Abstract

This paper proposes a theory of financial intermediation as a form of cognition. It shows that each of the important elements of financial intermediation performs a cognitive role. This includes foundational instruments such as money and institutions such as banks. By demonstrating the cognitive work it performs, this theory also offers a new explanation for emergent financial phenomena, such as asset price booms.

Keywords: Asset Price, Bank, Bubble, Cognitive, Finance, Financial Intermediation

JEL Codes: G12, G14, G20, E14
Finance as Cognition

Introduction

This paper proposes a theory of financial intermediation as a form of cognition, as the bridge between mind and things in the economic world. The fundamental problem in economic life is cognitive. This consists of two parts: (1) apprehending reality, and (2) translating that knowledge into action.

This paper will show that all of the institutions of finance at their root, at their most fundamental level, exist to solve these interconnected problems. Since the problem of cognition is evident in all aspects of finance, it is fundamental to a theory of finance. Cognition is the fundamental economic problem solved by finance. This paper presents a cognitive theory of finance.¹

To establish this point, this paper will survey each of the important elements of financial intermediation. It will survey the instruments of finance, the institutions of finance, and

¹ The approach of this paper is to use the word “cognition” in its original sense of referring to the act of apprehending reality. This usage precedes and stands in contrast to the extensive cognitive bias literature begun by Daniel Kahneman and Amos Tversky in the 1970s. Despite the widespread literature on biases, “cognition” is not a synonym for “cognitive bias.” The concept is broader. It includes cognitive biases, but it refers more broadly to, “The mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.” (Oxford Dictionaries online). Biases are aspects of cognition, but they cannot invalidate cognition, which must function on some level if goods are to be produced.
the emergent phenomena of finance. It will show that each of these elements of finance solves the twin cognitive problems of knowledge and action.

It will do this using a methodology that models the economic world from the point of view of the heterogeneous individual economic agents that populate it. Each of these economic agents, in their capacities as borrowers, bankers, savers, buyers and sellers of goods, speculators, and entrepreneurs, propels financial action by utilizing money instruments and banking institutions. Their actions result in the formation of institutions and emergent phenomena. Each of these agents also operates from a unique, individual cognitive vantage; each possesses a unique stock of information, which each individual apprehends in a unique, fallible mind. Each of these agents draws information from and acts with other agents at particular nodes of a cognitive financial network. It is a financial ecology of actors.

By presenting a comprehensive picture of financial intermediation by means of key illustrative examples, this paper shows how cognition is the fundamental economic role performed by finance.

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2 Wagner (1999:72-76) provides a good explanation of emergent phenomena in economics.
3 This analysis relies on the nodal/ecological information framework described in Wagner (2012), and applies it to the realm of finance.
4 This argument is similar to Hayek’s explanation of how the price mechanism performs a knowledge-acquisition role in the economy (Hayek 1945). In this paper, finance performs a similar knowledge-acquisition and economizing role with regard to knowledge of the uncertain future.
The Importance of Fundamental Examples

The aspects of finance that will be examined are instruments, institutions, and emergent phenomena. This paper begins with the foundational financial instrument: money. Then it will proceed to the basic institution of financial intermediation: banking. From there, it will examine a significant emergent phenomenon: asset price booms.

In addition to money, there are other instruments, such as equities, bonds, and derivatives. Besides banks, there are other institutions, such as stock, bond, and commodity exchanges, and insurance markets. There are also other emergent phenomena, such as business cycles.

This paper will not go into the multiplicity of these instruments, institutions, and emergent phenomena. Instead, it will describe the most important/fundamental of these, demonstrating by implication that the principle applies to all aspects of finance. Money and banking are, arguably, the foundational instrument and institution of financial intermediation, respectively. Therefore, we will begin there. If our argument applies to them, it should also apply to the other instruments and institutions that share their essential features, such as stocks and bonds, and commodity and stock exchanges.

Emergent financial phenomena are a topic worthy of its own special study. We will show that our argument applies to an important emergent phenomenon that is endemic to
capitalism: asset price booms. We will not argue here that asset price fluctuations are without doubt the fundamental emergent phenomenon in finance. That is arguably true. However, the frequency of asset price booms suggests that they are significant and possibly even fundamental.\(^5\) Showing that asset price booms also solve a cognitive problem will extend the reach of our hypothesis not just to instruments and institutions, but also to an important emergent phenomenon.

**Instruments: Money**

Money is the basis of all financial intermediation. It is the basis of credit and all other instruments, such as equities, bonds, and derivatives. It is the universal commodity that facilitates trade, the price mechanism, and the division of labor. It is the fundamental unit of account in transactions, and it acts as a store of value. It is the final asset that can redeem debts.

It should not be necessary to further establish that money is the fundamental -- i.e., foundational -- instrument of finance. We will consider money in its most basic role:

\(^5\) As evidence of this, consider that asset price booms have occurred in every major economy where there was significant financial intermediation during the capitalist era of the 18th-21st centuries, beginning with the Mississippi and South Sea Bubbles of 1720 which appeared in France and England, and continuing most recently to the housing finance bubble that began in the United States. They even occurred in 17th century Holland, which had a well-developed banking system, where speculators created a bubble in tulip bulbs during the so-called “tulip mania” episode. Moreover, as further evidence of fundamentality, these booms have occurred under all types of monetary and regulatory regimes -- i.e., with and without the gold standard, with and without central banking, and under widely varying bank regulatory regimes ranging from near-free banking to extensive regulation. See Kindleberger (2005), especially pp. 294-303, where all major financial crises (many of which involved asset price bubbles) are presented in chart form. For another comprehensive list, see also Janeway (2012:135-155).
exchange. One problem of exchange solved by money has been well-described in economics: the problem of indirect exchange. Money permits more efficient three-way trade instead of relatively inefficient barter. This solves the cognitive problem that each holder of a good has in locating someone willing to trade for his good.

This paper will draw attention to a different cognitive problem solved by money, how its role as the universal good also reduces the future risk associated with purchasing or holding specific, tangible goods. In its role of exchange, money solves a cognitive problem that is inherent in trade. The problem is that the purchaser of a good must make a decision in the present (ex ante) while facing future uncertainty (ex post) over the value of the good.

To see this, consider the knowledge problem faced by the owner of a particular good. The future value to him of that good is uncertain. As an example, consider someone who buys a new car. He does not know how much he will be able to sell it for three years from now. He does not know if the car will develop a mechanical problem that will affect its value. He does not know if gasoline will spike higher and reduce the value of his car, etc.

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6 Menger (1892) explains how money emerged to fulfill this role, by becoming recognized as the most “saleable good.” Smith (1776) explains how money facilitates the division of labor, and therefore rising productivity of labor and wealth creation.

7 Shackle held that the inherent uncertainty faced by agents who must act in the present while facing an unknown future outcome was central in economics. Referencing Gunnar Myrdal, who first proposed the concepts, he says, “Myrdal’s distinction of the ex ante from the ex post view, though mainly formal in his presentation, was one of the most transforming insights that theoretical economics has had.” (Shackle 1972:440). Lachmann developed this theme further as a criticism of static, equilibrium economics. See Lachmann (1986).
Moreover, he does not even know if the car will be useful to him in the future. He may take a job in New York City where prohibitive parking fees make owning a car unnecessary.\(^8\) In that case, the car will have little or no use value to him.

An owner of a particular good bears significant uncertainty and difficulty apprehending the future value of that good.

There is considerably less uncertainty over the future value of money. Compared to any specific good that can be purchased with money, the future value of money is usually considerably more stable and predictable; it bears less future value risk. The fact that makes its future value more predictable is that it is the universal good. It can be exchanged for nearly all other goods. Money is the most "saleable" of all goods.\(^9\) This anchors the future value of money to the entire universe of future real goods it can be exchanged for. The breadth of goods it can be exchanged for ensures its value will generally be more stable than that of any particular future good. Of course, this leaves aside fluctuations in the value of money due to extreme changes in money supply, such as hyperinflations or bank failures.

Money solves the cognitive problem for a seller of a good because the future value of money is much more certain than the future value of any particular good. A trade of a

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\(^8\) It typically costs $400-$600 per month to park a car in Manhattan, more than the typical lease payment of a car.

\(^9\) Menger (1892).
good for money, therefore, can be seen as a cognitive trade. Viewed this way, a person who sells a particular good for money is also selling the future value uncertainty associated with that good. By trading the good for money, the seller reduces his cognitive uncertainty. He gains money, a good with a more predictable future value.

Likewise, in reverse fashion, when someone purchases a good (for money), the person gains the good’s use value, but he also must bear the greater future value risk of the particular good he has purchased. Virtually any particular good -- a car, a house, a suit -- has greater uncertainty over its future value to him than the money he has parted with.

In any trade for money, a good’s use value must be sufficiently high to the purchaser to overcome the greater cognitive risk of the particular good relative to money. Money’s role with respect to cognition is that it reduces cognitive uncertainty. *Money is a cognitive risk-reducing instrument.*

**Institutions: Banks**

It might seem strange to think of money as an instrument that reduces cognitive uncertainty. It is probably less strange to think of banks performing this role.

It is well understood that banks serve the function of intermediation. Bankers intermediate between savers and borrowers. Banks pool the large number of small
deposits of savings and lends them out as larger loans to entrepreneurs and businessmen, and to consumer borrowers.

The funds that the banks collect and distribute can be thought of as tickets to real goods. The monies enable holders to buy real things. In this sense, savers are foregoing consumption of real goods so that the borrowers can acquire real goods. All of this is accomplished through money deposits and loans.

Bankers supervise all this. They collect the deposits and disburse the loans. This is not just physical intermediation, the physical acts of collecting and disbursing these funds. Fundamentally, it is an act of cognitive intermediation. To see this point, consider the cognitive benefits provided by a banker to the parties on each side of the intermediating process: savers and borrowers.

Cognitive Benefit to Savers

Savers face the problem of earning a return on their money. (They also entrust bankers with the security function of taking care of their amassed savings. This custodial aspect of banking is ignored here to focus on the cognitive issue of returns.)

Earning a return is a challenging cognitive problem for the saver. For the saver, managing his savings is just a small part of his life. He may work full-time and must
devote most of his attention and energies in that direction. It is costly and difficult for him to identify persons or firms to whom he could profitably and safely lend his money, in other words, to borrowers who would pay him interest and also reliably return his money to him.

Instead of taking on this difficult and time-intensive problem himself, he entrusts this role to the banker, who specializes in this activity. Thus, he lends his money to the banker in the form of deposits who, in turn, finds appropriate borrowers for this money.

The banker does this full-time. He is a specialist in identifying where to lend the money. He devotes his efforts to identifying and evaluating borrowers who are creditworthy and have an ability to generate profits.

All of the work that a banker performs is cognitive. The banker does not make physical things. His product is intellectual. The banker’s work is as cognitive intermediator.

Cognitive Benefit to Borrowers

The borrower receives an even greater cognitive benefit from the banker. If he is an entrepreneur, his goal is to start or expand a business. He desires to focus his mental energy and effort in the physical production of his firm’s products and services. However, in order to do this, he must have money in which to acquire his means of
production. The banker frees the businessman from the cognitive problem of identifying and amassing funds from a multiplicity of investors.

In financing an entrepreneur, note the important, redundant cognitive work performed by the banker. Just as the entrepreneur does himself, the banker must also evaluate the business prospects of the entrepreneur's plan. In this manner, the banker emerges as a cognitive partner to the entrepreneur in his difficult cognitive task.

The entrepreneur faces the extremely difficult cognitive task of ascertaining the future value of goods or services that he has not yet created. Not only must he ascertain the future value -- and therefore, demand -- for those goods, but he must correctly ascertain the future value of all of his costs of production. He must ascertain the future value of his revenues and costs in order to forecast whether his venture will be profitable and worth undertaking.

The banker, too, must perform this difficult cognitive work in order to ascertain whether the entrepreneur will repay his investment, plus interest. Because the banker is financing many entrepreneurs, his cognitive task is different than that of the entrepreneur. He can devote less effort to any particular entrepreneur because he operates from a wider informational vantage.
The banker occupies a different position in the financial-informational ecology. He compares his evaluation of the venture with his own knowledge of the industry, including his knowledge of other loans and other businessmen who are competing in the same or similar industries.

The cognitive work performed by the banker is difficult, but it is essential to wealth creation under capitalism. The banker allocates and re-allocates capital to the highest valued uses, as he perceives those uses each time at the moment he makes a loan or underwrites a securities offering.

The banker solves a cognitive problem in his job, but the problem is never "solved" in an equilibrium sense. There is no final state of rest, no state of perfect information to be achieved. Instead, the banker continually grapples with an ever-changing cognitive landscape. The challenge is perpetual because the facts that he must deal with change continually. New technological opportunities are constantly unfolding. Competitive opportunities are constantly changing. As a result of this, the banker must continually evaluate new business plans that are presented to him, and re-evaluate the prospects of his current borrowers. A banker is a full-time cognitive entrepreneur. He acts full-time to continually solve the cognitive problem inherent in financial intermediation.

We have shown that money and banking are foundational in the process of cognitive intermediation. Each instrument and institution performs a vital cognitive role in the
economy. Now we examine a key emergent financial phenomena, asset price booms. 
Asset price booms are the result of the purposive action of individual actors, but the 
boom itself is not intended. It is an emergent feature, a side effect, of the actions of asset 
buyers and sellers.

Emergent Phenomena: Asset Price Booms

How does an asset price boom (or bust) serve as a source of knowledge in a way that 
reinforces the boom or bust? For simplicity, this analysis focuses on booms but, by 
analogy, this reasoning also applies to busts.

The idea described here is in part not original to this author, but tying this idea to the 
notion of financial markets as a cognitive discovery process may be original. The idea is 
that asset prices, under certain circumstances, can rise in a self-reinforcing boom. The 
financier George Soros coined the term “reflexivity” to describe this phenomenon.\(^\text{10}\) 
Soros is also one of the world’s most successful hedge fund managers. “Reflexivity,” and 
knowing how it plays out in the financial markets, is the reason he gives for making 
billions as an investor.\(^\text{11}\)

\[^{10}\text{Soros (1994: 49-84).}\]
\[^{11}\text{Soros (2009).}\]
As discussed at the beginning of the paper, this analysis will generalize reflexivity by tying it in with an Austrian agent-based framework. Investors are agents who must discover investment opportunities in an ecology consisting of heterogeneous investor-agents and asset owner-agents, each of whom faces the same knowledge problem. Each possesses a unique stock of knowledge and is connected at a different node in the network. Each faces the cognitive problem of discovering to whom and at what price to profitably buy or sell assets.

This is a difficult cognitive problem. Very few of the agents have the knowledge, self-confidence, and financial means to be first-movers in this process. This is why using the observed prices of assets in the marketplace as indicators of their worth can be a rational investment method for information-economizing buyers and sellers of assets who are not first-movers. If the price of an asset is rising, or rising quickly (i.e., the first and second derivatives of prices with respect to time are growing), it indicates that other investors see it as valuable. The asset’s price movement provides information to buyers of that asset. By itself, the price movement does not mean that the asset is a good investment opportunity. Rather, it is a valuable and information-economizing signal that it may be worth investing in.

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13 See Schumpeter (1983 [1934]:74-79), where he describes a similar process for entrepreneurial innovation. There are very few entrepreneurial innovators because of the difficulty of innovating. An entrepreneurial first-mover overcomes difficult obstacles to implement his innovation, only to be followed by swarms of followers, who find it much easier to imitate rather than innovate.
14 Devenow and Welch (1996) survey the extensive literature on rational herding, including herding behavior associated with information acquisition in financial markets. While documenting a variety of phenomena, none of the cited papers tie it in with an overarching theory of finance showing how specific phenomena, such as asset price booms, are inherent in finance’s functioning as a cognitive system.
In the information and time-constrained real world, the mere fact of a price change is important information about the potential value of an asset. Depending on the particular investor-agent’s complementary knowledge and time limitations, the price change may be sufficient basis for him to invest in the asset -- and push its price up still further.

This discussion is encapsulated by the advice that a Wall Street executive offers to a new stock analyst. It is deceptively simple: “form correct, non-consensus opinions” about the future prices of stocks. Upon reflection, the advice is neither simple nor easy.

For example, it is easy to be non-consensus and wrong. A monkey throwing darts at a chart of stocks could do that. It is also fairly easy to be correct while joining the herd. But there is little or no money to be made in blindly following the herd. However, to be correct and alone, to be correct and first (or as close as possible to first) with an insightful investment idea is incredibly difficult. Consider the person who was a first investor in Microsoft in the 1970s, or a first investor in Google in the 1990s. Or, a first short-investor in housing-related securities in the late 2000s. Those are difficult achievements. The large size of their payoffs is evidence of the difficulty of their achievements.

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15 A personal story from the work experience of the author.
The difficulty of being a first-mover in investing is due to the knowledge problem. It is difficult, with limited knowledge and fallible brains, to correctly ascertain future changes in the valuations of assets. This is why most holders of financial capital, when it comes to investing, must be followers, not leaders.

This discussion leads to an ancillary question: Why don’t the leaders capture all the gains? One answer is that they can’t because, like all investors, they have a limited quantity of capital to invest. However, the deeper reason is cognitive. Even if they had a large amount of capital, they would not want to invest all of it in a single investment because they could be wrong; this is a cognitive limitation. Like all investors, they are not omniscient. They are fallible and have limited information upon which to act. Thus, no matter how good the prospective investment appears to be, to at least some degree they must diversify and hedge their risk.

The Role of the Copycat Investor

However, there is an additional, more fundamental reason the first-mover investor does not capture all of the gains. For that investor to make any gain on his investment, asset prices must move higher. To do that, there must be copycat investors. Copycat investors

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16 Hayek identified the “knowledge problem” in economics. The “central problem of economics” “is how the spontaneous interaction of a number of people, each possessing only bits of knowledge, brings about a state of affairs in which prices correspond to costs, etc...” (Italics mine) (Hayek, 1937:50). In Hayek (1945), he explains how the emergent institution of prices accomplishes this. In this paper, we explain how the institutions of financial intermediation accomplish this by facilitating the cognition of knowledge.
are essential if the original investor is to realize his gains by selling his asset and liquidating his investment.

This asset-valuing process -- consisting of the original, non-consensus investor, coupled with legions of followers -- is why the entire structure of financial markets -- bank lending, the equity and bond markets, and the markets for assets -- exists as a cognitive chain, a sort of knowledge feeding-trough. First movers make the initial investments. Then those movers themselves (and their bankers/market makers/brokers/facilitators) spread the knowledge of their investing actions so that the rest of the market can copy it. They do this through communications -- printed media, the Internet, television, conversations -- and it also happens via the price mechanism itself. Price movements serve as signals to the copycat investors. This copying is essential for the success of the original investment. It allows the original investment to be profitable.

Thus, the market needs asset booms. Asset price booms are simply the manifestation of a cognitive information feeding-trough process. It is how a first mover moves the market and then the secondary investors feed into it, pushing the value of the asset higher.

\[17\] In a related point, Janeway (2012:181-208) explains how financial bubbles are essential for financing innovation. The possibility of making speculative stock market gains brings in crucial financial capital that funds innovation. He says, "The most powerful enabler of risk taking at the frontier of innovation is the possibility of winning financially even if the funded project fails." (p. 208). He cites Brown, et al. (2009:152), which shows that during the Internet bubble, from 1994-2004, 75% of incremental R&D spending by "young high-tech firms" was financed by new equity issued during that period (p. 184).
Parenthetically, this doesn’t mean that an asset price boom is efficient in the neoclassical sense. The asset price over- or under-shoots. Some investors, especially latecomer copycats, lose money.\textsuperscript{18} This is only inefficient when starting from an initial assumption of “perfect information,” the standard assumption of neoclassical economics. However, to assume “perfect information” at the outset of a price discovery process is to assume away the problem. The process of price discovery, which involves asset price booms and other phenomena, is the process by which information is discovered.\textsuperscript{19} There are dangers in an economic model of simply assuming that such information already exists and then judging economic phenomena as if they are “inefficient” for not reflecting that information. Such a model vitiates itself as an explanation for the phenomena we are discussing here.

Banks and the financial markets sustain this process in an important way. They sustain it as information-economizing lenders themselves. Each time an asset is bought or sold, it becomes available as collateral for further lending.\textsuperscript{20} Thus, when a banker sees a house rise in value, or an equity, or a privately-held company, or any sort of asset, the price rise itself is conveying information to the banker about the value of that asset. Thus, the banker is willing to extend his lending on the increased value of that asset. This happened during the recent housing finance boom.\textsuperscript{21}

\textsuperscript{18} Emphasized in Janeway (2012).
\textsuperscript{19} Hayek (1978) shows how entrepreneurial competition is a discovery procedure. In an analogous manner, an asset price boom, driven by information-constrained profit-seeking investors, is a knowledge discovery procedure.
\textsuperscript{20} Kiyotaki and Moore (1997).
\textsuperscript{21} Iacoviello (2005).
In this manner, by self-interestedly pursuing profit opportunities in a costly information-constrained world, the banker also participates in the asset price boom. He participates in it by viewing the assets as collateral for further loans (or the issuance of other securities, such as equities, bonds, derivatives, etc.).

What ends this asset price boom? The short answer is that a new first-mover investor appears. He is the investor with special, first-handed insight who discovers that the asset has become too highly priced relative to its underlying economic cash flows or value.

This bearish first-mover sells (or short-sells) the asset. Then the process continues on the downside. In practice, that could involve a banker who clears and winds down the adverse clearing balance of a fellow bank whose loan portfolio has become delinquent. Or, like George Soros or James Chanos, it can be an investor who actively short-sells an asset.\(^{22}\) Regardless of the particular manner in which it happens, such market insight is difficult to achieve; by definition there must be only one or a few original-thinking investors who change the direction of an asset boom. Then the swarm of followers chime in, reinforcing the bust.

\(^{22}\) George Soros famously made $1 billion shorting the British pound in 1992. He correctly foresaw that it was overvalued at its fixed exchange rate, which had to be abandoned. James Chanos was the first major short-seller in Enron stock in 2001.
Whether on the up or the downside, the changes in asset prices contain information about the worth of those assets that is otherwise very difficult to discern. First-movers initiate this process in either direction, and second-hand followers -- in an information-economizing way -- chime in.

The cycle of asset boom and bust is a cognitive process of information discovery. Far from being a malady of the market to be somehow eliminated (except where government intervention makes them worse), they are a vital, integral mechanism by which the market incorporates new information into the valuations of assets.

**Conclusion**

In philosophy, an age-old problem since at least the time of Descartes, but tracing its roots to Greek philosophy, is the mind-body problem. Philosophers seemed to seesaw between holding the mind or the material world (i.e., body) as primary in reality. Plato stressed the former. He held that the perfect was the world of the Forms; the material world was just a poor reflection of it. Others, such as Democritus and Epicurus, held that ultimate reality consisted in the material world.²³

However, we exist in a world where mind and body are integrated, a world where both intentions and material results matter. Finance bridges those two realms. It facilitates

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²³ For the relevant discussion of Greek philosophy, see Copleston (1962, vol. 1). For Descartes, see Copleston, vol. 4.
how intentions -- the plans, goals, and thoughts of entrepreneurial agents -- get translated into action, i.e., into the physical production of goods.

Translating thoughts into action is, arguably, the fundamental economic problem. And it is finance that solves this problem. Financial intermediation is at its root a process of cognitive intermediation. All of the instruments, institutions and emergent phenomena observed in the financial world can be explained as elements that solve the difficult cognitive problem inherent in economic action. The problem is the apprehension of an uncertain future. Financial intermediation is the apprehension of that future. As a cognitive institution, it reduces uncertainty. Because of it, entrepreneurs can identify and secure the factors of production necessary for the production of future goods.
References


