. These scholars analyze various operations and forms of capital specialized in circulation, such as commercial credit, commercial capital, and banking capital. While this paper provides the theoretical foundation for such analyses, their detailed examination lies beyond its scope.

5. Conclusion

Marx's discussion of turnover in Volume II of *Capital* has two limitations. First, he did not consider the possibility of combining more than two production processes. Second, he did not sufficiently explore the implications of uncertainty in circulation for turnover. Of course, these limitations result from Marx's abstraction, which was intended primarily to explore the sphere of production.

Against this background, this paper makes three contributions to the analysis of turnover by drawing on approaches developed by Japanese Marxian and Unoist scholars. First, it shows that the overlapping continuous production method eliminates set-free money in production, thereby redirecting analytical attention to uncertain and unpredictable circulation.

Second, this paper develops the concept of uncertainty in circulation by introducing variance into the circulation time. Uncertainty with variance makes it impossible to determine the appropriate level of monetary reserves in advance. This feature becomes visible only through this analytical procedure.

Third, this paper demonstrates the dispersion of idle money among industrial capitals. Some capitals persistently hold excess idle money, while others face shortages that threaten the continuity of production. From this uneven distribution emerge various operations and forms of capital specializing in circulation, such as commercial credit and commercial capital. Theoretically, Marx emphasized that commercial credit among industrial and commercial capitals forms the basis of bank credit (Marx 1981: 525). This paper thus provides a conceptual foundation for further research on circulation-based operations among industrial capitals, even in the absence of banking capital.

Reference

De Marco, G. (2022). Marx's general rate of profit: How turnover time, accumulation and the rate of surplus value affect the formation of prices of production. *Review of Political Economy*, 34(3), 375–397.

De Marco, G. (2023). Turnover Time and Marx's Decomposition of Profit Adjustment in the Process of Equalization. *Research in Political Economy*, 39, 145–165.

Itoh, M. and Lapavitsas, C. (1999) *Political Economy of Money and Finance*. London: Macmillan.

Lapavitsas, C. (2013). *Profiting without Producing: How Finance Exploits Us All*. London: Verso.

Lapavitsas, C. (2017). *Marxist Monetary Theory: Collected Papers*. Leiden: Brill.

Liang, J., & Tang, C. (2024). Production Structures and Fluctuations in the Money Supply: An Analysis Based on Marx's Concept of Set-Free Money Capital. *Review of Radical Political Economics*, 56(4), 476–486.

Marx, K. (1973). *Grundrisse: Foundations of the Critique of Political Economy*. London: Penguin Books.

Marx, K. (1978). *Capital: A Critique of Political Economy, Volume II*. London: Penguin Books.

Marx, K. (1981). *Capital: A Critique of Political Economy, Volume III*. London: Penguin Books.

Marx, K. (2009). Marx's Economic Manuscript of 1867–68 (Excerpt). *Historical Materialism*, 27(4), 162–192.

Moseley, F. (2009). Marx's Economic Manuscript of 1867–68 (Excerpt): Editor's Introduction. *Historical Materialism*, 27(4), 145–156.

Passarella, M. V., & Baron, H. (2015). Capital's humpback bridge: 'Financialisation' and the rate of turnover in Marx's economic theory. *Cambridge Journal of Economics*, 39(5), 1415–1441.

Saros, D. E. (2008). The Turnover Continuum: A Marxist Analysis of Capitalist Fluctuations. *Review of Radical Political Economics*, 40(2), 189–211.

Shibasaki, S., & Ehara, K. (2022). What is commercial capital? Japanese contributions to Marxian market theory. *Capital & Class*, 46(2), 235–256.

Uno, K. (1980). *Principles of Political Economy: Theory of a Purely Capitalist Society*. Brighton: Harvester.

References in Japanese

石橋貞男［1984］「マルクスの資本回転論」『研究年報〈経済学〉』46(1), 47–64. (Ishibashi, S. (1984). Marx's Theory of the Turnover of Capital [in Japanese]. *The Keizai Gaku* (Annual Report of the Economic Society of Tohoku University), 46(1), 47–64.)

小幡道昭［2009］『経済原論：基礎と演習』東京大学出版会. (Obata, M. (2009). *Principles of Political Economy: Foundations and Exercises* [in Japanese]. Tokyo: University of Tokyo Press.)

高木暢哉［1948］『銀行信用論』春秋社. (Takagi, N. (1948). *A Theory of Bank Credit* [in Japanese]. Tokyo: Shunjusha.)

田中英明［1996］「流通過程の不確定性と産業資本：市場機構論の基礎」『彦根論叢』300, 155–176. (Tanaka, H. (1996). Uncertainty in the Circulation Process and Industrial Capital: Foundations of Market Mechanism Theory [in Japanese]. *The Hikone Ronso*, No. 300, 155–176.)

馬場克三［1965］「流動資本の回転と運転資本」『経済学研究』（九州大学）31(3–4), 37–57. (Baba, K. (1965). The Turnover of Circulating Capital and Working Capital [in Japanese]. *Keizaigaku Kenkyu* (Journal of Economics), Kyushu University, 31(3–4), 37–57.)

日高普［1977］『資本の流通過程』東京大学出版会 (Hidaka, H. (1977). *Circulation Process of Capital* [in Japanese]. Tokyo: Tokyo Daigaku Shuppankai.)

Appendix: The deviation among monetary reserves under random walk.

This appendix provides only an intuitive illustration rather than a formal proof.

In addition to the variables defined in Section 3.3, let X_t denote $S_t - P$.

For simplicity, let us assume S_t follows an i.i.d. normal distribution, $S_t \sim N(P, \delta)$[12]. This specification introduces stochastic variation while preserving the same average

[12] It means that S_t follows a normal distribution with mean *P* and standard deviation δ, and are independently and identically distributed. This assumption is made for simplicity; assuming other distributions would not materially affect the results.

circulation time as that assumed in Marx's analysis. In other words, the assumption, $\delta > 0$ represents an extension of Marx's presupposition, whereas his original assumption corresponds to the special case $\delta = 0$.

Accordingly, X_t follows an i.i.d. normal distribution, $X_t \sim N(0, \delta)$. By construction,

$$E[X_t] = E[S_t - P] = E[S_t] - P = 0$$

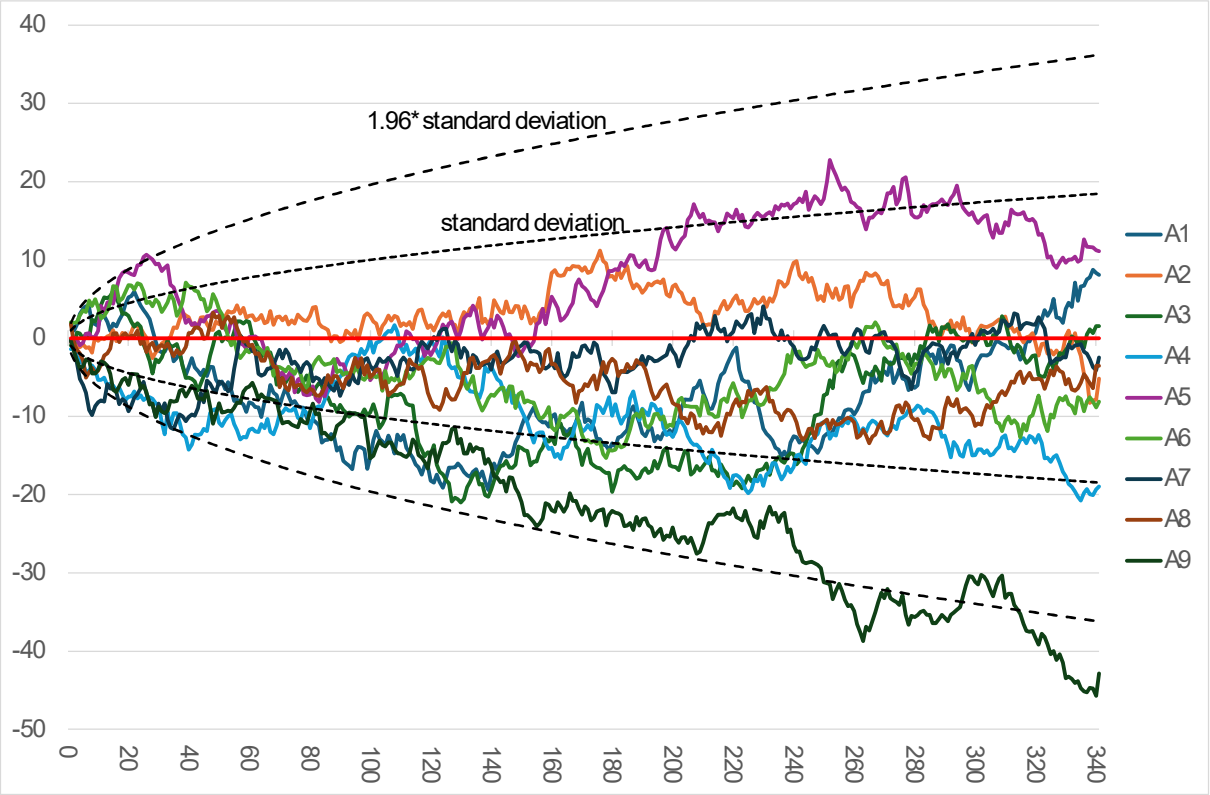
Although the mean of $X_t$is zero, its standard deviation is strictly positive under this assumption.

If the situation $X_t < 0$ persists, production cannot continue on the basis of sales revenue alone. By allocating sufficient initial monetary reserves R_0 such that $R_t > 0$ for all t, industrial capital can continue production without interruption.

The key issue is whether R_t remains above zero. In this setting, R_t follows a random walk. In a random walk, even when the mean increment is zero, the standard deviation increases in proportion to the square root of the number of steps.

Due to this property, R_t does not necessarily return to its initial level. Figure 6 illustrates nine random-walk series under the assumption $\delta = 1$. Because the values of R_t depend on R_0 of individual industrial capitals, Figure 6 assumes $R_0 = 0$ for all industrial capitals for ease of comparison.

Figure 6. Distribution of Idle Money among Individual Capitals



Some series fluctuate around the mean of zero, while others deviate from it for prolonged periods. However, it cannot be ruled out that a series that deviates far from its starting point will return to it in the future. This deviation provides a conceptual foundation for various operations and forms of capital specializing in circulation.