Formal Parallels Among Derivatives, Ponzi Processes, and Bubbles: A Behavioral Contingency Analysis

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Abstract

A behavioral contingency analysis of securitization, the creation of derivatives, the formation and bursting of bubbles, and Ponzi processes reveals that they involve similar behavioral dynamics and have the same formal structure, suggesting that the use of behavioral units can reveal non-obvious parallels and regularities in analyzing economic and financial phenomena.

The analysis begins with a conceptualization of property as a set of *behavioral contingencies* related to a given entity, rather than the entity itself. Such behavioral contingencies include the actions available to the property's "owners" and "non-owners" and the consequences of those actions for various parties. This conceptualization of property provides the foundation for definitions of property transfer, value, risk, leverage, and consensus. Large-scale property transfers, like various types of securitization, Ponzi processes, and bubbling, involve various forms of aggregation, partitioning, and multiple-stage property transfer, and are seen to share certain important features. One of these is the transfer-caused clouding, blurring, or obliteration of the contingencies that defined the original transferred properties—that being why such property transfers cannot be made fully transparent and inevitably entail a potential for deception, whether intended or unintended. Deception contingencies are situations in which a party may misperceive or mispredict the consequence of an action, often to its detriment.

Key words: Behavioral economics, behavioral contingencies, property, regulation, financial crisis, derivatives, securitization, deception, consensus, Ponzi, bubbles.

Introduction

This paper is directed at three audiences: (a) economists interested in how the use of behavioral units in the analysis of certain economic phenomena can reveal non-obvious regularities and parallels that may point to novel conceptualizations; (b) behavioral scientists interested in how their science can be applied in economics and finance; and (c) individuals interested in the potential implications of such analyses for society and public affairs.

By slicing economic and financial concepts along a different plane than does mainstream or neo-classical economics, behavioral contingency

analysis reveals different features and relationships, including surprisingly detailed structural parallels among financial phenomena that on the surface appear widely disparate. Among these are large-scale property transfers like certain types of securitization (e.g., the creation of derivatives), and multiple-stage property transfers, bubble formation and bursting, and Ponzi processes.

The analysis begins with a detailed examination of the concepts of property, property transfer, value, risk, deception, and consensus. The analytic tool is a formal symbolic language for the codification and analysis of behavioral contingencies (Mechner, 2008a, 2008b, 2010a, 2010b).[1] The resulting perspective differs from that offered by mainstream economics.

The rationale for the approach taken is that the phenomena involved consist entirely of the behavior of human beings, an observation no longer new in mainstream economic theory. Richard Thaler stated that all economics is "behavioral" (Stewart, 2005), and Herbert Simon (1998) pointed out that all economics necessarily makes assumptions about human behavior. This approach shows that the use of behavioral units can lead to new conceptualizations in economics and finance by revealing non-evident regularities.

Orientation of the analysis

The analysis focuses on some of the more evident behavioral contingencies that operate in economic and financial systems and the predictable consequences of those contingencies. It does not attempt to relate the conclusions to any economic philosophy or theory, and makes no assumptions about "rationality," bounded or otherwise, market behavior, or business cycles. It does, however, invoke some of the findings of behavioral economics in such areas as temporal discounting and choice behavior (Ainslie, 1992; Madden, Bickel & Jacobs, 2000;

[1] Basic elements of the language—those used in the present analysis--are presented in Appendix A.

Green & Myerson, 2004; Mazur, 1987; Pietras & Hackenberg, 2001; Rachlin, 2000), while dealing directly only with the behavioral dynamics and consequences of certain types of large-scale property transfer.

Although the results of this analysis may have implications for regulatory policy or other possible roles of government, these are not developed here. Some of the results may, however, be viewed as identifying behavioral underpinnings of certain of the theses of eminent economists like Joseph Stiglitz (e.g., 2001), Allan Meltzer (e.g., 2002, 2010; Brunner & Meltzer 1993; (Benartzi & Thaler, 1995; Kahneman & Tversky, 1979; Lucas, 1972), even though these may often reach different conclusions.

Behavioral contingencies

A formal language for the analysis of behavioral contingencies offers the advantages of being succinct and unhampered by the imprecisions and ambiguities inherent in natural languages. Also, it cuts across all natural languages and relates the invoked concepts to observable phenomena rooted in natural science. In general, formal languages, like those of chemistry, mathematics, or music often accelerate the maturation of their discipline by revealing regularities that can point to new conceptualizations (Mechner, 2010b).

A behavioral contingency states that *if* a certain party(ies) performs a certain act(s) in certain circumstances, certain consequences may follow. [2] Such consequences can have different time delays and probabilities and may be positive or negative to varying degrees for the various affected parties.[3] The parties may perceive and/or predict[4] such consequences and

[2]The *if* part of the statement is key, as a behavioral contingency (like an incentive) can be in effect without any of the specified acts or their consequences ever occurring. Behavioral contingency statements do not state what, if any, acts would *actually* occur. They state only the *if-then* conditions that set the occasion for their *potential* occurrence.

[3] Behavioral contingencies subsume the economist's concept of incentives and disincentives, but are broader in that they also include other features of situations that can affect behavior.

[4] The terms perceive and predict are used here as technical terms, and their precise definitions, and discussions of their importance, can be found in Mechner, 2008a, p.126, and 2010b, section "Elements of the behavioral contingency language."

may or may not be able to alter or prevent them.

All of these units of analysis are basic to all of the behavioral sciences, including economics. The formal symbolic language used in the present analysis is able to codify any type of behavioral contingency, including the most complex.

Property and ownership

The property concept is the means by which societies regulate the relationships of "owners" and "non-owners"—their rights, available actions, obligations, and prohibitions—with respect to the society's various entities. The term property is applied to tangible entities like an object, a house, an animal, a piece of land, or money, and also to intangible ones[5] like debt instruments, shares of a company, annuities, options, franchises, or patent rights. But it is not these entities themselves that constitute property, it is the set of behavioral contingencies—potential consequences of certain available acts by presumptive "owners" and "non-owners"—that define an entity's property status. The term "owner" is applied to the party for which the consequences of certain acts related to the entity are mostly positive, and the term "non-owner" to all other parties for whom similar acts, or other acts related to that entity, may have various other kinds of consequences.

This conceptualization of property ownership differs from most legal ones, which tend to view it as all-or-none—that one is either an owner or a non-owner (McCarty, 2002). The above behavioral definition, in terms of its defining contingencies, is more consistent with the way societies actually use the term, i.e., that ownership is always nuanced and qualified, never absolute. For example, when the property is a house, the presumptive owner's act of occupying it may have such positive consequences as shelter, etc., but his permissible acts with respect to the house (acts that would not have negative consequences) are limited to

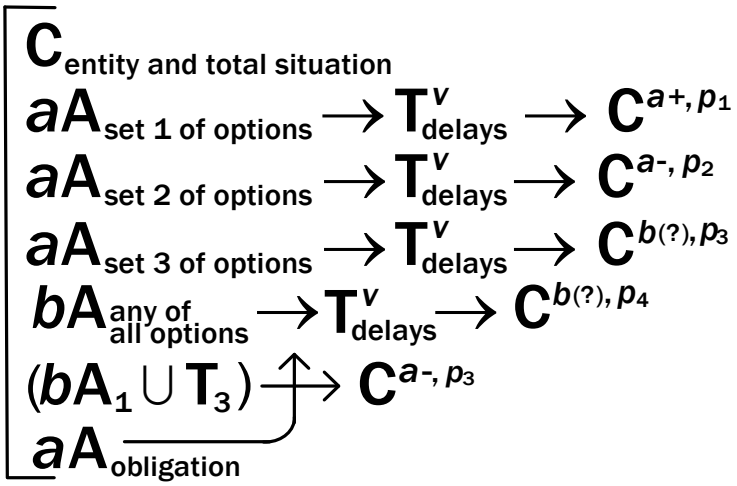
[5] In law, these are termed, respectively, personal property, real property, and intellectual property.

those that do not infringe on the rights of others, and may be further restricted by obligations like mortgages, taxes, maintenance requirements, zoning restrictions, and limitations on transmissibility. And non-owners' acts with respect to the house, such as trespassing, painting graffiti on it, or making noise in its vicinity, may result in negative consequences for such non-owners. Such contingencies are not mere details regarding the entity's ownership status; they are core elements of its definition.

In summary, a property is always a set of contingencies, never just an entity. Ownership is always contingent, never absolute. This definition is more basic and general than those that invoke such concepts as possession, ownership, rights, title, public, communal, and private (Alchian, 2008)—concepts which themselves require definitions that would invoke the set of defining contingencies described above.

Analysis of the property concept

The simplified behavioral contingency analysis presented below is a generic conceptual template for defining any kind of property.



Legend for this diagram: The specific entity whose property status is being defined is represented in the diagram as $\mathbf{C}_{\text{entity and total situation}}$. This includes all of the prevailing environmental (both physical and social) circumstances and aspects of the situation, which the legend can elaborate and describe at any desired level of detail.

The party (person(s) or organization(s)) whose ownership status is being defined is designated by the arbitrary letter ***a***, and all other possible parties (i.e., the rest of the society) by ***b***. The relevant acts available to ***a*** are represented by $\mathbf{A}_{\text{set 1 of options}}$, $\mathbf{A}_{\text{set 2 of options}}$, and $\mathbf{A}_{\text{set 3 of options}}$. These three sets of possible acts would have different kinds of consequences **C.**

Acts from Set 1 of options available to ***a*** would result in consequences that have generally positive "valences" [6] for ***a***, as shown by an ***a+*** in the **C**'s upper right ("attribute") position. For example, if act **A** were a sale, the **C** might be a price considered favorable by ***a***; and if **A** were driving a car, the **C** might be transportation or a pleasant ride.

Acts from Set 2 of options available to ***a*** are those that would have negative consequences ($\mathbf{C}^{a-}$) for ***a***, like driving the car into a tree or the reaction of a neighbor to ***a'***s act of playing a trumpet in the middle of the night. Potential negative consequences may be mediated by an individual, a community, a government ("prohibitions"), or the physical environment.

Acts from Set 3 of options available to ***a*** would have significant but indeterminate consequences ($\mathbf{C}^{b?}$) for *others* (shown by ***b?***)—possibly negative, as when the property is a weapon—or possibly positive, as when the property is a fund that could provide scholarships.

When any of the acts available to ***a***, or any other acts with respect to the entity, are performed by ***b***, their consequences would be different than when performed by ***a***. The consequence for ***b*** (as well as for ***a***) might be negative (e.g., trespassing or stealing may be punished), neutral (e.g., looking at the house), or positive (e.g., "getting away with stealing"). The consequences would clearly depend on the infinite range of possible prevailing circumstances and entities involved, and on the particular acts.

A society's need for the property concept is due entirely to the differences between the consequences of given acts for ***a*** and for ***b*** with respect to the entity. Absent ***b***, the concept of property would have no meaning.

[6] For a discussion of the concept of "valence," see Mechner, 2008a, pp. 126-127.

Obligations

An "obligation" is the contingency that failure by the property owner to perform a certain act (e.g., caring for an entity in accordance with prevailing norms, paying taxes on it, or feeding the dog) may have negative consequences for the property owner (perhaps loss of ownership). Obligations may be as formal as legal ones (e.g., paying taxes), or as informal as the performance of household chores.

In the diagram, $\boldsymbol{a}\mathbf{A}_{\text{obligation}}$ represents ***a***'s possible performance of an obligation—unless ***a*** performs act **A**, negative consequences for ***a*** may ensue. These may consist of acts by ***b***, again defined as all parties other than ***a***, including the community and external agencies like the physical environment (e.g., rain entering through an open window), governmental authorities levying penalties, or the passage of time **T** (as when ***a*** neglects to feed the horse or lets the crop rot in the field). The ∪ symbol from logic, meaning "and/or," indicates that such acts or events can jointly or singly produce a negative consequence. The vertical arrow cutting the horizontal arrow shows that ***a*** may have available to it acts ***a*****A** that would prevent the possible negative consequence, like performance of the obligation.

Modifiers of the consequences

The symbols p_1, p_2, p_3 and p_4 shown after the valences in the upper right quadrants of the **C**s, are the respective probabilities that each of those consequences would actually occur, and the $\mathbf{T}^{\boldsymbol{v}}$s are possible time delays of those consequences (the ***v*** attributes of the **T**s indicate that the time delays vary or are unknown). The diagram could also be elaborated to indicate the parties that might perceive or predict[7] each of the shown consequences, or the magnitudes of the valences of the consequences for each possible act. For instance, the expression ${}^{\boldsymbol{a}}\mathbf{C}^{\boldsymbol{a}+}$ means that party ***a*** would predict consequence **C** (indicated by the ***a*** in the **C**'s upper left), and the ***a***+ means that the predicted valence of this consequence would be

[7] For a more detailed discussion of these modifiers, see Mechner 2008a, pp. 128-130.

positive for ***a***. (See also Appendix A)

In summary, the property and ownership status of any entity, with all of its possible nuances, is defined by a set of behavioral contingencies—potential acts by various parties, including prohibitions and obligations, and the possible consequences of those acts. In addition to its possible theoretical interest, it will be seen that this analysis provides the necessary foundation for showing that many types of prevalent large-scale property transfer (a) have the potential for deception, (b) share a common formal contingency structure, and (c) entail significant externalities (effects on parties other than the transferor and transferee).

Property transfer

The above conceptualization of property provides the foundation for defining property transfer[8] as *a modification of the behavioral contingencies that define the property.* Such modification may involve alterations of some or all of ***a***'s and ***b***'s available acts (including rights, prohibitions, and obligations) and/or of the acts' consequences for ***a*** and ***b*** and their attributes. Many types of property transfer also change the prevailing situation, $\mathbf{C}_{\text{entity and total situation}}$, including the parties' relationships with each other.

The large-scale property transfers on which the present analysis focuses tend to occur at the level of institutions rather than individuals. The analysis does not deal with the familiar everyday types of property transfer as when individuals buy, sell, lend, gift, or share, or more unusual transfers like theft, robbery, fraud, bribery, abandonment, pawning, etc. However, all of these involve modification of the contingencies that define the transferred properties.

The consequences of property transfers affect not only the transferor and transferee, but usually also other parties—their "externalities"

[8] The term property transfer is more general than the more commonly used term "transaction," which is generally limited to transfers in which the parties and contingencies are known and the consequences specified.

(Greenwald & Stiglitz, 1986). The types of large-scale property transfer considered here often have particularly far-reaching economic and social consequences.

The value concept

The *value* of a property is defined here as the net valence of the predicted consequences of the full range of all possible acts, for "owners" ***a*** and "non-owners" ***b***. The amount of money exchanged in a transfer like a sale is clearly not the only type of consequence that defines a property's value. The consequence might include a promise of probable receipt of periodic payments or ***b***'s right to modify or reverse the transaction, as is possible when the transferred property is a debt instruments, a contract, or an annuity. Value can also include the effects of non-monetary components like enjoying the view from a window of the house, the pleasure of stepping on the car's accelerator, the companionship of a dog, or the mere passage of time (as when perishables deteriorate, a crop ripens, a payment is delayed, an obligation matures, or a right is lost).

The actual effective value must also takes into account the effects of probability and time variables, and acts available to ***b***, which jointly determine when and whether the predicted monetary or other value of the consequence of a potential property transfer will be realized. Time delays of consequences can have complex behavioral effects, some of which are described by hyperbolic temporal discounting functions (Mazur, 1987; Ainslie & Haslam, 1992; Mechner, 2008a, p.139). In financial environments, these effects relate to opportunity costs, risk, interest rates, etc. Temporal discounting research has shown that time delay and probability factors have important effects on perceived and actual value as defined by indifference functions (Rachlin, Raineri & Cross, 1991).

Effective Value and Utility

The term "Effective Value" is used here to reflect the effects of temporal, probabilistic, and all other relevant variables. It can be thought

of as similar to net reinforcing value in the behavioral sense, and to the economic concept of "ordinal utility," which refers to a ranking that reflects the net effect of all valences ("Ordinal utility," 2010). Probability and time factors are also components of what is generally called risk (Holton, 2004). Probabilities regarding the occurrence, favorableness, or magnitudes of the valences, or regarding external events or acts that may intervene, delay, or otherwise interfere with the enjoyment of the non-monetary components of the property's value, would be considered risk parameters of Effective Value. Probabilities can be reflected in the contingency diagram when they are considered material. The relationship between risk and leverage will be discussed in the next section.

Regardless of which parties (if any) perceive or predict them, the contingency modifications that constitute property transfers normally increase the property's Effective Value for some parties and decrease it for others. As will be seen, certain types of property transfer entail a greater potential than others for deception, and may often be driven by the realization of this potential.

Leverage and risk

Traditional definitions of leverage generally refer to investing borrowed funds, debt-to-equity ratios, and risk/reward tradeoffs as in the use of options (Van Horne & Wachowicz, 2005). The definition based on behavioral contingency analysis additionally takes into account the fact that the risk present in a property transfer is a function of all of the variables that define Effective Value, including probabilities, temporal delays, and actions available to party(ies) ***b***. Leverage is therefore said to exist when a party incurs an increased risk in exchange for a reward that is greater, more probable, or sooner. Thus leverage normally plays a role in any type of property transfer by shifting the risk-reward ratio in either direction between transferor and transferee—in simple transfers like

buying and selling or in more complex ones like those described in the sections that follow (Bookstaber, 2007).

Leverage plays a particularly significant role in the creation of new securities backed by presumptive collateral that consists of yet other securities (e.g., "derivatives"), sometimes several levels deep, with the presumptive collateral at each level created by yet other property transfers. The next sections will discuss how such transfers may be based on partitioning, aggregation, or multiple-stage transfers, with special attention to the attendant potentials for deception.

Partitioning as a form of property transfer

The term partitioning is defined here as any type of property transfer that involves dividing a property into smaller units, a common example seen in virtually all human societies being monetization—the practice of creating currencies and money as an exchange medium (Davies, 2002).

Here are some additional examples of partitioning:

- A meat packer partitioning a cow into packaged meat products.
- A corporation splitting its stock.
- The issuance of theater or airplane tickets to partition a limited seating capacity.
- The partitioning of a building when it "goes co-op or condo."
- A bank partitioning its property into withdrawal rights issued to its depositors according to the amounts of their deposits.
- Partitioning a financial property into "tranches" that have diverse risk and Effective Value characteristics (e.g., "equity" and "debt" tranches [Ashcraft, 2005]).
- Partitioning a financial property's risk and Effective Value characteristics by (a) taking out insurance on its value (e.g., via credit

default swaps) and/or (b) by shorting[9] it, thereby creating the option of transferring each part separately while obfuscating the existence of the other parts (Francis et al., 2005).

An important effect of partitioning is that it often blurs, clouds, or even obliterates information regarding the Effective Value and risk characteristics of the original property, thereby enabling the partitioner (transferor) to assign to the new fractional units a higher total Effective Value than that of the original partitioned property. The partitioner may be justified in doing this when the partitioning process itself adds value. The partitioner often has more information regarding the pre- and post-Effective Values than does the transferee—an instance of the "information asymmetries" described by Joseph Stiglitz (2001, 2009) —but although such asymmetries increase the transferor's opportunity to benefit himself, it does not depend on them—the clouding and blurring effects are operative even when both parties have the same information.

Property aggregation

Property aggregation—another type of property transfer—is the "bundling" of properties, often intangible ones like securities or contracts, into new and larger property units. Examples are the creation of funds,[10] of conglomerates (companies formed by merging two or more companies engaged in different businesses), of portfolios, of cooperatives, and of certain securities, e.g., derivatives like asset-backed securities (Zweig, 1993), collateralized debt obligations, as when a mortgage lender aggregates mortgages into a new security (Mongoose, 2009), or any other type of security that derives its value from an underlying portfolio of fixed-income assets and/or credit default swaps (Morrissey, 2008).

One possible desirable effect of aggregation to which the aggregator may point is a spreading of the risks associated with the Effective Values

[9] Shorting a property means borrowing it and immediately selling it, with an agreement to repurchase it at a future time at the future market price, and then return it to the lender.
[10] Index funds, hedge funds, mutual funds, money market funds, venture capital funds, etc.

of the individual aggregated properties. The mathematical analysis of this effect was originally published by Harry Markowitz (1959). Michael Milken applied it in the aggregation of "junk bonds" into new securities (Yago, 1991). The same mathematical principles apply to the spreading of a risk more evenly among properties like loans.

Another type of desirable effect can be synergy among the aggregated properties. For example, an apartment co-op is an aggregation in which the sharing of building services is synergistic; a pooling of capital can enhance buying power; and in conglomeration, synergies can result from economies of scale due to the sharing of corporate services and the merging of related lines of business (Yamey, 1973).

Undesirable effects of property aggregation

However, the process of aggregation, like that of partitioning, inevitably blurs, clouds, or even obliterates the information regarding the contingencies that defined the component property elements that were aggregated, including their Effective Values (e.g., does the claimed total value of the bundled mortgages fairly reflect the sum of the Effective Values of the individual mortgages?). This effect need not be due to a deliberate act of the aggregator (though it can be)—it is an automatic and normal result of the aggregation process itself.

This clouding effect may apply not only to the Effective Values but also to the actual identities of the individual aggregated properties, as well as to other relevant information ("Enhancing disclosure," 2003). A possible standard of reference for the Effective Value of an aggregate would be the sum of the previously established Effective Values of the aggregated individual component elements. In the case of mortgage aggregations, for instance, such a standard could include the summed valuations of the individual mortgages that were bundled, and/or the market values of the individual real estate properties. But the aggregation process itself normally makes these irretrievable.

Thus aggregation enables the aggregator to assign to the aggregate an Effective Value larger than the sum of the Effective Values of the individual component properties. As in the case of partitioning, aggregation often creates information asymmetries between transferor and transferee, but the transferor's opportunity to reap a benefit at the expense of the transferee does not depend on these.

Multiple-stage property transfers

When property transfers occur in multiple stages, the blurring and clouding effects are compounded, further degrading relevant information regarding the original contingencies. For example money laundering (Robinson, 1997)—a well known type of a multiple-stage property transfer—has the effect of obfuscating the contingencies that defined the original monetary property, particularly its provenance (the ownership trail).

Partitioning and aggregation processes can be repeated over several stages—aggregated properties can in turn be aggregated into larger aggregates, and partitioned properties partitioned into still smaller units. A common type of multiple-stage property transfer begins with aggregation (in one or more stages) followed by partitioning of the aggregate (also in one or more stages). Such multiple-stage transfers can totally obliterate the information regarding the original contingencies. Prominent examples are certain types of securitization and the creation of certain types of derivatives (e.g., collateralized debt obligations like bundled mortgages) repackaged as new asset-backed securities, which are then partitioned for further transfer (Acharya et al., 2009).[11]

Other examples of multiple-stage transfer

Credit default swaps include contracts pursuant to which insurance

[11] An example is Lehman Brothers' aggregation of loans it had made to realtors. The aggregation process made the true adjusted value of the aggregate difficult to ascertain. Lehman then partitioned the aggregate and sold off some of the resulting units at prices attractive to Lehman while keeping the most valuable ones for itself (Leonard, 2009).

companies like AIG (American International Group) guarantee that other transferred properties (e.g., derivatives consisting of aggregated mortgages or bonds) will retain the monetary values that the transferors assigned to them, even if they are inflated or unascertainable. In the event the insurance company must make good and doesn't have sufficient assets to do so, it is either wiped out or bailed out, but the insured parties may still have been able to benefit by using the inadequately insured property as collateral to make balance sheets look better or to support various other types of property transfer (Brown, 2008).

From the point of view of the shareholders of the insurance company, the contingencies that define this risk involve temporal discounting of the consequences (Miller & Shapira, 2000), under various scenarios. The contingencies for the insurance company's executives are very different from those for the shareholders. Executives' compensation agreements may provide for commissions or bonuses based on premiums the insurance company receives, regardless of the risks it incurs (Palmer, 2009) or losses the owners (or taxpayers) may suffer—that being the misalignment of interests of owners, managers, and taxpayers (Jensen & Meckling, 1976; Meltzer, 2009b; Stiglitz, 2009)[12]

The analysis of deception

Deception is a basic and pervasive biological function that evolved as an essential part of the behavioral repertoire of most animal species (Mechner, 2010a). When deception is intentional, its main function is to benefit the deceiver, often to the detriment of the deceived.[13]

The essential feature of simple forms of deception is shown in the

[12] This same issue is present whenever there is a misalignment of interests between owners and managers—only effective contingencies will prevent managers from transferring the owner's property to themselves. Compensation contingencies can easily incentivize acts by managers that entail hidden or obfuscated costs to owners—large risks, hidden or delayed costs, or opportunity costs (Jensen & Meckling, 1976).

[13] Behavioral contingency analysis also shows that deception can take many nuanced forms that depend on which parties would perceive and/or predict the consequence, and the associated higher-order recursive characteristics regarding which parties would perceive and/or predict the other parties' perceptions and/or predictions.

diagram: $\mathbf{a}\mathbf{A} \rightarrow {}^{\mathbf{a}}\mathbf{b}^{\mathbf{x}}\mathbf{C}^{\mathbf{b}-}$ (See Appendix A for the elements of the symbolic language). We say that party ***a*** would be "intentionally" deceiving party ***b*** when ***a*** predicts that ***b*** would mispredict and/or misperceive a circumstance or consequence **C**, generally one that has a negative valence for ***b***. If the act's agent ***a*** *would not* predict the misperception and/or misprediction, the deception would be considered unintentional. A rigorous definition of an act's intentionality is that the act's agent predicts the act's consequence or the modifiers of the consequence (Mechner, 2008a, p.11; 2010a).[14] Whether intentional or unintentional, this formulation constitutes a parsing of the economics concept of "information asymmetry" (Stiglitz, 2001).

Deception in property transfers

This analysis of deception and intentionality is directly applicable to commonly seen financial transactions. The presumption that an act's agent would predict the act's consequence (i.e., that the act was intentional) is related to the legal concept of foreseeability (Buckley & Okrent, 2003), which takes into account the individual's knowledge and experience as modifiers of the prediction.[15]

Setting the Effective Value of a transferred property in a way that is advantageous to the transferor need not be deceptive. However, given the near-impossibility of reconstructing the contingencies that defined the original properties in large-scale property transfers—even after a single transfer stage—the potential for deception (unintentional or intentional) is always present, even without any special further action by the transferor or the existence of information asymmetries. Since most types of property transfer cause the transferees to misperceive, mispredict, not perceive, or not predict the Effective Value of the transferred property (this being a

[14] The concept of intentionality has also been discussed by Chisholm (1957), Baum and Heath (1992), Foxall (2007), and Hineline (2003).

[15] Common law normally imputes intent (i.e. a "motive") to acts whose consequence is predictably positive for the acts' agent (Kaveny, 2004

way to parse forms of deception), the transferor normally has an opportunity to benefit himself.

Thus all three of the large-scale property transfer modes that have been discussed—partitioning, aggregation, and multiple-stage transfer—provide transferors with the opportunity to obfuscate and to deceive.

Standard inhibitors of property value increases

The act of increasing a property's Effective Value is normally inhibited or restrained by countervailing contingencies. In finance, these can include objective comparison standards. For instance, when the transferred property consists of a company's stock, the comparison standards can include the so-called fundamentals—earnings, dividends, sales volumes, growth rate, debt-to-asset ratio, book value, or the opinion of a respected authority (McClure, 2003; Schmidt, 2008). When the property consists of real estate, the comparison standards may include the prices of similar real estate in similar markets, or construction costs. Such comparison standards are normally the main moderators of moderators of Effective Value increases.

The disabling or deactivation of standard inhibitors

Most kinds of large-scale property transfer, by virtue of their clouding, blurring, or obliteration effects, disable and deactivate such inhibitors and restraints. The transfer process itself, without a special separate act by the transferor, almost inevitably obliterates the information that would be necessary for an objective determination of the real Effective Value and risk characteristics of the transferred property.

Such obliteration effects are seen in the creation of stock funds and funds of funds, and in various types of derivatives, including collateralized debt obligations (Mongoose, 2009), various types of asset-backed securities (Zweig, 1993), and credit default swaps (Morrissey, 2008). Mortgage lenders may aggregate mortgages into new securities which they may then transfer again (e.g., sell or use as collateral), or bundle into yet

further aggregates (like so-called CDO-squared securities—securities that are backed not by a pool of mortgages but by a pool of other CDOs, sometimes created solely for the purpose of being re-aggregated ["Re-securitizing CDOs," 2009]), with further obfuscation of the Effective Values and the defining contingencies of the underlying properties.

Free-market theory raises the issue of whether standard inhibitors, even when they are functioning, need to be supplemented by a governmental (e.g., regulatory) agency so as to prevent unacceptable effects of the potential deceptions, and if so, whether regulations can be made circumvention-proof (Meltzer, 2008, 2010b).

Implications for "transparency"

One often hears calls for "transparency" in connection with property transfers like those described above. The term transparency used in this sense presumably refers to the provision of information regarding the defining contingencies of transferred properties, including risk and Effective Values. Full transparency would then require reconstruction of all of the relevant contingencies that defined the original properties, including their correct and relevant time delay and probability components. But the insuperable obstacle to doing this is that the original contingencies were normally not sufficiently known, understood, documented, or stable, or retrievable even if they had been known. That is why transparency in this sense is unachievable for large-scale property transfers like aggregation and partitioning, whether single stage or multiple-stage, because such transfers inherently and inevitably cloud, blur, or obliterate the contingencies that defined the original properties.

But even when transparency is provided for some relevant aspects of a property transfer, as in "red herring" disclosure for IPOs or the "small print" in contracts, the inhibiting effects of such disclosures is routinely frustrated by a process of long-term progressive desensitization—the lulling that occurs when parties learn, as they often do, that the transferor's

permitted actions, damaging though they would be, have rarely materialized in practice and are not predicted or feared by others. The effect of such lulling is that the damaging actions, having been "disclosed," are made legally permissible and will be able to occur under certain conditions (Guttentag, 2007).

Implications for regulatory policy

The default view of partitioning, aggregation, and multiple-stage property transfers should be that they are potentially deceptive, by effect and often also by intent, even when the profit taken by the transferor is justified by economies of scale, the sharing of resources, or synergy among the aggregated property units (as when the property transfer itself increases the Effective Values of the transferred property). The argument that some such transfers stabilize markets in desirable ways (Naranjo & Toevs, 2002) raises the issue of whether such effects are permanent or transient. If transient, the parties should be expected to behave in accordance with the contingencies that will prevail after the stabilizing effects have ended.

The scope of the present analysis does not cover its possible implications for the potential design and imposition of laws and regulations intended to avert effects that certain types of large-scale property transfers may have on the economy and society, like those seen in the 2007-2009 economic crisis. Free market theory introduces the issue of whether a society should accept some of these risks and effects, and whether a socially acceptable long-term economic equilibrium would be achieved, taking into account the nearer-term externalities consisting of attendant collateral damage, including market swings and occasional convulsions, and whether the costs of such externalities can be kept within an acceptable range (Stiglitz, 2001; Brunner & Meltzer, 1993).

Overarching contingencies relevant to government regulation

A comprehensive analysis of the relevant operative behavioral

contingencies would need to take into account not only those that affect the behavior of property transferors and transferees, but also those that affect the behavior of the presumptive regulators (Kane, 2009; Lucas, 1976), of the public officials who install and control the regulators, and of the financial interests that may incentivize some of these parties (Stiglitz, 2008, 2009; Meltzer, 2002, 2010).[16] For instance, laws and government regulations can have the paradoxical effect of legitimizing certain deceptive types of property transfer they are ostensibly intended to prevent, as when a regulation accepts as sufficient the disclosure of irrelevant information while allowing the germane information to remain obfuscated, or permits ineffective disclosures of the germane information (Garrod & Hadi, 1998; Stewart, 2003). It may also specify penalties that can function as acceptable costs of doing business when the gains outweigh the costs (e.g., fines for strip mining of coal, cap-and-trade proposals) (Greenbaum & Harvey, 1980). Finally, such government interventions are often made ineffective when the affected parties influence the design of the contingencies under which they will be operating (e.g., designing regulations with loopholes that facilitate their future frustration or circumvention), (Meltzer, 2002, 2010). When those parties install, incentivize, or disincentivize lawmakers and regulators, those overarching contingencies trump many of the others.

Any analysis of these complex dynamics must also take into account the fact that in most democratic societies, voters generally require their elected representatives to assign greater weight to the near-term than to the long-term effects of their regulatory or legislative actions, in accordance with universal temporal discounting principles (Ainslie, 1992; Green & Myerson, 2004; Madden, Bickel & Jacobs, 2000; Mazur, 1987; Pietras & Hackenberg, 2001; Rachlin, 2000). Although the effects of these overarching contingencies lie outside the scope of the present analysis, it

[16] Analysis of these other contingencies would support Stiglitz's statement that "there are often problems in ensuring that a regulator's behavior is consistent with social welfare (for example that he/she is not beholden to those whom he/she is supposed to be regulating)." (Stiglitz, 2009).

is important to note that any comprehensive contingency analysis of large-scale property transfers would have to take them into account.

Pseudo-explanations of the 2007-2009 economic crisis

One often hears that the economic crisis of 2007-2009 was brought about by greed or selfish behavior. But most instances of such behavior are biologically normal and predictable responses to prevailing contingencies. Other pseudo-explanations cite irrationality, exuberance, pessimism, and similar lay psychology concepts. A recent example is the statement that certain undesirable financial practices are due to shortsightedness that puts short-term considerations ahead of long-term considerations (see President Obama's April 2009 speech ["Transcript – Obama's Remarks," 2009] and Geithner, 2009)—a description of well-established and inescapable temporal discounting principles to which all members of the animal kingdom, including corporate executives and government officials, are subject. Pseudo-explanations can provide politically useful sound bites, but exhorting individuals not to act in accordance with fundamental behavioral principles is futile. If a society wishes some of its members to act otherwise, it must arrange appropriate behavioral contingencies and rely on these for their predictable effects (Bickel & Marsch, 2000). This would require a correct analysis of the incentives and disincentives for all of the parties involved in each specific situation and circumstance (Meltzer, 2010b; Mechner, 2008).

Explanations that have no true explanatory or predictive value are harmful in that they deflect efforts to identify the real causative behavioral contingencies, ideally ones that can be managed. The real causes of the 2007-2009 economic crisis are still being debated.[17]

[17] For instance, one substantive attempt to explain it was offered by Diana Furtchtgott-Roth, former chief economist at the U.S. Department of Labor (2008):
"The government (required) banks to make loans to people who could not afford them, through the 1977 Community Reinvestment Act. It forced banks to improve lending and service to borrowers in poorer neighborhoods, including people with poor credit histories. Some of these borrowers qualified only for subprime mortgages, which had introductory low rates that eventually rose…Fannie Mae and Freddie Mac were given implicit government guarantees, letting them

Consensus and the formation and bursting of "bubbles"

Economists have defined bubbles in terms of "inflated" or accelerating valuations that appear to disregard normal valuation standards, often accompanied by high trading volumes (Abreu & Brunnermeier, 2003). But such definitions do not address the antecedent or causal conditions that lead to the formation and bursting of bubbles—they are merely descriptive. Explanations that have predictive value must be sought at a level of analysis that considers the underlying behavioral processes.

A key to understanding bubble phenomena is the concept of consensus. It was noted earlier that one of the ways the general property diagram is oversimplified is that it does not indicate the party(ies) that may predict or perceive the consequences **C** and their Effective Values. These modifiers of the **C**s must be considered now in the context of bubbling analysis.

In behavioral contingency analysis terms, a consensus is a *joint prediction* by a number of parties regarding the consequence **C** of a certain act. To indicate that a number **n** of parties ***a*** would have a joint prediction of consequence $\mathbf{C}^{\mathbf{a}(val)}$, (the Effective Value of the consequence for ***a***), the

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borrow at favorable rates. The rationale given …this was the way that less-affluent Americans could get homes of their own—housing that they could not afford otherwise. While the government was pressuring financial institutions to increase lending, the Federal Reserve was lowering interest rates …This vast expansion of money and credit had to go somewhere—and it went into an inflation of housing prices of horrendous proportions (4 trillion dollars of mortgages lent out by 2007), the real estate bubble that eventually burst."

Allan H. Meltzer in his Testimony before the House Financial Services Committee (2010b) supported this explanation, stating: "Without the policies followed by Fannie Mae, Freddie Mac, and the destructive changes in government housing and mortgage policies, the crisis would not have happened." The 4 trillion of mortgages that resulted provided much of the raw material that fed financial institutions' ensuing securitization frenzy and manufacture of derivatives against which they could then bet profitably (i.e., take short positions) (Brenner, 2009).

During the 1997-1999 period Brooksley Born, then chair of the CFTC under President Clinton, argued that the uninhibited creation of the hundreds of trillions of dollars of derivatives (consisting of aggregations and securitizations of the resulting mortgages and other CDOs) constituted a time bomb (Roig-Franzia, 2009). She argued this point against the opposition of government officials like Allan Greenspan, Robert Rubin, Arthur Levitt, and Lawrence Summers, and of banks like Morgan Stanley, and Goldman Sachs, which derived as much as 40 percent of their profit from the creation and trading of the derivatives (Sanati, 2010). The Bank for International Settlements' report that the total of all credit default swaps were at $36 trillion in 2009 ("BIS Quarterly Review," 2009, p.23) provides an indication of the magnitude of this potential time bomb.

These various explanations are cited here as examples of substantive explanatory efforts, not as arguments that they are correct or complete.

notation would be $^{n(a_c)}C^{a(val)}$. The subscript **c** in a_c indicates that a_c is a consensus group, not an individual. The members ***a*** of the consensus group would all be affected by $C^{a(val)}$. **n** refers to the number of individuals in the group a_c.

Consensus and its perception

The diagram below shows that party(ies) ***b*** (any party(ies) that is not a member of the consensus group na_c) perceives the consensus group.

$$_b(na_c)C^{a(val)}$$

To perceive a consensus means to perceive some aspect of the number **n** of individuals comprising it, and the particular prediction $C^{a(val)}$ to which the consensus applies.

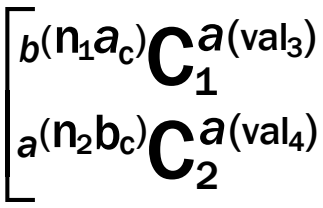
There can also be cases where we want to show that ***b*** not only perceives the existence of the consensus, but also perceives its object $C^{a(val)}$ *directly*. The notation of such cases would be

$$_b(na_c)_bC^{a(val)}$$

The next diagram shows the cases where the ***b*** party/ies would also, independently, make the same prediction as na_c.

$$b,\ _b(na_c)_bC^{a(val)}$$

But na_c and ***b*** may also have *different* predictions of $C^{a(val)}$. When ***b*** consists of more than a single individual, it may then be shown as a second consensus group n_2b_c that predicts a different consequence for ***a***, and some of the members of n_1a_c may perceive this second consensus group and the different consequence it predicts:



This diagram becomes significant in the analysis of how bubbles burst, as will be seen.

Consensus in monetary systems

A property's transferability is facilitated by monetization, as when a a tangible property (like gold) is partitioned into currency units. The flip side of this benefit is that the $\mathbf{na}_{\boldsymbol{c}}$ regarding the exchange value of currency units is usually less stable than the $\mathbf{na}_{\boldsymbol{c}}$ regarding the exchange value of the underlying partitioned tangible property (Meltzer, 2002).

The value that $\mathbf{na}_{\boldsymbol{c}}$ predicts for the exchange value of the currency can become detached from that of the underlying partitioned tangible property (Ritter, 1995), as when the United States abandoned the gold standard. In such cases the value of the underlying partitioned tangible property is increasingly replaced by the consensus $\mathbf{na}_{\boldsymbol{c}}$ that predicts the actual exchange value of the currency units. The drifts of this prediction, along with such variables as changes in the money supply, are generally referred to as inflation or deflation (Schwartz, 2008).

How banking depends on consensus

Banks aggregate deposits and other properties and then partition the resulting aggregates into withdrawal rights, interest entitlements, and "reserves." The total Effective Value of these may exceed that of the bank's property (depending on how the various components of the aggregate are valued and weighted by risk [Paletta, 2009]). The bank's stability then depends on the depositors'($\mathbf{na}_{\boldsymbol{c}}$) prediction that they will not all exercise their withdraw rights at the same time, and on all potential future depositors' (the $\boldsymbol{b}$'s) perception of that consensus (Morris & Shin,

2000). It is therefore vital for a bank to ensure the maintenance of the bank depositors' consensus (the $\mathbf{na_c}$) that the act **A** of exercising their withdrawal rights will result in their getting their deposit back (the $\mathbf{C^{a(val)}}$).

There are various ways in which a bank can try to maintain this consensus $\mathbf{na_c}$ and its perception by potential future depositors ***b.*** Non-deceptive ways include increasing the number of its depositors and reserves and insuring these reserves effectively (Kroszner, 2008). Deceptive ways include exaggerating the number of depositors and the size of the reserves, citing sham insurance for the claimed reserves and the bank's age, image, or size, as supposedly relevant evidence. Another deceptive way, discussed earlier, is to desensitize depositors to the "small print" that permits the bank to change the depositors' rights under certain conditions.

The $\mathbf{na_c}$'s and/or ***b***'s predictions of the $\mathbf{C^{a(val)}}$ may differ. For example, ***b*** may say, "I perceive that there exists a consensus among depositors (i.e., they predict) that they would be able to take out their deposits, but I predict that they wouldn't." Any splintering of $\mathbf{na_c}$ can result in a run on the bank (Kaufman, 2008), a process similar to that which occurs in the bursting of a bubble, as seen in the next sections.

Consensus in multiple-stage property transfers, and bubble formation and bursting

The sheer number of times a property has been transferred can constitute a history on which a consensus group may base its prediction of the $\mathbf{C^{a(val)}}$ (Ying, 1966). Each additional transfer stage may result in a progressive increase in the $\mathbf{C^{a(val)}}$ of the aggregate. The first stage may be the original formation of the aggregate, and subsequent ones may be additional instances of aggregation or partitioning (e.g., securitization, derivative creation). At each stage, the aggregator can assign an increasing value to the $\mathbf{C^{a(val)}}$ without there having been any actual change in the $\mathbf{C^{a(val)}}$s of the underlying individual properties. This dynamic describes

how one type of bubble can form. An instance of it was the multi-trillion dollar mortgage bubble of the past decade. Some lenders issued unsound mortgages (inadequately collateralized loans) and then aggregated them into new securities, like derivatives and collateralized debt obligations (Mongoose, 2009) and in some instances bundled the aggregated debt obligations into further aggregates. Each stage of transfer further obfuscated the actual (and irretrievable) values and defining contingencies of the underlying properties.

Another example of bubble formation is a run-up in the price that the members of a consensus group (in this case the buyers) assign to a stock without an accompanying change in the stock's fundamentals. When the basis of a consensus group $\mathbf{n}a_c$'s prediction is a recent history of $\mathbf{C}^{a(\text{val})}$ increases or decreases (i.e., the first derivative of value), the $\mathbf{n}a_c$ will tend to predict a continuation of such increases or decreases and thus be disposed to buy or sell at the new price. An outside consensus group $\mathbf{n}_2b_c$, whose members b perceive $\mathbf{n}_1a_c$ and the same history of increases or decreases, may then join $\mathbf{n}_1a_c$ in its prediction of $\mathbf{C}^{a(\text{val})}$, thereby perpetuating or even accelerating the change in the most recent direction. When a third consensus group then perceives not only the same $\mathbf{C}^{a(\text{val})}$ increases or decreases, but also the swelling $\mathbf{n}$ of the consensus group(s), the momentum of the change would increase yet again, a process that would repeat as additional consensus groups join, in a self-perpetuating cycle. When the change is an increase, this general process describes bubble formation. When it is a decrease, it describes a crash or the bursting of a bubble.

Noteworthy is the degree to which the power of this recent-history-of-change effect can overcome and outweigh the factors that normally inhibit and restrain $\mathbf{C}^{a(\text{val})}$ changes—the standards of comparison and reference for $\mathbf{C}^{a(\text{val})}$ described earlier. The consensus group's predictions increasingly discount the comparison standards' relevance and replace

them with the most recent history of $\mathbf{C}^{a(val)}$ movements—a key dynamic of bubble formation and panics.

How bubbling ends

Predictions of continued $\mathbf{C}^{a(val)}$ change in a particular direction are necessarily self-limiting—there always comes a point where the $\mathbf{C}^{a(val)}$ reaches a level that is so discrepant from the normal reference standards that the balance shifts back in favor of those standards. At the same time, and separately from this increasing discrepancy, new contingencies, such as increasingly attractive prices at which to buy or sell, are created when the $\mathbf{C}^{a(val)}$ reaches new highs or lows. The consensus group splinters when some members of its members then defect and the first derivative of $\mathbf{C}^{a(val)}$ moves back toward zero, thus presenting a new recent movement history with a resulting strengthening of the relative weight of the normal comparison standards.

Another factor that limits bubble formation is depletion of the finite supply of new recruits for the consensus group. For their perpetuation, the processes of bubble formation and bursting both require the continuing recruitment of new members.

The role of deception in bubble formation

When stockholders set up contingencies that reward the company's management on the basis of stock price changes, management acts accordingly. To make the stock price go up independently of the traditional value indicators, managers must influence the $\mathbf{na}_{\boldsymbol{c}}$. Deceptive ways to do this include:

- Motivating rating agencies (Davies et al, 2008) or securities analysts to issue ratings or predictions that will influence the market (Gross, 2002).
- Reporting current earnings, assets, or transactions inaccurately, issuing overoptimistic projections, falsely showing inadequately collateralized debt obligations as full assets.

- Citing variables that have no predictive value, like a recent history of increasing stock prices, or of dividend or interest payments.
- Engaging in aggregation, partitioning, and multiple-stage transfers with misleading effects on balance sheets.
- Falsifying the timing of important transactions.

The recent Enron story is a prominent example of several of these types of deception (McLean & Elkind, 2003).

Aggregation and partitioning in Ponzi schemes

Bernard Madoff aggregated the investments he received and partitioned the resulting aggregate into (a) withdrawal rights, (b) interest entitlements, (c) reserves, and (d) funds that he appropriated for himself. He crafted a consensus $\mathbf{na_c}$ that mispredicted the $\mathbf{C}^{a(\text{val}),\,p}$, namely the probability that the investors would receive regular interest payments and would be able to withdraw their investments on demand. He maintained this misprediction by continuing to obfuscate the contingencies that defined the aggregate, including its greatly reduced $\mathbf{C}^{a(\text{val}),\,p}$, thereby continuing to postpone a splintering of the $\mathbf{na_c}$ (Markopolos, 2010).

Ponzi situations in which victims participate

Ponzi processes (Walsh, 1998) in which the "victims" are also participants depend on the existence of a consensus in which the participants predict not only $\mathbf{C}^{a(\text{val})}$ but also the perceptions and predictions of others in a recursive regress, i.e., that a sufficient number of others would in turn perceive and predict that a sufficient number of yet others will perpetuate the process. Knowing that the world supply of potential participants is finite, the participants normally also predict that the process will eventually have to end, but at a point that is acceptably far in the future. At the time of a particular act of participation, the Effective Value of the act's short-term positive consequence outweighs its long-term negative effect in accordance with temporal discounting principles, as discussed earlier. Or, the participant may predict that the act's short-term

gain outweighs the risk that the bubble will burst immediately—a strategy that has been called "riding the bubble," which can be optimal for the individual under certain conditions (Kole et al, 2008). Some of Madoff's investors may have continued their participation for some of these reasons.

It may be noted that the act of incurring new debt to repay old debt, or of falsely claiming that an incurred obligation is adequately collateralized, seen in many Ponzi processes, also characterizes the operation of social security systems, the actions of governments when they continue to increase a debt, the exploitation of non-renewable natural resources, and degradation of the biosphere. These types of acts are usually acceptable to a society when the day of reckoning is sufficiently distant, even though foreseeable. Indeed, there is evidence that temporal discounting principles function in much the same way when applied to inter-generational and macro-economic outcomes as when applied to outcomes that occur within the subject's own lifetime (Chapman, 2001).[18]

Parallels between large-scale property transfers, bubbles, and Ponzi processes

We have seen that property transfers that involve partitioning, aggregation, or multiple stage transfers, like the creation of derivatives, provide the transferor with great discretion in assigning a value to the property. In multiple stage transactions, the transferor can take a profit at each stage.

The bubble formation process can be thought of as a large-scale series of multiple stage property transfers by thousands of individuals, with value increases occurring at each of thousands or even millions of transfers, based on a perception of consensus and recent price movements rather than normal comparison standards. This is a key part of the

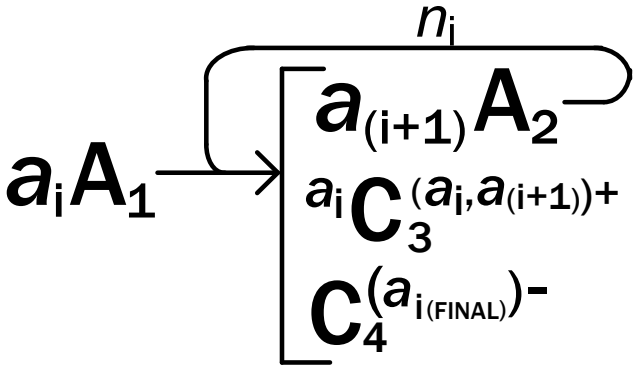
[18] One of our society's most nefarious instances of this contingency is the one that governs the actions of elected government officials faced with a problem they must solve quickly in order to achieve reelection—a problem whose only short-term solutions entail inevitable long-term damage and whose far-sighted solution is politically unpalatable. Allan Meltzer (2009) cites high unemployment and inflation as examples of problems whose correct but politically unpalatable solutions normally have two-year time lags.

behavioral explanation of the fine-grain structure of most instances of bubble formation. The participants in Ponzi processes, too, may derive short-term profits at each of such multiple stages of transfer without regard to the Effective Value of the transferred property or to comparison standards that might establish an underlying value, or to the ultimate negative consequence.

Thus, in all of these property transfer phenomena, the transferors are able to secure a profit at each transfer stage, due to the detachment of value from the comparison standards that normally inhibit increases. In all cases, an upstream party(ies) eventually incurs a negative consequence.

Diagrammatic representation of the formal parallels

The diagram below codifies the behavioral contingencies shared by all of these types of property transfer. Its purpose is to show that they have the same basic contingency structure, differing only with respect to the nature of the transfer acts, the consequences of those acts, and the number of transfers involved.



n refers to the number of property transfer stages. n_i represents the i^{th} n. The $a_i A_1$ at the left is the initiating potential property transfer, with i in a_i being zero when no recycling has yet occurred. Subsequent values of i reflect possible subsequent recyclings and transferors. C_3 is the near-term positive consequence for the transferors and transferees at that transfer stage. C_4 is the long-term negative consequence for the ultimate transferee ($a_{i\,FINAL}$).

a_i A_1 results in three consequences: (Topline): The occasion for the next (who may be again the same) transferor $a_{(i+1)}$ to perform a further transfer; (Second line): The value change due to that transfer, which may be positive for both transferor a_i and transferee $a_{(i+1)}$; (Third line): The negative consequence of the final transferee(s). That negative consequence, depending on the type of transfer involved, could be owning a "toxic asset," a stock with an inflated value at the peak of a bubble, or a Ponzi participant "left holding the bag."

The diagram shows that all of these types of property transfer differ only in the value of n and the definitions of the particular acts and consequences. Their dynamics are the same. The various forms of deception that are involved in all of the transfers, as shown earlier, could also be codified in the diagram but are omitted here so as to avoid obscuring the essential structural features.

The role of behavioral contingency analysis

Regardless of their potential theoretical significance, these particular parallels provide an example of how an analysis that uses behavioral units can reveal regularities and suggest new conceptualizations in fields like economics and finance, as well as in any discipline whose underlying phenomena consist of human behavior.

One may reasonably ask whether these behavioral contingency analyses really required the use of a formal symbolic language. Perhaps not, but, like Wittgenstein's ladder, which is discarded after having been climbed (Wittgenstein, 1922), the contingency language's contribution can easily be downplayed once the goal has been reached. After an explorer has reached his destination and created a map, it is usually evident that he could have followed a shorter route. The same principle applies to many applications of the formal language for the analysis of behavioral contingencies.

Appendix A

1. **A** → means "*If* act **A** occurs *then* … (a consequence)."

2. Every **A** is preceded by an implied "*if*."

3. ***a*A** means act **A** would be performed by party ***a***.

4. **A** → **C** means that **C** would be the consequence of act **A**.

5. A positive valence, $\mathbf{C}^{+}$, can mean beneficial, desired, positively reinforcing. A negative valence, $\mathbf{C}^{-}$, can mean harmful, hurtful, aversive, punishing. The party(ies) that would be affected by the valence(s) are indicated in front of the valence sign: $\mathbf{C}^{a+}$, $\mathbf{C}^{b-}$, $\mathbf{C}^{ab-}$.

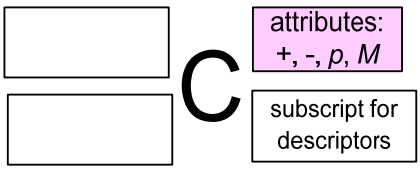
6. **T** → **C** means "upon termination of time **T** …" *Example:* After the egg has boiled for ten minutes, it will be hard boiled.

7. $\mathbf{C}^{p}$ The probability ***p***, in the analyst's estimation, that **C** would occur.

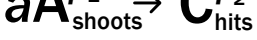
8. A bracket around vertically listed **A** s, **T** s, or **C** s indicates *simultaneity*. The order of listing has no significance.

9. Every entity **A**, **C**, **T**, ***a***, or ***p*** can have modifiers, shown in the entity's four quadrants.

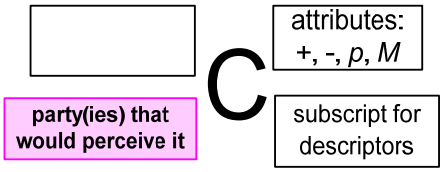
10. The attributes + and - (possible valences), or ***p*** are shown in the upper right quadrant. The subscript refers to a description or identification of the entity.



11. Subscripts can be arbitrary numbers indexed to a legend, or, the entities can be described by words shown in the subscript position, as in the diagram.



12. $_{a}\mathbf{C}$ means "party ***a*** would *perceive* consequence **C,**" meaning "see", "hear," "notice," "respond to," or "understand."



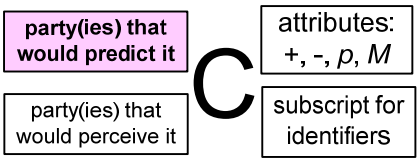
13. $_{b}\mathbf{aA}$ means that ***b*** would perceive that ***a*** is **A**'s agent.

$_{b^x}\mathbf{aA}$ means that ***b*** would *misperceive* the fact that ***a*** is **A**'s agent, as in false accusations or misperceptions of the agent of a gift.

14. The $\mathbf{C_2}$ in the diagram is what the analyst believes would *actually* occur. The subscript can refer to an explanation of what ***a*** would (mistakenly) perceive instead.

$a_1^x C_2$

15. $\mathbf{A} \rightarrow {}^{a}\mathbf{C}$ means ***a*** would *predict* **C.** Prediction is always based on prior contact with similar contingencies or a verbal communication. In $\mathbf{aA} \rightarrow {}^{b}\mathbf{C}^{a-}$, ***b*** would *predict* that ***a*** would hurt himself.



16. In $\mathbf{aA} \rightarrow {}^{a^x}\mathbf{C}^{a-}$, ***a*** would *mispredict* that he would hurt himself. In the diagram at the right, ***b*** would *perceive* that ***a*** would mispredict $\mathbf{C}^{a-}$, as when ***b*** would *perceive* that ***a*** would unwittingly walk into a trap.

$_{b}a^{x}C^{a-}$

17. A vertical arrow (initiated by an **A** or a **T**) cutting a horizontal arrow terminates the contingency represented by that horizontal arrow.

REFERENCES

Ainslie, G. (1992). *Picoeconomics: The strategic interaction of successive motivational states within the person*. New York: Cambridge University Press.

Ainslie, G., and Haslam, N. (1992). Hyperbolic discounting. In G. Loewenstein & J. Elster (eds.) *Choice over time* (pp. 57-92). New York: Russell Sage Foundation.

Abreu, D., and Brunnermeier, M. K. (2003). Bubbles and crashes. *Econometrica, 71*, 173-204.

Acharya, V. V., Brenner, M., Engle, R. F., Lynch, A. W., and Richardson, M. (2009). Derivatives: The ultimate financial innovation. In V. V. Acharya & M. Richardson (eds.) *Restoring financial stability: How to repair a failed system*. New York: Wiley Finance.

Alchian, A. A. (2008). Property rights. *The Concise Encyclopedia of Economics*. Library of Economics and Liberty. Retrieved March 19, 2010 from http://www.econlib.org/library/Enc/PropertyRights.html

Ashcraft, A. (2005). How does tranching add economic value? *Federal Reserve Bank of New York.* Retrieved June 15, 2010 from http://www.bis.org/publ/cgfs23ashcraft.pdf

Baum, W. M., and Heath, J. L. (1992). Behavioral explanations and intentional explanations in psychology. *American Psychologist, 47*, 1312–1317.

Benartzi, S., and Thaler, R. H. (1995). Myopic loss aversion and the equity premium puzzle. *Quarterly Journal of Economics, 111*, 73-92.

Bickel, W. K., and Marsch, L. A. (2000). The tyranny of small decisions: Origins, outcomes, and proposed solutions. In W. K. Bickel & R. E. Vuchinich (eds.) *Reframing Health Behavior Change with Behavioral Economics.* New Jersey: Lawrence Erlbaum Associates.

BIS Quarterly Review: International Banking and Financial Market Developments. (2009, December). *Bank for International Settlements*. Retrieved March 1, 2010 from http://www.bis.org/publ/qtrpdf/rqt0912.pdf

Bookstaber, R. (2007). *A demon of our own design.* John Wiley & Sons. Hoboken, NJ.

Brenner, R. (2009). What is good for Goldman Sachs is good for America: The origins of the current crisis. *Center for Social Theory and Comparative History, Institute for Social Science Research, UC Los Angeles.* Retrieved June 15, 2010 from http://escholarship.org/uc/item/0sg0782h.

Brown, E. (2008, April 10). Credit default swaps: Derivative disaster du jour. Retrieved March 1, 2010 from The Web of Debt website: http://www.webofdebt.com/articles/derivative-disaster.php

Brunner, K., and Meltzer, A. H. (1993). *Money and the Economy: Issues in Monetary Analysis.* Cambridge: Cambridge University Press.

Chapman, G. B. (2001). Time preferences for the very long term. *Acta Psychologica, 108*, 95-116.

Chisholm, R. M. (1957). *Perceiving: A philosophical study*. Oxford, England: Cornell University Press.

Davies, G. (2002). *A history of money from ancient times to the present day*. Cardiff, Wales: University of Wales Press.

Davies, P. J., Chung, J., and Tett, G. (2008, July 21). Reputations to restore. *Financial Times*. Retrieved June 12, 2009 from http://www.ft.com/cms/s/0/5740fe62-5749-11dd-916c-000077b07658,dwp_uuid=5fd271ee-61f6-11dc-bdf6-0000779fd2ac.html?nclick_check=1

Enhancing disclosure in the mortgage-backed securities markets: A staff report of the task force on mortgage-backed securities disclosure. (2003). *U.S. Securities and Exchange Commission.* Retrieved March 23, 2010 from http://www.sec.gov/news/studies/mortgagebacked.htm#seciv

Foxall, G. R. (2007). Explaining consumer choice: Coming to terms with intentionality. *Behavioral Processes 75*, 129–145.

Francis, J., Venkatachalam, M., and Zhang, Y. (2005). Do short sellers convey information about changes in fundamentals or risk? *Fuqua School of Business, Duke University.* Retrieved June 15, 2010 from http://faculty.fuqua.duke.edu/seminarscalendar/Short.pdf

Furtchgott-Roth, D. (2008, October 16). Commentary: Capitalism is not dead. *Reuters.* Retrieved June 15, 2010 from http://www.reuters.com/article/idUSTRE49F9C420081016

Garrod, N., and Hadi, M. (1998). Investor response to cash flow information. *Journal of Business Finance & Accounting, 25*, 613-630.

Geithner, T. F. (2009, September 23). Written testimony: House Financial Services Committee. Retrieved March 1, 2010 from http://www.treas.gov/press/releases/tg296.htm

Green, L., and Myerson, J. (2004). A discounting framework for choice with delayed and probabilistic rewards. *Psychological Bulletin, 130,* 769-792.

Greenbaum, M., and Harvey, C. E. (1980). The internalization of surface-mining externalities. *Energy Economics, 2,* 161-165.

Greenwald, B., and Stiglitz, J. E. (1986). Externalities in economies with imperfect information and incomplete markets. *Quarterly Journal of Economics, 101,* 229-64.

Gross, J. (2002). Securities analysts' undisclosed conflicts of interest: Unfair dealing or securities fraud? *Columbia Business Law Review, 2002*, 631-676.

Guttentag, J. (2007, April 21). Fixing lender disclosures. /The Washington Post/, p.F09.

Hineline, P. N. (2003). When we speak of intentions. In K. A. Lattal & P. N. Chase (eds.) *Behavior theory and philosophy*. New York: Kluwer Academic/Plenum Publishers.

Holton, G. A. (2004). Defining risk. *Financial Analysts Journal, 60,* 19-25.

Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3,* 305-360.

Kane, E. J. (2009). Unmet duties in managing financial safety nets. Retrieved September 15, 2009 from http://www2.bc.edu/%7Ekaneeb/Unmet%20Duties-8-31.doc

Kaufman, G. G. (2008). Bank runs. *The Concise Encyclopedia of Economics.* Library of Economics and Liberty. Retrieved June 12, 2009 from http://www.econlib.org/library/Enc/BankRuns.html

Kahneman, D., and Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47,* 263-291.

Kaveny, M. C. (2004). Inferring intention from foresight. *Law Quarterly Review, 120*, 81-107.

Kole, E., Guenster, N. and Jacobsen, B. (2008). Riding bubbles. Paris December 2007 Finance International Meeting AFFI-EUROFIDAI Paper. Retrieved June 12, 2009 from http://ssrn.com/abstract=1071670

Kroszner, R. S. (2008, March 3). Liquidity-risk management in the business of banking (Speech given at the Institute of International Bankers Annual Washington Conference). *Board of Governors of the Federal Reserve System.* Retrieved June 15, 2010 from http://www.federalreserve.gov/newsevents/speech/kroszner20080303a.htm

Leonard, D. (2009, May 2). How Lehman Brothers got its real estate fix. *The New York Times*. Retrieved March 1, 2010 from http://www.nytimes.com/2009/05/03/business/03real.html

Lucas, R. E. (1972). Expectations and the neutrality of money. *Journal of Economic Theory, 4, 103-124.*

Lucas, R. E. (1976). Econometric policy evaluation: A critique. In K. Brunner, K & A. H. Meltzer (eds.) *The Phillips Curve and Labor Markets, Carnegie-Rochester Conference Series on Public Policy, 1* (pp. 19-46). New York: American Elsevier.

Madden, G.J., Bickel, W. K., and Jacobs, E. A. (2000). Three predictions of the economic concept of unit price in a choice context. *Journal of the Experimental Analysis of Behavior, 73,* 45-64.

Markopolos, H. (2010). *No one would listen: A true financial thriller.* New Jersey: John Wiley & Sons.

Markowitz, H. M. (1959). *Portfolio selection: Efficient diversification of investments*. New Jersey: John Wiley & Sons.

Mazur, J. E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin, & H. Rachlin (eds.) *Quantitative analyses of behavior, Vol. 5. The effect of delay and of intervening events on reinforcement value* (pp. 55-73). Hillsdale, New Jersey: Erlbaum.

McCarty, L. T. (2002). Ownership: A case study in the representation of legal concepts. *Artificial Intelligence and Law, 10,* 135-161.

McClure, B. (2003). What are fundamentals? *Investopedia*. Retrieved June 12, 2009 from http://www.investopedia.com/articles/fundamental/03/022603.asp

McLean, B., and Elkind, P. (2003). *The smartest guys in the room: The amazing rise and scandalous fall of Enron*. New York: Portfolio.

Mechner, F. (2008a). Behavioral contingency analysis. *Behavioral Processes, 78*, 124-144.

Mechner, F. (2008b). Applications of the language for codifying behavioral contingencies. Retrieved July 15, 2010 from http://mechnerfoundation.org/newsite/downloads.html

Mechner, F. (2010a). Anatomy of deception: A behavioral contingency analysis. *Behavioral Processes, 84*, 516–520.

Mechner, F. (2010b). Behavioral contingency analysis: A formal symbolic language for the analysis of complex contingencies. A PowerPoint presentation. Retrieved July 15, 2010 from http://mechnerfoundation.org/newsite/downloads.html

Meltzer, A. H. (2002). *A History of the Federal Reserve, Volume 1, 1913-1951.* Chicago, IL: University of Chicago Press.

Meltzer, A. H. (2008, March 27). Regulatory Overkill. *Wall Street Journal (Eastern Edition),* p. A.14.

Meltzer, A. H. (2009, June 30). Can the Fed control inflation? Yes. Will it? Unlikely. *The Enterprise Blog, Journal of the American Enterprise Institute.* Retrieved June 15, 2010 from http://blog.american.com/?p=2666

Meltzer, A. (2009b). Reflections on the financial crisis. *CATO Journal*, *29*, 25-30.

Meltzer, A. H. (2010). *A History of the Federal Reserve, Volume 2, 1951-1969.* Chicago, IL: University of Chicago Press.

Meltzer, A. H. (2010b, March 17). Testimony, House Financial Services Committee. *United States House of Representatives, 111th Congress, 1st Session.* Retrieved June 14, 2010 from http://www.house.gov/apps/list/hearing/financialsvcs_dem/meltzer.pdf

Miller, K. D., and Shapira, Z. (2000). Behavioral option theory: Foundations and evidence. *Purdue University Economics Working Papers 1133*. Retrieved June 12, 2009 from http://www.krannert.purdue.edu/programs/phd/Working-paper-series/Year-2000/KentMiller7-2000.pdf

Mongoose, D. (2009). Collateralized debt obligations: From boon to burden. *Investopedia*. Retrieved June 12, 2009 from http://www.investopedia.com/articles/bonds/09/collateralized-debt-obligations.asp

Morris, S., and Shin, H. S. (2000). Rethinking multiple equilibria in macroeconomic modeling. *NBER Macroeconomics Annual, 15,* 139-161.

Morrissey, J. (2008, March 17). Credit default swaps: The next crisis? *Time*. Retrieved June 12, 2009 from http://www.time.com/time/business/article/0,8599,1723152,00.html

Naranjo, A., and Toevs, A. (2002). The effects of purchases of mortgages and securitization by government sponsored enterprises on mortgage yield spreads and volatility. *The Journal of Real Estate Finance and Economics, 25,* 173-195.

Ordinal utility. (2000-2010). AmosWEB Encyclonomic WEB*pedia. Retrieved March 19, 2010 from http://www.amosweb.com/cgi-bin/awb_nav.pl?s=wpd&c=dsp&k=ordinal%20utility

Paletta, D. (2009, April 2). Regulators agree to create stricter capital requirements for banks. *The Wall Street Journal*. Retrieved March 1, 2010 from http://online.wsj.com/article/SB123868295604882511.html

Palmer, B. (2009, March 16). The bonus explainer: How did the AIG executive "bonuses" become a legal obligation? *Slate*. Retrieved March 1, 2010 from http://www.slate.com/id/2213885/

Pietras, C. J., and Hackenberg, T. D. (2001). Risk-sensitive choice in humans as a function of an earnings budget. *Journal of the Experimental Analysis of Behavior, 76,* 1-19.

Rachlin, H. (2000). *The science of self-control.* Boston, MA: Harvard University Press.

Rachlin, H., Raineri, A., and Cross, D. (1991). Subjective probability and delay. *Journal of the Experimental Analysis of Behavior, 55,* 233-244.

Re-securitising CDOs. (2009, August). *Credit*. Retrieved June 12, 2009 from http://www.creditmag.com/public/showPage.html?page=168575

Ritter, J. A. (1995). The transition from barter to fiat money. *American Economic Review, 85*, 134-149.

Robinson, J. (1997). *The laundrymen: Inside money laundering, the world's third-largest business*. New York: Arcade Publishing.

Roig-Franzia, M. (2009, May 26). Credit crisis Cassandra. The Washington Post. Retrieved March 1, 2010 from http://www.washingtonpost.com/wp-dyn/content/article/2009/05/25/AR2009052502108.html

Sanati, C. (2010, April 30). Study: Derivatives rule would cost banks billions. *The New York Times.* Retrieved June 15, 2010 from http://dealbook.blogs.nytimes.com/2010/04/30/study-derivatives-rules-would-cost-banks-billions/

Schmidt, M. (2008). The characteristics of a successful company. *Investopedia*. Retrieved June 12, 2009 from http://www.investopedia.com/articles/stocks/08/successful-company-qualities.asp

Schwartz, A. J. (2008). Money supply. *The Concise Encyclopedia of Economics.* Retrieved June 16, 2010 from http://www.econlib.com/library/Enc/MoneySupply.html

Simon, H. (1998). Behavioral economics. In P. Newman (ed.) *The New Palgrave Dictionary of Economics and the Law*. London: Macmillan.

Stewart, B. D. (2003). Disclosure of the irrelevant? – Impact of the SEC's final proxy voting disclosure rules. *Fordham Journal of Corporate and Financial Law, 9*, 233-253.

Stewart, S. A. (2005). Can behavioral economics save us from ourselves? *University of Chicago Magazine, 97.* Retrieved March 17, 2010 from http://magazine.uchicago.edu/0502/features/economics.shtml

Stiglitz, J. (2001). Information and the change in the paradigm in economics. Nobel prize lecture, December 8, 2001. Retrieved March 1, 2010 from http://www2.gsb.columbia.edu/faculty/jstiglitz/download/2001NobelLecture.pdf

Stiglitz, J. (2008, September 16). The financial crisis is the fruit of dishonesty on the part of financial institutions. The Guardian. Retrieved March 1, 2010 from http://www.guardian.co.uk/commentisfree/2008/sep/16/economics.wallstreet

Stiglitz, J. (2009). Regulation and failure. In D. Moss & J. Cisternino (eds.) *New Perspectives on Regulation* (pp. 11-23). Cambridge, MA: Tobin Project.

Transcript - Obama's Remarks on the Economy. (2009, April 14). *The New York Times*. Retrieved June 12, 2009 from http://www.nytimes.com/2009/04/14/us/politics/14obama-text.html?pagewanted=1

Van Horne, J. C., and Wachowicz, J. M. (2005). *Fundamentals of financial management* (12th ed). New York: Prentice Hall.

Walsh, J. (1998). *You can't cheat an honest man: How Ponzi schemes and pyramid frauds work… and why they're more common than ever*. New York: Silver Lake Publishing.

Wittgenstein, L. (1922). *Tractatus Logico-Philosphicus*. C.K. Ogden, Translator. London: Kegan Paul, Trench, Trubner.

Yago, G. (1991). *Junk bonds: How high-yield securities restructured corporate America*. New York: Oxford University Press.

Yamey, B. S. (1973). *Economics of industrial structure: Selected readings*. New York: Puffin.

Ying, C. C. (1966). Market prices and volumes of sales. *Econometrica, 34*, 676–685. Zweig, P. L. (1993). Asset-backed securities. *The Concise Encyclopedia of Economics*. Library of Economics and Liberty. Retrieved June 12, 2009 from http://www.econlib.org/library/Enc1/AssetBackedSecurities.html