Integrating SAMs and SFMs—
Theory, Praxis, and Cases

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Abstract:

The purpose of this paper is to demonstrate how the Social Accounting Matrix (SAM) and the Social Fabric Matrix (SFM) can be integrated. The paper begins with a comparative look at the theoretical and methodological underpinnings of the two approaches. Then the paper describes in comparative terms again how researchers actually construct both an SAM and and SFM. This section also describes how researchers from either approach can benefit from the other approach. The final section of the paper utilizes previously published research utilizing both approaches separately, and describes how a researcher utilizing the SAM might reconstruct or otherwise utilize the published SFM research, and vice versa.

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1. Introduction

2. Theory

2.1 SAMs—Theoretical Foundations

Social accounting matrices (SAMs) were developed by Nobel Prize winner Sir Richard Stone to document national income and product accounts in a way that highlights the interdependence among the various 'sectors' (producers, markets, households, and institutions) in economic systems (Stone, 1986). SAMs have been prepared for dozens of countries around the world. They are used for multiplier analyses (e.g., Defourney and Thorbecke, 1984; Roberts, 1998) or as a basis for computable general equilibrium models (e.g. Isard et al., 1999; Kilkenny, 1995) to analyze issues ranging from ozone pollution to agricultural trade.

For a good primer on SAMs, see Pyatt and Round (1985). Briefly, social accounting matrix construction is quite similar to double-entry bookkeeping. The difference is that *left* and *right* columns representing receipts and expenditures in double-entry accounts are displayed as *rows* and *columns* in the square SAM matrix. An element of the matrix represents the transaction between two accounts, by convention, *to* i *from* j. The sum across row entries is total incomings or receipts, and the sum of column entries is total outgoings or expenditures.

Despite the long held convictions that a matrix format would be the most desirable presentation of government accounts to facilitate interregional comparisons (Burkhead, 1964; Bennet, 1980), few multi-region, multi-jurisdiction, fiscal SAMs (Kilkenny & Failde, 1998 and Nota, 2008). The vast majority of SAMs are of single national entities. There are fewer SAMs that disaggregate government, public sector accounts, and taxes. We know of one for Mexico by Pleskovic and Trevini (1985), one for Swaziland by Pyatt and Round (1985) and one for the state of Iowa by Kilkenny and Failde (1998).

Advantages of SAM framework: The SAM accounting framework offers many advantages for fiscal accounting. One is that transactions need be *recorded only once*. What is incoming to account i is outgoing from account j. A second advantage is that all accounts can be *reconciled simultaneously*. The balance between income and expenditure in an account is the account's row sum minus its column sum. A SAM is "*balanced*" when all row-column sums equal zero simultaneously. A third advantage is that by imposing SAM balance on the available data, we can *solve for missing data* about interactions between accounts[3]. Even though agencies keep accounts in different ways according to their differing needs, using a SAM we can reconcile the potentially different reports. The fourth advantage is that *direct and indirect interactions are easily distinguished* in SAMs. Direct interaction between i and j is shown by SAM element a_{ij} (or a_{ji}). An indirect interaction is shown by using an intermediary account, e.g., *k*, and two entries a_{ik} and a_{kj}.[4] By the same token, an

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[3] The various methods of balancing a SAM are described in detail under section 4.

[4] The intermediary account, *k*, can be called a "pooling" account (Stone, 1961). In this case, incomings from any number of accounts are summed, and outgoings to the jth account are not identical to the incoming from only the ith account.

interregional flow can be directly articulated or indirectly articulated. A fifth advantage of the SAM format is that it very efficiently displays all interactions in a consistent manner, which greatly *facilitates comparisons* across accounts or sets of accounts.

Uses of SAMs in I/O Research: Given the complete accounting of monetary flows in region, there are many uses for regional social accounting matrices. Three possible uses are: descriptive analysis; tax analysis; and CGE modeling.

1. Descriptive Analysis: The most basic analysis that can be done is descriptive. Identifying the flow of dollars through an economy is an important step in understanding the structure of the local economy. Though industrial production and consumption is important, non-industrial dollar flows can also be a large part of local economic activity.

2. Tax Analysis: The impact on taxes from changes in economic activity can be modeled. Income information can be combined with SAM tax information to make estimates of the taxes generated by change in final demand. The simple ratio estimate, but it will give a good first estimate of the tax effects. The same can be done with business tax. Taxes are paid out of labor income and limit disposable income. Tax policies can be examined with regard to individual tax burdens on different income groups. A SAM allows the researcher to examine the actual magnitude of taxes and transfer payments. Using a SAM with a spreadsheet program such as Excel or Locus allows you to analyze the impact effects on taxes.

3. Computable General Equilibrium Modeling: Local level SAM data from IMPLAN models can be used for regional CGE modeling. Production and consumption function forms and elasticities must be added to the IMPLAN SAM data to build a CGE model. Basically a SAM is a database for CGE.

2.2 SFMs—Theoretical Foundations

The challenge for social scientists in undertaking research that is relevant for policy purposes is to provide results using methods that are consistent with the particular social context. The SFM methodology is a rigorous *way to go about thinking* about a particular problem or issue, from which useful information and efficient solutions can be obtained, that also by its structure requires the researcher to embed analysis in the socio-technological-ecological context. As Hayden explains,

> The purpose of the SFM is to provide an analytical tool that will integrate diverse scientific literature and diverse kinds of data bases. In this way it is possible to describe a system and identify knowledge gaps in the system for future research; evaluate policies, opportunities, and crises within the system; and create a data base for future monitoring. [Hayden 1993b, 307-308]

The SFM's is primarily founded on systems theory and instrumentalist philosophy, with substantial reference to Institutional Economic (hereafter, Institutionalism, or OIE for "Original Institutional Economics") theory in both cases.

Regarding instrumentalist philosophy and its relationship to the SFM, Hayden (2006, chapter 3) lists three conceptual pillars for applying it in the policy sciences: the transactional approach to science, a problem-centered approach to science, and judging actions by their consequences. Hayden writes, "'trans' means across, and the emphasis is on the reality that there are numerous rules, regulatory criteria, enforcement agencies, laws, institutions, and beliefs across any relationship or transaction; numerous overlapping forces guide the agents and their actions" (25). Research in a transactional context begins with determination of what information is to be learned and which questions are to be answered. That is, "the solution [to the question of what part of a theory or real-world system to study] is to define the context of inquiry by the problem to be solved" (ibid.); if the problem to be investigated is not defined, "there is no indication of where to start, go, or stop the policy research" (29). The problem-based approach in a transactional context is also a natural fit with OIE, whose founders long ago recognized the non-equilibrium, evolutionary nature of real-world capitalism. Thorstein Veblen, John Commons, Karl Polanyi, and Clarence Ayres, for instance, all made significant contributions to current understanding of the legal, sociological, and technological foundations of economic systems. Veblen's purpose in distinguishing between ceremonial and technological processes was evaluation of "what is bad and deleterious and what is good and efficient" (Hayden 1982, 640). As all Institutionalists know, Veblen saw technological processes as related to problem solving, while Ayres considered that all institutional processes, including social uses of technology, ought to be judged within the context of the entire system, which led Ayres to incorporate John Dewey's philosophy of instrumentalism (640).

For Dewey, the act of creating knowledge was a normative, purposeful activity. Furthermore, we can speak of research guided by the interests (and, perhaps most importantly, money provided by) governments, corporations, or religions, while the conceptual framework of the culture and society will guide the scientific community (Hayden 1995, 380). Therefore, as Marc Tool has written,

> Value premises permeate the whole of social inquiry. If inquiry is purposive—and it must be—it is value laden. Inquiry necessarily requires a continuing and successive exercise in the making of choices. To choose among or between items compels recourse to a criterion on the basis of which such choices can be made. Value assumptions, premises, criteria, are involved in our perception of what is a proper object of inquiry.
>
> The normative permeation of inquiry does not end, obviously, with the setting of the initial question of "why" or "how come," the choosing of the object of inquiry. Value theory guides in identifying the problem to which inquiry is addressed. It is reflected in the selection of means and methodologies of inquiry. Normative notions help generate the hypotheses that guide inquiry. (1986, 57)

As research, methods, and models are guided by normative concerns,

> The inferences drawn from analytic disclosures, the formulation of feasible options of correction as institutional adjustments, the choice among available institutional options, and an assessment of the options implemented (appraisal of consequences), *all* compel recourse to social value theory. (57)

The instrumentalist approach thus emphasizes the normative, embedded *process* of research and its influence on experience, the relationship of knowing to the purpose of solving problems, and the need for solutions to evolve with changing and evolving contexts. Research and policies are instrumentally efficient when they move society in the direction of "resolution of a problematic situation resulting in a reconstructed experience or consummation."

Finally, as instrumentalism is an evaluative approach based upon problems in a transactional context, policies should be judged by their consequences: "the purpose of policy analysis is to discover the consequences of particular actions, and to formulate policy so as to secure some consequences and avoid others" (Hayden 2006, 29). *Criteria* used in evaluation are necessarily normative since problems and the nature of inquiry are normative in nature as well. Instrumentalist philosophy thus points to normative, social criteria as *standards of judgment*. Hayden (1982) suggests three sources of normative criteria for instrumental evaluation of consequences, drawing upon the work of Institutionalists Karl Polanyi, Walter Neale, and Marc Tool. Polanyi's (1957) concept of *sufficiency* was necessary to evaluate consequences (Hayden 2006, chapter 9). When a given process is insufficient for a desirable system to be sustained, the process is not instrumentally efficient. Significantly, sufficiency may not be consistent with "optimization" of deliveries. Tool (1979) claims that *participatory democracy* provides a swift feedback to policies and proposed solutions since affected groups or social interests are able to voice concerns. The increased speed of instrumental valuation of policies enables better refinement and application of normative criteria (Hayden 2006, chapter 3). Finally, Neale argues that "a requirement for social processes is that they be *legitimate*" (1980, 393; emphasis in original):

> Legitimacy requires a social moral consensus on norms with regard to the *consequences* of social policy and with regard to the *procedures* which produce those consequences. Therefore, policy analysis for structuring social processes cannot be fruitful unless the social criteria guiding the policy analysis are fair and just. If there is not a social consensus on these criteria, then the resulting policy will be inconsistent with the social consensus. (Neale, cited in Hayden 1982, 643)

Turning now to systems theory, in designing effective policy solutions, there is a clear need to bring to bear the most current and up-to-date knowledge created by experts in the relevant, diverse fields. Systems theory originated in the natural sciences and has been central to the emerging chaos theory, complex-adaptive systems theory, or self-organizing systems theory literatures. Ludwig von Bertalanffy, one of the most important originators of systems theory, similarly noted that the "concepts and principles of systems theory are not limited to material systems, but can be applied to any [whole] consisting of interacting [components]" (quoted in Greene 1991, 234). Kenyon De Greene agreed that "we can speak of a *transportation system, an urban system, a health services system, an anti-crime and violence system,* etc." (De Greene 1973, 4; emphasis in original).

Within the economics literature, consideration of a systems-oriented approach is central in the work of several of the founders of OIE. Thorstein Veblen's dichotomy between ceremonial and technological aspects of society emphasized the need to examine interrelationships and conflict from a perspective incorporating both social customs and technical evolution. Karl Polanyi (1957) argued that social systems are instituted processes in which human institutions, technology, and the ecology interact with one another. John

R. Commons (1955) founded his analysis of the workings of capitalism on analysis of the codification of social beliefs, customs, and norms into laws and regulations. Each suggested that an appropriate approach to analysis of economic problems embedded economic analysis within an examination of the social fabric relevant to these problems.

The most fundamental point of emphasis within systems methodology is a *holistic*, or "top-down" approach, which "has been viewed by scientists and practitioners as a revolutionary departure from earlier mechanistic, reductionist thinking . . . [and] . . . represent[s] a major shift or global reorientation in scientific thinking" (De Greene 1991, 228). Reductionist thinking is the analysis of individual parts in isolation from the whole, and the whole is then seen as the sum of its parts, or isomorphic. And while systems analysts will also investigate parts of a system, in contrast to reductionist methods, systems theorists disaggregate the system into subsystems without engaging in reductionism by recognizing that "(a) each of the fractions, in isolation, is capable of being completely understood, and most important, that (b) *any* property of the original system can be reconstructed from the relevant properties of the fractional subsystems" (Hayden 2006, 54).

By taking a holistic approach to analysis, systems analysts have recognized several characteristics of real-world systems (Hayden 2006, chapter 4):

1. Real-world systems exhibit *interdependence* and *openness*: Systems theory is concerned with parts of a system with respect to their relationship to the whole, positing that parts of a system do not act in isolation. In human societies, behaviors influence and are influenced by value systems, government regulations, technologies, societal structures, and so forth. Indeed, it is the interaction and evolution of the components of the system that is under investigation in the systems approach. Real world systems are also *open systems*, having a context within and interdependence with other systems outside themselves.

2. Real-world systems, as all complex systems are *non-equilibrium* systems, but at the same time exhibit the potentials of *self-governance* and *homeostasis*. That is, rather than short-run, static or stable equilibrium or becoming motionless, the concern within the system is with maintenance of certain system structures and properties of their processes within which evolution and sustainability may coexist. Complex systems can respond to changes in the environment in achieving goals, and thus may exhibit some *equifinality* in that certain outcomes can be achieved from a number of different points of origination and along a variety of different paths. They also exhibit *control* and *self-regulation* mechanisms. Social systems are continuously influenced in their evolution by the influence of evolving technological standards and requirements and have beliefs, rules, regulations, and requirements that influence the performance of the system (Hayden 2009a). Finally, Swaney (1987) explains that ecological systems provide constraints and rules for themselves and for the interaction of ecosystems with socio-technical systems.

3. Complex systems typically have *hierarchical arrangements* that can come in many forms. Flows of physical materials and/or information integrate levels of existing system hierarchies and reinforce relations among the system components.

4. Always present in real-world systems is some form of *feedback*, namely *positive* feedback in critical developments. Positive feedback reinforces growth or encourages decay in systems (De Greene 1973, 22); it is "fundamental to all growth processes in both living and non-living systems. . . . [including] . . . fire, organisms, knowledge, capital, fads and fashions, mob violence, and political bandwagons" (22). Negative feedback may sometimes be associated with "self-regulation and goal directions" and can be seen in "oscillations, fluctuations, and periodicities" associated with efforts to restore levels consistent with system sustainability (22).

5. *Sequenced deliveries and flows*, or action-reaction sequences among agents, may integrate hierarchical levels and reinforce interdependent/overlapping components, feedback, and control mechanisms within the system. As sequenced flows, systems exist in *real* or *historical time*, where the flows and deliveries are the actual "clock" for the system that must remain coordinated for the sustainability of the system's functioning.

6. Complex systems exhibit *differentiation* and *elaboration*, evolving and becoming more complex; parts of social systems and ecosystems become more specialized in their roles. Such activities may enable a system to avoid entropy and preserve the character of the system through growth or they may ultimately change qualitatively the functioning of the system. Differentiation and elaboration implies that the future products or outcomes of system processes are truly uncertain, path-dependent and *non-ergodic* (Arthur 1988, Davidson 1996), since the past record may not be a mirror of the future behavior. More complex combinations within systems produce more possible outcomes.

The systems approach thus emphasizes examination of real-world systems through a holistic "lens" while recognizing the, interdependent, homeostatic/self-sustaining potentials of real-world systems. During examination, research focuses upon describing and modeling system structures, processes, orbits, attractors or sustainability thresholds, the paths that the system follows to achieve its outcomes, system control mechanisms, hierarchical arrangements, positive and negative feedback, sequenced flows, and characteristics contributing to differentiation and elaboration, all in an attempt to understand, predict, and generate suggestions for future use by actors, regulators, and policymakers within the system.

Overall, to ensure that the approach of the scientist is consistent with the goal of creating research relevant for understanding, evaluating, and designing policies for real world economic systems, "tools" of analysis must be developed. As Hayden puts it, researchers "can only operationalize a perspective through tools of analysis, and the tools must exist before the analysis can proceed" (1982, 638).

> The focus of the SFM is to provide a means to assist in the integration of diverse fields of scientific knowledge, utilize diverse kinds of information in order to describe a system, identify knowledge gaps in a system for future research, analyze crises and opportunities within a system, evaluate policies and programs, and create social indicators for future monitoring. (Hayden 2006, 73)

The SFM approach by design requires that the researcher take an analytical perspective that is “holistic and transactional” (218) such that inescapable *a priori* value judgments of the SFM’s design are consistent with the design of an integrated framework for the purpose of bringing holistic, systems-oriented theory and research into the policy arena in an organized and effective manner (Hayden 1993, 307). It is thereby part of the researcher’s tool kit that can provide rigor and “operationalize a perspective” in order that “analysis can proceed” and consequently produce relevant and instrumentally-useful information.

3. Praxis

3.1 Building a Social Accounting Matrix

A description of a SAM: A social accounting matrix (SAM) constitutes a “circular flow of income around the familiar macro-economic loop of demands on activities, leading to demands for factors, hence to the incomes of institutions, and from there back to demands on activities” (Pyatt and Round 1985, 9). The SAM as a technique illustrates that the distribution of employment and income opportunities and hence a society’s living standard is “inextricably interwoven with the structure of production and the distribution of resources” (2).

A social accounting matrix is primarily concerned with the organization of information about the economic as well as the social structure of a country or region in a particular year. The provision of this statistical base also enables a country to develop economic models through which policy analysis and decisions can be made. A schematic illustration of a basic SAM is presented in Figure 1. A SAM is a square matrix with rows and columns. Rows represent income/receipts while columns cater for expenditure/payments.

Besides analyzing the interrelationships/interdependence of various accounts as indicated in Figure 1, a SAM views the aggregate economy as a complex interaction of interdependent activities, since outputs of one activity form part of the raw materials/inputs of the other (Pyatt and Round, 1985). In the matrix the rows are aggregated according to commodity, activity, factor, household, institution and government, capital and rest of the world receipts or incomes while along the columns expenditures of the same accounts are represented.

Total income from each account, say commodities or factors, must equal total expenditure for the same account. Specifically, row totals for each account must equal column totals for that account. Government, as distinct from an administrative activity, can be separated from institutions and be made an account on its own in conformity with macro-economic theory. In this scenario, government spends on its current and capital accounts and also receives tax revenues and transfers abroad.

Figure 1 under activities (across row 1), illustrates that receipts or income are gained from sales on the domestic market, exports and government subsidies, the row total gives the aggregate value of production. Activity expenditure (column 1) covers the purchase of intermediate inputs, payment of factors and remitting taxes to government. The total column total for activities represents as aggregate expenditure.

Payments made by the commodity account for goods domestically produced by activities are also known as the make matrix. The column total for commodities represents domestic supply. Both the use/absorption and make matrices are central to the conventional Leontief input-output tables or inter-industry interactions. Input and output tables are made up of commodity and activity accounts only (Sadoulet and de Janvry 1995, p.285). As a result, the income and expenditure relations in the economy with institutions, government and international transactions are not captured in input and output accounts/tables. In order to capture the full impact of external policy impact on the economy as illustrated in (Basic SAM structure), government and the rest of the world, are included in the conventional input-output accounts (Francois and Reinert 1997, 96). In fact, input-output tables or accounts are a subset of a SAM.

Each of the accounts in Figure 1 can be disaggregated into sub-accounts. Further, when the SAM multiplier analysis is to be undertaken, it is necessary to determine which accounts are endogenous and which are exogenous. Endogenous accounts comprise those that can be influenced within the system or those whose level of expenditure is directly influenced by changes in income, while exogenous accounts constitute those whose expenditures are independent of the changes in income (Sadoulet and de Janvry 1995, 288).

Construction a SAM:

i) Choose a level of spatial aggregation (urban and rural etc)
ii) Choose a sector aggregation (Agriculture, Mining, Gaming, Trade, etc)
iii) Local government accounts (county, city, school district, other)
iv) Separate tax accounts (property tax, sales and use tax, etc)

Methods of Balancing a SAM: This section presents various methods of balancing a Social Accounting Matrix. Almost always when a social accounting matrix is created from raw data, the columns (receipts) do not equal the rows (expenditures). However, this balance is crucial if any analysis is to be done using the SAM. Various methods of balancing a SAM have been devised, and among them are the entropy method, method of least squares, linear program by minimizing the norm L1 of the adjustments, and linear program by minimizing the norm L infinite adjustments.

Entropy Method: Given the original square SAM (S) from raw data which is made of several elements: $a_{i,j}$ with $i=1.........48$ (in rows) and $j=1..........48$ (in columns). Each element $a_{i,j}$ consists of a transfer from account j to an account i. The final SAM $\left(\hat{S}\right)$ is regarded as the matrix estimated by the method of entropy. This final SAM is also composed of various elements: $\hat{a}_{i,j}$ with $i=1.........48$ (in rows) and $j=1..........48$ (in columns). Here 48 is an arbitrary number chosen.

The objective of the entropy method is to estimate a new matrix whose principle of balance (equity) between the rows and the columns is checked. This balance can be expressed mathematically as follows:

$$\sum_{i=1}^{48}\hat{a}_{i,j}=\sum_{j=1}^{48}\hat{a}_{i,j} \qquad [1]$$

That is, the sum of rows equals the sum of columns in the final SAM $\left(\hat{S}\right)$.

The entropy method entails minimizing the objective function of the entropy between and $\left(\hat{S}\right)$ subject to the constraint of the equation of the equity principle. This entropy minimization problem can easily be expressed as following:

$$\min \quad z_1 = \sum_{i=1}^{48}\sum_{j=1}^{48} a_{i,j}\left[\log\left(\frac{\hat{a}_{i,j}}{a_{i,j}}\right) - 1\right]$$

[2]

$$s.t. \quad \sum_{i=1}^{48}\hat{a}_{i,j} = \sum_{j=1}^{48}\hat{a}_{i,j}$$

Method of Least Squares: In the same vein as its use in regression analysis, the principle of least squares is to minimize the sum of squared errors. In this context, $a_{i,j}$ and $\hat{a}_{i,j}$ are the initial and estimated SAM values. This method minimizes the sum of squares subject to the equation of principle of preceding equality. This minimization problem can be expressed as following:

$$\min \quad z_2 = \sum_{i=1}^{48}\sum_{j=1}^{48} a_{i,j}^{\ 2}\left[\left(\frac{\hat{a}_{i,j}}{a_{i,j}}\right) - 1\right]^2$$

[3]

$$s.t. \quad \sum_{i=1}^{48}\hat{a}_{i,j} = \sum_{j=1}^{48}\hat{a}_{i,j}$$

Method of Linear Program by Minimizing the L1 of the Adjustments: This method involved adding two types of elements:

$d^{+}_{i,j}$: the element which defines the positive difference between $a_{i,j}$ and $\hat{a}_{i,j}$

With: $d^{+}_{i,j} = \max[(a_{i,j} - \hat{a}_{i,j}),0]$

$d^{-}_{i,j}$: the element which defines the negative difference between $a_{i,j}$ and $\hat{a}_{i,j}$

With: $d^{-}_{i,j} = \max[-(a_{i,j} - \hat{a}_{i,j}),0]$

This method imposes two constraints when minimizing the sum of these preceding elements:

(i) The equation of the principle of equity ($\sum_{i=1}^{48}\hat{a}_{i,j} = \sum_{j=1}^{48}\hat{a}_{i,j}$)

(ii) The equation of equality enters the difference between $d^{+}_{i,j}$ and $d^{-}_{i,j}$ and the difference between $a_{i,j}$ and $\hat{a}_{i,j}$

Mathematically:

$$\min \quad z_{i,j} = d^{+}_{i,j} + d^{-}_{i,j}$$

$$s.t \quad \sum_{i=1}^{48} \hat{a}_{i,j} = \sum_{j=1}^{48} \hat{a}_{i,j} \qquad [4]$$

$$d^{+}_{i,j} - d^{-}_{i,j} = a_{i,j} - \hat{a}_{i,j}$$

Method of Linear Program by Minimizing the Norm L Infinite of the Adjustments: This method is different from the previous method only on the level of the objective function. It is expressed as following:

$$\min \quad z_{i,j} = \sum_{i=1}^{48} \sum_{j=1}^{48} \left[(d^{+}_{i,j} + d^{-}_{i,j}) / a_{i,j} \right]$$

$$s.t \quad \sum_{i=1}^{48} \hat{a}_{i,j} = \sum_{j=1}^{48} \hat{a}_{i,j} \qquad [5]$$

$$d^{+}_{i,j} - d^{-}_{i,j} = a_{i,j} - \hat{a}_{i,j}$$

All these different methods were tried and the method that yielded the most efficient results was the entropy method. After multiple iterations of the model given constraints for some cells to be zero[5], we will have the final balanced fiscal SAM.

The entropy method minimizes the difference between the rows and columns of the SAM and this generates missing values that were not available in the raw data. Since the numbers from the raw data sometimes vary depending on the source, during balancing they were allowed to change. However, these changes were strictly monitored to make sure they did not deviate strongly from the available raw data.

[5] Numbers are not expected in some cells since no tractions between those particular entities exist in the real world. For example, diagonal cells and expenditures from education and human services to the state and federal government.

Deriving Fiscal SAM Multipliers: By imposing some assumptions on the way in which the values in the fiscal SAM are generated, one can derive further insights into the strength, structure and distribution of linkages within and across regions. Whilst the fiscal SAM can be used to parameterize a wide range of different models, this section describes the simplest form of SAM-based model by applying the assumption of fixed prices and Leontief technology and behavior.

A multiplier is the cumulative sum of the endogenous effects. It is inversely related to the exogenous portion of the local activity. In order to compute the SAM multiplier, we need to define some relevant matrices. First, let Y be the vector of total activity levels (in value terms) in the multi-region economy, and S denote a normalized transaction coefficient matrix, including both intra- and inter-regional sub-matrices of the SAM (derived by dividing the elements in the SAM by the column total in which they occur), and X a column vector showing flows from the endogenous accounts to the exogenous accounts. Given that S is parametric; any change in X is accommodated by a corresponding change in Y. The assumption that S is parametric is that the average expenditure propensities elicited from the SAM equal the marginal propensities of each account. The other assumption that total activity (Y) can passively accommodate a change in X relies on another assumption that factor supplies are perfectly elastic. Both assumptions are based on the long-run assumption that all pieces (and wages) ultimately remain the same. (Otherwise, a change n relative prices could mean that coefficients change, or, an increase in factor demand simply drives up local factor prices than expand output). We can express the total activity matrix as $Y = SY + X$

From these matrices one can solve for Y as follows:

$$Y = (I - S)^{-1} X \qquad [6]$$

Where the term $(I - S)^{-1} = M$ known as the multiplier matrix.

Therefore we can express equation 6 as $Y = MX$.

The multiplier matrix shows the cumulative effect on all activities of a given change in exogenous accounts. In particular, the elements of a particular column of the multiplier matrix show the dollar effects of a dollar change in the exogenous part, on each activity. In the case of an inter-regional fiscal SAM model, the multiplier matrix M captures a whole range of relationships in the system. Not only do they take into account the effect of relationships within sub-regions, but also interdependencies between sub-regions stemming from inter-regional flows[6].

For multiplier analysis using a SAM, the first task is to distinguish endogenous from exogenous accounts. This critical choice is called macro-closure, and should relate to the objective question (Adelman and Robinson 1986; Thorbecke 1994). The resulting multiplier is sensitive to the closure choice. With respect to sub-state regions, the most important determinant of the multipliers are the shares of regional spending outside the region.

Under a state/sub-state analysis of fiscal federalism, the part of final demand that originate outside the state/region can reasonably be assumed exogenous. Labor income earned by out of state/region commuters, and part of the state/local government, agency, or program revenues coming from the federal government are assumed exogenous with

[6] Because the multiplier from the inter-regional fiscal SAM captures both intra- and inter-regional relationships, it is useful to decompose the aggregate matrix, M, to elicit the relative importance of various different types of linkages and interdependencies that exist. This decomposition will be done later in this section.

respect to any change in local activity. Employee compensation, proprietary income, and returns to land are endogenous.

After making the macro-close decision, the next step in the fiscal SAM multiplier analysis is to calculate the multiplier matrix. The matrix S (derived by dividing the elements in the SAM by the column total in which they occur), as explained above is parametric and this implies that each account will continue to allocate constant proportions of its totals across the activities regardless of exogenous shocks. With respect to government accounts, this is equivalent to assuming that the underlying preferences over public expenditure alternatives are represented by a Cobb-Douglas (fixed share) function (Adelman and Robinson 1986).

The last step in constructing the multiplier is to subtract the coefficient matrix (S) from the identity matrix (I), (I-S). Finally, the infinite sum of the effects of changes in X on Y is given by the inverse of that net matrix, which gives us the multiplier matrix: $M = (I - S)^{-1}$.

The multiplier matrix (S) can be calculated for the two region fiscal SAM. The elements in a specific column account of the multiplier matrix show the effects on the row region and institutions of a dollar change in exogenous activity (federal government expenditure) in the column account. Thus, the column coefficients show the backward linkages of a region or sector. A specific account row shows how that account is affected by dollar changes in the column accounts, or, the forward linkages of the sector or region account.

Given the inter-regional nature of the fiscal SAM, the resulting multiplier matrix (M) is an aggregate of account relationships within a sub-region, and dependencies between sub-regions or regions stemming from inter-regional flows. It is thus useful to decompose the aggregate matrix, M, to elicit the relative importance of various different types of leakages and interdependencies that exist. The explanations of multiplier decomposition offered here are based on the methods suggested by Round (1985) and Pyatt and Round (1979).

First, to examine the nature and importance of inter-regional linkages, the inter-regional SAM can be expressed analytically in partitioned form as follows:

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} S_{11} & \hat{s}_{12} \\ \hat{s}_{21} & S_{22} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} + \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \qquad [7]$$

where subscript 1 and 2 relate to either urban or rural region, and ^ is a diagonal sub-region matrix.

Maintaining the assumption that each sub matrix S_{ii} and s_{ij} has constant elements, one can derive multipliers from the system, this time separating out the effects that arise within and between regions.

From equation (7),

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} S_{11} & 0 \\ 0 & S_{22} \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} + \begin{bmatrix} 0 & \hat{s}_{12} \\ \hat{s}_{21} & 0 \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} + \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \qquad [8]$$

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} (I - S_{11})^{-1} & 0 \\ 0 & (I - S_{22})^{-1} \end{bmatrix} \left\{ \begin{bmatrix} 0 & \hat{s}_{12} \\ \hat{s}_{21} & 0 \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} + \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \right\} \quad [9]$$

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} 0 & (I - S_{11})^{-1} \hat{s}_{12} \\ (I - S_{22})^{-1} \hat{s}_{21} & 0 \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} + \begin{bmatrix} (I - S_{11})^{-1} & 0 \\ 0 & (I - S_{22})^{-1} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \quad [10]$$

Defining $A_{ij} = (I - S_{ii})^{-1} s_{ij}$, then

$$\begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix} = \begin{bmatrix} I & -A_{11} \\ -A_{22} & I \end{bmatrix} \begin{bmatrix} (I - S_{11})^{-1} & 0 \\ 0 & (I - S_{22})^{-1} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \quad [11]$$

Or

$$Y = M_{rz} M_{r1} X \quad [12]$$

M_{rz} in equation (12) contains inter-regional multipliers, capturing the repercussions of spatial flows between the accounts in one region and those in the other. In contrast, M_{r1} captures the intra-regional multiplier effects, multipliers that arise from linkages between accounts in each separate sub-region of the system.

3.2 Building a Social Fabric Matrix

As mentioned in the previous section, the SFM methodology begins with the defining of a problem for study or inquiry. This enables the researcher to define the scope of the study and thereby identify which system components are important and which ones are not. Research thus begins not with the building of a model, but through determination of what information is to be learned and which questions are to be answered. Then construction of the SFM occurs through a process of consulting and interacting with documents and agents from the real-world system under consideration.

In the process of researching the problem and its context, the researcher constructs a list of components relevant to the system and the problem under consideration. This requires the researcher to organize the system's parts or components using the SFM taxonomy of six component categories: cultural values, social beliefs, personal attitudes, natural environment, technology, and social institutions (Hayden 2006, 76-85). The categories are drawn from interdisciplinary scholarship in both the social and natural sciences (Hayden 1993, 308) and "by tracing the evolution of the [OIE] paradigm" (Hayden 1982, 638). There is also a taxonomy of possible deliveries among the six categories, shown in Figure 2, derived from anthropology, social psychology, institutional economics, and natural resource-based literatures (Hayden 2006, 75).

The system's components are listed in the SFM as in a standard input-output matrix (though deliveries within an input-output matrix would typically make up only a small percentage of those in a SFM), such as the sample SFM in Figure 3. The system's values, beliefs, institutions, and so on—the components—are listed in the first column of the matrix (one for each row); these are then duplicated in the top row (one for each column) of the matrix. The components in the first column, listed vertically, are "delivering entries"; those listed in the first row, horizontally, are "receiving entries." As the entries in the first column have been repeated in the first row, the list of receiving entries duplicates the list of receiving entries, meaning that receiving entries may be deliverers, and vice versa. "What is immediately found with respect to any problem is that many of the separately listed components affect each other" (Hayden 2006, 88). For this reason, the same list of components is listed for matrix rows as are listed across the columns, which means that "a row component can be followed horizontally across the matrix to discover the direct columns to which it makes deliveries based upon research available" (88).

The purpose of illustrating deliveries and receipts within the SFM is twofold:

> One principle is that *flow levels* are needed to fully describe societal and environmental processes. The flows of goods, services, information, and people through the network both structure and maintain community relationships. For example, the flow of investment to particular kinds of cultivation technology will determine the level of organic matter in the soil. (Hayden 1993, 312; emphasis in original)

> The other principle . . . is that real-world systems depend on *delivery* among the component parts. Systems deliver bads and disservices as well as goods and services. Natural environments deliver nitrogen-fixing bacteria as well as floods. Factories deliver output as well as pollution. The continuity of a system depends on delivery among components according to social rules and natural principles. For example, income must be delivered to households for the continuance of the economic system, and organic residue and amino acids must be delivered to ammonia-producing bacteria for the continuance of the nitrogen cycle. Problems are created in systems when the delivery among the components is inconsistent with the maintenance of the system. (Hayden 1993, 312; emphasis in original)

The underlying implication is that the process of delivering and receiving is ongoing and the analysis is of a system in motion (Hayden 1989, 37).

Because the SFM is designed to "express the attributes of the parts as well as the integrated process of the whole," its design encourages the researcher "to discover [component parts] and delivery linkages not yet recognized" (Hayden 1993, 312). As the researcher refers to his/her understanding of the system and notes in the SFM where deliveries are occurring,

> the SFM becomes a tool to aid thinking and organize research. As researchers is conducted cell-by-cell across each row, linkages among components and elements will be discovered that otherwise would have been overlooked. This process helps to discover research gaps, identified as particular matrix cells for which there is inadequate information. Furthermore, the process of completing the research for the matrix will job researchers' memories of additional components to be added to the original list. They can quickly be inserted as new row and column entries and their deliveries noted in the cells. (Hayden 2006, 88)

Gill similarly notes the importance of the *process* of designing the matrix in aiding and developing the researcher's understanding of the system and problem under considerations: "The final configuration of the matrix is less important than the process underlying its construction. Through building the matrix, the analyst will derive relevant insights into the cause of the problem under investigation" (173).

It cannot be emphasized enough that during each step of constructing a SFM—listing components, determining where there are deliveries, determining the nature of the deliveries—the researcher is always consulting and interacting with documents and agents from the real-world system under consideration. For instance, Hayden and Bolduc (2000) developed an SFM describing costs and operations of a low-level radioactive waste site that would serve five different states in the following manner:

> The analysis is based on a great deal of personal experience by the authors with the actors and institutions of the network. In addition, numerous primary documents have been consulted. They include the main contracts and agreements, the invoices and accounting systems, meeting minutes, the legal opinions and court decisions, legislative bills, considerable correspondence, the U.S. Security and Exchange Commission (SEC) 10-K reports of the primary corporations, and the Safety Analysis Report (SAR) which is the name given to a multiple volume application submitted for a license to build and operate the CIC radioactive waste facility.

Once again, Gill (1996, 173) gets at the heart of the matter: "the final product should reflect the thinking of the system's constituency, not just that of the analyst."

It is customary, within the cells where a delivery is occurring between two components, to enter a "1" into that cell. If no delivery is occurring, either nothing or a "0" is entered. The character of the deliveries between components denoted in the cells is dependent upon the problem and resulting characteristics of the system under investigation. The SFM is a non-common denominator process matrix, as Hayden has frequently noted:

> For example, it can handle energy, pollution, and dollars as well as water, steel, and belief criteria. . . . All the information in the rows and columns [therefore] are not summative ([contrary to] an input-output matrix). (Hayden 1989, 39)

The information needed for each cell depends upon the context of the delivery and the problem being studied, but the following should be considered: What is delivered? What is the size or magnitude of the delivery? What is the relative importance of the delivery? Geographic location of delivery? Time of delivery? Appropriate rule for delivery? An accompanying discussion, spreadsheet data, or some other explanation of deliveries is common practice. The description of deliveries provides a database of system specific information; beyond using this information for understanding the system, it ultimately can also aid the development of social indicators for use in instrumental evaluation of the system's outcomes against goals and other criteria.

Having designed a SFM, explained the various deliveries within the system, and developed an overall understanding of both the context and details related to the problem, the researcher then has a number of further SFM-related "tools" that can be employed:

1. Normative Systems Analysis: Hayden (2009a) describes qualitative analysis of the normative details of a social system. The goal is to further detail and thereby understand the purposive actions of actors in a system that contribute to how it achieves its goals and sustains itself. In doing so, Hayden presents a taxonomy utilizing the terms rules, regulations, and requirements, which is inspired by normative philosophy and deontic logic. The result is further elaboration of the component categories, particularly those related to social beliefs and social belief criteria. Normative systems analysis explicitly incorporates the normative process by which institutions articulate prohibitions, obligations and permissions such that major norms ultimately guide or at least significantly influence institutional action.

The framework might be summarized as follows: primary normative or social belief criteria give rise to policy goals, standards, and so forth. To carry out the process and achieve the desired normative ends, the appropriate rules, regulations, and requirements are articulated and implemented. Figure 4 illustrates the relationships between major norms, institutional authorities, and processing institutions as described in Hayden (2009a). From the figure, the sub-criteria are delivered to the higher institutional authorities as standards for rules, which frequently appear in legislation and are written to both embody and be consistent with the primary criteria. Lower authorizing institutions design regulations that appeal to rules as reasons for their existence and which attempt to control, govern, or otherwise shape the behavior of processing institutions in a manner consistent with rules by setting down various requirements. Requirements require responses by processing institutions to situations in order to fulfill the regulations.

Institutional actions occur within the context of rules, regulations, and requirements and are thus normative in that "working rules" that dictate prohibitions, obligations, and permissions are in place and ultimately derive from the primary belief criteria. The dotted lines in Figure 4 correspond to the indirect influence of major norms on the actions of lower institutional authorities and processing institutions via the design and implementation of rules, regulations, and requirements. The articulation of major norms into rules, regulations, and requirements generally provides prohibitions and obligations that result in behaviors inconsistent with some other belief criteria. As Hayden (2009a) points out, when such conflicts are significant, the negative consequences for the entire system can be significant. Fullwiler (2009) shows that such conflict is present in the U. S. Federal Reserve System, for example, particularly with respect to norms related to stabilization of the payments system at times being in conflict with norms related to preferences for leaving settlement and control of payments systems to private financial institutions and clearinghouses.

Overall, understanding the goal-oriented, *normative* character of a system is imperative since it is through such characteristics that the *facts* of the system are "created" or come into being. As Hayden (2009a, 106) puts it, norms "determine the patterns of institutional activity that give institutions correlative capability and statistical regularity." And while neoclassical economists increasingly combine more sophisticated econometrics with exceptionally thin institutional analysis, the former is clearly not much use without the latter.

2. Time and Timeliness: Hayden defines systems as "flows of sequenced deliveries" for which an SFM is an illustration. In order to properly understand how the deliveries are *sequenced* and how to undertake successful planning, time must be properly understood. *Time* is "not a natural phenomenon; rather it is a societal construct. What exists in society are duration clocks and coordination clocks selected by society, and the sequencing of events as scheduled by societal patterns" (Hayden 2006, 146). Real time, or system time, refers to the sequential events of a system, rather than to clock time. In real time, "the system determines the measurement instrument. . . . Real time is defined in a system context that takes account of the appearance, duration, passage, and succession of events as they are interrelated within a system" (Hayden 1987, 1306). In other words, the sequential deliveries themselves are the "clock" with which to measure time in modern sociotechnical processes.

Real-world processes have several characteristics consistent with a real time perspective. Processes within a system occur at different temporal rates; for example, the very slow pace of the U.S. Court's or Congress's decisions with regard to the function of markets compared to the much more rapid pace of market transactions themselves (Hayden 2006, 180). Real world systems are *polychronic* in that events occur simultaneously (175-178). Succession and evolution in real world systems, common in both the social sciences and the natural sciences, create alternating as well as new time and durational relationships (180-181). Real world processes are non-equilibrium systems since stability is not maintained through achievement of a "point of rest" but rather through maintenance of sufficient levels of sequenced flows (179). In real-world systems there is no duality of dynamic change and stability; since processes are evolutionary in nature, both dynamic change (including influences of legislative, court, or regulatory decisions) and "control are necessary to maintain stability and the re-creation of processes" (179).

Researchers, planners, and policymakers want to be able to effect instrumentally efficient outcomes from a system. In other words, because "policies determine which species are to exist, which children are to go hungry, how soon the ozone cover will be depleted, how high the incidence of cancer will be, how high the flow of income and investment will be, and so forth," Hayden argues, "the task goes beyond simple coordinating processes; the task is to determine them. With this recognition, we step beyond real time to social time through which societal decision making determines [. . .] timeliness" (2006, 182).

Hayden (170-171) suggests detailed mapping of processes and system deliveries in order to enable analysis of systems operating in real time. *Digraphs*, for instance, can be made to illustrate different temporal rates, *polychronicity*, non-equilibrium characteristics, succession, evolution, and dynamic stability, which are all characteristic of real time processes. In the attempt to achieve timeliness, the design of SFMs and digraphs "that will permit policy analysts to computerize the databases that describe processes, to model socioecological collectives, to determine the thresholds of deliveries, to monitor change, to allow for real-time order and response, and to conduct network evaluation" becomes an important tool of analysis (185). Fullwiler (2003) considered timeliness in the U. S. Federal Reserve's daily operations, noting that the latter had three different "types" of time to remain aware of at all times—daily, maintenance period, and seasonal "event sequences." From this understanding, Fullwiler was able to demonstrate that (1) the Fed's operations are most fundamentally about stabilizing the payments system, (2) there is no liquidity effect in the Federal Reserve's operations related to changes in the target rate, and (3) direct control over the monetary base is not possible (absent interest on reserve balances being paid at the target rate (Fullwiler 2005)).

3. Boolean Mathematics: The customary use of zeroes and ones in the SFM's cells enables Boolean algebra matrix manipulations of the SFM (Hayden 1989, 2006). The SFM itself is a form of adjacency matrix, which shows the one-step connections between parts of a network (Hage and Harary 1983). A short list of other Boolean-algebra-based matrix manipulations (as explained in Hage and Harary (1983)), includes the limited reachability matrix (which shows whether or not each component can be reached from each other component across a pre-specified number of deliveries (or *n*-steps) through other components), the reachability matrix (which shows how many *n*-step connections there are for each pair of component in the matrix), the distance matrix (which indicates for each component of the matrix the smallest possible number of steps across other components taken to reach from one component to another) and measures of centrality (which estimate the control of flows by one or more components of a system (Freeman 1979, Bonacich 1987)) and were applied using the SFM by Hayden and Stevenson (1995).

4. System Dynamics: The approach taken in system dynamics simulations, like that taken in the SFM, is holistic, systems oriented in nature. Of particular interest within the system dynamics literature is the modeling of the consequences of positive and negative *feedback loops* in a system which are the sources of non-linear and self-correcting behavior in real world systems. Feedback patterns in a system can be explicitly revealed through design of the SFM and subsequent digraph transformation of the SFM (Gill 1996, Radzicki 2009). As Gill writes,

> The social fabric matrix is a powerful process through which an investigator might develop insights into the nature of system functionality. As a qualitative modeling procedure, the emphasis is on the development of insights shared with actual system actors. The social fabric matrix may be regarded as a systematic learning process. If some subsequent quantitative investigation is required, revealed system insights may be directly translated into a formal sytem dynamics model for further exploration. The two procedures are highly compatible, in both conceptual and applied terms. (1996, 175-176)

Further, through construction of a SFM and through real-time descriptions and digraphs of the sequenced deliveries, minimum and maximum *thresholds* for system stability maintenance can be sought (Hayden 1987, 1989, 2006). System Dynamics simulations offer researchers the ability to simulate how different flows would affect the ability to maintain stability or how they might even affect the conditions required for stability. In the future, understanding how parts of a system and system evolution affect system stability thresholds and the ability of the system to remain within the threshold boundaries might constitute determining whether a given delivery was "big" or not; such analysis is a natural context for the integration of SFM and system dynamics methodologies.

5. Social Indicators: Once a system is detailed through the SFM, a researcher can determine which indicators ought to be gathered from the real world in order to assess the consequences of a particular policy according to instrumental criteria. Social indicators are at once both the culmination and the beginning of the policy research process. Because "facts" are never value-free, one must choose the right values with which to generate facts. It is first necessary to design social indicators consistent with the goals of policy, the latter having been derived from social beliefs and cultural values (Hayden 2006, chapter 5). Second, the outcomes of a particular process that are measured by social indicators are assessed for their consistency with values, beliefs, and policy goals. Third, models or frameworks used for understanding the real-world process must be consistent with policy goals and indicators used to understand consequences of policies. When measurements indicate that consequences do not conform to values, beliefs, and resulting goals, or models, the process begins anew: policies may be altered, laws may be changed, and alterations to models are made (or at least should be) as a result in order to generate indicators of the new policies. Fullwiler and Allen (2007), for example, show that neoclassical macroeconomic models of the inflation process—including those generally in use at the Federal Reserve—are inconsistent with actual real-world measures of aggregate prices such as the Consumer Price Index or the Personal Consumption Expenditure Price Index (that is, the social indicators in use).

6. "Meta" Framework: Hayden (2006, ch. 10) shows that the SFM approach has a central role within a comprehensive, or "meta" framework for policy making and policy research. Gray and Gill (2009) show that this framework has the characteristics necessary—systems-theory based, transdisciplinary, instrumentally-based, and so forth—for solving real-world "wicked problems" that are either now or are expected to be in the future facing real-world socio-technological-ecological systems.

4. Cases

This section looks at two different cases—K-12 education finance at the local level and U. S. Treasury debt operations—to demonstrate how the SAM and SFM approaches can be complementary. These particular examples were selected because (1) in both cases, there is already some research published from both SAM and SFM perspectives, and (2) they demonstrate SAM and SFM applications to monetary transactions in both microeconomic and macroeconomic contexts.

4.1 State and Local Level K-12 Education Financing

Hayden (2009b) presents an SFM that articulates a state system of financial aid for public schools. The analysis contained therein developed or otherwise uncovered formulae for the distribution of funds to local public schools. Some of the central issues in developing this formula include equity, ability to pay, adequacy, need, willingness to pay taxes, geographical sparcity, tax burdens, the political power to acquire more money for an area, and so forth.

Approaching the issue of equity in a framework that could be incorporated in a SAM:

i) *Fiscal Capacity:* total taxes that could be collected from an area if the maximum legal tax rate is used. Most taxes on local levels are expressed as ranges (e.g 3-5% property tax). Local governments can then choose any number within the required range. The fiscal capacity of governments depends on a variety of factors including industrial capacity, natural resource wealth and personal incomes. When governments develop their fiscal policy, determining fiscal capacity is an important step. Identifying fiscal capacity gives governments a good idea of the different programs and services that they will be able to provide to their citizens. It also helps governments determine the tax rate necessary to provide a certain level of programs. The theory behind fiscal capacity can also be used by other groups, such as school districts, who need to determine what they will be able to provide to their students.

ii) *Fiscal Effort:* The amount of revenue collected by a government, often shown as a percent of the fiscal capacity. This value creates an estimate of the total amount the government could collect in revenue. The amount that a government collects in revenue, mainly taxes, is dependent on several factors. This includes the tax rates for individuals and businesses, and the tax breaks and exemptions offered to the population. The fiscal effort is also determined by the government's ability to enforce tax laws and collect the taxes.

The distinction between fiscal capacity and fiscal effort is critical especially in relation to the policies regarding the funding of public schools. Education being a public good sometimes requires different jurisdictions to share burden (costs). If one region is not raising enough revenue to meet its basic public goods needs (education), when should other regions help or share the burden? When should revenues be pooled from different jurisdictions and get reallocated based on need?

In our analysis we suggest that equity should imply that a region can only get help from other regions if it is clear that they are exerting enough effort to reach their full capacity. Otherwise, some regions will choose lower tax rates then the states reallocate more revenues to them, taking advantage of those regions that tax at rates close or right at their fiscal capacity. This could be expressed in a SAM framework as shown in Nota (2008) and in Figure 5. Assume two local regions (urban and rural counties), and a state. Urban and rural households and firms pay taxes to the state, and then the state redistributes these taxes based on need. In this instance, our version of equity implies that the state should allow rr > RR if and only if the rural fiscal effort is as close to rural fiscal capacity as possible. Otherwise most people will sense the inequality and vote with their feet by moving from urban to rural regions.

The information presented in the SFM by Hayden could be used to construct a SAM. Just like SFM construction, SAM construction is dependent of the research question on hand. To that end, a number of decisions have to be before constructing a SAM. These decisions include choosing the level of spatial aggregation (urban, rural, etc), level of sector aggregation, local government accounts (county, city, school districts, other), and choosing number of separate tax accounts (property tax, sales and use tax, etc).

i) Choosing level of spatial aggregation

In the SFM, although it includes a local school district account, it does not provide levels of spatial aggregation used in the analysis. However, it does include accounts such as remoteness factor, Indian land factor, and transportation allowance. We can use these factors to determine the accurate level of spatial aggregation in a SAM. The three factors could be used in a cluster analysis to determine level of aggregation such as urban counties, rural counties and Indian land counties.

ii) Choosing sector aggregation

In general SAM construction, industry sectors might need to be divided and sometimes aggregated in a way that sheds more light to the research question on hand. The SFM on Nebraska state aid for local K-12 public school system does not articulate specific industry sectors; therefore in the SAM we will use the highest level of industry aggregation (activities and commodities).

iii) Local institutions and government accounts

One of the main accounts that are present in both SAMs and SFMs are those for institutions. In the case of Nebraska state aid for K-12, the author included a number of authority institutions. In the SAM we will only include those that actually carry out monetary transactions (local K-12 public school systems, State Department of Education, State Department of Revenue). To these institutions we will add local government accounts such as city, and county, and finally households.

iv) Separate tax accounts

The financing of public goods such as public education is done mainly through taxation. Therefore, in both SAMs and SFMs that knowledge of what taxes are levied and how much they pay plays a pivotal role. Hayden includes a number of taxes in his SFM (property tax, income tax and local tax). Figure 6 shows a list of selected taxes and what they fund; this information can be derived from the SFM matrix and be used in constructing the SAM. In Figure 6 we can tell that property tax, sales tax, and gaming taxes are crucial for local K-12 public schools and therefore should be included as separate accounts in a SAM that addresses the financing of these local schools.

Transforming an SFM into a SAM: The SFM show relationships between different entities both qualitative and quantitative. In most cases the SFM is showing the rules, regulations and social beliefs. The SAM only shows the financial transactions that transpire between the included accounts. Figure 7 shows how entries in a SFM will be presented in a SAM framework. The accounts used in Figure 7 come from the authority institutions listed in Hayden (2009b). In figure 4, the shaded accounts are the ones notes in a SFM to highlight the inter-relations between accounts.

For instance “A” denote the rules and regulations that may bound the department of education and local K-12 school districts in a SFM. The same account in a SAM will show the department of education’s expenditures on local K-12. The SAM will also include the account “a” showing expenditures of schools districts on the department of education. This might be the fees collected by local K-12 school districts that is sent to the department of education and then later be redistributed back to school districts. Account "B" in a SFM shows that there is a relationship between the school districts and collected property tax. The same account in a SAM represents the amount of property tax spent on school districts. In addition, the SAM will also include account "a" which shows the amount of property tax contributed by school districts.

Policy Questions that could be answered by a SAM and not SFM: Once a complete SAM with all the accounts discussed above is created and balanced as explained in the Praxis section above, multipliers (also discussed in the Praxis section) could be derived from the SAM. These multipliers will be used to answer questions such as what would happen to state aid funding of public goods if say legal system (an authority account in SFM) decides to raise or lower taxes such as property or sales tax.

4.2 Treasury Debt Operations

Fullwiler (2009) presents an analysis of operations of the Federal Reserve (hereafter, the Fed) using the SFM and, in particular, the normative systems analysis also in use in the previous case's discussion of public school financing. This case is focused upon a subset of operations involving the Fed—the debt operations of the U. S. Treasury (hereafter, the Treasury). Figure 8 presents a simplified version of Fullwiler's SFM of the Fed's operations (Figure 1 on page 125 in Fullwiler 2009) showing only the institutions relevant for the Treasury's debt operations and two core technologies of the monetary system.

The integration of the SAM approach with the SFM in Figure 8 relies substantially on the two technologies listed there—double-entry accounting and payment clearing and settlement. As any Institutionalist knows, the transaction was the core unit of analysis for John R. Commons. The emphasis here on double-entry accounting (T1 in Figure 8) is not unrelated—every transaction in a capitalist economy affects the financial statements of those involved. If the transaction is of utmost importance, then understanding how that transaction is represented on the financial statements of the transactors is similarly key to analysis. Within the SFM framework, double-entry accounting is a technology of modern capitalism—it is a tool the both influences and is influenced by actions, rules, regulations, and requirements of social institutions. The technology of payment clearing and settlement (T2) is similarly at the core of any analysis of the monetary system, namely clearing and settlement of wholesale payments such as in money markets and transactions among banks, dealers, the Federal Reserve, and the Treasury. As with double-entry accounting, payment clearing and settlement technologies influence and are influenced by rules, regulations, requirements, and actions of social institutions. In particular with regard to Treasury debt operations, is necessary to understand that (1) Treasury auctions settle on the book-entry system of Fedwire, the Fed's real-time gross settlement system, and (2) Fedwire transactions are only settled by transfers from the senders' reserve accounts with the Fed. For more details on wholesale payment settlement, see Fullwiler (2006, 2009).

Figure 8 also shows the hierarchy of the institutions involved in the Treasury's debt operations for purposes of a normative systems analysis. As in the Congress and President are shown as the system's only higher institutional authority (IA-1) articulating major norms into rules (legislation). The Fed is one lower institutional authority—its own existence a result of an act of Congress and the President (i.e., the Federal Reserve Act)—

that is authorized by rules to issue regulations and requirements to processing institutions (banks and primary dealers in particular in this case). The Treasury is also a lower institutional authority that similarly sets out requirements for banks and primary dealers related to its own spending, revenue, and debt issuance operations, which it is authorized to issue given the rules provided by acts of Congress and the President.

The Treasury's debt operations occur within the context of timing of its own spending (as determined in budgets set by Congress and the President) and revenues. The Federal Reserve Act currently specifies that the Fed can only purchase obligations of the Treasury in "the open market" (though this has not always been the case). This necessitates that the Treasury have a positive balance in its account at the Fed (which, as set in the Federal Reserve Act, is the fiscal agent for the Treasury and holds the Treasury's balances as a liability on its balance sheet). Therefore, prior to spending, the Treasury must replenish its own account at the Fed either via balances collected from tax (and other) revenues or debt issuance.

Further, given that the Treasury's primary account is a liability for the Fed, flows to/from this account affect the quantity of reserve balances. Consequently, the Treasury's debt operations are also inseparable from the Fed's monetary policy operations for setting its target rate. More specifically, flows to/from the Treasury's account must be offset by other changes to the Fed's balance sheet if they are not consistent with the quantity of reserve balances required for the Fed to achieve its target rate on a given day. As such, the Treasury uses transfers to and from thousands of private bank deposit (both demand and time) accounts—usually called tax and loan accounts—for this purpose (Garbade 2004). Prior to fall 2008, the Treasury would attempt to maintain its end-of-day account balance at the Fed at $5 around billion on most days, using "calls" from tax and loan accounts from its account at the Fed and "adds" to them from the same account to achieve this.

In other words, *timeliness* in the Treasury's debt operations requires consistency with both the Treasury's management of its own spending/revenue time sequences and the time sequences related to the Fed's management of its interest rate target. As such, under normal, "pre-Lehman" conditions for the Fed's operations in which the target rate was set above the remuneration rate to banks for reserve balances in their reserve accounts (set at zero prior to fall 2008), there were six financial transactions required for the Treasury to engage in deficit spending. Since it is clear that these "post-Lehman" conditions for the Fed's operations (in which the target rate is set at the remuneration rate) are intended to be temporary and at some point there is a desired (by Fed policy makers) return to the more "normal" "pre-Lehman" conditions, these six transactions are the base case analyzed here (the "post-Lehman" conditions are discussed for comparison purposes afterword, though they do not significantly impact conclusions reached).

The six transactions for Treasury debt operations for the purpose of deficit spending in the base case conditions are the following:

A. The Fed undertakes repurchase agreement operations with primary dealers (in which the Fed purchases Treasury securities from primary dealers with a promise to buy it back on a specific date) to ensure sufficient reserve balances are circulating for settlement of the Treasury's auction (which will debit reserve balances in bank accounts as the Treasury's account is credited) while also achieving the Fed's target rate. It is well-known that settlement of Treasury auctions are "high payment flow days" that necessitate a larger quantity of balances circulating than other days (Fullwiler 2003, 2009). The transaction is represented in Figure 8 by the "1" in IA2-1 to IP-2, though the "1" here corresponds to other relationships as well, including various requirements primary dealers must meet before they can actually become primary dealers; similarly, throughout the discussion of the rest of the six transactions, a "1" in Figure 8 often refers to multiple relationships including the transaction itself.

B. The Treasury's auction settles as Treasury securities are exchanged for reserve balances (IP-2 to IA2-2), bank reserve accounts are debited to credit the Treasury's account (IP-1 to IA2-2), and dealer accounts at banks are debited (IP-1 to IP-2).

C. The Treasury adds balances credited to its account from the auction settlement to tax and loan accounts (IA2-2 to IP-1). This credits the reserve accounts of the banks holding the credited tax and loan accounts (IA2-1 to IP-1).

D. (Transactions D and E are interchangeable; that is, in practice, transaction E might occur before transaction D.) The Fed's repurchase agreement is reversed, or, otherwise stated, the second leg of the repurchase agreement occurs in which a primary dealer purchases Treasury securities back from the Fed. Transactions in A above are reversed.

E. Prior to spending, the Treasury calls in balances from its tax and loan accounts at banks. This reverses the transactions in C.

F. The Treasury deficit spends by debiting its account at the Fed, resulting in a credit to bank reserve accounts at the Fed and the bank accounts of spending recipients (IA2-2 to IP-3).

Again, it is important to recall that all of the transactions listed above settle via Fedwire (T2). Also, the analysis is much the same in the case of a deficit created by a tax cut instead of an increase in spending, as in the former case the Treasury would similarly end up deficit spending earlier than otherwise, *ceteris paribus*.

Instead of using a transaction-based SAM as in the previous case, this case will utilize the stock-flow consistent (hereafter, SFC) SAMs as developed by Wynne Godley and seen in numerous research papers (many of which were published as working papers by various authors the Jerome Levy Economics Institute) and in Godley and Lavoie (2006). As such, the focus of the SAM for this case will be to demonstrate how transactions A through F above affect the balance sheets of the respective institutions. This is more appropriate given that—as a result of wholesale payment settlement systems (T1)—individual transactions can affect the balance sheets of multiple institutions in Figure 8. For instance, transaction A—the first leg of the repurchase agreement between the Fed and primary dealers—impacts the balance sheets of the Fed, the primary dealers, and banks. The alternative approach of simply mapping transactions—such as a representing transaction A with a payment from the Fed to primary dealers—would miss important details in this case that SFC SAMs do not. It is also obviously consistent with the emphasis on the technology of double-entry accounting in the SFM analysis of the Treasury's debt operations.

The SAM for transactions A through F is shown in Figure 9. Like those in the SFC SAM literature, the relevant institutions are shown on the horizontal axis, and the asset/liabilities that are affected are shown on the vertical axis. Given that this SAM must show six different transactions, letters A through F within individual cells denote the respective transaction. Also, as the SFC SAM literature does, Figure 9 denotes changes affecting the asset side of an institution's balance sheet using minus signs (-); that is, an increase asset X is shown as "-X" ("+X" for an increase in liability X), while a decrease in asset X is shown as "-(-X)" ("-(+X)" for a decrease in liability X). The rationale here, which is perfectly consistent with the statement of cash flows for a business, is that rising assets require or "use" funds, whereas liabilities and equity are a source of funds. Therefore, transactions A through F in Figure 9 are as follows:

A. For the Fed's repurchase agreement with dealers:
    i. Increase in Treasury securities held by the Fed (-TS) and decrease them for primary dealers (-(-TS)).
    ii. Increase reserve balances (RB) in bank reserve accounts (+RB for the Fed, -RB for banks).
    iii. Increase deposits for primary dealers (-Dpd for primary dealers, +Dpd for banks).
B. For the settlement of the Treasury's auction:
    i. Decrease deposits for primary dealers (-(-Dpd) for primary dealers, -(+Dpd) for banks).
    ii. Decrease reserve balances in bank reserve accounts (-(-RB) for banks, -(+RB) for the Fed).
    iii. Increase the balance in the Treasury's account at the Fed (-TA for the Treasury, +TA for the Fed).
    iv. Increase Treasury securities held by primary dealers (-TS) and raise outstanding debt of the Treasury (+TS).
C. For the Treasury's transfer from its account at the Fed to its tax and loan accounts:
    i. Reduce balances in the Treasury's account at the Fed (-(-TA) for the Treasury, -(+TA) for the Fed).
    ii. Increase reserve balances in bank reserve accounts (-RB for banks, +RB for the Fed).
    iii. Increase balances in tax and loan accounts at banks (-Dt for the Treasury, +Dt for banks).
D. For the second leg of the Fed's repurchase agreement with primary dealers:
    i. Decrease deposits for primary dealers (-(-Dpd) for primary dealers, -(+Dpd) for banks).
    ii. Decrease reserve balances in bank reserve accounts (-(+RB) for the Fed, -(-RB) for banks).
    iii. Decrease in Treasury securities held by the Fed (-(-TS) and increase them for primary dealers (-TS).
E. For the Treasury's call of tax and loan balances to its account at the Fed:
    i. Decrease balances in tax and loan accounts at banks (-(-Dt) for the Treasury, -(+Dt) for banks).
    ii. Decrease reserve balances in bank reserve accounts (-(-RB) for banks, -(+RB) for the Fed).
    iii. Raise balances in the Treasury's account at the Fed (-TA for the Treasury, +TA for the Fed).
F. For the Treasury's deficit spending:
    i. Decrease balances in the Treasury's account at the Fed (-(-TA) for the Treasury, -(+TA) for the Fed).

ii. Increase reserve balances in bank reserve accounts (-RB for banks, +RB for the Fed).
iii. Increase bank deposits for recipients of the government's spending (-Dsr for spending recipients, +Dsr for banks).

Column 6 of Figure 9 shows that transactions for each row sum to 0; that is, there are no "black boxes" in a SFC SAM as the origin and destination of every balance sheet change is accounted for. Row 5 of Figure 9 shows the sum for each column: the Treasury ends with additional debt outstanding; banks end with fewer primary dealer deposits and greater deposits for spending recipients; primary dealers replace bank deposits with Treasuries, and spending recipients have additional bank deposits.

Overall, the SFM and SAM together enable a number of facts of the Treasury's debt operations to be clearly articulated that are largely in contradiction to the neoclassical view:

1. The SAM for the Treasury's debt operations demonstrates that government deficits create net financial wealth for the non-government sector (denoted by the shaded columns of Figure 9): spending recipients have seen their financial assets grow without adding to their liabilities, while banks and primary dealers have seen their financial positions remain unchanged. These facts obviously run completely counter to the more typical position of neoclassical economists that Treasury security issuance reduces deposits of the non-government sector and "crowds out" funds available for the non-government sector. That is, the prevailing view is that deficits accompanied by issuing Treasury securities are less stimulative to the economy than not issuing securities.

2. Indeed, one could go further and note again that the deposits of the primary dealers used to purchase the Treasury security were themselves created by previous lending from the Fed. And later, when the Fed's repurchase agreement is settled, dealers obtain deposits to settle this via borrowing in the repurchase agreement markets. Overall, primary dealers add to their assets such as Treasury securities usually with funds borrowed by lending their existing assets. That is, it is not the case that Treasuries are being purchased by "savers," (and the endogenous creation of credit money is not limited by the existing quantity of saving, at any rate (Fullwiler 2009)) while the Treasury security now held by primary dealers can serve as collateral for still more credit creation (such as in repurchase markets). Thus, far from being less stimulative or "crowding out" funds available for private investment, the Treasury may in fact be the catalyst for more credit creation than would occur in its absence.

3. That government deficits raise deposits even when Treasury securities are issued is if anything even more obvious where banks purchase them rather than primary dealers or other non-bank investors. Figure 10 presents a SAM for Treasury debt operations in the case of banks purchasing the Treasuries. As seen in row 5, the summation of the columns leaves banks holding Treasuries and the recipients of government spending holding deposits, with obviously no exchange of primary dealer deposits for Treasuries.

4. To achieve timeliness in the Fed's operations, sufficient reserve balances must be supplied to reserve accounts for settling Treasury auctions. If not, reserve accounts would be in overdraft and the Fed's ability to achieve its target rate would be compromised. This is necessary since only reserve balances can settle Treasury auctions via Fedwire. Note, though, that the only sources of reserve balances over time (that is, aside from various short-term effects from autonomous changes to the Fed's balance sheet) are loans from the Fed or the Fed's purchases of financial assets either outright or in repurchase agreements. Further, the vast majority of the time the Fed purchases Treasury securities or requires Treasury securities as collateral for repurchase agreements. Since Treasury securities are obviously evidence of a previous deficit, it is the case that the reserve balances required to purchase Treasury securities are the result of a previous government deficit or a loan from the Fed to the non-government sector. This is true even though the Treasury must have a positive balance in its account before it can spend, and even though the Fed is legally prohibited from providing the Treasury with overdrafts in its account.

5. From Figure 8, it is clear who stands at the top of the decision-making hierarchy: Congress and the President. In other words, the rule forbidding the Treasury from receiving overdrafts into its account at the Fed should the Congress and the President decide to incur budget deficits is clearly *self-imposed*; as noted above, this constraint has in the past been changed, and can be changed precisely because it is self-imposed.

6. Were the Treasury to obtain overdrafts to its Fed account when it incurred deficits (assuming the rule prohibiting this were altered for the moment), either the Fed or the Treasury would in fact be required to issue securities in order to achieve timeliness in the Fed's operations (unless the Fed is allowed to pay interest on reserve balances). Otherwise, the deficit would leave banks holding undesired excess balances in reserve accounts and the overnight rate would fall below the Fed's target rate. With the prohibition of overdrafts in its account at the Fed, it is obvious that the Treasury is the one issuing the securities when it incurs a deficit.

7. Similarly, the Treasury's use of tax and loan accounts in private banks, while serving the purpose of aiding the Fed's ability to achieve timeliness in its operations (in the absence of interest paid on reserve balances at the target rate), also serve to reduce the Treasury's deficit since many tax and loan accounts earn interest for the Treasury, while its account at the Fed does not. The latter may be seen as necessary given that the self-imposed constraint against overdrafts is usually incorrectly viewed as something more like the constraint facing deficit spending by a household or a business. (Thus, even with interest payment on reserve balances at the target rate and no need to aid the Fed's operations, the Treasury still has reason to continue utilizing its tax and loan accounts.)

8. Overall, adding the rule that the Treasury must finance its own operations in the open market to the combination of double-entry accounting, the need to achieve timeliness in the Fed's operations results in the six transactions described above for the Treasury's debt operations. The added complexity in the Treasury's operations that results are arguably unnecessary since it does not change the facts that (1)

reserve balances must be provided via previous deficits or Fed loans to the private sector in order for Treasury auctions to settle, and (2) deficits accompanied by Treasury security issuance does not result in fewer deposits circulating than without such security issuance. Further, the rule itself and the added complexity can be counter-productive if they influence policy makers' decisions regarding options available in times of macroeconomic difficulty.

9. In the case of interest paid on reserve balances at the Fed's target rate and substantial excess reserve balances circulating, the analysis is unchanged. While the Fed would not have to actively engage in operations specifically related to Treasury auctions, the reserve balances already circulating were created via Fed lending to the private sector (or purchases of private sector securities) or previous deficits. As noted in point 5 above, the Treasury may continue utilizing tax and loan accounts much like without interest on reserve balances, though this would no longer be necessary for aiding timeliness in the Fed's operations.

5. Conclusion

6. Works Cited

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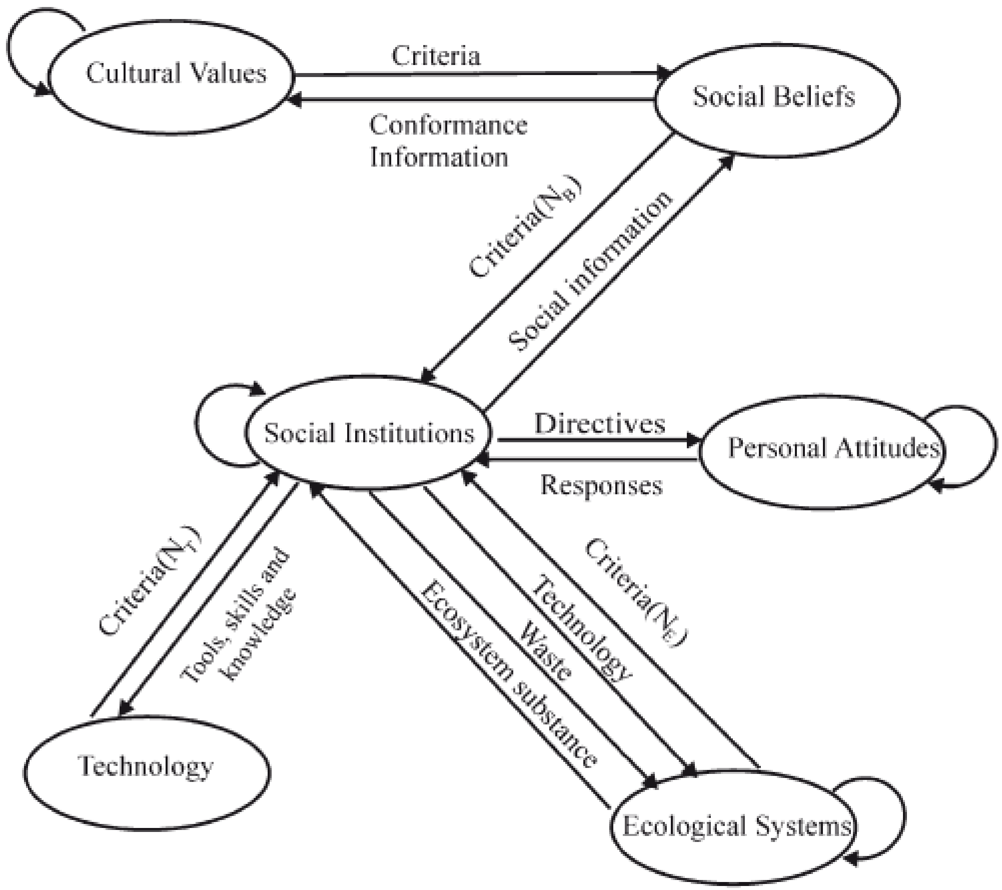
Figure1
General SAM Framework

	Industry	**Comm**	**Factors**	**Institutions**	**Enterprises**	**Capital**	**Trade**	**Row. Total**
Industry		Make					Exports	
Commodity	Use			Consumption		Consumption		
Factors	Value Ad						Exports	
Institution		Sales	Transfer	Transfer	Transfer		Exports	
Entepreneurship								
Capital						Transfer	Exports	
Trade	Import		Factor Trade	Imports		Transfer	Exports	
Col. Total								

Figure 2: Social Fabric Matrix Component Categories and their Transactions



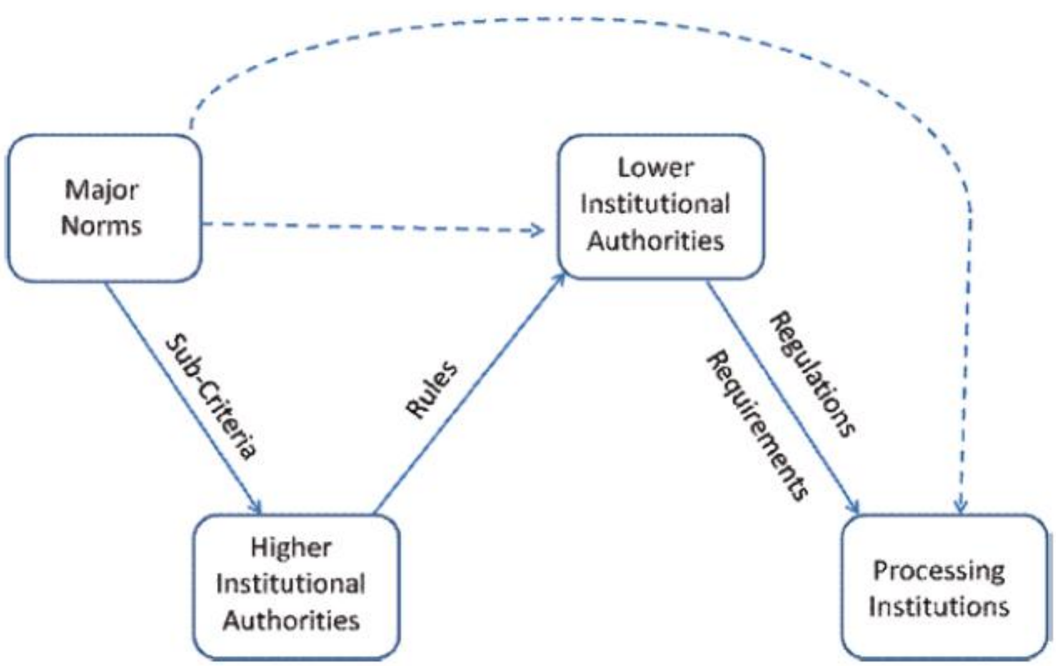
Source: Hayden (2006, 18)

Figure 3: Simple Social Fabric Matrix

Delivering Components \ Receiving Components	Households 1	Water Aquifer 2	Goods Producer 3	Chemical Processor 4	River 5	Farmers 6
1. Households	0	0	0	0	0	0
2. Water Aquifer	1	0	0	0	0	0
3. Goods Producer	1	0	0	0	0	0
4. Chemical Processor	0	1	1	0	0	0
5. River	0	0	0	0	0	0
6. Farmers	0	0	0	1	1	0

Source: Hayden (2006, 93)

Figure 4: Articulation of Major Norms into Rules, Regulations, and Requirements



Source: Fullwiler (2009, 131)

Figure 5: A System of Share Fiscal Burden

	Urban	Rural	State
Urban			**uu**
Rural			**rr**
State	**UU**	**RR**	

Figure 6: Taxes and What They Fund

Type of tax	**State**	**Local**	**K-12**	**University System**	**Other**
Property Tax	X	X	X		X
Sales Tax	X	X	X		X
Unemployment Insurance Tax					X
Gaming Taxes	X	X	X	X	

		Dept. of Education	Dept. of Revenue	Property Tax	School Districts		Households		Total
					K-12	Other	Urban	Rural	
Dept. of Education			d		a		g		
Dept. of Revenue		D		c			f		
Property Tax			C		b		e		
School Districts	K-12								
	Other	A		B			h		
Households	Urban								
	Rural	G	F	E	H				
Total									

Figure 7: SFM to SAM Transformation

Figure 8: Social Fabric Matrix of the Treasury's Debt Operations

Delivering Components \ Receiving Components	IA1-1 *Congress & President*	IA2-1 *Federal Reserve*	IA2-2 *Treasury*	IP-1 *Banks*	IP-2 *Primary Dealers*	IP-3 *Non-Bank Private Sector*	T1 *Double-Entry Accounting*	T2 *Payment Clearing/Settlement*
IA1-1 *Congress & President*		1	1	1	1	1	1	1
IA2-1 *Federal Reserve*			1	1	1		1	1
IA2-2 *Treasury*		1		1	1	1	1	1
IP-1 *Banks*			1	1	1	1	1	1
IP-2 *Primary Dealers*		1	1	1	1		1	1
IP-3 *Non-Bank Private Sector*				1			1	1
T1 *Double-Entry Accounting*	1	1	1	1	1	1		
T2 *Payment Clearing/Settlement*	1	1	1	1	1	1		

Figure 9: Stock-Flow Consistent Social Accounting Matrix of Treasury Debt Operations

		1 Federal Reserve	2 Treasury	3 Banks	4 Primary Dealers	5 Spending Recipients	6 ∑
1	Δ Bank Reserve Accounts at the Fed	A. +RB B. -(+RB) C. +RB D. -(+RB) E. -(+RB) F. +RB		A. -RB B. -(-RB) C. -RB D. -(-RB) E. -(-RB) F. -RB			0 0 0 0 0 0
2	Δ Treasury Account at the Fed	B. +TA C. -(+TA) E. +TA F. -(+TA)	B. -TA C. -(-TA) E. -TA F. -(-TA)				0 0 0 0
3	Δ Treasury Securities	A. -TS D. -(-TS)	B. +TS		A. -(-TS) B. -TS D. -TS		0 0 0
4	Δ Deposit Accounts at Private Banks		C. -Dt E. -(-Dt)	A. +Dpd B. -(+Dpd) C. +Dt D. -(+Dpd) E. -(+Dt) F. +Dsr	A. -Dpd B. -(-Dpd) D. -(-Dpd)	F. -Dsr	0 0 0 0 0 0
5	∑	0	+TS	+Dsr -(+Dpd)	-TS -(-Dpd)	-Dsr	0

Figure 10: Social Accounting Matrix of Treasury Debt Operations with Bond Sales to Banks

		1 Federal Reserve	2 Treasury	3 Banks	4 Primary Dealers	5 Spending Recipients	6 ∑
1	Δ Bank Reserve Accounts at the Fed	A. +RB B. -(+RB) C. +RB D. -(+RB) E. -(+RB) F. +RB		A. -RB B. -(-RB) C. -RB D. -(-RB) E. -(-RB) F. -RB			0 0 0 0 0 0
2	Δ Treasury Account at the Fed	B. +TA C. -(+TA) E. +TA F. -(+TA)	B. -TA C. -(-TA) E. -TA F. -(-TA)				0 0 0 0
3	Δ Treasury Securities	A. -TS D. -(-TS)	B. +TS	B. -TS	A. -(-TS) D. -TS		0 0 0
4	Δ Deposit Accounts at Private Banks		C. -Dt E. -(-Dt)	A. +Dpd C. +Dt D. -(+Dpd) E. -(+Dt) F. +Dsr	A. -Dpd D. -(-Dpd)	F. -Dsr	0 0 0 0 0 0
5	∑	0	+TS	+Dsr -TS	0	-Dsr	0