

FERMIers¹ required: applying watershed governance to banking and finance

W. Travis Selmier II

Visiting Scholar, Political Science, Indiana University, USA

wselmier@indiana.edu

Abstract: This paper conceptualizes financial markets as virtual environments which should be subject to stewardship requirements found in natural environments. As in natural environments, irresponsible self-governance and lax or off-target regulation result in environmental damage and social loss. Watershed governance is proposed as the best-fitting analogy to financial markets governance for seven reasons: 1, scaling the watershed analogy from small to large fits well with financial markets; 2, both consist of a variety of users who 3, tap hydrologic [capital] resources for many different uses. 4, financial markets, like watersheds, are made up of private, club, common pool and public goods, and 5, may be better-managed through polycentric institutions with a range of public-private governance arrangements. 6, governmental, private sector and mixed agents seek to support and manage [sustainable] exploitation in each. 7, environmental degradation comparisons are robust. Upstream-downstream interlinkage and cross-border riparian negotiations in combination with financial market cases illustrate challenging financial market governance issues.

Keywords: Banking and financial governance, environmentally responsible management, pollution haven, polycentric governance, property rights, riparian systems, watershed management

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I. Introduction

“In environmental economics, there is a basic principle, called polluter pays principle. Wall Street has polluted our economy with toxic mortgages. It should pay for the cleanup.”

Joseph Stiglitz, 2008

Joseph Stiglitz’ Congressional testimony before the House Committee on Financial Services in 2008 echoed the feelings of many observers, participants and regulators involved in financial markets- that the economy had been “polluted” and that cleanup costs should be borne by bankers and financiers. Stiglitz’ idea that financial markets specifically and the economy generally could be viewed as a kind of virtual environment had a long, well-accepted pedigree.² But his analogy was incomplete. Firstly, acting solely on this idea that “*Wall Street has polluted our economy*” will not lead to a more effective governance model. Secondly, there is a presumption of a financial environment which has been polluted; this assumption needs to be fleshed out and the analogy made whole. We can go further, utilizing lessons from natural resource management plus theory from environmental economics to develop and apply a more robust, more comprehensive governance regime.

Readers from environmental economics and natural resource management may find it curious that Stiglitz’ environmental referent is broadly used in financial economics. But environmental concepts are extensively employed to describe firms, products and geographically-demarcated economies, including localities, states and provinces, countries, regions, or even global financial markets (three representative pieces from the top-ranked journal in financial economics, *Journal of Finance*, include Sametz 1964; Van Horne 1985; Myers 2000). Product life cycles, death of a firm, sclerosis within an economy and start-up incubators are four disparate but oft-used examples of environmental and biological analogies. These analogies extend to seeing corporate “persons” as social actors with citizenship responsibilities (Strike et al. 2006; Madsen 2009). With these corporate social responsibilities come deepening requirements to engage in environmentally-responsible management, or ERM (Porter and van der Linde 1995; Rugman and Verbeke 1998; Madsen 2009). It is but a few short steps from requiring the stewardship which we expect corporations to exercise toward natural environments to

² As a point of reference, Google Scholar returned 28,500 matches for the term “financial environment” on June 11, 2015.

requiring banks and financial institutions to engage in similar-minded stewardship in financial environments.

In the recent financial crisis, blame was laid at many doors for the environmental disasters which occurred in financial markets. Some faulted financial institutions, others government; some blamed consumers, others greedy mortgage bankers. A view coalesced that all parties held some blame (Bhidé 2009; Congleton 2012; Lo 2012). That all parties share responsibility for the crisis leads us to suspect that a simple market-based approach to governance and regulation was ineffective and will continue to be ineffective. In fact financial markets are not simple markets, but rather consist of all four archetypes of goods: private, club, common pool, and public (Cerny 2014; Selmier 2014). But markets exist to trade primarily in private goods.

A private good’s property rights enable an owner to exclude others from consumption and, through the act of consuming, remove that specific good from circulation in an economy. In contrast, a pure public good is shared by all through consumption and does not, theoretically, diminish through usage. Table 1 provides a typology of these four goods based on two simple property rights inherent in each good type’s consumption: whether consumption of a good removes it from the supply available to others for its consumption or use, and whether a consumer or user may be excluded from consumption or access to the good in question.

Property rights of common pools and club goods are, theoretically, mirror images on this simple two-by-two matrix. Users may not be excluded from common pools but the resources and goods contained within the common pool may be removed from the economy through consumption. In contrast, a club good’s owners and users jointly manage, consume or use club goods, but may exclude others outside “club walls” (Ostrom and Ostrom 1977; Sandler and Tschirhart 1997; McNutt 1999). Hence financial markets through which financial products are agreed upon, traded and transacted require appropriately-tuned governance principles and practices which accommodate the property rights inherent to each of these four types of goods.

Accepting Pierre and Peters’ (2000, 1), view of governance as involving “the whole range of institutions and relationships involved in the process of governing,” this paper introduces a broader systemic approach to govern financial markets which explicitly includes these four good types. First, I examine why different

Table 1: Four archetypes of goods by property rights.

Consumption	Rival	Non-rival
Excludability	Private goods	Club goods
Non-excludability	Common-Pool resources: <i>McNutt notes this creates a “Private Externality”</i>	[Pure] Public good: <i>McNutt notes this creates a “Public Externality”</i>

Sources: from Selmier et al. (2014). Adopted and adapted from McNutt (1999: 930, Tables 1 and 2); Ostrom and Ostrom (1977).

types of financial goods may call for a new approach in financial market governance, an approach which would benefit by drawing from natural environments in which all four good types are found. Choosing watersheds as the appropriate analogy, the second section integrates concepts and ideas from environmental economics and resource management with banking theory and ERM practices to explore watershed governance as an analogic construct for financial market governance. The third section applies the watershed governance analogy to banking.³ Lastly, I discuss limitations and extensions of this analogy and conclude. Throughout the paper I seek to introduce the two sides, environmental policy and banking, to each other, and to show what they share in common. Understanding commonalities should lead to better governance mechanisms.

2. Governance complications arising from financial products' typology

“Policy makers can only regulate the banking and finance sectors effectively if they have a reasonable idea of how markets work. If regulators believe that capital markets are efficient, they will adopt light-touch regulation with the results we have seen over the past couple of years.”

Paul Woolley (2010, 127)

Financial economists like Paul Woolley have long recognized the limitations of viewing financial markets as efficient, private goods markets governed under “light-touch regulation.” Many market participants, observers and regulators implicitly assume that all financial products are private goods traded on open markets theorized as consisting of such large numbers of buyers and sellers transacting so as to not to individually affect prices. In fact, part of the governance complexity Woolley and others have noted arises because of the many different property rights structures of financial products including club goods, common-pools and public goods (May et al. 2008; Calomiris 2011; Cerny 2014). Financial products and financial intermediation arrangements map into each of the four goods archetypes based on their inherent property rights (Selmier 2014), as shown in Table 2 below. These property-rights structures require regulatory and governance mechanisms which differ from those used for private goods (McGinnis 2007; Ostrom 2010).

Pure private goods are rather rare in finance as financial risk is shared and spread through risk management and through the very nature of financial markets. Many financial products consist of a composite of different, separable goods. For instance, shares in a company, which in simplest form consist of dividend stream, which is a private good, plus shared risks, profits and share price appreciation,

³ To simplify the discussion, this paper employs a purposefully-broad view of banking which financial economists may see as financial intermediation.

which are all jointly shared through ownership in a club good structure (Selmier 2014).

Club good structures are common in finance. Sandler and Tschirhart (1997, 335) generically define a club as “a voluntary group deriving mutual benefits from sharing one or more of the following [categories]: production costs, the members’ characteristics, or a good characterized by excludable benefits.” We find all three categories in finance: one, production costs are lowered in venture capital firms, mutual fund complexes, banking partnerships and other financial organizations which concentrate capital, contacts and information to create, invest and manage financial products. Two, members’ joint and individual expertise constitute unique characteristics which give some firms and structures advantages over others. And three, the goods which benefits members of such club good structures in finance are greater return, lower risk and unique informational advantages, all of which lead to powerful informational asymmetries.

Not only do the unique properties of club good structures in finance enable members to better control risks while sharing of profits, but the hierarchical ownership structure engineered into a club may also concentrate profit toward the higher tiers of the club’s management. Categorizing representative modern financial products and financial structures into the four goods archetypes as shown in Table 2 enables us to understand the variety of governance challenges which arise due to differing property rights.

Modern finance could not function without provision of public goods. Central banks’ policy of setting interest rates provides key governance essentials to any financial market or economy: interest rates set a price on both cost of capital as well as the risk associated with extending capital to a borrower or debtor (Bagehot 1873; Goodhart 1987). Interest rates also provide information to all economic actors by giving key indicators of an economy’s health, thereby indicating the central bank’s view on a business cycle, providing signs as to currency exchange rates vis-à-vis other countries’ currencies, and signaling a central bank’s overall

Table 2: Applying the goods typology to financial products.

Consumption	Rival	Non-rival
Excludability	Private goods: <ul style="list-style-type: none"> • Option contracts • Individual proprietorship of firms 	Club goods: <ul style="list-style-type: none"> • Mutual funds • Asset-backed securities • Private equity and venture capital structures, • Banking partnerships • TBTF- “too big to fail”
Non-excludability	Common-pool resources: <ul style="list-style-type: none"> • Financial risk at market level 	[Pure] Public good: <ul style="list-style-type: none"> • Currency • Central bank oversight

Sources: Adopted and adapted from Selmier (2013, 2014) and Selmier et al. (2014).

policy stance regarding future economic direction. Those central banks which attain political independence and whose bankers are provided incentives through well-constructed performance contracts usually perform better in their ability to modulate systemic financial risk (Cukierman 1992; Capie et al. 1994); better-run macro-economies' interest rate policies enable adaptive governance approaches.

Economists since Bagehot (1873, 56–64; see also Capie et al. 1994, 84–5) have argued that central banks are tasked to provide these public goods in some form or another. These earlier economists extended the public goods nature of finance beyond central banking and financial risk. Recognition of the benefits of private banking to the public good was common at the time of Bagehot, embodied in common sayings such as “finance is the handmaiden of industry.” Polski noted (2003, 42):

“The earliest American banks were chartered because they were considered as ‘some sort of public utility,’ or in the more mystical terminology of the 18th and 19th centuries, ‘public blessing’.”

Cerny (2010, 2014) argues this public goods nature of finance practiced by non-public financial institutions has not disappeared; rather, the importance of its nature had been brought front and center in ongoing systemic financial crises and their inherent risks. But who benefits from these public goods is contended, and this contention makes us question whether all the goods in question are truly public goods. An example would be policies which stabilize the banking system- clearly an important public goal- through an implicit insurance policy protecting the largest banks (Bhidé 2009; Congleton 2012). Former Federal Reserve Board Member Frederick Mishkin (2006, 992) has argued that this implicit insurance against risk of failure should not be called too-big-to-fail, but rather “too-politically-important-to-fail.” Financial economists have found banks willing to pay premiums in bank acquisitions (Brewer and Jagtiani 2013) to “enter this club,” within which they obtain a lower cost-of-capital (Hughes and Mester 1993), in both cases indicating that the public good of bank stability has been turned into a club good benefiting larger banks and other financial intermediaries.

It is axiomatic that banks and other financial intermediaries seek to increase profits and reduce risk, of course, but there are also attempts to lower the level of uncertainty by pulling more of the future into risk baskets. These attempts harken back to Knight's differentiation between uncertainty and business risk (1921, 1924), where the former cannot be estimated while the latter can be estimated:

“Profit is stated to be related to risk and uncertainty... Risks, however, can be reduced by various means, especially by insurance or by their grouping and averaging. But there remain other uncertainties which the entrepreneur cannot eliminate, so far as they affect him, by paying an insurance premium” Watkins (1922, 683).

Insurance or “grouping and averaging” have become ubiquitous means to lessen risk and increase profits.

Selmier et al. (2014) argue that financial risk’s type is subject to boundary conditions and that financial risk shifts, or “transmutates”⁴ between different good types. In small doses, financial risk may be “consumed” by an individual actor and so would be typed as a private good. But, as the impact of a specific financial risk grows, financial risk transmutes into a club good when the risk position is taken on in a venture capital firm or by a mutual fund. As the impact, whether real or potential, spreads further to a systemic level, financial risk grows to become a common-pool and possibly a public good [or better put, a public bad]. This effect of “socializing risk” means that economic actors are “not excluded *even if they wished to be excluded*” (Selmier 2013, 5–6). Drawing on Schlager and Ostrom’s (1992) argument that property-rights structures in natural resource common pools are best viewed as tiered, Selmier et al. (2014, 120) show that all economic actors bear risk but that a “dealer can literally alienate others from access to market risk as a common-pool resource.” In other words, externalities linked to financial risk may be forced onto society at large, but access to the capacity to offset those externalities may be denied.

Governance of risk in financial markets proves more difficult at lower levels as information does not flow as easily from those club-like structures or actors who have asymmetric information advantages and so have a better understanding of financial risk (Calomiris 2011; Goodhart and Lastra 2012). Such asymmetric information advantages enable these actors to obtain larger profits while lowering their own risk profiles. But offsetting risk to other actors does not lower systemic risk (Rajan 2006; May et al. 2008; Bhidé 2009). Understanding systemic risk better would require understanding the complex environment of finance where all forms of goods exist and in which risk-sharing may be engineered, ad hoc, sometimes simply unknown to all participants, or some combination of all three. Providing better governance at a firm level requires microprudential supervision, where the inner workings of investment managers, banks and insurance companies are scrutinized. Recognizing the challenges in scrutinizing these inner workings, which can often be divined only when financial firms disclose the required data, Dutch central banker Houben (2013, 211) argues:

“In absence of solid data on the resilience of the overall financial system, microprudential supervisors are destined to underestimate risks. This is evident in the case of concentration risks that only become visible when granular data on different institutions is combined and common exposures are detected.”

Effective microprudential regulation in the virtual environment of financial markets requires banks, bankers and other financial intermediaries to accept

⁴ Selmier (2014, 328, 332) defines this process of transmutation as one “in which actors employ technology and developments in theoretical finance to package financial goods into new financial products whose resultant property rights shift their good type in this typology matrix.”

responsibility for externalities caused by their practices and disclose the required data. Business scholars call this environmentally responsible management (ERM) (Rugman and Verbeke 1998; Madsen 2009). ERM is premised on business practices which seek to eliminate, minimize or offset those externalities (Porter and van der Linde 1995; Strike et al. 2006). A controversy which began in the 1990s still rages over whether ERM can be good for business profits through environmental standards. One camp argues that ERM may “create the maximum opportunity for innovation... foster continuous improvement, ...[and] leave as little room as possible for uncertainty” (Porter and van der Linde 1995, 110), while the opposing camp counters that “in [our] model of innovation in abatement technology, an increase in the stringency of environmental regulations unambiguously makes the polluting firm worse off” (Palmer et al. 1995, 125). Suffice it to say that the subsequent two decades has not witnessed a stampede to improve environmental policy and reap profits, but there are considerable efforts on the part of some MNEs to practice ERM. If environmental disasters occur in that virtual environment of banking (Bhidé 2009; Reinhart and Rogoff 2009), is it not fair and logical to ask that banks act in an “environmentally responsible” manner?

Stepping back from a pollution analogy to view finance in broader terms, as a virtual environment, gains us a better vantage point from which to construct a robust analog. A virtual environment analogy encompasses the significant complexity arising through the number and variety of actors, and the array of property rights structures which encompass all four goods types in finance. Forests, fisheries and air provide possible analogs. In each case, issues of setting the boundaries exist, as is also the case with financial environments.

Yet these three natural resource-based environments do not provide the robustness required for a thorough analogical comparison. First, boundaries of financial environments vary greatly, ranging from local to global. Generally, atmospheric “boundaries” are viewed in either municipal or global terms, and fishery boundaries are usually delimited to specific water bodies or fish migration patterns. Scale of forests does indeed range from local to regional. Comparison difficulties between virtual and natural environments increase as we look at what constitutes environmentally-irresponsible actions, where effects on forests and fisheries are typically more localized,⁵ while air-linked environmentally irresponsible actions *might* be “scaled” from individual to large-scale just as in the financial environment. But the choice of air as natural environment analogy for the virtual environment of financial markets falls short in three crucial areas; one, there is no discernable product based on air as a resource; two, the mechanism is unclear as to how non-biologic actors such as firms, government organizations or other organizations utilize the resource or suffer from its environmental degradation, and three, there seems to be no clear tiering of access rights as in natural environments

⁵ Globally-important forests like the Amazon basin provide an exception not discussed in this paper.

(Schlager and Ostrom 1992) or financial environments (Selmier 2014; Selmier et al. 2014).

The natural environmental analog chosen must be sufficient robust to encompass a similar spread of economic actors, geographic spread, and types of goods and property rights structures which forests, fisheries and air do not provide. As discussed in the next section, the nature of watershed management provides a suitable analog to the inherent complexities of financial markets' governance.

3. Watersheds as an appropriate analogy for financial markets

“A watershed is a special kind of common pool resource: an area defined by hydrological linkages where optimal management requires coordinated use of natural resources by all users.”

Kerr (2007, 89)

Substitute the terms *capital market* for *watershed*, *financial* for *hydrological*, *capital* for *natural resources*, and the analogy fits for financial markets at first pass. Delving more deeply into comparative aspects, Kerr highlights the common pool resource nature of a watershed in management terms. Following Kerr, this paper considers watershed *governance* as an analog to financial markets' governance. Each environment is therefore socially-engineered with a goal of optimal management; whether natural or virtual, each environment consists of all four goods archetypes even though the fundamental nature of the relevant resource may differ.⁶ Table 3 below compares watersheds and financial markets across four general measures: Environment (consisting of “hydrology”, actors, and make-up of environment); Governance (consisting of the nature of governance and institutions and available information); the Tipping Point (consisting of its nature and how return to equilibria may occur); and Environmental Damage (which involves irresponsible actions, “discharge”, and what constitutes pollution).

It is important to view financial markets and watersheds as institutionalized environments in which humans interact with environmental features to construct a governance structure. I presuppose that complex human/nature interactions encompassing watershed governance are evolutionary over a long time period (Dearing et al. 2010), and such an evolutionary perspective may be applied to financial markets.⁷ Management principles and design rules mentioned below rely in part on Cox, Arnold and Villamayor Tomás' meta-analysis of studies examining natural resource management design (2010). Employing these concepts and

⁶ Water is considered a common pool to which access is governed under *usus* and *usus fructus*, loosely, rights of use. Capital may be privately owned, unlike water. The author thanks Dan Cole for pointing this out.

⁷ Selmier (2013) looks at the development of investment banks in a similar evolutionary path over 2 centuries.

integrating the comparisons from Table 3, I propose seven points as to why watershed governance is a fitting analogy to financial market governance:

1, scaling the watershed analogy from small to very large fits well with financial markets [community to regional]. The comparative basis is strong in part because the resource in question flows downstream and may be utilized by users who have rights or access to the water (capital). Both watersheds and financial markets range in size partly due to the complexity of drawing boundaries. Complexity of boundary-setting (Ostrom 1953) exists in both cases (Woolley and McGinnis 1999, 579–580; May et al. 2008). Boundary issues complicate governance of watersheds and financial markets in ways similar and differing. Blomquist and Schlager’s (2005, 106) comment on watersheds that “[l]ike the choice of boundaries, the choice of decision making arrangements is a political choice” could easily be employed in Goodhart and Lastra’s (2012, 329) view of financial markets where “border problems are pervasive, and complicate the application of regulatory measures both within and between countries.”

Volume of water (capital) grows in size downstream as the rainfall catchment areas increase in size (or as banks increase capital available through the multiplier effect⁸). However, there may be fewer barriers to rapid expansion of financial markets during robust economic periods than there is for riparian systems like watersheds.⁹ This is a limitation of the watershed analogy, as riparian systems drain into oceans and so global comparisons are limited.

2, watersheds and financial markets each consist of a variety of users ranging in all sizes (Merton 1995; Financial markets: Allen and Santomero 1997; Watersheds: Huitema et al. 2009; Villamayor Tomás 2014). In the give and take which gives rise to governance policies, “modern banking is best thought of as a partnership between the government and a group of bankers, a partnership that is shaped by the institutions that govern the distribution of power in the political system” (Calomiris and Haber 2015, 13). The forms of partnership are varied across watersheds and financial markets, and include private, public, consortia, and combinations of private/public actors (Ostrom 1953; Financial markets: Chapman 1984; Polski 2003; Watersheds: Lansing and Miller 2005; Selmier et al. 2014; Villamayor Tomás 2014).

⁸ Under a fractional banking system, banks may lend out available capital up to their reserve requirement as mandated by their central bank. For instance, Bernanke et al. (1996) examine how a “financial accelerator” mechanism works through fractional lending. While not pursued in this paper, their analysis whereby financial deceleration brought about by tightened lending requirements imposed by a central bank may be analogous to the effects posed by a drought on a watershed.

⁹ As supported through interest rate equalization across national lines.

3, hydrologic [capital] resources are **tapped for many different uses**. Water is to life as capital is to business; without the first, the second does not exist. In the simplest terms of a managed watershed, water is used for irrigation. This leads to discussions of usage and barter rights amongst members of the watershed's community. But hydrology of larger watersheds support economic activity ranging from natural resource extraction to manufacturing to urbanites' lawns. Kerr (2007, 91) explains that while one might think "that upstream-downstream hydrological relationships within watersheds are just externalities that can be managed through such approaches as Coasian bargaining, command-and-control, or taxes and subsidies," in reality complexity can rarely be managed so simply due to many interested parties.

4, complexity of uses and access rights leads the variety of actors to construct (financially-engineer) **property rights structures consisting of all four goods archetypes**: private, club, common pool, and public in large-scale cases (Woolley and McGinnis 1999; Morrison and Wilhelm 2004; Lansing and Miller, 2005; For watersheds, see Kerr 2007; For financial markets, Cerny 2014; Selmier 2014). Echoing Goodhart and Lastra's comment above regarding political boundaries in financial markets, Blomquist and Schlager (2005, 102) note:

"as a unit of organization, "the watershed" does not resolve fundamental political questions about where the boundaries should be drawn, how participation should be structured, and how and to whom decision makers within a watershed are accountable..."

5, So this complexity of property rights often pushes larger watersheds toward **polycentric governance through a range of public-private arrangements** (Koontz et al. 2015). Consider just one complication in watershed governance, the tricky question of land resources and tenure (by definition, immovable) in contrast to water rights, which may prove difficult to govern as ground and stream water flow onto other properties. A successful example of managing this question is seen by Villamayor Tomás (2014), who finds a complex, multilevel governance system with water cooperatives, government agencies, individuals and companies working together to manage scarce water resources in the Pyrenees. Blomquist and Schlager (2005, 108) sketch similar arrangements in which:

"The polycentric arrangements commonly observed in the United States and elsewhere typically involve a mixture of general-purpose governments organized around some kinds of communities of identity, interest, and place and designed to make trade-offs across policy topics, and special-purpose governments organized around policy topics and other kinds of communities of identity, interest, and place."

Similar efforts exist in institutionally-robust financial markets through a polycentric combination of self-governing organizations (Calomiris 2011; Oh et al.

Table 3. *Watersheds and financial markets – comparing environments.*

	Watersheds	Financial markets
Environment		
“Hydrology”		“hydrology”-based, in terms of water and capital
Actors		all sizes, private, public, consortia, combinations of private/public
Construction	“natural,” socio-ecologically engineered	manufactured, virtual
Goods types	Consists of all four goods archetypes: private, club, common pool, public in large-scale cases	
Governance		
Institutions	Rarely a central institution controlling “taps”	Usually a central institution controlling “taps”
	Nearly always overlapping governance; polycentric	Varies from single regulatory body to polycentric approach
Information	Generally more dispersed, concentration in outside experts	Concentrated: information stores in financial intermediaries
Tipping point		
Nature of return to equilibria	Crisis-nature may range from slow to quick	Crisis-nature is typically quick onset
	Equilibria can be restored; multiple equilibria possible	Equilibria can be restored; multiple equilibria possible
Environmental damage		
Irresponsible actions	Overusing water; pollution, including agricultural runoff; overusage of river; destruction of watershed drainage	Creating systemic risk; fraudulent behavior; hiding information
“Discharge”	Measurable and can be monitored	Is a fuzzy concept at best; What is monitored?
Pollution is	Chemicals, particulates, agricultural chemicals, Particulates, NO ₂ ,	<i>difficult to define</i>

Source: Author's conception.

2013), public-private arrangements (Woolley 2010; Bakır 2013; Calomiris and Haber 2015), and regulatory bodies enhanced through more open information and watchful citizen base (Hu 2012; Herzig and Moon 2013). As noted in the following section, these efforts may benefit from watersheds' examples.

6, under this polycentric governance model governmental, private sector and mixed agents seek to support and manage [sustainable] exploitation in ideal cases. This point sits upon the foundation of the previous four: that watersheds (capital markets) consist of a variety of users, who tap a resource for many different uses and, in so doing, construct property rights structures consisting of all four goods archetypes which theoretically pushes better governance structures toward polycentric governance through a range of public-private arrangements.¹⁰

Experts and expertise are relied upon to advise these agents in sustainably exploiting the resource. In both cases, "The politics of watershed (financial markets) policymaking includes value-based assessments over competing priority actions and scientific issues" (Woolley and McGinnis 1999, 591, "financial markets" added by this author). But there is a crucial intermediation difference between watersheds and financial markets, in that financial institutions act as intermediaries which employ enormous informational advantages while actively engaged in exploiting the resource in question (van Horne 1985; Greenbaum and Thakor 1995; Rajan and Winton 1995). This informational asymmetry empowers bankers to pursue their own agenda.¹¹

7, comparisons of causes and results of environmental degradation are robust between watersheds and financial markets. Tellingly, proximity to resources, whether hydrologic or capital, does not create better use of resources. Woolley (2010) argues that proximity to financial resources serves to create an agency problem because financiers gain an asymmetric information advantage and often exploit it. Naive reliance on collaboration will not work in watershed management for watersheds (Blomquist and Schlager 2005; Kerr 2007) or in financial markets (The title of Barth et al. 2005 book about bank governance suggests not waiting "until angels govern"). Sometimes environmental problems result from simple disregard or lack of understanding of consequences, as Blomquist and Schlager note for watersheds (2005, 106–108) and Bhidé (2009) for financial markets, or the assumption that others will monitor the actions of those with expert knowledge, resulting in massive free-rider issues (Acharya and Richardson 2009; Bhidé 2009).

¹⁰ Huitema et al. (2009) and Koontz et al. (2015) note that polycentric outcomes are not always optimal or even beneficial.

¹¹ In general, international business terms, Rugman and Verbeke (1998) propose that MNEs are able to exploit firm-specific advantages to capture the benefits while not paying all costs.

Table 4: 7 Points for watersheds as the analogy to financial markets.

	Point	Note
1	Scaling the watershed analogy from small to large fits well	But riparian systems drain into oceans and so truly global comparisons are limited
2	A variety of users	Ranging in all sizes and including private, public, consortia, combinations of private/public actors
3	Resources tapped for many uses	Water is to life as capital is to business; without the first, the second does not exist.
4	Property rights structures of all four goods archetypes	But financial markets skewed toward club goods. only risk is a common pool- [thus far]
5	Polycentric governance through many arrangements	“organized around some kinds of communities of identity, interest, and place”*
6	Agents seek to support and manage [sustainable] exploitation	financial institutions have informational advantages and are actively engaged in exploiting the resource
7	Comparisons of causes and results of environmental degradation are robust	But measurement of “discharge” in finance is difficult.

Source: Author’s conception. *Blomquist and Schlager 2005, 108.

Table 4 summarizes these seven points. Drawing from these comparative points, the following section proposes four lessons from watershed management which may improve financial market governance.

4. Environmentally-responsible management in finance- applying the watershed analogy

“Our bankers are the stewards of our whole intricate credit system...[T]heir sense of obligation and their feelings of responsibility for the maintenance of that system in a high state of adequacy and efficiency are as lofty as the motives of other professional men.”

Saturday Evening Post editorial of December, 1928

The stewardship concept in banking is not a new idea, but rather the revival of an old one. Before the Great Depression brought about a great change in sentiment, bankers in many countries were viewed as the epitome of prudence and financial responsibility. This view was due in no small part to the importance of reputational capital and the ever-present danger of a personal bankruptcy should a banker misstep (Chapman 1984; Morrison and Wilhelm 2004). As reputational capital declined in importance at the expense of financial capital and expertise, the sense of stewardship declined as well (Bhidé 2009; Woolley 2010; Selmier 2013).

Several key issues complicate financial market governance when compared with watersheds: first, financial markets are built around private intermediary institutions like banks,¹² while watershed management often involves public or public/private institutions which may not directly intermediate. Second, financial intermediation works in part because information is proprietary to banks (Greenbaum and Thakor 1995; Boot 2000; Morrison and Wilhelm 2004). So policy shifts must at least partially protect banks' proprietary information or banking will not function. Hence some informational asymmetry will always exist and is actually desirable because it not only protects banking clients (Greenbaum and Thakor 1995; Allen and Santomero 1997), but also the banks themselves. Banks take on risk through intermediation and so are subject to bank runs; keeping some information private helps keep short-term deposits within a bank (Diamond and Dybvig 1983; Merton 1995). Third, financial market participants *actively seek* to extend and cross boundaries in financial markets as part of their business operations (van Horne 1985; Goodhart and Lastra 2012). This constant testing and crossing of boundaries generates much of financial engineering and product innovation (van Horne 1985; Allen and Santomero 1997; Palmer 2012). Fourth, "discharge" can be described, monitored and measured in watersheds, but in financial markets it is a fuzzy, hard-to-measure concept. Fifth, the self-contained nature of watershed community membership is somewhat different from that found in financial markets. That is to say, members of watersheds generally know they are members; some "members" of financial markets discover their membership when financial crises strike and they are adversely affected.

I propose four lessons from watershed management which may improve financial market governance and help reinvigorate stewardship in banking:

1. *Using informational asymmetry in market governance*

Proprietary information regarding clients and trading positions enables banks to protect their clients and to shoulder financial risks required of financial intermediaries (Boot 2000). Without accepting those risks while concurrently maintaining some informational secrecy, modern banking would simply not work (van Horne 1985; Greenbaum and Thakor 1995; Allen and Santomero 1997). But banks sometimes engage in their intermediation role in less productive ways. In the recent crisis, "Instead of acting as intermediaries between borrowers and investors by transferring the risk from mortgage lenders to the capital market, the banks became primary investors" (Acharya and Richardson 2009, 200).

Rather than merely accept that informational advantage heightens the environmental risks created by banks, those informational advantages

¹² Again, for simplicity I purposefully employ a very broad view of banking which financial economists may see as financial intermediation broadly defined. Note there are public banks involved in financial markets as well.

may be employed to improve governance. Watershed management explicitly recognizes informational asymmetry and attempts to improve regulation through disclosure. Recognizing that this informational asymmetry in financial markets cannot be eliminated can be utilized to push banks toward governance roles. As social actors with citizenship responsibilities, banks must realize that environmental responsibility is not simply an aspect of corporate social responsibility; it is one of the most important aspects. Efforts toward ERM have worked in Canada, where moral suasion by the Bank of Canada in combination with bankers' sense of social responsibility have guided financial traders toward less risky, more resilient outcomes (Chant and Acheson 1986; Calomiris and Haber 2015).

ERM requires the bank to recognize the risks imposed on society (Selmier et al. 2014) and recognize that its "discharge" flows downstream (Acharya and Richardson 2009; Goodhart 2010; Woolley 2010). Incentives can be created to monitor this discharge within markets through payment of reporting "bonuses" and by widening- or restricting- access to financial market segments based on proactive ERM practices (see Herzig and Moon 2013; Oh et al. 2013). For instance, some of the largest Brazilian banks are government run. By providing smaller depositors with banking services, Caixa Econômico Federal has expanded access for less well-heeled clients, and the Brazilian National Development Bank not only engages in small and micro- loans but also infrastructural and industrial project-linked investments (Stallings and Studart 2006, chapter 8; von Mettenheim 2006; Wise and del Tedesco Lins 2014). These practices influence private Brazilian banks' social policies.

2. *Monitoring helps to determine externalities and encourage ERM*

While easy to request that banks recognize externalities, this will lead to better governance only when members of the financial communities also recognize, monitor, and publicize effects of the "discharge". Monitoring by interested parties is a hallmark of successful watershed management (Huitema et al. 2009; Cox et al. 2010; Villamayor Tomás 2014) and has made advances in financial markets through professionals from the private-sector (Barth et al. 2005, 60–61). Regulatory capture issues may be alleviated by encouraging non-government agents to monitor. Cox et al. (2010) point out that extending local-level community action to geographically-broader, institutionally-deep situations may be difficult (Olsson et al. 2006; Dearing et al. 2010; Beever et al. 2014). But large private financial institutions, which engage in monitoring other financial institutions to manage risk, have the necessary resources (Rajan and Winton 1995; Herzig and Moon 2013). The California Public Employees' Retirement System (CalPERS) has been waging a battle with Exxon Mobil through proxy voting over climate change policy, and this has had large indirect influence on Exxon Mobil's banks (Hulac 2016).

A proactive approach to ERM can be encouraged, one in which banks' actions are characterized not by the absence of bad behavior, but by the presence of good behavior (Strike et al. 2006; also Porter and van der Linde 1995). Government monitors in conjunction with private monitors can encourage banks and bankers to develop ERM practices into a key part of their strategies (Oh et al. 2013). In this way, banks can and should link ERM and CSR concepts into an integrated strategy of stewardship. Porter and van der Linde (1995) argue that, by adopting and supporting strong environmental regulation, MNEs may actually enhance their firm-specific advantages. Banks may adopt a similar strategy to gain a similar advantage (Oh et al. 2013). But, as in watersheds, financial markets require buy-in by all interested parties.

3. *Import governance lessons from watersheds into financial markets*

A well-developed environmental governance concept which fits well in finance is adaptive management. Adaptive management brings the concept of constantly reengineering policy based on iterative loops (Dearing et al. 2010); previous policy is implemented, evaluated, reengineered and optimized in order to implement a better-targeted policy (Olsson et al. 2006; Villamayor Tomás 2014; Koontz et al. 2015). Financial intermediaries constantly reengineer their products and policies, which sometimes adds to the turbulent nature of financial markets. While the concept of adaptive management fits well in financial market governance at a systemic level during stable periods, policy reaction is often ad hoc and crisis-driven from the regulatory side (Bhidé 2009; Goodhart 2010; Woolley 2010). Olsson et al. (2006) analysis of socio-ecological water systems in which rapid, transformational change requires leadership to attain a successful new system is very apt for financial markets. Their point that leadership may or may not deliver the goods, but that a community sense will improve outcomes, is quite applicable in financial markets.

Failures and shortfalls which arise in the application of adaptive management to watersheds have much to teach when applied to governance of financial markets. There are three reasons as to why: first, watershed management scholars adopt a more pragmatic approach when considering what works and what does not. Some prominent financial scholars have reified markets and the capacity to consistently innovate productive new products (Merton 1995; Allen and Santomero 1997) even while other prominent ones have asked "Is there a bubble effect that allows an idea to be paraded in the guise of a financial innovation?" (van Horne 1985, 627). Second, a pragmatic consistency has impelled those who study watersheds to look for integrated frameworks to improve watershed policy rather than to search for "market failure" theories which are prominent in financial market governance. Such theories often lead to addressing

a symptom or prominent cause for failure rather than systemic issues. Thirdly, while pragmatic views providing integrated frameworks may be found among senior financial economists (Barth et al. 2005; Acharya and Richardson 2009; Woolley 2010), the ongoing debate about efficiency of financial markets complicates taking a systemic view. This has begun to change as financial economists like Calomiris and Haber (2015) argue that the American system is prone to failure with its over-emphasis on efficient market theory, while Canada has never had a banking crisis in its 200-year history because Canadian government authorities and bankers work together. Their title critiques the American financial market problem: “fragile by design.”

Acceptance of a systemic view in natural environmental models is beginning to resonate in the virtual environment of finance. May et al. (2008, 893) have noted that environmental scholars recognize that “models may be fundamentally incomplete, and that the wider ecosystem and environmental context (by analogy, the full banking and market system) are required for informed decision-making.”

4. *Fuzzy boundaries sometimes helps in governance*

In an odd way, fuzzy boundaries may help in banking governance. To understand why, we may consider Rugman and Verbeke’s (1998) warning that MNEs may attempt to capture the benefits of their firm-specific advantages while not paying all costs by arbitraging between different region’s regulations. Strike et al. (2006) describe this as “Being good while being bad.” Rugman and Verbeke (1998) argue that an ERM-shirking danger arises because few industrial or financial institutions are truly global, so regional governance is critical, regional support crucial, but regional shirking potential still possible. That is to say, MNEs will take advantage of their regional focus to evade regulation and governance. Because financial firms’ assets were more portable than MNEs, and informational asymmetry might have enable banks to evade regulatory restrictions and monitoring by private-sector professionals, the argument went that financial firms and banks found it easier to shirk. Returning to the Canadian model, national banks, a powerful central bank able to cajole recalcitrant bankers and national borders which protect the Canadian financial system are mirrored in Stevens’ comparison (2009) to Australia’s “Four Pillars” model, where four large banks are similarly protected yet cajoled (Chant and Acheson 1986; Bakır 2013; Calomiris and Haber 2015).

Whether this *was* the case or not, it has become more difficult to shirk in the present. Banking and financial governance has become increasingly global (Goodhart 2010). At local, national, regional and global levels there are many eyes on banking, and many ears attuned to what bankers and financiers do. In fact a major issue now is the plethora of

overlapping regulation and governance for banks, and fuzzy boundaries have led to increased governance rather than increased capacity to shirk (Young 2013). This will lead to better ERM among banks as the incentives/reasons for ERM increase with stronger global governance (Bhidé 2009; Woolley 2010).

5. Limitations to these ideas and final points

“No manner of councils and committees in which each of the constituents retains its particular value orientation and operating assumptions can develop an integrated resource program.”

Ostrom (1953, 493)

There are at least three limitations to the concept that virtual financial market environments are like natural environments. Firstly, the resource comparison of capital versus hydrologic suffers from the fact that capital has a circulatory nature. Once invested through a transaction, the capital is then employed by the receiver (usually seller) to invest or spend, and this cycle continues. Hydrological resources in watersheds do, eventually, circulate as the water is taken up into the atmosphere and precipitated. But the circulatory nature is not as geographically-limited, temporally-quick or institutionally-controlled as with capital. In a watershed, downstream flow alone determines the amount of hydrological resource available, post-precipitation; in financial markets, the supply of capital is influenced by central banking authorities and credit-granting financial intermediaries like banks. Secondly, in broader evolutionary terms, banking environments change at a very fast pace. Watersheds may also change at incredibly rapid rates, but then settle into a new human-engineered equilibrium of sorts barring environmental upheaval (Lansing and Miller 2005; Villamayor Tomás 2014). Thirdly, banks and bankers may be seen as acting in many different environments which include not only a “natural” one, but also social, competitive, and ideational ones.

This leads us into limitations encountered using watersheds as governance analogies for virtual financial environments. Firstly, there is a significant difference in legal rights between the two cases. With hydrological resources, access rights are dependent, or at least influenced, by land ownership. The complex, contentious, long-term negotiated access rights to the Colorado River have been analyzed for decades (Ostrom 1953, 486, 489) and are still contended. While access to capital is certainly contended as well, there are not legal rights per se to *access* this resource. Rather, capital may be privately owned, while water may only be appropriated for use, not owned (see fn 6). Secondly, the nature of state/regional, national and multinational governance seems very different. Banking and financial markets have highly formalized government or multinational organizations and regulators, while watershed governance may be more ad hoc. Some institutions of watershed governance conform to the watershed at hand, often developing with the gradual economic development of the watershed itself.

Thirdly, as noted earlier there are conceptual and practical difficulties of comparing tangible externalities like soil degradation and pollution with intangible externalities such as excessive risk and crisis-inducing fraud. Some of these issues relate to tipping points. As an example, when does financial fraud move from losses experienced by a small number to a systemic issue, and is this only identifiable post hoc (see Selmier et al. 2014 for a discussion)?

This paper has argued that financial markets are a virtual environment, and so banks and bankers should practice responsible environmental stewardship. I argued that banks should proactively apply business ethics concepts of CSR and ERM (corporate social responsibility and environmentally responsible management). I proposed using watershed management as an analogy to improve governance in financial markets. In this paper the analog is two-tiered: first, I describe the virtual environment of banking and finance, and then suggest managed watersheds as financial market proxies. However, with any analogy there are complications and difficulties. Discussing limitations helps to frame challenges in the social science analytics herein, as well as provide opportunities to address those limitations. Dearing et al. (2010) note that “analogs prove problematic for systematic assessments of current and future land systems, especially as boundary conditions change,” and boundary conditions constantly change in finance.

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