

Desde los estados financieros microcontables hacia la macro contabilidad. Un modelo basado en el *measurement approach*⁽¹⁾

Sergio Miguel Hauque

Universidad Nacional del Litoral, Facultad de Ciencias Económicas,
Santa Fe, Argentina.

✉ sergiohauque@yahoo.com.ar

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Resumen: Los campos de la contabilidad nacional, pública y financiera comparten el término “contabilidad”, pero han desaprovechado las posibles sinergias entre ellos. Aunque la contabilidad es una herramienta analítica potente que genera datos a niveles micro y macro, la persistente división entre micro y macrocontabilidad ha limitado estas sinergias. Varios académicos han explorado el potencial contable como disciplina integral, resaltando las complejas conexiones entre los niveles macro y micro.

Este estudio propone un modelo conceptual para abarcar identidades contables fundamentales desde lo micro hasta lo macro. Utilizando conceptos abstractos como Dichev y Tang (2008), Dichev (2008, 2017) y Miller & Bahnsen (2010), organiza información sobre *stocks* y flujos de valor económico.



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(1) In the course of composing this paper, the author employed OpenAI technology with the objective of enhancing the textual composition's quality. Subsequent to the utilization of this computational tool, the author examined and refined the manuscript, hereby assuming complete responsibility for the resulting text.

mico, alineándose con el concepto de contabilidad bajo condiciones ideales (2015). Basado en el “*measurement approach*” (1989), este estudio confirma que solo los activos reales constituyen el capital concreto de la sociedad y describe la dinámica cíclica de la renta obtenida de diversos activos. Este enfoque analítico busca comprender la naturaleza de la disciplina contable y propone diversas vías para futuras investigaciones, desde la estimación empírica de valores hasta la adaptación de categorías abstractas a requisitos situacionales.

Palabras clave: Microcontabilidad; macrocontabilidad; convergencia; niveles de agregación.

From micro financial statements to macro accounting: an integrated model based on the measurement approach

Abstract: The nomenclature in national, public, and financial accounting, while sharing a common noun, has yet to explore potential synergies. Despite accounting’s capacity for powerful analysis at micro and macro levels, the persistent microaccounting-macroaccounting dichotomy limits these synergies. Despite modest reception, scholars have explored converging Accounting into a comprehensive discipline, emphasizing interconnections between macro and micro levels.

This study presents a conceptual model spanning micro, meso, and macro fundamental accounting identities. Employing abstract concepts like Dichev and Tang (2008), Dichev (2008, 2017), and Miller & Bahnson (2010), it organizes economic value stocks and flows from micro to macro levels. Aligned with Scott’s concept of accounting under ideal conditions (2015), it’s grounded in beaver’s measurement approach (1989). The study confirms, through micro accounting consolidation, that only real assets constitute society’s concrete capital. It outlines cyclic dynamics of rental phenomena from diverse assets, accruing rental values at each aggregation level. This analytical approach aids understanding accounting’s nature and identifies avenues for future research, including empirical estimation and periodic reassessment of abstract categories.

Keyword: Microaccounting; macroaccounting; convergence; aggregation levels.

Da microcontabilidade das demonstrações financeiras à macrocontabilidade. Um modelo baseado na abordagem de medição

Keyword: Os campos da contabilidade nacional, pública e financeira compartilham o termo “contabilidade”, mas perderam as sinergias potenciais entre eles. Embora a contabilidade seja uma ferramenta analítica poderosa que gera dados tanto em nível micro quanto macro, a divisão persistente entre a micro e a macrocontabilidade tem limitado essas sinergias. Vários estudiosos exploraram o potencial da contabilidade como uma disciplina integral, destacando as complexas conexões entre os níveis macro e micro.

Este estudo propõe um modelo conceitual para abranger as identidades contábeis fundamentais do micro ao macro. Usando conceitos abstratos como Dichev e Tang (2008), Dichev (2008, 2017) e Miller & Bahnson (2010), ele organiza informações sobre estoques e fluxos de valor econômico, alinhando-se com o conceito de contabilidade em condições ideais (2015). Com base na abordagem de mensuração (1989), este estudo confirma que

somente os ativos reais constituem o capital concreto da sociedade e descreve a dinâmica cíclica da renda obtida de vários ativos. Essa abordagem analítica busca entender a natureza da disciplina contábil e propõe vários caminhos para pesquisas futuras, desde a estimativa empírica de valores até a adaptação de categorias abstratas a requisitos situacionais.

Palavras-chave: Microcontabilidade; macrocontabilidade; convergência; níveis de agregação.

1. Introduction

The nomenclature of national, public, and financial accounting incorporates a common noun, yet despite this nominal similarity, these disciplines have not fully exploited potential synergies. Notably, accounting, functioning as an analytical instrument, possesses the capability to furnish data at both micro and macro levels. However, microaccounting and macroaccounting have persistently maintained distinct realms (Yu, 1966, p. 8). Recent developments are endeavoring to transcend this schism, seeking to establish interconnectedness across the entirety of the accounting spectrum.

In the macro accounting realm, the System of National Accounts (SNA) explicitly acknowledges interdependence with international accounting standard setters. A salient feature of the 2008 SNA update is its recognition of the escalating adoption of international accounting standards by corporations and the public sector. It explicitly references the International Accounting Standards Board (IASB) and the International Public Sector Accounting Standards Board (IPSASB) norms. Notably, the principles underpinning the International Financial Reporting Standards (IFRS) align predominantly with the principles of the SNA. It is noteworthy that the introduction to the standards emphasizes the precedence of economic substance over legal form (United Nations *et al.*, 2008, 1.70 and 21.61).

In the domain of Public Accounting, the commencement of a transformative trajectory within the traditionally conservative accounting discipline was heralded by the 2001 iteration of the Government Finance Statistics Manual (GFSM) (IMF, 2014) and the International Public Sector Accounting Standards (IPSAS). This manual explicitly acknowledges the intrinsic correlation between the guidelines dictating the reporting of Government Finance Statistics (GFS) and the standards governing accrual-based public sector accounting. Furthermore, the convergence between these elements is substantiated by the acknowledgment that adherence to high-quality accrual accounting standards, exemplified by the IPSAS, facilitates a government's formulation of fiscal statistics in alignment with the GFSM guidelines (IMF, 2014, app. 6.1).

Commencing in the early 1990s, Financial Accounting experienced a revolutionary shift, emphasizing the balance sheet over the income statement and prioritizing fair value over historical cost (Beaver, 1989). The adoption of the measurement approach, rooted in economic science principles, became predominant in Financial Accounting. The widespread integration of International

Financial Reporting Standards (IFRS) introduced the concept of fair value, paving the way for a more comprehensive harmonization approach. The conventional stewardship function of accounting, focusing on past events, yielded to a future flows approach aligning with orthodox economic theory foundations.

The contemporary introduction of novel branches such as Social and Environmental Accounting, coupled with innovative circular economy approaches, presently stimulate synergistic academic research in this domain (Mattesich, 2002, p. XVI).

A plausible future scenario envisions a convergence between micro and macro accounting, bridging the gap between economists and statisticians in the Macro accounting domain and accountants confined to their Micro accounting sphere. This convergence could materialize through a judicious theory of value aggregation, transforming accounting into a descriptive map of economic value. Analogous to cartographic maps offering useful information to travelers, accounting reports should furnish valuable insights at all levels of aggregation. This vision could manifest as a kind of “Google Maps” for economic value, allowing seamless navigation between general and specific scopes with the ability to zoom in or out, consistently linking stocks and flows of economic value across past, present, and future moments and periods.

This paper serves as an initial output of a research process aspiring towards an integrated model of the entire economic system, incorporating contributions from each accounting branch. The pivotal framework is rooted in the measurement approach and extends across all sets. Subsequent to this introduction, the paper encompasses chapters dedicated to research questions, methodology, a concise literature and theory review, detailed development of the proposed model in chapters 4 and 5, an appendix featuring a simulated case, and a discussion of initial results in chapter 6. In chapter 7 the paper includes an analysis of the main consequences of relaxing some assumptions. The conclusive chapter presents the final remarks together with proposals for future research in the field.

2. Objective and methodology

In this phase of the investigation, the primary aim is to formulate an initial integrated set of micro and macro accounting identities designed to systematically organize and describe the dynamics of economic value stocks and flows. This endeavor seeks to establish a cohesive linkage between micro, meso, and macro perspectives through the utilization of the measurement approach. The model under construction is contingent upon a defined set of assumptions, and its structure must encompass the repercussions of relaxing these assumptions.

In terms of methodology, this study endeavors to persist within the paradigm advocated by Dichev and Tang (2008), Dichev (2008 and 2017), and Miller & Bahnson (2010), thereby embracing the challenge of revitalizing interest in

theoretical aspects. The approach put forth proposes a descriptive and abstract model for organizing and delineating information related to economic value stocks and flows, commencing from the micro level and progressing through various aggregation levels via a consolidation process. This methodology aligns with the notion of accounting under ideal conditions (Scott, 2015, p. 27).

During this preliminary phase, it is prudent to constrain the methodological approach to the proposition of logically consistent theoretical frameworks capable of facilitating the connection between micro and macro accounting identities. These models are concerned with analyzing identities that solely describe economic value, as opposed to equations employed to offer explanations for the evolution of value. Theories implicit in equations can be subjected to empirical testing, while descriptive proposals articulated through identities may be discarded due to logical inconsistencies or their lack of utility.

The specific methodology employed in this study to build new identities emanates from an adaptation of the “design-by-analogy” paradigm (Linsey *et al.*, 2012; Verhaegen *et al.*, 2011; Moreno *et al.*, 2014). This method presupposes the existence of a source-domain with an established design-solution for its problem and a target-domain grappling with a problem seeking a design-solution inspired by an analogical process (Jia *et al.*, 2018, p. 33). In this context, the source domain consists of traditional double-entry micro identities that resolve the micro-level connection between economic value stocks and flows. The paper unfolds a typical consolidation process, shaping various meso and macro steps toward the formulation of a comprehensive identity for the global economic system.

3. Literature and theory review

Despite its relatively limited popularity within the realms of accounting and economics, various authors have explored the potential for convergence in accounting as a comprehensive discipline, particularly through the interconnections between Macro and Micro levels (Yu, 1966; Postner, 1988a and b; Mattessich, 2002; Rodríguez Bolívar & Cid Gomes, 2002; Utsunomiya, 2003; Gortes & Shrestha, 2004; Laliberte, 2004; IPSASB, 2014; Dupuis *et al.*, 2006; Author *et al.*, 2013; Hossain, 2017; Cenar and Cenar, 2021; Malay, 2021; Rincón-Soto *et al.*, 2021; Woetzel *et al.*, 2021; Chen and Ogneva, 2021). The delineation of this field’s exact placement within accounting, statistics, or economics remains elusive. However, such categorization is inconsequential as long as the research yields valuable insights.

Within the academic discourse, certain publications delve into the specificities of constructing accounts for individual countries (Lande, 2000). Efforts have also been made to reconcile micro and macro fields, originating either from the macro (Morales, 2012) or the micro level (Nshi, 2017). Nonetheless, a lack of a

universally accepted foundational basis poses a challenge in linking these various accounting branches.

The Macro Accounting System of National Accounts (SNA) currently utilizes a potent tool for transitioning from Macro to Micro levels: the social accounting matrix (SAM) (Lemelin et al, 2013). It is a representation that allows for the inclusion of additional details of special interest. The efficacy of a SAM lies in selecting an appropriate form of disaggregation to investigate the topic of interest (United Nations *et al.*, 2008, 2.164).

A multitude of accounting principles, concepts, and methodologies within macroeconomic statistics are grounded in the domain of public sector accounting. The incorporation of the accrual basis rule in governmental accounting, coupled with the extensive adoption of double-entry bookkeeping practices, has facilitated the convergence between public accounting and traditional microaccounting spheres. The advantages and drawbacks of this integration have been scrutinized by various authors, including SOLGM (2012), Sarmiento (2018), Polzer *et al.* (2019), Ouda (2020), Gómez Villegas *et al.* (2020), and Columbano (2021).

The micro accounting measurement or decision-usefulness approach (Mouck, 1993; Williams & Ravenscroft, 2015) aligns closely with the mainstream of economic science. The measurement school draws inspiration from neoclassical economics, aiming to approach the well-defined values and incomes within a fully developed general equilibrium model. (Demski, 2005, p. 4).

While it could be posited that “under ideal conditions accounting and reporting standards are not needed”, as per Scott (2015, p. 558), the unbiased or ideal conditions model may serve as a foundation for integrating micro and macro accounting. The unbiased model, associated with value accounting, emerges when there is no possibility of internally generated goodwill (IGG) (Stahle & Lampenius, 2011). The Feltham-Olson (FO) model decomposes a firm’s market value into its book value and the present value of discounted expected abnormal earnings (Lundholm, 1995; Russell, 1995; Lo & Lys, 2000). Under active, complete, and efficient markets, the second term equals zero, representing unbiased accounting (Scott, 2015, pp. 223 & 226). This version of the unbiased model demands not only active and complete markets but also efficient markets equating the value of every asset and liability with the present value of their future cash flows. Although an ideal system like this is impractical in the real world, akin to engineering models without friction, unbiased accounting can be regarded as a benchmark for designing a set of identities converging at the macro accounting level.

Despite these strides towards convergence, contemporary challenges persist. Macro accounting grapples with issues in balancing concrete SAMs with real numbers, public accounting faces obstacles in adopting full accrual basis, and

the measurement approach in financial accounting encounters resistance from conservative accounting, particularly since the 2008 market crash.

Nevertheless, social and environmental accounting has emerged as a potential catalyst for integration, often through various designs of value-added statements (Haller & Van Staden, 2014) or by considering new frameworks for integrated micro standards. Achieving coherence between business and macro-level indicators could facilitate a unified approach towards socioecological transformation. While this may not be the primary driving force, it constitutes a crucial element within a broader puzzle encompassing various policy changes (Malay, 2021, p. 3).

4. The proposed model

Considering the methodology described above the preliminary version of the model is described as follows.

4.1. List of symbols and acronyms

AS: Accounting subjects.

BS: Balance sheet.

C: Cash.

CB: Central Bank.

Cpr: Private consumption.

Cpu: Public consumption.

CS: Consolidated statement.

D: Dividends of share`s owners.

ES: External savings.

F: Private firms.

FNA: Foreign net assets.

HH: Households.

Ipr: Private investment.

Ipu: Public Investment.

IS: Internal savings.

ISt: Income statement.

L: Liabilities.

NA: Net assets (obtained from assets – liabilities).

NFPS: Non-financial public sector (financial public sector only includes CB).

NI: Net income.

NW or E: Net wealth or equity (only for the AS whose NW is divided into shares).

PA: Personal assets.

OPA: Other personal assets (cash and foreign net assets non included).

P: Macroeconomic product.

RA: Real assets.

RONA: Rent or return on net assets.

RONApu: Rent or return on net assets only regarding the public sector.

Spr: Private savings.

Spu: Public savings.

Su: Subsidies.

T: Taxes.

(X - M): External current account balance.

Y: Macroeconomic Income. Value identical to macroeconomic product (P).

4.2. Assumptions

The proposal is based on the following assumptions.

4.2.1. Micro accounting identity for each accounting subject

The accounting subject (AS) is assimilated to the issuer of the financial statements. They may be considered atomically or with different levels of aggregation. Together, they must cover the control of the complete economic stocks and flows of the country's economic system. Each consolidation step in the macro direction reduces the number of AS.

There is one micro accounting identity for each AS, that is to say:

$$A - L \equiv E \text{ or NW for every AS from 1 to } n \quad (1)$$

A is Assets; L is Liabilities; E stands for Equity; NW is for Net Wealth; and n is for the number of AS. The model employs E for those AS whose NW is divided into shares held by other AS.

4.2.2. Valuation method. Assets and return on net assets

The valuation method for every AS follows the unbiased model within the measurement approach with the assumption of micro accounting under ideal condi-

tions. Every asset and liability is considered at the present value of their expected future cash flows. Consequently, the only economic flow for periods that constitutes Product (P) is a fixed relative rent⁽²⁾ on the value of net assets (RONA). This rate is supposed, within the model, identical for every AS and Asset. Every factor of production, including labor, is considered within the model as a stock (asset) and as a flow (rent). This valuation method assures that reciprocal personal assets vis-à-vis liabilities or equities have the same stock value at the same moment⁽³⁾.

4.2.3. Assets representing different capitals of the economic system

Assets can be considered in the sense of different categories of capital⁽⁴⁾ of the economic system: financial, manufactured, intellectual, human, social and relationship, and natural (Value Reporting Foundation, 2021, p. 2). As a first significant taxonomy related to law, assets can be divided into one category that allows control of future cash flows based on personal or contracts rights (personal assets -PA-), and a second category based on Real or in rem rights (real assets -RA-).⁽⁵⁾ For the model, assets are divided into:

- Cash (C) is a kind of financial capital (PA). It is assumed as a special kind of liability for the Central Bank.
- Other personal assets (OPA). They include loans, equities, accrued dividends, and, in general, personal rights with associated future cash flows other than cash itself. They are considered financial capital.
- Real Assets (RA) are represented by all assets that generate future cash flows, mostly derived from real rights. It includes manufactured, intellectual, human, social and relationship, and natural capital considered as assets.
- Foreign Net Assets (FNA) represents the net value of nationals' personal rights against foreigners in the model. It could be positive or negative. To simplify the model, they are only held by the Central Bank and they do not yield rents. It includes every stock related to foreigners, so variations in its stock completely reflect the current account balance. It is also considered financial capital (PA).

4.2.4. Liabilities and dividends

Liabilities (L) are financial obligations; dividends (D) are considered completely accrued for the shareholders within the period in which Net Income was registered.

(2) Defined as the retribution to every factor of production.

(3) On possible deviations between SNA and micro accounting fair value valuation methods for loans in practice (Utsunomiya, 2003)

(4) In Sombart's words, capital is equivalent to what private micro accounting calls business assets (Sombart, 1984, p. 143).

(5) An analysis of the possibilities and limits of this ancient distinction between rights in modern times, could be seen in Garrido (2010, pp. 780-781).

4.2.5. Clear surplus

Every change in E or NW is explained through Net Income (NI). The income statement of the period modifies consequently its contents and explains every change for period 1 between moment 0 and moment 1. Thus, the BS on moment 0 will add for moment 1 a term with the NI of period 1 and if it corresponds, a term with D for the period (Assumption 5.2.4.).

4.2.6. General price level

No significant changes in the general price level.

4.2.7. External effects

No significant external effects.

4.2.8. Depreciation of assets

Asset depreciation is supposed to equal zero.

4.2.9. Conservation of value. Value Additivity Principle

Economic Value Additivity Principle (VAP) is assumed for every and each aggregation level:

$$V(A) + \dots + V(Z) \equiv V(A, \dots, Z) \quad (2)$$

$V(A), \dots,$ and $V(Z)$ are the economic values of assets A to Z considering each one as isolated units; and $V(A, \dots, Z)$ is the total value of the whole set of assets considered as a system.⁽⁶⁾

4.2.10. Banking system

It is assumed no commercial banking system to simplify the model. There is only a Central Bank whose shares are entirely in the public sector's hands and owes no RA.

4.2.11. Nonexchange transactions

Public taxes (T) and subsidies (Su) are only related to HH in order to simplify the model.

4.2.12. Consumption

Consumption is only considered for HH and NFPS. It is supposed as a fixed percentage on the RONA of each AS.

(6) For Copeland *et al.*, (2005), against Paugam *et al.* (2018).

4.2.13. Principal macro accounting economic value identities⁽⁷⁾

$$Y \equiv P \equiv C_{pu} + C_{pr} + I_{pu} + I_{pr} + (X-M) \quad (3)$$

$$IS + ES \equiv I_{pu} + I_{pr} \quad (4)$$

$$SP_r - I_{pr} \equiv -(T + RONA_{pu} - Su - C_{pu} - I_{pu}) + (X-M)^{(8)} \quad (5)$$

5. Micro and macro accounting identities of the model

5.1. Private sector

Firms (F):

$$C + OPA + RA - L \equiv E \quad (6) \text{ BS}^{(9)} \text{ assumptions 5.2.1, 3 and 4.}$$

$$RONA - D \equiv NI - D \quad (7) \text{ ISt assump. 5.2.3, 4, 5 and 8.}$$

Households (HH):

$$C + OPA + RA - L \equiv NW \quad (8) \text{ BS assumptions 5.2.1, 3 and 4.}$$

$$RONA - C_{pr} - T + Su \equiv NI \quad (9) \text{ ISt ass. 5.2.3, 4, 5, 8, 11 and 12.}$$

Private sector after consolidation between firms and households:

$$C + OPA + RA - L \equiv E + NW \quad (10) \text{ BS 6 and 8 CS.}$$

$$RONA - C_{pr} - T + Su \equiv NI \quad (11) \text{ ISt7 and 9 CS.}$$

OPA, L and E are only limited to those related to public sector.

5.2. Public sector

Central Bank (CB):

$$FNA + OPA - C \equiv E \quad (12) \text{ BS assumpt. 5.2.1, 3, 4 and 10.}$$

$$RONA - D \equiv NI - D \quad (13) \text{ ISt assumpt. 5.2.3, 4, 5, 8 and 10.}$$

Non-financial Public Sector (NFPS)

$$C + OPA + RA - L \equiv NW \quad (14) \text{ BS assumpt. 5.2.1, 3 and 4.}$$

$$RONA - C_{pu} + T - Su \equiv NI \quad (15) \text{ ISt ass. 5.2.3, 4, 5, 8, 11 and 12.}$$

(7) Cfr. i.a. Mankiw (2019, Chapter 2.1.).

(8) Commonly analyzed as the ex-post identity of deficits and surpluses of the private, public, and external sectors. The rents on public net assets are included as one of the public sector incomes.

(9) Every Balance Sheet in the model is defined for moment 0. Balance sheets for moment 1 must be constructed considering the initial components together with assumption 5.2.5.

Public Sector after consolidation between CB and NFPS:

$$FNA + OPA + RA - L - C \equiv NW \quad (16) \text{ BS 12 and 14 CS.}$$

$$RONA - Cpu - T + Su \equiv NI \quad (17) \text{ ISt 13 and 15 CS.}$$

OPA, C and L are only limited to those related to private sector.

5.3. Consolidated global economic system

$$FNA + RA \equiv NW \quad (18) \text{ BS 10 and 16 CS}$$

$$RONA - Cpu - Cpr \equiv NI \quad (19) \text{ ISt 11 and 17 CS.}$$

5.4. Macro accounting variables obtained from micro accounting data

Besides the macro accounting identities listed in 5.2.13., the model allows conforming the following identities for the whole economic system within the assumptions:

$$Y \equiv P \equiv \sum RONA \text{ for every asset from 1 to n} \quad (21)$$

$$S \equiv NI \quad (22)$$

$$I \equiv RA_1 - RA_0^{(10)} \quad (23)$$

$$ES \equiv FNA_0 - FNA_1 \equiv M - X \quad (24)$$

The Appendix includes a complete simulated numerical case.⁽¹¹⁾

6. Preliminary results

An initial validation of the theoretical feasibility of deriving macro identities through the consolidation of micro identities concerning each economic agent is established. Additionally, the following considerations can be made:

6.1.

At the highest aggregation level in macro accounting, the predominant share of the capital stock is formed by real assets, concomitant with foreign assets. Consequently, at a global aggregation level, the entirety of the world's capital is represented solely by real assets, due to the cancellation of the foreign net assets after the international consolidation process.

6.2.

Macro accounting Income is ascertained within the model by summing the rents on net assets of each economic agent. This approach incorporates the rent from

(10) An economic flow for period 1 is obtained by the difference in the value of stocks in moments 1 and 0.

(11) In the Appendix every identity of the model will include a simulated numeric value and it will be identified by its number of the identity and the letter A for Appendix.

the assets of the public sector into the determination of product, negating the necessity to use public expenditure to determine the public sector's contribution to the national product. The model assumes the measurement approach valuation of every public asset, encompassing all capital categories, although this is presently challenging to achieve. The assumption that public assets, including natural assets, yield returns equivalent to private assets is complex to substantiate but may be relaxed, as discussed in the final chapter. If public assets' rent is allocated to households through free public goods and services, they may be regarded as subsidies within the model. The absence of market prices should be treated similarly to the proposal outlined in Section 7.2 of this paper for external effects.

6.3.

The practical absence of Micro Accounting records for households, a significant hurdle for Macro Accounting, is not circumvented by the proposed model. It presupposes the availability of data, yet, in practice, such data is challenging to obtain.

6.4.

The rents of a firm's assets are attributed to the economic sector to which the shareholder belongs. If the Public Sector possesses shares in private firms, their rent is attributed to the public shareholder. This convention may be altered without compromising the model.

6.5.

The model assumes that Intellectual, Human, Social and Relationship, and Natural Capital can be quantified as stocks and incorporated into the assets of economic agents. However, estimating their value remains considerably challenging in practice.

6.6.

A key advantage of the model lies in its ability to effortlessly cancel every liability and equity with their reciprocal assets in the consolidation process by combining the measurement approach and the VAP assumption (5.2.2. and 5.2.9.). If this equilibrium is not maintained, compensatory entries would be necessary for each cancellation to preserve global identities, as discussed in the final section.

6.7.

The model is conceptualized solely at an abstract level. Numerous practical obstacles hinder its complete realization with available data. Nevertheless, it can be regarded as a potential benchmark for analyzing current practices at both micro and macro levels.

6.8.

The principal micro-macro links derivable from the model, alongside traditional macro accounting identities, include:

6.8.1.

The relationship between macroeconomic Product and the aggregate flow of rents from every production factor obtained through their respective assets, as per each micro identity.

6.8.2.

The connection between the micro consolidated Net Income flow and macroeconomic Savings.

6.8.3.

The identity between variations in the levels of Real Assets from the beginning to the end of the period and the macroeconomic Investment flow.

7. Main consequences arising from the relaxation of certain assumptions

Several instances of assumptions being relaxed and their resulting implications are elucidated in the subsequent sections.

7.1.

Variable relative rents on different assets and accounting subjects (assumption 4.2.2): the model, under the simplifying assumption of a uniform fixed rate of rent for each asset type, could be refined to accommodate diverse rates for distinct capital categories, particularly human, natural, and public capital. However, an in-depth analysis is requisite to comprehend the specific repercussions in each case.

7.2.

Significant external effects (assumption 4.2.7): the acknowledgment and internalization of external effects have long been central concerns in social and environmental accounting (e. g., Mathews and Lockhardt, 2001). Due to the absence of market prices, valuing externalities is challenging, potentially compromising reliability. Environmental economists have devised varied measurement techniques, such as the contingent valuation method, travel cost method, benefits transfer, dose-response models, hedonic pricing models, and choice-modelling. Despite initial discussions regarding the applicability of these non-market valuation techniques in accounting literature, practical experimentation remains limited (Herbohn, 2005). Incorporating externalities necessitates addressing the intricate task of delineating their coherent effects on economic value stocks and flows for each agent, accounting for property rights limits (e. g., Boudreaux & Meiners, 2019; Schäfer, 2019).

7.3.

Asset depreciation (assumption 4.2.8): recognizing asset depreciation could enhance the model's sophistication, resulting in a more intricate structure. However, initial observations indicate no discernible alterations in findings and conclusions.

7.4.

Value additivity principle (assumption 4.2.9): relaxation of the Value Additivity Principle (VAP) allows for the recognition of synergies among accounting objects and subjects (McKeown, 1972; Miller, 1973; Burns, 1987; Paugam *et al.*, 2018). Without the VAP assumption, different market values may arise for the same set through distinct group aggregations in the measurement process. While abandoning VAP captures more real-life aspects, the consolidation process becomes considerably more complex. The value-additivity relationship facilitates various computational operations, enabling the development of valuation relationships for diverse cash flow patterns (Copeland *et al.*, 2005, p. 849). However, without VAP, maintaining the consolidation process becomes challenging as liabilities and equities may exhibit disparate values. Although a compensatory entry could seemingly address the issue, the discussion remains open. Given the centrality of this principle to accounting and finance, its total or partial relaxation necessitates thorough analysis (Hatchuel & Weil, 1995).

7.5.

Introduction of the Commercial Banking System (assumption 4.2.10): the model's refinement by incorporating commercial banking agents, while keeping other assumptions intact, leads to a more complex model. However, preliminary assessments suggest no significant alterations in findings and conclusions.

7.6.

FNA held by accounting subjects different than the Central Bank and yielding rents (assumption 4.2.3.4): it leads to a more complex model but preliminary analysis suggests no significant alterations in finding and conclusions.

8. Final remarks

The research process substantiates the notion that the three aforementioned branches of accounting can derive mutual benefits through the dissemination of their contents and methodologies, facilitating a form of "cross-pollination" (Grodal y Thoma, 2014). This collaborative exchange engenders the potential emergence of innovative solutions for persisting issues. Within this framework, the model presented herein contributes to the comprehension of the macro system by replacing Public Expenditure with the rent of public assets as the variable representing the public contribution to the Macro Product. Additionally, it enhances understanding regarding the true nature of transfers and subsidies among accounting subjects.

A noteworthy contribution of this study involves confirming, within this specific model, through a micro accounting consolidation process, that only real assets (manufactured, intellectual, human, social and relationship, and natural) collectively constitute the concrete capital of human society. The manuscript additionally elucidates the cyclic dynamics of rental (flow) phenomena emanating from diverse assets (stocks), concurrently constituted by the accretion of rental values at each hierarchical aggregation level within the comprehensive model.

This analytical approach may assist educators and students in grasping the inherent nature of the entire accounting discipline from its foundational identities (Nikolova, 2023). Numerous avenues for future research beckon, encompassing not only the formidable empirical undertaking of estimating concrete figures for the variables within the model but also the periodic reassessment of abstract categories to tailor them to specific situational requirements.

Arnold (2009) and various other authors have previously elucidated the connections between micro accounting methods and the timing and duration of macroeconomic crises. This paper only endeavors to reintroduce the discourse on a comprehensive theory, not confined to micro or macro accounting but embracing Accounting as a unified discipline, harmonized with economic theory.

The model presented constitutes an initial attempt open to diverse rearrangements, relaxation, or modification of assumptions, all aimed at narrowing the disparity between macro and micro accounting. A broader perspective is emerging through the social and environmental branch, considering the societal implications of accounting practices. Accounting must evolve beyond the pursuit of objective measurement to integrate with the subjective well-being of individuals and society, as advocated by Stiglitz *et al.* (2009). The field will also need to reconcile the provision of quantitative information within double-entry systems with single-entry data, alongside purely qualitative information. These challenges might be more effectively addressed through a holistic approach to the entirety of the accounting discipline.

It is evident that this analysis is in its nascent developmental stage. For the purpose of integration, each accounting branch must compromise some of its distinct identity to establish agreement on general principles. While not an uncomplicated task, the potential rewards justify its pursuit.

9. Appendix: simulated case

9.1. Supposed data for the case

Rent on assets 10% for every asset per period. Consumption: considered only for households and non-financial public sector as 70% of accrued rents of the period.

Concept	Stock Moment 0	Flow of the period	Stock Moment 1
Loans ⁽¹¹⁾ from F to NFPS	150		170
Loans from F to HH	50		50
Loans from HH to F	70		70
Loans from CB to F	10		10
Loans from NFPS to F	20		20
Cash in F	50		50
Real Assets in F	300		325
Equity F	450		450
Equity F HH Shareholders	350		350
Equity F NFPS Shareholder	100		100
Cash in HH	30		65
Real Assets in HH	500		489,7
Loans from HH to NFPS	130		130
Loans from NFPS to HH	40		75
Taxes		350	
Subsidies		345	
FNA in CB	120		90
Loans from CB to NFPS	100		188
Equity CB	130		130
Cash in NFPS	20		30
Real Assets in NFPS	1800		1896,9

9.2. Results ⁽¹²⁾

9.2.1. Private sector

Firms

At moment 0, OPA is composed by 50 of Households` liabilities and 150 Public Sector`s liabilities. L is composed by 70 Households` creditors and 30 by Public Sector`s creditors.

$$C + OPA + RA - L \equiv E$$

$$50 + 200 + 300 - 100 \equiv 450 \quad (6A) \text{ BS Moment } t = 0$$

RONA is calculated on Net Assets for the ISt.

$$RONA - D \equiv NI - D \quad (7A) \text{ ISt Period 1.}$$

$$0,10 \cdot 450 - 45 \equiv 45 - 45$$

At moment 1, OPA is composed by 50 of Households` liabilities and 170 Public Sector`s liabilities. L is composed by 70 Households` creditors and 30 by Public Sector`s creditors. Besides the dividends owned to the shareholders are considered 35 pertaining to Households and 10 to Non-Financial Public Sector)

$$C + OPA + RA - L \equiv E + NI - D \quad (6A) \text{ BS Moment } t = 1$$

$$50 + 220 + 325 - (100 + 45) \equiv 450 + 45 - 45 \quad \text{Ass. 5.2.5.}$$

Households

At moment 0, OPA is composed by 350 of equities, 70 Firm`s liabilities and 130 Public Sector`s liabilities. L is composed by 50 Firms` creditors and 40 by Public Sector`s creditors.

$$C + OPA + RA - L \equiv NW \quad (8A) \text{ BS Moment } t = 0$$

$$30 + 550 + 500 - 90 \equiv 990$$

RONA is calculated on Net Assets and Cpr on RONA, for the Ist.

$$RONA - Cpr - T + Su \equiv NI \quad (9A) \text{ Ist Period 1.}$$

$$0,10 \cdot 990 - 69,3 - 350 + 345 \equiv 24,7$$

At moment 1, OPA is composed by 350 of equities, 35 of dividends (assumption 5.2.5.), 70 Firm`s liabilities and 130 Public Sector`s liabilities. L is composed by 50 Firms` creditors and 75 by Public Sector`s creditors.

$$C + OPA + RA - L \equiv NW + NI \quad (8A) \text{ BS Mom. } t = 1 \text{ Ass. 5.2.5.}$$

$$65 + 585 + 489,7 - 125 \equiv 990 + 24,7$$

9.2.2. Consolidated private sector

At moment 0 C is the addition of F and HH cash. OPA is composed by Public Sector`s liabilities owned by F and HH. RA adds the amounts of both F and HH. L includes only liabilities of F and HH with the Public Sector.

$$C + OPA + RA - L \equiv E + NW \quad (10A) \text{ BS Moment } t = 0$$

$$80 + 280 + 800 - 70 \equiv 100 + 990$$

RONA is calculated on Net Assets owned by the Private Sector (assumption 5.2.4. on dividends), and Cpr on RONA, for the Ist.

$$RONA - Cpr - T + Su \equiv NI \quad (11A) \text{ Ist Period 1.}$$

$$0,10 \cdot 990 - 69,3 - 350 + 345 \equiv 24,7$$

At moment 1 C is the addition of F and HH cash. OPA is composed by Public Sector`s liabilities owned by F and HH. RA adds the amounts owned both by F and HH. L includes only liabilities of F and HH with the Public Sector, considering 10 for the NFPS dividends.

$$C + OPA + RA - L \equiv E + NW + NI \quad (10A) \text{ BS}$$

$$115 + 300 + 814,7 - 115 \equiv 100 + 990 + 24,7 \equiv 1114,7 \quad t=1 \text{ Ass. 5.2.5.}$$

9.2.3. Public sector

Central Bank

At moment 0, OPA is composed by 10 Firm`s and 100 Public Sector`s liabilities.

$$FNA + OPA - C \equiv E \quad (12A) \text{ BS Moment } t = 0$$

$$120 + 110 - 100 \equiv 130$$

RONA is calculated on Net Assets for the Ist.

$$RONA - D \equiv NI - D \quad (13A) \text{ Ist Period 1.}$$

$$0,10 \cdot 130 - 13 \equiv 13 - 13$$

At moment 1, OPA is composed by 10 Firm`s liabilities and 188 Public Sector`s liabilities. C constitute a special liability integrated by the total amount of cash outside the Central Bank.

$$FNA + OPA - C - D \equiv E + NI - D \quad (12A) \text{ BS Mom. } t = 1 \text{ Ass. 5.2.5.}$$

$$90 + 198 - 145 - 13 \equiv 130 + 13 - 13$$

9.2.4. Non-financial public sector

At moment 0, OPA is composed by 100 of equities of private firms, 20 Firms` liabilities, 40 Households` liabilities, and 130 of the Central Bank equity. L is composed 150 firms` loans, 130 households` loans and 100 Central Bank`s credits

$$C + OPA + RA - L \equiv NW \quad (14A) \text{ BS Moment } t = 0$$

$$20 + 290 + 1800 - 380 \equiv 1730$$

RONA is calculated on Net Assets and Cpu on RONA, for the Ist.

$$RONA - Cpu + T - Su \equiv NI \quad (15A) \text{ Ist Period 1.}$$

$$0,10 \cdot 1730 - 121,1 + 350 - 345 \equiv 56,9$$

At moment 1, OPA is composed by 110 of private equities and its dividends, 20 Firms` liabilities, 75 Households` liabilities, 143 of the Central Bank equity and dividends (assumption 5.2.5.). L is composed 170 firms` loans, 130 households` loans and 188 Central Bank`s loans.

$$C + OPA + RA - L \equiv NW + NI \quad (14A) \text{ BS Moment } t = 1 \text{ Ass.}$$

$$30 + 348 + 1896,9 - 488 \equiv 1730 + 56,9 \quad 5.2.5.$$

9.2.5. Consolidated public sector

At moment 0 C is the amount in hands of the Private Sector. OPA is composed by Public Sector`s liabilities owned by F and HH and the E shares in hands of

NFPS. RA adds the amounts of both F and HH. L includes only liabilities with the Private Sector.

$$FNA + OPA + RA - L - C \equiv NW \quad (16A) \text{ BS Moment } t = 0$$

$$120 + 170 + 1800 - 280 - 80 \equiv 1730$$

RONA is calculated on Net Assets owned by the Public Sector (assumption 5.2.4. on dividends), and Cpu on RONA, for the ISt.

$$RONA - Cpu + T - Su \equiv NI \quad (17A) \text{ ISt Period 1.}$$

$$0,10 \cdot 1730 - 121,1 + 350 - 345 \equiv 56,9$$

At moment 1 C is the amount in hands of the Private Sector. OPA is composed by Private Sector`s liabilities and equity plus its dividends owned by the Public Sector. RA adds the amounts owned both by CB and NFPS. L includes only liabilities of CB and NFPS with the Private Sector.

$$FNA + OPA + RA - L - C \equiv NW + NI \quad (16A) \text{ BS}$$

$$90 + 215 + 1896,9 - 300 - 115 \equiv 1730 + 56,9 \equiv 1786,9 \quad t=1As \text{ 5.2.5.}$$

9.2.6. Global Economic System

At moment 0 FNA is the total amount in hands of the Central Bank (assumption 5.2.3.4.). RA adds the amounts of both consolidated Private and Public Sectors.

$$FNA + RA \equiv NW \quad (18A) \text{ BS Moment } t = 0$$

$$120 + 2600 \equiv 990 + 1730$$

RONA is calculated on the country`s assets, and Cpu and Cpr on RONA, for the ISt.

$$RONA - Cpu - Cpr \equiv NI \quad (19A) \text{ ISt Period 1.}$$

$$0,10 \cdot 2720 - 121,1 - 69,3 \equiv 81,6$$

At moment 1 FNA is the total amount in hands of the Central Bank (assumption 5.2.3.4.). RA adds the amounts of both consolidated Private and Public Sectors.

$$FNA + RA \equiv NW + NI \quad (18A) \text{ BS Mom. } t = 1 \text{ Ass.}$$

$$90 + 2711,6 \equiv 990 + 1730 + 81,6 \quad 5.2.5.$$

(11) The word "Loan" is generically applied to every financial instrument that entitles the lender to claim future cash flows from the borrower.

(12) Every identity will be related with the model described in the paper with its number and the letter A standing for Appendix. Besides it will include the moment or period of time related to the identity.

9.2.7. Macroeconomic identities

$$P \equiv Cpu + Cpr + Ipu + Ipr + (X - M)$$

$$272 \equiv 121,1 + 69,3 + 96,9 + 14,7 + (-30) \quad (3A)$$

$$IS+ ES \equiv Ipu + Ipr$$

$$81,6 + 30 \equiv 96,9 + 14,7 \quad (4A)$$

$$Spr - Ipr \equiv - (T + RONAp_u - Su - Cpu - Ipu) + (X - M)$$

$$(24,7 - 14,7) \equiv -(350 + 173 - 345 - 121,1 - 96,9) - 30 \quad (5A)$$

Table 1. Stock macro accounting variables obtained

Stock macro accounting variable	Moment 0	Moment 1	Micro-foundation
Foreign net assets	120	90	CB Micro Account.
Real assets	2600	2711,60	Addition of the RA of every micro accounting subject

Table 2. Flow macroeconomic variables obtained

Flow macro accounting variable	Flow of the period	Micro-foundation
Product and Income	272	(990*0,1 + 1730*0,1) Fixed relative rent on RA. (21A)
External savings	30	(120 - 90) Variation in the stock of FNA. It is also obtained by M - X. (24A)
Private consumption	69,3	(99*0,7) 70% of Private Sector RONA.
Public consumption	121,1	(173*0,7) 70% of Public Sector RONA.
Private savings	24,7	24,7 Private Sector Micro Acc. Net Income
Public savings	56,9	56,9 Public Sector Micro Acc. Net Income
Savings	81,6	81,6 Total Micro Acc. Net Income. (22A)
Public investment	96,9	(1.896,9 - 1.800) Stock change of Public RA.
Private investment	14,7	(814,7 - 800) Stock change of Private RA.
Investment	111,6	(2711,60 - 2.600) Stock change of total RA. (23A)

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