FULL PAPERS

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Accounting & Finance Papers

MODELING EARNINGS UNDER TWO TYPES OF RISK

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ABSTRACT
This paper develops a unified framework for earnings measurement by introducing two types of risk: inflow-related risk and outflow-related risk. Using the concept of risk tolerance—the acceptable level of stock-related risk—the framework spans the full range of earnings measures, from conservative cash-based accounting to forward-looking economic income. The analysis shows that (i) the asymmetry between inflows and outflows is central to earnings recognition, (ii) varying risk tolerance explains practices such as historical cost and depreciation, and (iii) realization, matching, and conservatism can be reconciled within a risk-based model. The contribution lies in formally linking risk tolerance to the stock–flow structure of accounting, providing a clearer representation of how uncertainty shapes earnings measurement. The framework offers implications for both theory and practice while also facing limitations, including its stylized two-period setting and simplified risk measure. These point to directions for future extensions and empirical validation.

Keywords: *Earnings, Stock-flow congruence, Matching/realization, Risk tolerance, Uncertainty*

JEL classification: *M41*

1. INTRODUCTION

In recent years, accounting research has increasingly drawn on insights from information economics. At the same time, traditional accounting theory has long emphasized foundational concepts-such as realization, the matching principle, and conservatism—that explain how earnings are determined. While these concepts are fundamental to accounting practice, their reliance on verbal reasoning and interpretive frameworks has often hindered their incorporation into formal theory and empirical analysis. As a result, these foundational ideas are often excluded from contemporary information-based models. The matching principle, in particular, is a prime example of a concept whose analytical treatment remains limited. To address this gap, this study seeks to develop a generalizable framework that encompasses all logically possible earnings measurement methods. In accounting, earnings are determined by allocating cash inflows and outflows across periods. To evaluate the optimal form of earnings measurement, it is first necessary to delineate the entire spectrum of logically possible methods. Only then can we assess which constraints or assumptions give rise to a normatively preferable method of earnings measurement.

This paper focuses on situations where the relationship between stocks and flows is not straightforward—specifically, cases where changes in stocks cannot be clearly observed. For example, while the disappearance of a physical asset clearly implies a flow (i.e., an expense), depreciation reflects a less transparent decline in value. In such cases, accounting requires a conceptual justification for expense recognition. To address these ambiguities, this study introduces the concept of risk. Specifically, it focuses on risks inherent in stocks arising from cash inflows and outflows, and explores how such risks shape the recognition of stocks and flows in accounting. By incorporating the concept of risk, we show that a wide spectrum of earnings measurement methods—ranging from strict cash-based accounting to economic income—can be expressed in terms of varying degrees of risk tolerance. At the same time, the model enables us to analytically revisit traditional accounting principles and articulate their roles more precisely. In doing so, the study offers a new theoretical justification for foundational concepts whose importance has long been recognized in practice but seldom formalized rigorously.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature, focusing on how risk has been treated in discussions of earnings measurement. Section 3 presents a formal analysis of the stock–flow relationship in accounting. Section 4 introduces the principle of congruence and shows how earnings arise from the intertemporal allocation of cash flows. Section 5 develops a model with two types of risk and demonstrates that earnings can be represented as a function of risk tolerance. The paper yields three key findings. First, under uncertainty, the central issue in earnings measurement lies in the stock–flow structure rather than in the traditional asset–liability versus revenue–expense dichotomy. Second, the proposed framework unifies diverse earnings measures by varying the degree of risk tolerance for inflows and outflows. Third, it shows that single-risk models fail to capture the logic of matching, while also explaining why traditional accounting principles remain institutionally resilient under uncertainty. A preliminary version of this study was previously presented as a poster under the same title, which has limited archival visibility. The present paper substantially extends the model and provides updated analyses and results.

2. PREVIOUS STUDIES

The concept of risk in accounting can be broadly divided into two types (Sunder, 2015). The first is risk as hazard (downside risk), which focuses on the possibility of adverse outcomes such as losses or failures. This perspective is closely related to the traditional accounting principle of conservatism, which calls for early recognition of potential losses and delayed recognition of uncertain gains. Modern IFRS standards have redefined this principle under the concept of prudence, which advises caution in making judgments under conditions of uncertainty.

The second type is risk as dispersion of outcomes, which treats both upward and downward variations as sources of risk. This conception is central in finance and has become increasingly prominent in accounting standards. The IFRS Conceptual Framework refers to uncertainty in terms of existence (whether an asset or liability exists), outcome (the timing and amount of future inflows or outflows), and measurement (estimation uncertainty) (IASB, 2018, paras. 5.14, 6.61, 5.20). However, these references often acknowledge risk without specifying how accounting information should represent or convey it effectively to users (Barker & Penman, 2020).

The Accounting Standards Board of Japan (ASBJ) has addressed this issue in its Discussion Paper on *the Conceptual Framework for Financial Accounting*. It emphasizes that accounting information should help investors assess the extent to which expected investment outcomes have been realized, introducing the concept of "*release from investment risk*" (ASBJ, 2006, para. 3.23). This concept differentiates between business investments, where revenue is recognized upon realization of operating cash flows, and financial investments, where changes in fair value can be immediately recognized in earnings due to asset liquidity.

Penman (2016) further contrasts historical cost and fair value accounting in their treatment of risk. Historical cost accounting delays recognition until uncertainty is resolved, whereas fair value accounting incorporates forecasts of future cash flows, thereby making risk visible only retrospectively through earnings volatility. Penman (2016) argues that, despite its forward-looking nature, fair value accounting may mislead users by incorporating unrealized expectations into reported earnings. On the other hand, Barker and Penman (2020) classify earnings recognition into four types of uncertainty resolution: Type 1 (direct matching of revenues and expenses), Type 2 (ex ante matching, e.g., depreciation), Type 3 (ex post matching, e.g., fair value changes), and Type 4 (no matching, e.g., immediate expensing of R&D). While Types 3 and 4 challenge the matching principle, they highlight how accounting standards address different forms of uncertainty resolution.

In a model-based analysis, Wagenhofer (2003) identified conditions under which accrual accounting outperforms cash flow as a performance measure. Dutta and Zhang (2002) analyzed how different revenue recognition rules affect managerial decision-making and showed that desirable earnings tend to embody a conservative bias. However, these studies primarily focus on risks associated with cash inflows in revenue recognition, while treating the matching principle as a given assumption rather than a subject of analysis. In a different approach, Konstantinidi and Pope (2016) examined the risk inherent in earnings themselves. They showed that even a parsimonious model based on accrual earnings, cash flows, and special items can reasonably predict the distributional shape of earnings.

3. STOCK AND FLOW

3.1. Conceptual Foundations of Stocks and Flows

In earnings measurement, a long-standing debate concerns whether it should be based on stocks or flows. Ultimately, the key issue is how the relationship between stocks and flows is conceptualized. In economics, a stock is defined as a quantity at a specific point in time, while a flow represents the change in that quantity over a period (Mankiw, 2016). We adopt the same view: a stock refers to the quantity of an item at a point in time, and a flow is the change in that item over a period. Whereas a stock can be defined independently, a flow is necessarily derived from changes in stocks.

A stock measure alone is often insufficient for decision-making under uncertainty. If changes in stocks followed a deterministic rule, flows could be directly inferred. In reality, however, future changes in stocks are uncertain. Understanding such changes requires decomposing past flows-for example, distinguishing between inflows and outflows—in order to identify their underlying causes. This decomposition is essential for forecasting. Therefore, both stock and flow measures—particularly the explanatory content of flows—are indispensable for providing decision-useful information under uncertainty.

3.2. Stock and Flow in Financial Statements

Financial statements embody this distinction: the balance sheet reports stocks, and the income statement reports flows. The FASB (1976) distinguishes two approaches: the asset–liability approach, which emphasizes measuring assets and liabilities and defines earnings as changes in net resources; and the revenue–expense approach, which focuses on recognizing revenues and expenses and defines earnings as their difference. Yet the essential issue lies in the stock–flow relationship. Can equity be derived from previously defined revenues and expenses—in other words, can stocks be constructed from flows?

The IASB (1989) defines revenue as increases in equity from asset inflows or liability reductions, excluding capital transactions. This definition presupposes the prior concepts of assets, liabilities, and equity. Without them, revenues and expenses cannot be meaningfully defined. Moreover, if capital transactions are not clearly separated, classifying flows becomes problematic. Thus, accounting flows depend on prior stock definitions. Flows represent changes in stocks, and their definition depends on identifying the underlying stock items. However, this does not resolve the debate. Even when stocks are defined first, their scope may be adjusted to serve the purpose of flow measurement. The key question is not whether to prioritize stocks or flows, but rather how stocks are defined. The historical development of accounting may have blurred these distinctions. Framing the debate merely as a choice between the asset–liability and revenue–expense approaches yields limited insight.

Prior research (e.g., Kusano, 2012) links the asset–liability approach to fair value measurement, and the revenue–expense approach to historical cost. The former emphasizes valuing assets and liabilities, while the latter focuses on recognizing revenues and expenses. However, valuing assets and liabilities does not necessitate the exclusive use of fair value. Fair value typically reflects equilibrium market prices, which may diverge from a firm's specific economic value. As Barker and Penman (2020) note, fair value involves substantial uncertainty, especially for long-term investments without active markets, which can mislead investors. Under uncertainty, identifying which elements are certain becomes critical. Although not market-based, historical cost indicates how capital has been invested and provides a conceptual justification. Even within the asset–liability approach, fair value is not mandated. The FASB (1976) explicitly states that neither approach is tied to a specific measurement basis. Both fair value and historical cost can, in principle, be valid under either framework. Asset and liability measurement is also closely tied to principles such as realization and matching, further complicating the simplistic link between measurement approach and basis.

4. THE PRINCIPLE OF CONGRUENCE

As discussed in the previous section, accounting flows are defined as changes in stocks, especially in the context of measuring equity and earnings. Rather than treating stocks and flows as opposing concepts, we have argued that both serve as equally essential sources of information for financial reporting. In this section, we clarify the relationship between cash flows and earnings—a relationship that underpins the measurement of equity. We then further examine the fundamental nature of stocks and flows in accounting. Specifically, we analyze how changes in cash during each accounting period are allocated over time and represented as accounting stocks and flows. This analysis lays the foundation for our subsequent focus on the risks embedded in cash flows and how these risks influence the structure of earnings measurement.

We assume a setting without uncertainty at any point in time $t(= 0, \ldots, T)$, where T denotes the time of the firm's liquidation. Under this assumption, the firm's assets A_t are equal to the sum of its liabilities L_t and equity E_t, as expressed by the basic balance sheet identity:

$$A_t = L_t + E_t \tag{1}$$

While accounting classifications may be more detailed in practice, assets A_t can generally be divided into three categories: cash equivalents C_t, uncollected items representing future income FI_t, and capitalized items resulting from past cash outflows PO_t. These items are recorded as economic resources on the balance sheet. Similarly, liabilities L_t can be divided into past inflows PI_t, such as deferred revenues, and future outflows, FO_t including accrued expenses and obligations like borrowings. These classifications can be expressed as follows:

$$A_t = C_t + FI_t + PO_t \tag{2}$$

$$L_t = PI_t + FO_t \tag{3}$$

As shown in Equation (1), equity E_t on the balance sheet is defined as the difference between assets A_t and liabilities L_t. Given the linkage between the balance sheet and the income statement, equity can also be understood as the sum of contributed capital S_t, representing capital contributions from shareholders, and retained earnings R_t, which consist of past earnings not distributed as dividends. These relationships are expressed as:

$$E_t = S_t + R_t \tag{4}$$

Retained earnings R_t, as a component of equity, increases with current-period earnings e_t and decrease with dividends d_t paid during the same period. In other words, earnings can be viewed as a flow, calculated as the difference between revenues and expenses, or as a stock-based measure, derived from the change in retained earnings adjusted for dividends. This relationship holds regardless of any changes in contributed capital S_t and can be expressed as:

$$e_t = R_t - R_{t-1} + d_t \tag{5}$$

The relationship between earnings e_t and cash flows can be formally derived as follows. Substituting Equation (4) into Equation (5), we obtain: $e_t = R_t - R_{t-1} + d_t = (E_t - S_t) - (E_{t-1} - S_{t-1}) + d_t$. Next, substituting Equation (1) into this expression, and applying Equations (2) and (3), we derive the following. Here, let Δ_t denote the change in variable between time t.

$$\begin{aligned} e_t &= (A_t - L_t - S_t) - (A_{t-1} - L_{t-1} - S_{t-1}) + d_t \\ &= (C_t + FI_t + PO_t - PI_t - FO_t - S_t) \\ &\quad - (C_{t-1} + FI_{t-1} + PO_{t-1} - PI_{t-1} - FO_{t-1} - S_{t-1}) + d_t \\ &= \Delta C_t + \Delta FI_t + \Delta PO_t - \Delta PI_t - \Delta FO_t - \Delta S_t + d_t \end{aligned} \tag{6}$$

As shown in the preceding discussion, Equation (6) demonstrates that earnings e_t are determined by the temporal allocation of cash flows and related accrual adjustments. Specifically, the second through fifth terms in Equation (6) represent changes in the following accrual-related items: (a) accrued revenues (i.e., cash inflows to be received in future periods), (b) deferred expenses, such as capital investments to be expensed in later periods, (c) deferred revenues (i.e., cash inflows received in past periods but not yet recognized), and (d) accrued expenses (i.e., cash outflows to be paid in future periods). Over the firm's full life span, up to liquidation, these accruals eventually offset one another: accrued revenues and accrued expenses are realized as cash flows in future periods, while deferred revenues and expenses are recognized as revenues and expenses, respectively. As a result, their cumulative effect becomes zero when aggregated across all periods. Accordingly, the cumulative sum of earnings can be expressed as:

$$\sum e_t = \sum \Delta C_t - \sum \Delta S_t + \sum d_t \tag{7}$$

Equation (7) shows that the cumulative amount of earnings is equal to total cash inflows and outflows, excluding transactions related to capital contributions and distributions. In other words, regardless of the specific method used to calculate earnings, when accumulated over the firm's entire life up to liquidation, total earnings converge to net cash inflows minus outflows, adjusted for capital transactions. This fundamental property is known as the *principle of congruence*, which underscores the central role of cash flows in modeling and interpreting earnings over time.

5. EQUITY AND EARNINGS FROM THE PERSPECTIVE OF TWO RISKS

In the previous section, we examined how both equity (a stock) and earnings (a flow) arise from the allocation of cash inflows and outflows over time. Earnings, as increases in equity, represent the outcomes of investment activities once associated uncertainties have been resolved. In this sense, the concept of earnings is fundamentally linked to risk. Barker and Penman (2020) argue that the traditional dichotomy between the asset-liability and revenue-expense approaches is misleading. They advocate for a framework in which earnings are interpreted through the lens of uncertainty. Schmalenbach (1955) similarly emphasized that both stocks and flows are essential components of earnings. In this section, we revisit the concept of earnings by focusing on two distinct but interrelated types of risk: those associated with cash inflows and those with cash outflows.

5.1. Earnings Measurement from the Perspective of Risk

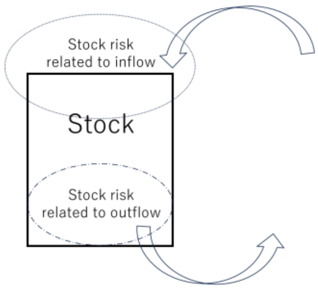
According to IASB (2018), uncertainty in accounting arises in two forms: outcome uncertainty, concerning variability in cash flows, and existence uncertainty, concerning whether an asset or liability exists. However, under the clean surplus assumption, stock and flow are interdependent, casting doubt on the utility of treating these uncertainties separately. Barker and Penman (2020) propose that uncertainty should instead be understood as a unified concept. This unified view aligns with ASBJ (2006), which defines revenues and expenses as the portions of asset and liability changes *released from investment risk*. Once invested resources contribute to generating cash flows, they are regarded as having been discharged from risk. This approach applies equally to assets, revenues, and expenses, thereby supporting a single, integrated risk perspective.

Sakurai (2007) interprets this notion of "released from investment risk" as a conceptual substitute for the realization principle. Because expenses are recognized concurrently with revenues, the matching principle is also implicitly embedded within this view. Moreover, since risk exposure is typically tied to investment activities, the notion of *control* —that is, whether a firm has authority over the use of resources—may also be relevant. Taken together, the unified risk perspective appears to encompass several foundational accounting principles. However, reducing these principles to a single framework risks oversimplifying their distinct roles and normative functions. Earnings are determined by allocating cash inflows and outflows across time—two components that differ in both dynamics and informational content. Although earnings are ultimately observed as a single variable, a single-risk approach may conceal the inherent asymmetry between inflows and outflows. We therefore proceed to analyze risk in earnings measurement from both perspectives.

5.2. Risk and Tolerance in Cash Inflows and Outflows

We model equity and earnings as functions of two types of stock-related risk: (1) *inflow-related risk*, associated with assets that may generate future revenue, and (2) *outflow-related risk*, tied to assets that give rise to future expenses. These risks can be represented, for analytical purposes, by the variability (e.g., standard deviation) of relevant stock items. Because both assets and liabilities may embody elements of each risk type, stocks and flows must be treated in an integrated fashion.

A basic accounting assumption is that only identifiable and verifiable economic resources are recognized on the balance sheet. When the existence and use of a resource are certain—such as risk-free cash compensation—it can be recognized without explicit reference to risk. By contrast, when the existence of a resource is uncertain, the concept of risk becomes essential to determining whether it qualifies as stock.



Barker and Penman (2020) classify earnings measurement into four types. In Type 1, involving the direct matching of revenues and expenses, some elements may not involve explicit risk. For example, in some merchandise sales, inflow-related stock risk exists at the time of purchase, but revenue is recognized only once the sale occurs and the right to receive cash is certain. Here, revenue recognition corresponds to the resolution of risk. Expense recognition, in contrast, follows the disappearance of the asset upon delivery, rather than risk resolution per se.

For outflows, as illustrated by depreciation, the associated risk is often difficult to quantify and may not evolve linearly. Even as time passes, the exact extent of depreciation remains uncertain. Accounting practice therefore, seeks to exclude high-risk stock items from recognition, consistent with the principle that non-existent resources should not be reported. A central issue, then, is to determine whether a given item surpasses the threshold for recognition—effectively, evaluating the degree of risk attached to both inflows and outflows.

To formalize this idea, we define *risk tolerance* as the acceptable level of stock-related risk in calculating equity and earnings. For example, accounts receivables are generally recognized as revenues despite some collection risk, as they are presumed to be relatively low risk. Similarly, unrealized gains on marketable securities may be recognized despite uncertainty, due to the liquidity of their market value. The degree to which risk is incorporated into earnings depends on both the nature of each transaction and broader economic conditions. In practice, uncertainty can never be fully eliminated. Accordingly, earnings measurement should be understood as a process that reflects the degree of risk tolerance embedded in accounting recognition.

5.3. Modeling Risk Tolerance in Earnings Measurement

It is possible to represent all forms of earnings calculation methods—from strictly cash-based accounting to economic income—within a unified framework by adjusting the risk tolerances associated with inflows and outflows of stock. Such a framework enables comprehensive comparison of alternative approaches to earnings measurements and provides a basis for evaluating what may constitute an optimal earnings measure.

For cash inflows, when the tolerance for stock-related risk is extremely low, earnings are not recognized until the inflow becomes certain, and only cash is recognized as stock. Non-cash assets are excluded from recognition because they carry the risk of non-realization. Conversely, under high risk tolerance, expected future inflows may be recognized as stock, with increases recorded as earnings. Thus, various forms of revenue recognition can be represented by adjusting the level of tolerance for inflow risk. For cash outflows, when tolerance for stock-related risk is very low, all cash outflows—including those related to fixed assets—must be immediately expensed. Even if made with investment intent, such outflows are treated entirely as expenses because their value is expected to decline over time. By contrast, with high tolerance, the asset is retained on the balance sheet despite the associated risk, and the related expense is deferred until the decline in value becomes sufficiently certain.

According to this model, adjusting the levels of the two types of risk tolerance allows us to represent the entire spectrum of earnings measurement systems—from conservative, cash-based approaches to forward-looking concepts of economic income. In practice, accounting standards position themselves somewhere between these two extremes. If the entire range is made explicit within the model, it is reasonable to assume that an optimal earnings measure from a social perspective exists within it. Furthermore, by examining how current accounting standards incorporate these two forms of risk, we can concretely assess the gap between existing practices and theoretically optimal measures. To support such an analysis, we now introduce a stylized model based on a set of simplifying assumptions.

As an example, we propose a simplified model to illustrate how the calculation of revenues and expenses depends on the degree of risk tolerance, given the relationship between investment and cash flows. We consider a two-period model with time points t = 0, 1, and 2. At time t = 0, a cash outflow of I_0 occurs as an investment, and the investment is assumed to expire worthless at t = 2. A tilde (~) indicates a stochastic variable. Let $\tilde{I}_t$ denote the stochastic value of the investment, and let $\tilde{C}_t$ denote the stochastic cash inflow generated by this project at time t. Their realizations are denoted by $\tilde{I}_t$ and $\tilde{C}_t$, respectively. For simplicity, we assume no cash outflows occur at t = 1 or t = 2.

Let $E_t[\cdot]$ denote the conditional expectation given the information available at time t, and let $\sigma_t[\cdot]$ denote the corresponding measure of risk. The notion of risk here may refer to any quantity derived from the conditional distribution of the stochastic variable; for example, it may be specified as the standard deviation. To classify the degree of risk, let α and β be two positive real numbers with $\alpha \leq \beta$. These values serve as thresholds for evaluating risk:

- If $\sigma_s[\tilde{C}_t] \leq \alpha$, the cash flow $\tilde{C}_t$ is considered low risk at time s.
- If $\sigma_s[\tilde{C}_t] \geq \beta$, the cash flow $\tilde{C}_t$ is considered high risk.
- If $\alpha < \sigma_s[\tilde{C}_t] < \beta$, the risk is regarded as moderate.

We refer to the pair (α, β) as the risk tolerance parameters. The same classification applies analogously to $\sigma_s[\tilde{I}_t]$ as well.

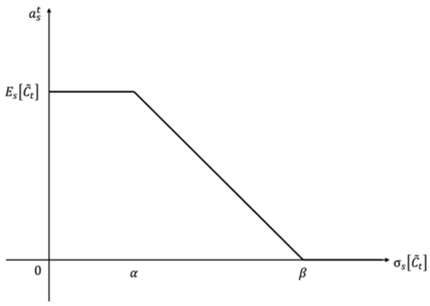
We now define earnings as follows. Let a_t and b_t denote the revenue and expense at time t, respectively. Then, the earnings e_t at time t is given by $e_t = a_t - b_t$. In this context, both a_t and b_t are specified in terms of the stochastic variable $\tilde{I}_t$ and $\tilde{C}_t$ with particular emphasis on the risks.

Let the risk tolerance for the cash inflow $\tilde{C}_t$ (for $t = 1,2$) be given by the pair (α, β). Based on this, we define the contribution of $\tilde{C}_t$ to the revenue a_s at time s, denoted by a_s^t, sequentially from $s = 0$ as follows. First, if $\sigma_0[\tilde{C}_t] \leq \alpha$, that is, if the risk of $\tilde{C}_t$ at time 0 is considered low, then $a_0^t = E_0[\tilde{C}_t]$. If $\sigma_0[\tilde{C}_t] \geq \beta$, meaning that the risk is considered high at time 0, then $a_0^t = 0$. For the intermediate case where $\alpha < \sigma_0[\tilde{C}_t] < \beta$, we define a_0^t as the value of a continuous function of $\sigma_0[\tilde{C}_t]$ that passes through the two points $(\alpha, E_0[\tilde{C}_t])$ and $(\beta, 0)$. For simplicity, we adopt the following linear specification for a_0^t when the risk of $\tilde{C}_t$ lies between α *and* β:

$$a_0^t = -\frac{E_0[\tilde{C}_t]}{\beta - \alpha}\sigma_0[\tilde{C}_t] + \frac{\beta E_0[\tilde{C}_t]}{\beta - \alpha}$$

Summarizing the definition of a_0^t, we have:

$$a_0^t = \begin{cases} E_0[\tilde{C}_t], \ \sigma_0[\tilde{C}_t] \leq \alpha \\ \left(\dfrac{\beta - \sigma_0[\tilde{C}_t]}{\beta - \alpha}\right) E_0[\tilde{C}_t], \ \alpha < \sigma_0[\tilde{C}_t] < \beta \\ 0, \ \sigma_0[\tilde{C}_t] \geq \beta \end{cases}$$



Given the above definition of the contribution of each cash inflow $\tilde{C}_t$ to revenue, the total revenue at time $s = 0$ is expressed as $a_0 = a_0^1 + a_0^2$

Expenses at time t are defined on the basis of the decline in asset value $\tilde{I}_{t-1} - \tilde{I}_t$. Let the risk tolerance for this reduction be given by the pair (α', β') with $(\alpha' < \beta')$. The contribution of period t to expenses at time 0, denoted by b_0^t, is defined as follows:

$$b_0^t = \begin{cases} 0, \ \sigma_0[\tilde{I}_{t-1} - \tilde{I}_t] \le \alpha' \\ \left(\dfrac{\sigma_0[\tilde{I}_{t-1} - \tilde{I}_t] - \alpha'}{\beta' - \alpha'}\right) E_0[\tilde{I}_{t-1} - \tilde{I}_t], \ \alpha' < \ \sigma_0[\tilde{I}_{t-1} - \tilde{I}_t] < \ \beta' \\ E_0[\tilde{I}_{t-1} - \tilde{I}_t], \sigma_0[\tilde{I}_{t-1} - \tilde{I}_t] \ge \beta' \end{cases}$$

By defining expenses in this manner, total expenses at time 0 are given by $b_0 = b_0^1 + b_0^2$. With an appropriately chosen pair (α', β'), any expense b_0 satisfying $0 < b_0 < I_0$ can be represented. Accordingly, when combined with the definition of revenues, it follows that by specifying suitable levels of risk tolerance, any earnings e_0 satisfying $-B_0 < e_0 < E[\tilde{C}_1] + E[\tilde{C}_2]$ can be expressed.

Finally, we decompose the stochastic reduction in asset value into a component correlated with revenues and an orthogonal residual: $\tilde{I}_{t-1} - \tilde{I}_t = \gamma_t \tilde{C}_t + \tilde{\epsilon}_t$, where

$$\gamma_t = \frac{\mathrm{Cov}[\tilde{I}_{t-1} - \tilde{I}_t, \tilde{C}_t]}{Var_0[\tilde{C}]}$$

is a constant, and $\tilde{\epsilon}_t$ is orthogonal to $\tilde{C}_t$, i.e. $\mathrm{Cov}[\tilde{C}_t, \tilde{\epsilon}_t] = 0$. The term $\gamma_t \tilde{C}_t$ represents the portion of the asset reduction that moves together with revenues, while $\tilde{\epsilon}_t$ represents the reduction independent of revenues. Since $E_0[\tilde{I}_{t-1} - \tilde{I}_t] = \gamma_t E_0[\tilde{C}_t] + E_0[\tilde{\epsilon}_t]$, the expected reduction $\gamma_t E_0[\tilde{C}_t]$ can naturally be regarded as the expense corresponding to the expected revenue. Hence, if the recognized revenue is a_0^t, the corresponding expense is naturally defined as $\gamma_t a_0^t$.

For the residual component $E_0[\tilde{\epsilon}_t]$, expenses are recognized depending on risk tolerance. Let the risk tolerance for $\tilde{\epsilon}_t$ be given by (α', β'). Then, the contribution of period t to expenses at time 0 is defined as

$$b_0^t = \begin{cases} 0, \ \sigma_0[\tilde{\epsilon}_t] \le \alpha' \\ \left(\dfrac{\sigma_0[\tilde{\epsilon}_t] - \alpha'}{\beta' - \alpha'}\right) E_0[\tilde{\epsilon}_t], \alpha' < \sigma_0[\tilde{\epsilon}_t] < \beta' \\ E_0[\tilde{\epsilon}_t], \sigma_0[\tilde{\epsilon}_t] \ge \beta' \end{cases}$$

Summarizing, the contribution of the period to expenses at time 0 is defined as $\gamma_t a_0^t + b_0^t$. Thus, the model provides a unified representation of revenues and expenses under different levels of risk tolerance, thereby reconciling the principles of realization, matching, and conservatism within a single analytical framework.

6. CONCLUSION

This paper has examined earnings measurement from the perspective of two types of risk—those associated with cash inflows and those associated with cash outflows. By introducing the concept of risk tolerance, we proposed a unified framework that encompasses approaches ranging from conservative, cash-basis accounting to forward-looking concepts of economic income. In this sense, we demonstrate that earnings measurement is ultimately a matter of how risk is treated within accounting.

Our analysis yields three key findings. First, the asymmetry between inflows and outflows lies at the core of earnings recognition. Second, varying levels of risk tolerance reproduce diverse accounting practices, such as historical cost and depreciation. Third, traditional principles of realization, matching, and conservatism can be formally reconciled within a risk-based model. Compared with prior literature, the main contribution of this study is to provide a formal representation of risk tolerance that links stock–flow structures with earnings measurement, thereby offering a theoretical framework that spans the entire spectrum of logically possible methods.

The proposed framework carries implications for both theory and practice. It provides a basis for integrating foundational accounting concepts with modern information-based approaches, clarifies why traditional principles remain resilient under uncertainty, and helps interpret how existing standards implicitly reflect assumptions about risk.

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