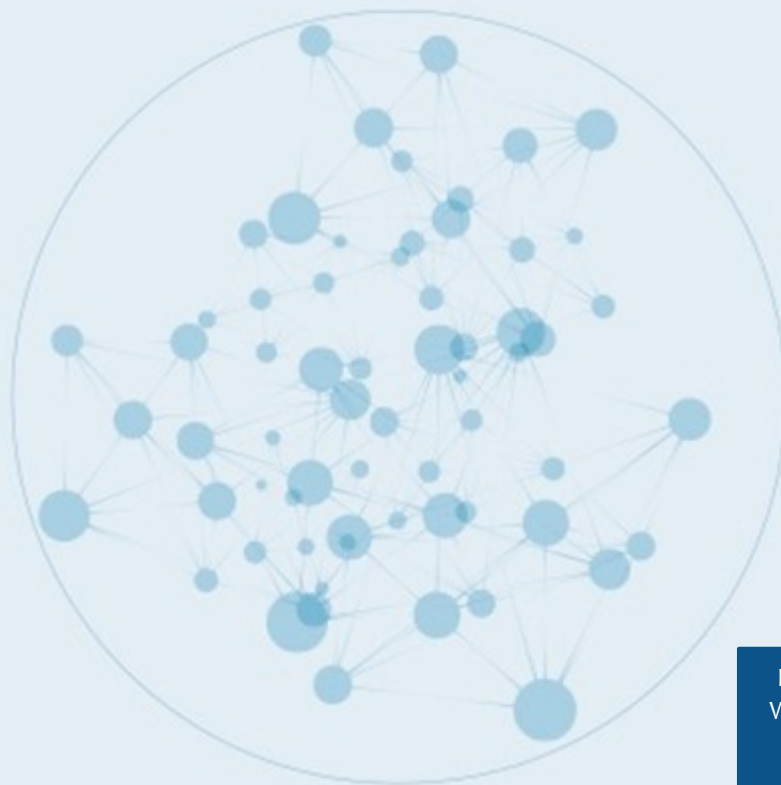




TOWARDS A PERFORMANCE FRAMEWORK FOR A SUSTAINABLE FINANCIAL SYSTEM



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The UNEP Inquiry

The Inquiry into the Design of a Sustainable Financial System has been initiated by the United Nations Environment Programme to advance policy options to improve the financial system's effectiveness in mobilizing capital towards a green and inclusive economy—in other words, sustainable development. Established in January 2014, it published its final report, *The Financial System We Need*, in October 2015 and is currently focused on actions to take forward its findings.

More information on the Inquiry is at: www.unep.org/inquiry and www.unepinquiry.org or from: Ms. Mahenau Agha, Director of Outreach mahenau.gha@unep.org.

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Comments are welcome and should be sent to nick.robins@unep.org.

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Contents

BACKGROUND AND INTRODUCTION	4
1 PERFORMANCE FRAMEWORK SUPERSTRUCTURE	5
2 ANALYTICAL APPROACH – MARKET DESIGN.....	7
3 PRINCIPLES RELATED TO OUTCOMES: CAPITAL REQUIREMENTS, FINANCIAL FLOWS AND RESILIENCY	10
3.1 Capital Requirements	10
3.2 Financial Flows	11
3.3 Integration of Financial Flows with Capital Requirements	12
4 PRINCIPLES RELATED TO PROCESS: EFFICIENCY AND EFFECTIVENESS.....	19
4.1 Efficiency	20
4.2 Effectiveness	26
5 MARKET DESIGN.....	28
5.1 Outcome-based Principles	28
5.2 Process-based Principles	29
5.3 Liquidity	30
6 CONCLUSIONS	33
APPENDIX A.....	34
APPENDIX B.....	36
APPENDIX C	37
REFERENCES.....	39

Background and Introduction

The mandate of the *UNEP Inquiry into the Design of a Sustainable Financial System* is to identify and consider potential changes to the “rules governing the financial system” that would better align the system’s workings and consequences to sustainable development. These rules include financial and monetary policies, financial regulations and standards, financial system-facing fiscal measures and non-governmental standards and rules (such as those originating with credit rating agencies, the accounting profession and industry groups).

The Inquiry has grounded its work in country-level innovative practices, and is building on this and associated cross-cutting analysis and international engagement into a practical set of suggested actions, principally by central banks, ministries of finance, financial regulators and standard setters. The Inquiry’s operational research based on existing practice, albeit often at an early stage, provides a useful “proof of life.” However, a catalogue of existing practices can lead to a fragmented view of financial systems by focusing attention on the distinctions among different practices and on their idiosyncrasies. This paper is intended to provide a unifying set of principles for describing a “sustainable financial system”, one that is aligned to the long-term needs of a dynamic, inclusive, sustainable economy, and ideally a method for measuring the relative sustainability of different financial systems: a “Performance Framework”.

Aggregate performance measures are useful for analysis of financial systems but need to be treated with caution. This is particularly true in their application to large-scale and complex financial systems that are characterized by high levels of often unpredictable heterogeneity and dynamism. However, they do allow, with suitable caveats, system performance to be overseen, compared over time and between subsystems, and to some extent nudged and shaped according to implied and expressed normative criteria. With such complexities and nuances in mind, checks and balances that can ensure a sustainable global economy remain lacking; hence this paper seeks to establish a Performance Framework across a range of metrics that can be used to determine whether a given financial regime is moving toward or away from a sustainable financial system.

This paper is intended to serve as a window on the Inquiry’s analytical approach, providing a deeper understanding of the unifying criteria for evaluation of multiple market designs for financial systems in a variety of economic, political and social settings. It is also intended to provide a foundation for investors and corporate management and policymakers, including central bankers, finance ministry professionals, market regulators as well as legislators, regulatory and executive officials, to shape consideration of the sustainability of their financial systems. Finally, it is hoped that this paper will inspire and inform further inquiry into the relationships between market designs and sustainability and inclusiveness by academics and other researchers. In short, this paper is intended to provide structure to an entirely new convention for understanding the relationships between financial systems and sustainability and inclusiveness.

While further work is required to definitively rank financial systems in the context of sustainability and inclusiveness, this paper is intended as the foundation for the construction of one or more indices. Each index would be similar to the financial development index used by the International Monetary Fund¹ (which assesses financial sectors across the dimensions of depth, access and efficiency) and, to a lesser extent the World Economic Forum² (that measures systems based on institutional and business environments, financial stability, banking and non-banking financial services, financial markets and financial access) and the World Bank (that measures inclusiveness based on broad interview sets).³ The performance framework is intended to prompt development of an index for sustainable finance and, as a complement to the World Bank Global Findex, inclusiveness.

1 Performance Framework Superstructure

The Performance Framework will consist of five related principles that, in concert, will be the bases for evaluation of a financial market system in terms of sustainability and inclusiveness:

- **Capital Requirements.** This is a time-based projection/forecast of the private capital investment volumes, weighted in accordance with the relevant consequences of such investments, needed to achieve goals for sustainability and inclusiveness by milestone dates. It is anticipated that capital requirements will be continuously recalibrated to account for changing circumstances and refinements of assumptions and factors that influence projections/forecasts. These capital investments occur in three distinct forms:
 - Deployment of capital to fund incremental assets or activities, either via (a) direct investment by aggregators of savers (including banks, insurance companies, shared and individual retirement savings and pooled investment funds), or (b) investment of corporate earnings in new or expanded undertakings ;
 - Elimination of assets and activities previously funded by capital; and
 - Reserving capital against conditions that could challenge sustainability, including insurance against the consequences of the realization of risks.
- **Financial Flows.** This represents flows of investment capital (both newly raised capital and retained earnings) deployed to fund capital requirements. It is anticipated that financial flows will be measured on an historic and current basis and will also be projected/forecast. Financial flows for an economy will be compared with capital requirements and actual financial flows will be a factor in forward-looking recalibrations of capital requirements. Existing stocks of capital assets are built into the concept of financial flows as integrated into the Performance Framework. The meaning of financial flow is a function of its adequacy to fulfil a capital requirement. Thus, existing stocks of capital assets form a basis for evaluation. Moreover, retirement of capital assets that negatively affect sustainable development is treated as type of positive financial flow, though its valuation may be somewhat differently calculated. Appendix A includes a conceptual measurement of the adequacy of financial flows to meet capital requirements for a given economy.
- **Resiliency.** The third related principle is resiliency, meaning the susceptibility of the system to catastrophic disruptions as a consequence of unsustainable development. This principle is the clearest driver of timescales and the diffusion among multiple entities of value and risk associated with sustainability and inclusiveness. Events and conditions that cause catastrophic disruptions may be projected or forecast to occur outside conventional business, finance and policy planning horizons, even after decades of time. These events and conditions are analytically very different from those typically considered by prudential regulatory authorities in connection with analysis of the susceptibility of financial systems to crashes, as occurred in the US markets in 2008. Those conditions are a function of short timescale fragility that can result in a relatively sudden crash with the occurrence of one or more events. Sustainability resilience is a function of linear deterioration of conditions that will inevitably lead to disruptions at some future point. This type of disruption can become practically or actually inescapable at one or more points along the timeline or could be triggered by a change of conditions. As a consequence, the analytical time horizon for sustainability resilience should be far further into the future.

- **Efficiency.** This is the measure of the transaction-specific and comprehensive costs generated within an economy's financial market system. Traditionally, transaction costs have been seen as the proper representation of the efficiency of the system, founded on the neoliberal economics tenet that so long as transaction costs are minimal, a high transaction volume will generate fundamentally sound pricing and therefore optimal capital allocation from a social perspective. The assumptions behind this tenet are that information relevant to price is generally available without material time lags among market participants and that market behaviours motivated by price and profit do not diminish optimal capital allocation. The Performance Framework will supplement this approach with alternatives from academic literature and challenge the sufficiency of the entire concept.
- **Effectiveness.** This is the measure of how effectively a specific category of information regarding value is transformed into the price of actual or potential capital investments. In the context of the Inquiry, the categories of information involve the greater or diminished value derived from sustainability or inclusiveness associated with the capital investments. Effectiveness is a different measure of the quality of a financial system from efficiency. Ineffectiveness could infer that information is not uniformly available (only some market participants are informed), that no market participants are informed of certain information or that certain types of information are systematically excluded from price formation. Several critical questions need to be considered in modelling effectiveness, for example: to whom does the referenced value accrue (e.g., investors, the financial sector or the public); the current and potential models for transforming value to price; principal/agent issues embedded in the process.

Basing the Performance Framework on these five principles should not suggest that measurement of each of the five is wholly independent. In particular, *efficiency and effectiveness* interact with each of the other principles. For example, an inefficient or ineffective financial system, measured in terms of pricing that reflects values that contribute to the long-term economic well-being of the population, will probably have poor results in the pricing and allocation of capital (even though individual agents operating as intermediaries within the system are very efficient in their operations and remain profitable). Thus, *financial flows* are likely to be inadequate to fulfil *capital requirements*. And such inefficiencies and ineffectiveness are also likely to affect asset pricing processes, inducing asset price bubbles through imbalanced recognition of value that can precipitate problems of *resiliency*.

2 Analytical Approach – Market Design

Underlying the analytical approach described in this Performance Framework is that we are indeed inquiring about *systems*, consistent with the usage of that term by economists, physicists and mathematicians: defined environments in which interdependent components interact dynamically with results that can be measured as an integrated whole. The Performance Framework is to evaluate how effective, efficient and resilient systems are and how well they deliver financial flows that meet capital requirements, all in the context of sustainability and inclusiveness. This requires an understanding of the dynamics of each system.

Inclusivity is an issue that has been examined in the past. The Framework proposes the integration of data points from central banks that will enhance the existing World Bank survey data by focusing more on financial system characteristics. This is outlined in Appendix B.

The particular type of system that the Framework is most focused on relative to sustainability broadly is the capital intermediation system. This is the system in which capital that has been accumulated by investors is allocated among potential users of that capital, businesses governments and households. Investors include holders of debt and equity interests and companies that deploy or have deployed self-generated capital or capital raised in private or publicly traded markets. Capital intermediation is broadly defined for purposes of the Performance Framework, including

- Deposit taking and lending by banks;
- Processes for public offerings of shares or debt securities;
- Direct investment in equity via private, less liquid interests or other forms;
- Reinvestment of retained earnings within enterprises
- Secondary market trading environments and venues that provide price signals to investors engaged in market activities;
- Analytical agencies that are integral to pricing (such as credit rating agencies); and
- Contractual arrangements that are used to price disaggregated elements of securities or other investments, such as insurance and derivatives;

The capital intermediation system can be viewed as a subsystem of the larger financial system or as a separate system, but such a specification is not relevant to the Framework analysis. The Framework inquiry views components of the capital intermediation system as including

- Shareholders and other asset owners (e.g. pension holders),
- Savers/lenders,
- Holders of tradable debt securities,
- (somewhat unconventionally) derivatives counterparties of consumers of capital,
- Insurance and reinsurance companies,
- Corporate boards of directors and managers,
- Intermediaries in the primary and secondary markets for debt and equity (described more fully within),

- Providers and analysers of information in particular credit rating agencies, accounting firms and index providers,
- Providers of system infrastructure, such as exchanges, trade matching venues and clearing houses, and
- Market regulators and prudential regulators that can affect behaviours within system components.

These components interact to generate investment at prices determined by the process. The outcomes of these interactions are expressed within the Framework as capital requirements, financial flows and resiliency while the quality of the interactions is expressed in terms of efficiency and effectiveness.

The diversity of possible market designs is, for practical purposes, infinitely large. Each element of a given market design can affect the quality of a financial system in terms of outcomes, and the Inquiry will not shy away from addressing individual elements of market design.⁴ However, a far simpler measurement is needed for comparison among financial systems and for overall evaluation of a given market design. The Framework will propose a conceptual methodology based on an independent and a dependent variable. This methodology is not sufficiently developed to generate a functional real world model, but it is hoped that the Inquiry will inspire this development. The methodology's independent variable is a concept of capital liquidity, similar to a concept previously used in evaluation of development of financial markets and economies. Capital liquidity includes the aggregate savings of an economy that are, or are intended to be, invested in non-governmental capital assets. As a subset, capital liquidity includes the amount of capital devoted to the process of intermediation between savings based on widely available data. The characteristics of this capital liquidity are qualitatively different for different financial systems and are closely related to its size (relative to the economy), complexity and development stage. Indeed, it is conceivable that an index based on weighted values for capital liquidity (and within that factor, financial sector capital liquidity), size, complexity and development stage could be created. Individual elements of market design will be considered separately. The dependent variable will be the adequacy of financial flows to fulfil capital requirements based on criteria to assure resiliency. The interaction of the variables will be a function of efficiency and effectiveness in that an efficient and effective system should, within a range, generate fully adequate financial flows and assure resiliency.

Outcomes can be relatively predictable in financial systems that are smaller and less complex. In these systems, available capital is inadequate for current demand: capital liquidity within the system is often a constraining factor on all potential investments. As liquidity increases, competition for liquidity is often an important condition as governments may intervene to prioritize investments generating high immediate productivity gains over sustainability and inclusiveness in order to accumulate additional funding capital through GDP growth.

In the largest and most complex systems (*i.e.*, those with high levels of liquidity devoted to the capital intermediation system and the means to deploy capital in quantity to meet demand and to accommodate growth), there are varying views of predictability, differentiated by distinct theories of the dynamics underlying the capital intermediation system interactions:

- If the primary dynamic is movement toward price equilibrium (*i.e.*, relatively stable prices founded exclusively on the fundamental value⁵ of the investment), complexity (facilitated by technology) can speed the interactions to achieve equilibrium more rapidly and certainly. This kind of system dynamic is the subject of the efficient markets hypothesis,⁶ which holds that

prices in large and sophisticated financial markets are based on widely shared information and that there is almost no opportunity for riskless gain.⁷ Thus, asset price risk and reward tend toward symmetry around a price that is the collective best assessment of fundamental value.

- If the primary dynamic is instability, meaning prices that do not perfectly and stably reflect the fundamental value of the underlying financial contract or instrument, such complexity can yield non-linear consequences and heighten distortions in prices in terms of variation from fundamental value. This reflects the view of adherents to Hyman Minsky: “[O]nce we admit that institutions are man-made and at least in part the product of conscious decision, we must also face the effects of institutional arrangements on social results.”⁸ He writes “that almost all systems which are multidimensional, nonlinear,⁹ and time dependent” are inherently unstable.”¹⁰ In Minsky’s view, periods of market stability are destabilizing and markets are inescapably instable.

These two views have been articulated in the context of the efficiency and effectiveness of the market in continuously delivering prices that are reflective of stable fundamental value as expressed by the willingness of informed buyers and sellers to transact at that price without regard to non-fundamental factors. Increasingly, it is apparent that the efficient markets hypothesis does not represent a universal description of the dynamics of large and sophisticated financial systems or, in some academics’ views, a description that is useful for explaining observed market dynamics.¹¹ One alternative view of financial markets focuses on the influence of the behaviour of individual agents within the markets.¹² Another alternative approach is provided by imperfect knowledge economics that sees financial market dynamics as subject to phase transformations from one dynamic (for example, price equilibrium) to another (for example volatile price correlation breakdowns) at unpredictable times and with non-linear consequences.¹³ This viewpoint is closely aligned to the concept of organized complex systems, in which fractal phase changes of organizing dynamics occur at unpredictable times with force subject to power laws.¹⁴

There is no need to explore in detail alternative universal theories of financial markets in this Framework. If financial market systems are not universally driven by the efficient markets hypothesis (and even strong supporters of the hypothesis have moved in that direction),¹⁵ then forces apart from fundamental value, beyond mere elimination of regulatory constraints, are important to outcomes and efficiency and effectiveness are not merely matters of broad access to information on fundamental value and elimination of market regulation. In other words, market structures and factors such as the relative power and capability of market participants and choices regarding valuation models made by investors make a difference, and these are appropriate subjects for the Framework.

Thus, both efficiency and effectiveness are considered. Effectiveness is seen as the quality of the interaction of the components of the system in the transformation of information relevant to fundamental value into price and effectiveness does not necessarily follow from efficiency. In that the Framework is focused on sustainability and inclusiveness, value is meant here to describe value of increasing the sustainability and inclusiveness of the productive political economy. Efficiency and effectiveness, in turn, will interact with the outcome-oriented capital requirements, financial flows and resiliency of the system.

Appendix C sets forth a conceptual methodology for assessing the quality of market designs based on the delivery of needed financial flows. This is intended as a gross measure of market design and the financial system’s size, sophistication and development stage are represented by the per capita level of capital available for investment within the economy. Analysis of specific elements of market design is too varied for a gross measurement, but the Inquiry does not shrink from analysis of specific design elements.

3 Principles Related to Outcomes: Capital Requirements, Financial Flows and Resiliency

These are measures of the outcome of a financial market system, specifically how well and reliably the financial system produces required capital investment in sustainability and inclusiveness. The measures will be referred to herein as “system outcomes.” They can be described in three time frames: past system outcomes, current system outcomes and future system outcomes.

System outcomes are useful only in regard to a benchmark or goal. For example, one can measure whether a financial market system has facilitated/is facilitating/will facilitate the type and quantity of investment necessary to fund renewable energy generation assets required to reduce greenhouse gas emissions by a given amount and a certain date. It is an exercise in identifying the existence of an investment need (or gap with regard to a targeted level) and then measuring how well or poorly the gap is likely to be closed over time, given projections.

It is notable that previous academic analyses of highly developed financial market systems have largely ignored measurement of system outcomes because their focus has been on transactional price transparency and the assumption that efficient transactional price formation and discovery is fully aligned with socially optimal capital allocation. If the system just generates transaction prices that are low and transparently related to fundamental value, the system will allocate capital to benefit society optimally.

As the Inquiry’s focus is on potential misalignment regarding sustainability and inclusiveness, this type of alignment cannot be assumed to exist and efficiency, effectiveness and system outcomes, though related, must be measured separately. As discussed above, much of the academic literature conflates efficiency and socially optimal capital allocation, largely because of the conventional economic theory that was more widely accepted prior to the financial crisis of 2008, holding that efficiently priced transactions in a market without significant limits on liquidity would effectively generate socially beneficial investment, within the constraints of the political and regulatory framework and macroeconomic conditions.

3.1 Capital Requirements

There are three fundamental conditions to measuring capital requirements:

- There must be a benchmark or goal against which results (whether past, current or future) are measured.
- Capital requirements measure the demand for investment from non-governmental capital sources and therefore must consider government intervention to fund sustainable and inclusive investments as a matter of fiscal policy. This also includes partial funding via subsidy and side-by-side investments of public and private capital.¹⁶ The government can always elect to devote its fiscal resources to investments. This will diminish the need for investment by the private financial system and will affect measurement of capital requirements. That is to say, if the government funds more investment, there is less for the private sector to do. Ergo, capital requirements are lower. The aggregate social cost may, however, be higher than full reliance on private capital investment. For purposes of the Framework, it is assumed that the optimal result is that government investment funds costs that private capital cannot feasibly fund and that this yields the highest level of a sustainable financial system.

- Additionally, to measure capital requirements precisely, investments must be weighted in terms of effect on sustainability and inclusiveness. For example, investment in reducing the need to generate a kilowatt-hour of power from fossil fuels is more effective than investing in a less damaging form of fossil fuel generation (more than one kilowatt-hour of power must be generated to fulfil one kilowatt-hour of demand because of various inefficiencies in production and transmission). Thus, it is not just a question of the volume of investment, but also the consequences per unit of investment on sustainability and inclusiveness. Substantial further work is also needed to develop natural capital finance metrics for the implications of financing overexploitation of forests, fresh water and other natural resources.

With these three conditions established, a metric can be structured that quantifies along a timeline the unmet investment needs to achieve benchmark goals.

It would also need to take into account the need for reduction of investment in capital assets and activities that diminish progress toward benchmarked goals, including decommissioning existing facilities as well as diverting new investment away from business-as-usual pathways.

A few countries have generated individual estimates of capital requirements and several are outlined in the individual country papers that are included in the Inquiry reports. There are a variety of differences in assumptions, scope and measurement techniques, among other things. Greater uniformity would clearly enable the generation of performance frameworks that can reliably be used to measure capital requirements that are comparable and reflect changes over time. Nonetheless, the current lack of uniformity, if acknowledged and described, should not impede the development of useful capital requirement measurements.

3.2 Financial Flows

In order to measure and project/forecast systems outcomes, a further understanding is needed of the flow of financing into three designated classes of real economy finance, including:

- *Green finance*, which could be organized into three environmental segments: remediation, prevention and generative. These can be measured for effectiveness-weighted volume over time.
- *Grey financial flows*, in effect the inverse of *green finance*, representing new or continued finance of activities such as: direct and indirect consumption of high carbon-emission or non-renewable fuels; activities that lead to overproduction of fossil fuel reserves in excess of planetary boundaries; and dangerous conditions or degradations of natural systems like deforestation or over-exploitation of freshwater.
- Investment in assets and activities that increase *inclusivity* for broad participation in the economy, drawing on extensive existing work on financial inclusion, financing for small and medium sized enterprises, accessibility of financial services for households and investments that enhance both growth of wage incomes and equality of income and wealth.

Recent efforts to provide a definition of “*Green Finance*,” such as the World Bank’s Common Principles for Climate Mitigation Finance Tracking,¹⁷ have improved common understanding of the term. However, the measurement of gaps will likely require further refinement of the concept, to both clarify measurement standards and to ensure that measurement does not actually lead to financing of fossil fuel intensive activities regardless of such standard setting, such as recent Japanese investments in coal power plants in Indonesia and Bangladesh in the Green Climate Fund.¹⁸

3.3 Integration of Financial Flows with Capital Requirements

3.3.1 Sustainability

Volumes of financial flows for sustainable capital finance (properly weighted for system outcome consequences) needed in order to achieve benchmarked goals, as discussed above, are significant largely as they relate to benchmarked goals. This comparison represents the *gap in sustainable capital finance requirements over actuals*. A sustainability capital finance gap may be a consequence of lack of *effectiveness* of the financial market system, for example, if the system does not accurately transmit the value of making investments in sustainability into capital investment. Alternatively, it may be the consequence of a deficiency of the economy (insufficient wealth and productivity to fund the investment) or of real economy policies, regulations and uncertainty. It is notable that system outcome shortfalls caused by lack of effectiveness should undoubtedly be the highest priority to address as they represent a misallocation of capital resources.

Overall, infrastructure is expected to dwarf all other forms of new investment in the decades ahead. Other asset classes are expected to grow, but not at the rate of infrastructure, which may well triple or even quadruple in size over the next generation. This growth in expected infrastructure investment is closely related to sustainable finance, which would benefit if the expected next US\$50-100 trillion of such investment is as green as it possibly can be across its normal categories, aided by measurement of gaps consistently with the Performance Framework. According to analysis from the IEA and elsewhere, as much as half of future infrastructure investment must be devoted to a low-carbon future if benchmarks are to be met. Any shortfall could be called an ongoing “Green Infrastructure Gap,” and the Performance Framework could be the basis for the Green Infrastructure Gap calculation.

The IEA suggests US\$1.5 trillion per year is needed through 2040, or US\$35-40 trillion, in cleaner economy investment. The WRI separately suggested in April 2015 that “between 2015 and 2030 the world will need to invest an average of US\$6 trillion in infrastructure annually. In order to keep global temperature rise below 2°C¹⁹ and prevent the worst impacts of climate change, this infrastructure investment has to follow a model that’s consistent with a low-carbon economy. Securing this vast amount of ‘climate finance’²⁰ will require action from the full range of finance actors—from development and commercial banks to climate funds to institutional investors and asset managers.

Appendix A is a broad structural description of a Performance Framework for system outcome analysis in respect of climate change, as an example, based on capital requirements and financial flow. While it is not a fully built-out, functional model, it is architecture upon which to construct a model.

3.3.2 Inclusiveness

Inclusivity is important, not just from a sustainable development standpoint but arguably as a direct global competitiveness issue. One manifestation of non-inclusiveness is inequality. Inequality because of pre-existing or declining inclusiveness involves diminished income and wealth of households. That the economy allocates to them a lower proportion of the economic pie than they otherwise might receive raises questions of fundamental fairness of distribution.

However, new research from the Organisation for Economic Co-Operation and Development²¹ indicates that increased inequality can cause the economic pie to be smaller than it otherwise would be. This would, of course, have the potential of stressing *effectiveness*. The OECD study measures the effect on GDP of numerous countries of growing inequality (measured by increases of the Gini inequality

coefficient) over the period 1985-2005. The effects occur with a lag so they are measured over the period 1990-2011. For example, the study finds that the increasing inequality in the United States cumulatively reduced the US GDP between six and seven percentage points over the period of analysis. For comparison, this is larger than the decline in GDP during the Great Recession. It is also notable that replacing this lost productivity could fund sustainability as a by-product of increasing inclusiveness.

One measure of inclusiveness is the availability of financial services to households and small businesses. The Bank for International Settlements (BIS) examines inclusivity in its recent analysis²² that included the following findings:

‘The degree of financial inclusion varies widely by region and income level. The share of adults who owned an account ranges from just above 20% on average in low-income countries to almost 90% in high-income economies. Focusing on geographical regions with many emerging and developing economies, account ownership is lowest in Africa, with around 20% of adults financially included by that measure. Within the largest emerging market economies (EMEs), surveys suggest that less than 40% of adults have an account in India, Mexico and Nigeria while over 60% do so in China and Poland.

One essential element of financial inclusion is access to instruments that allow for saving or borrowing or both. The share of adults that reported saving at a formal financial institution is considerably greater in countries with higher income levels than in low-income economies. In contrast, in terms of new borrowing, the numbers are more alike across different income groups, and do not increase in lockstep with levels of income.

The Financial inclusion of firms is central to their ability to finance production and purchases of capital goods, just as it helps households to smooth consumption. The World Bank collects data on the share of firms that have loans or credit lines at formal financial institutions. In many emerging and developing economies, less than 40% of small and medium-sized firms had a bank loan or line of credit in 2013.

Firms in emerging Europe tend to enjoy greater financial access than those in Africa and Asia. And, in countries across all three regions, substantially fewer small firms generally have access to credit than do medium-sized ones. Data from IMF surveys suggest that there have been significant increases in financial inclusion over the past decade. In terms of the geographical outreach of financial services, the number of commercial bank branches per 100,000 adults increased from three to five during 2004-12 in Africa, and from 11 to 23 in Latin America and the Caribbean. Meanwhile, the number of ATMs per 100,000 adults surged in Eastern Europe. More bank branches or ATMs should help to improve access, as surveys report that “too far away” is an important barrier to having an account (Demirgüç-Kunt and Klapper (2012)). The use of financial services has increased as well, with the number of deposit accounts per 1,000 adults rising by over 30% in Colombia and Thailand and by over 80% in Argentina and Mexico. All these data come with caveats. For example, the aggregate number of bank accounts is not the same as the number of depositors, since some individuals may have multiple accounts. Similarly, and relevant for any data on account ownership, some accounts may be dormant (Subbarao (2012)). Further, the share of adults who reported new borrowing in any given period may partly reflect a change in demand for financial services due to cyclical factors rather than improved access. And if new bank branches or ATMs are clustered in urban areas, they may do little to improve financial access in rural regions.’

As described above, the World Bank has developed an index for measurement of financial system inclusiveness.²³ The World Bank's Global Findex is based on a wide-ranging poll through questionnaires administered by the Gallup organization. The Framework proposes to supplement the poll data by the addition of data points available from most central banks to generate an index with a broader base. Appendix B sets forth a broad structure for a Program Framework that would incorporate this index together with other factors to measure System Outcome of inclusivity of a financial system. The index incorporates values for the following factors:

- Percentage of population having bank accounts;
- Bank branches per capita;
- ATMs per capita; and
- Percentage of small- and medium-sized firms with credit facilities.

The system outcome framework for inclusivity would be particularly helpful in terms of measuring change over time.

Adaptation of existing research seeking and establishing ideal levels of inclusivity in global lending in order to establish metrics showing gaps in Inclusivity as potentially affects global competitiveness, could be useful for identifying an inclusivity gap.

Inclusivity gaps could also be expressed on a regional basis as well as globally, suggesting regional inclusivity gaps, not only across countries, but also separating trends across urban, rural and suburban sub-regions.

3.3.3 Resiliency

The third related principle is *resiliency*. A financial market system cannot be said to perform well if it suffers catastrophic systemic failure, even if it is effective and efficient. It could be argued that a fully effective and efficient financial system would necessarily be resilient, but that will not be a working assumption of the Framework. Financial system resiliency will be tested both systemically and on a per institution basis.

Financial systems function best when setting and creating conditions that allow for long-term stable growth. This includes the interconnected global system of financial systems. Such conditions have not been met after asset value bubble formation and other, often unforeseen, conditions that in retrospect lead to crises. Attempts have been made to assess and benchmark financial systems across metrics such as size, access, efficiency and stability, yet systemic trends continue that make medium-term financial crises more likely, and the crises become more likely and potentially more catastrophic so long as these trends are not addressed.

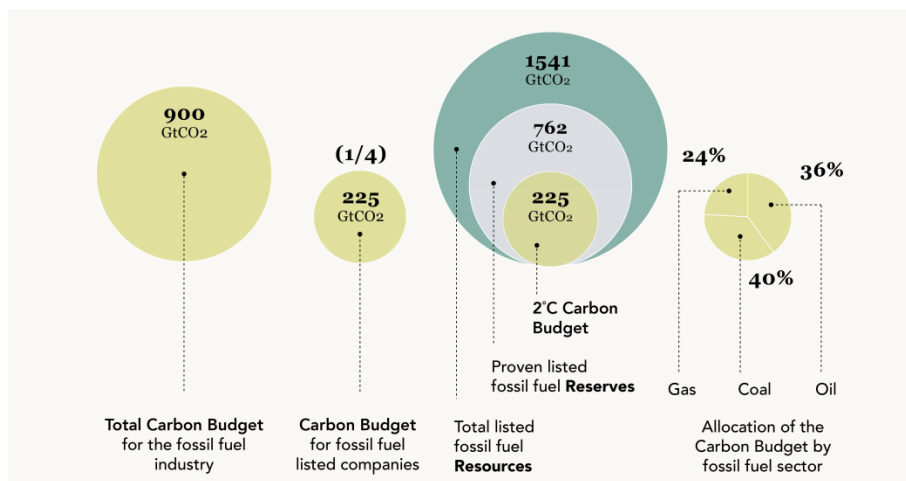
Such trends include, but are not restricted to:

- Climate change and other resource constraints as are fully expected by the scientific community to affect fresh water and food access by 2030,²⁴ with increasing related chances of conflict and other longer-term collateral effects including population displacement from sea level rise.
- Additional environmental “side effects” include the health of natural systems as are being affected by deforestation, as well as the implications of ongoing air and oceanic pollution, which financial systems have often treated as externalities not financially valued.

- Social implications also abound from issues including increasing levels of wealth and income inequality.
- Overstepping a rapidly expiring carbon budget, a potential consequence founded on the consensus view of scientists in the IPCC²⁵ as well as the IEA,²⁶ and clearly articulated by groups such as the Carbon Tracker Initiative. Other expiring categories of natural systems health are additional forthcoming systemic risk challenges fully expected to affect value.
- Failure of asset owners and fund managers to factor in environmental considerations, creating conditions for future exposure and financial risk from loans and other forms of investment where valuations may change over time.

As elaborated by the IEA, the world has had an effective carbon budget of just over 2000 Gt of carbon dioxide, most of which has been spent since 1900. Roughly 900-1000 Gt remains that can be emitted into the atmosphere within budget constraints. The IPCC has coalesced around a similar estimate of 1000 Gt remaining, and the Carbon Tracker Initiative analysis is illustrated below.

Figure 1: Fossil Fuel Reserves versus the Global Carbon Budget



Source: Carbon Tracker Initiative (2015)

As implied by Figure 1, agreement by global governments to adhere to a carbon budget would have potentially significant financial implications for investors who are financing exploration and production of proven or possible reserves that would not be brought to market so that return of and on investment could be thus realized.

Capital expenditure, whether financed by banks, investors or the operating companies themselves are typically longer-term investments that take years to develop, making it cheaper to bring to market resources for which sunk costs are already realized.

The Carbon Asset Risk body of work of UNEP is a specific area to monitor this question, from which future risk metrics can be derived for better use and understanding levels of financial exposure involved. It is anticipated that environmental stress tests based on these metrics can be performed with confidence.

Aggregated environmental stress tests can also provide an understanding of the distance from a state of *resilience* incorporating the necessary global energy transition. To overcome the “tragedy of horizon,” the impacts of future environmental shocks need to be considered and included in today’s asset values and capital allocation decisions. Environmental stress testing can be applied as a tool to evaluate the

financial impacts of plausible environmental scenarios on assets, portfolios, institutions and financial markets as a whole.²⁷ If global regulators were to perform such stress tests on all financial institutions of size, this could provide perspectives on investment gaps as well as systemic exposure to climate risk.

Many parts of the financial system—banks, insurance, and pension funds—are accustomed to a scenarios-based approach to stress testing for risk factors generally associated with crises involving runs on the system, such as the one that occurred in 2008. Stress testing for these issues is a tool that prudential regulators around and international bodies have adopted. The Environmental stress testing approach applies and adapts the implemented stress test approaches for environmental risks such as urban air pollution, natural disasters, water insecurity and climate policy. Quantification of environmental impacts and their costs to society across all scopes of business from operations to supply chains remains very much a work in progress, complicating the ability to generate stress test results at high confidence levels. Time horizons are also uncertain so that scenario analysis rather than direct projections are often more useful analytically, and stress tests are useful for this purpose.²⁸

Stress tests can also be performed by investors on their own levels of potentially stranded assets among other categories of potential exposure, including their own gaps in sustainable finance, not only at the systemic annual level of ongoing carbon budget analysis.

Resilience in this regard may be best expressed by a form of a net metric that could look at annual global new infrastructure investment in the old versus new economy, as suggested in the form of a Carbon P&L for investors by the Dutch consultancy Ecofys.²⁹ Such a net metric then reflects another perspective on green and grey finance metrics of *effectiveness*, which can be managed to specifically over time.

There is also a clear need for both system-wide metrics (such as the carbon budget discussed by the IPCC, the IEA and the Carbon Tracker Initiative among others) that can be managed to and measured for annual progress, as well as parallel individual institution metrics showing levels of exposure to stranded or overvalued assets accordingly.

On an institutional basis, a first task then is to understand the relative exposure to environmental damage costs that are already financed and externalized, and perhaps more importantly, that are going to be financed over time, and this then becomes an additional *resiliency* metric to make fully robust global, regional as well as each individual institution's measure of future unsustainable intended finance.

Managing 'slow onset' environmental and social progress and processes

Forward-looking environmental and social impact outcome scenarios suggest that changes are necessary to short-term decision-making, yet implementing these changes remain a challenge in light of even shorter-term financial considerations.

As laid out in the World Economic Forum (WEF) Global Risk Reports, and in the work of scientists at global institutions such as the Lamont Observatory at Columbia University, other risks are important to consider. These include risks manifesting from cybersecurity, earthquakes and other natural hazards as well as material issues that are likely to manifest over time across environmental, social and corporate governance concerns.

Future environmental risks can be brought into measures of financial resiliency. For example, stranded carbon assets may represent trillions of US dollars of exposure to balance sheets that are currently inadequately disclosed in financial statements. Operations and buildings at risk from sea level rise add another layer of risk, as does the costs of social unrest.

Consideration of time as a key factor in the resiliency, or lack thereof, especially the medium- to longer-term implications of trends, not only concerning climate change, but also on deforestation, fresh water availability, biodiversity, the health of the oceans and much more as relates to environmental impacts, resource use, as well as on social dimensions.

Discount rates are another time factor affecting asset valuation and effects of climate change with the potential for such to help frame public policy considerations. Risks in this regard are many, including:

- The future effects of sea level rise to property value and the related costs of social disruption;
- Potential supply chain disruption costs, the value of retaining a license to operate in key regions and operational location decision-making including moving costs;
- The value of state-owned enterprises involved in potentially unsustainable business activities; and
- The ability to pay back loans on business lines and infrastructure investments that are no longer profitable or otherwise sustainable.

The reinsurance sector has the longest standing experience in incorporating environmental factors such as extreme weather events into their annual solvency assessments, testing their resilience against the worst combination of 1 in 200 year events. Importantly, progress has been achieved not through a single measure, but a series of interlinked regulatory metrics, financial regulation and reporting, credit ratings, accounting standards and investor analysis and accountability. A separate UN initiative has explored how to extend this approach in the wider financial system, which could be done through new requirements for key public and private organizations to report their financial exposure to extreme weather and a minimum of 1% per year risk.³⁰

In the case of exposure to climate policy risk (or “carbon exposure”), work to date has included equity analysis of the discounted cash flow (DCF) implications of a low-carbon transition for fossil fuels companies.³¹ While it has been reported³² that some fossil fuel-producing companies have stress tested their own business models against a 2°C scenario, no results are available.

The interconnectedness of financial, social and natural systems, in combination with the predominant short-term nature of market actors and their behaviour, increases the long-term risk of asset and enterprise value. Concerns have been recently voiced by the Bank of England,³³ and the G20 as of April 2015 has taken up an investigation on the risk of fossil fuel to the financial system.³⁴

In addition, longer-term actors such as the US Department of Defense and the WEF see potential degradation in value coming from environmental and social factors including, among others, resource constraints and social unrest (such as are regularly discussed in the WEF Global Risk Reports³⁵). For example, the WEF finds that, over the next 10 years, the largest risk categories expected to manifest are failure of climate change adaptation, fresh water crises and unemployment or underemployment.

Finance allocates capital (the accumulated wealth) based on price determined by risk-weighted valuation of future flows. Because of the increased ability to sell and buy financial assets, longer-term risks and values have been progressively lower weighted. Failure of the global financial system to monitor and calibrate these risk categories greatly increases the occurrence of multiple, interconnected disasters with significant downside financial implications in some cases on a regional basis while other issues are global and would have or cause global effects.

In summary, three areas closely associated with *resiliency* are:

- Social imbalances surrounding inequality and related potential economic instability. Of particular note is Thomas Piketty's work³⁶ suggesting that returns on investments will inevitably grow relative to growth in the overall economy ($r > g$), causing a potential chronic and growing lack of wealth equality that is not sustainable.
- Resiliency of financial systems and the global financial system vis-à-vis environmental shocks, including both risks endogenous to the global financial system such as the potential for stranded carbon and any exogenous lack of resilience to physical environmental shocks.
- The ability of the financial system to both understand and manage longer-term 'slow onset' processes (such as inequality and climate change).

The responses to the unprecedented events of the financial crisis remain both an aid and a hindrance to consideration of resiliency in the context of sustainability and inclusiveness. Prudential regulators are still trying to address the issues that threatened large-scale defaults of banks in 2008. The G20 argued in 2014 for the building of financial resilience in terms of establishing financial stability and reliable market conditions as important for the sake of strong, sustainable and balanced growth.³⁷

The phenomenon of 2008 was rooted in the transformation of a set of assets that was almost universally considered to be simple (US residential mortgages) into a set of assets (debt securitized by vertical and horizontal tranches of portfolios of mortgages and derivative contracts based on such debt) that behaved in ways that had not been predicted. US mortgage loans were thought of as highly diverse but simple assets that could never lose value as a class. They were perfect for financialization with complex sets of instruments. As we now know, there was a large and significant risk that this analysis was incorrect. The entities that intermediated this risk were the banks, first in the US and then throughout the world. They had financed the assets with short-term borrowing based on the belief that a massive and uniform price change could not occur. When it did, the financing was no longer balanced against asset values.

Financial institutions often fail because they fail at a primary undertaking, intermediating risks based on assumed correlations over time. This is often referred to as "term transformation". The response of governmental authorities to the massive failure in the intermediation of term transformation was twofold: banks were required to use better procedures to measure risks; and they were required to set aside reserves to cover loss in case of failure to assess the risk, based on the Basel process.

This response was understandable but was focused on just one problem, the failure of financial sector agents. It did not address the underlying problem of financial systems that no longer help, and actually burden, economies that could drive the productivity, inclusiveness and sustainability of the world. Widespread bank failures can have devastating consequences, but so can climate change and massive income and wealth inequalities.

Term transformation is an important function of the financial system. It is particularly important to investment in sustainability and inclusiveness because of the need to deploy savings, which are largely short term sources of capital, into exceedingly long term investments – infrastructure, research and development and resource consumption reduction. Discouraging the financing of long-term assets impairs economic and social resilience and is thus counterproductive. Therefore, either improving incentives for long-term funding sources or otherwise increasing the stability of short-term funding is needed.

4 Principles Related to Process: Efficiency and Effectiveness

These are the measures of how efficiently (meaning how costly) and effectively (meaning how accurately and completely) information regarding value is transformed into investment prices by interactions within the capital intermediation system. The scope of “value” used by the Inquiry distinguishes its work from prior analyses of financial market systems, and the Performance Framework accommodates this. The need for this analytical distinction should not be surprising as it is very different from the value model that has most prevalent in today’s most highly developed financial markets. Rapid advances in technology and quantitative analytics have allowed investors and capital intermediaries to measure value accurately at smaller and smaller timescales and to act on price changes in those timescales. This has led to the primacy of the concept of continuous secondary market liquidity, the ability at all times to move into and out of an investment at a discernible and predictable price. Capital intermediation of a given investment is continuous, not ending when the investment is placed with an investor in the primary market. Intermediation continues through the availability of a secondary market in which comparable investments are traded constantly, providing both the outlet for transactions and price quotations so that the outcome of a transaction is predictable.

This form of capital intermediation has become dominant in large and sophisticated financial systems (most notably in the US and UK). Investors and their advisors, in large measure, assess performance of their portfolios against prices derived from the traded markets.³⁸ This is where the investors find access to liquidity, the valuable ability to liquidate or acquire investment positions as desired at discernible and reliable prices. As a consequence, this market structure encourages the use of “marked-to-market” valuation of positions. Marked-to-market value is, in theory, continuous so that “value” is highly dependent on the precise time to which it is pegged.

Liquidity in today’s trading markets is almost exclusively provided by “information traders”, who are in the business of profiting from short timescale price moves because of their superior information and ability to deploy capital quickly in response to that information. Therefore, information that affects price in very short timescales is most important to trading market prices in today’s trading environment and deeply influences marked-to-market valuation and the performance assessment of institutional investors and their advisors.

Longer timescale value is particularly relevant to investment in sustainability and inclusiveness. In less developed financial market systems, longer timescale information is not inhibited by market practices that radically shorten timescales. In these systems, more familiar issues of efficiency and effectiveness are dominant, such as inadequacy of capital liquidity needed to fund investments (to be contrasted with liquidity to trade investment assets or contracts post funding), which may also result in high transaction costs. However, in highly developed systems, the declining effectiveness of longer timescale information processing is the pressing issue for investment in sustainability and inclusiveness. Therefore, a highly developed financial system may be more efficient than one that is less developed, but may also be less effective (per unit of deployable capital liquidity). As discussed in greater detail below, these relationships appear to manifest along a continuum rather than as siloed categories of less developed and more developed financial market systems

As pointed out above, efficiency and effectiveness of a financial system are qualitative measures of a process. The process is referred to as “capital intermediation”, the functions that are required or useful in accommodating the transmission of capital from pools of savings held by investors to capital uses administered by businesses, governments and households. Generally, if (a) the excess of the benefit

provided to society from capital intermediation, over (b) the cost to society for intermediation is (c) as high as it can be, then (d) the financial system is efficient and effective.

4.1 Efficiency

Efficiency is a measure of the direct cost of intermediation. Intermediation is provided by the financial sector and includes everything from bank lending to primary market underwriting of new issues of stocks and bonds to secondary market trading to agent advisory services for both investors and entities raising capital. Intermediaries take fees and earn profits from moving money and assets around in the markets as principals.

Direct costs of intermediation depend on the type of intermediation involved.

- In both highly developed and less developed systems, banks aggregate the savings of households, businesses and governments, deploying these sums through intermediation into activities seeking investment, absorbing the risk of deploying capital from short-term sources to long-term investment uses.
- In more developed systems, while intermediation through such bank activities also exists, intermediation through traded markets is more prevalent. The intermediaries in the traded markets consist of (a) underwriters who buy new issues of stocks and bonds from issuers for resale to investors who have aggregated savings in the primary market and (b) “information traders” who actively trade previously issued stocks and bonds in the secondary market and provide continuous price signals that can reliably be acted on by investors. The provision of price signals that are reliable and executable is a form of continuous liquidity for investors and this is crucial to achieving a highly developed system. In highly developed financial systems, this form of intermediation is predominant.
- Also in highly developed systems, derivatives contracts are a significant element of intermediation, though they are not commonly thought of in that way. As described in more detail below, the use of derivatives contracts between banks and businesses and governments must be considered in any Performance Framework that evaluates efficiency in any highly developed financial system.

Two ways are commonly used in economics literature to assess the cost of intermediation. Intermediation is a series of transactions. One way to look at intermediation cost is to calculate the cost per transaction, which is how the efficiency of intermediation has traditionally been evaluated. Another way is to consider the inferred cost to the economy that derives from the way the system of intermediation works. For example, if one measured the amount of finance delivered between savers and users of capital and then measured the value extracted by the financial sector in performance of its intermediation function, the unit cost of intermediation could be calculated. By comparison with historic unit costs, one could then determine whether unit costs were going up or down. It should be noted that in a traded market system where financial assets are originated and transferred, there are many more transactions per unit of capital intermediated because secondary market trading serves the purpose of providing liquidity. This potentially increases the value extracted by the financial sector, but may increase the value it delivers, by opening up more opportunities for savings to reach investments and increasing the discipline of investment. The ultimate question is whether the value of secondary market price discovery and liquidity is offset by the increased intermediation cost attributable to the volume and type

of transactions that occur outside of the primary market for raising new capital investment – in other words, does it raise or lower the cost of capital.

4.1.1 Transaction-Specific Analysis

Almost all economics literature that evaluates the quality of financial market systems measures efficiency and efficacy in terms of individual transaction cost.

In loan intermediation markets, transaction costs include direct expenses of executing the transaction. They also include the differential between the bank's cost of funds and the risk-adjusted cost of capital to the party raising capital (loan interest rate less risk premium). This is readily calculable by referencing the profitability of lending. Larger and deeper bank lending capacity can reduce these costs.

In traded markets, transaction cost is a function of (a) fees and charges paid to service providers and for access to market infrastructure,³⁹ (b) underwriting fees in the primary markets and (c) the cost of secondary market liquidity. Liquidity is a condition in which transactions can be reliably and promptly consummated at discernible prices based on fundamental factors (as contrasted with costs of frictions and distortions embedded in the marketplace). This is enhanced by competitive and deep interest to buy and sell. In such conditions, the going interest at price levels between buyers and sellers (that is to say the unconsummated marketplace) is narrow. In trading markets, this is called the "bid/ask spread." If there is high interest to transact and the price difference between buyers and sellers is narrow, the costs of transactions are low and the probability of transacting at the going price is high.

Most of the recent work in this area has focused on the practice known as "High Frequency Trading," or HFT. HFT is the rapid entry and exit into the market of traders that greatly increases the churn of offers to purchase and sell and actual transactions on a short timescale basis (measured in milliseconds). HFT and efficiency has been a popular topic because it has been a subject of public debate since the "flash crash" of the US equities markets in May 2010 and other similar events that disrupted markets dramatically. HFT also poses the question whether all liquidity is good or whether too much liquidity can be harmful. The best compilation of this work is provided by Charles Jones of Columbia University in a defence of HFT.⁴⁰ This was partially in response to a report critical of HFT, which was not addressed directly in Jones' work, but should be considered.⁴¹ Jones sites a number of studies relevant to the analysis of transaction costs

- Analysis of the low profit per transaction of HFT traders. [Hendershott and Riordan (2010)]
- Findings that bid/ask spread levels are mostly cyclical. [Jones (2009)]
- The coincidence of historic lower bid/ask spreads and technology that improves information flows. [Easley, Hendershott and Ramodorai (2009)]
- The narrowing of bid/ask spreads over recent history. [Chordia, Roll, and Subrahmanyam (2005), Hendershott, Jones, and Menkveld (2010), and Angel, Harris, and Spatt (2010)]
- Potential adverse selection costs borne by smaller investors who cannot afford highest level technology. [Biais, Foucault, and Moinas (2011)]
- The consumption of liquidity by HFT traders that can lead to volatility that can be beneficial or harmful under given conditions. [Martinez and Rosu (2011) and Foucault, Hombert, and Rosu (2012)]

- The demand on exchanges to invest in technology to match HFT traders. [Pagnotta and Philippon (2011)]
- The cost of HFT as a layer of activity. [Cartea and Penalva (2011)]
- The reduction in latency (differences in technology speed) that allows more effective updating of orders, improving liquidity. [Moallemi and Saglam (2012)]
- The effect on bid/ask spreads of the introduction of HFT to the New York Stock Exchange. [Hendershott, Jones, and Menkveld (2011)]
- The effect on bid/ask spreads of the introduction of HFT to the trading of Dutch Stocks on Euronext. [Jovanovic and Menkveld (2011) and Menkveld (2012)]
- The effect on bid/ask spreads of the introduction of HFT to the Deutsche Boerse. [Riordan and Storkenmaier (2012)]
- Analysis of recent message transfer activity of technology upgrades and colocation. [Boehmer, Fong, and Wu (2012)]
- The effects of technology upgrades at NASDAQ. [Gai, Yao, and Ye (2012)]
- Analysis of differences between human trading and HFT and algorithmic trading. [Hendershott and Riordan (2012), Hendershott and Riordan (2011) and Brogaard (2011a, 2011b, 2012)]
- Analysis of NASDAQ order and cancellation activity. [Hasbrouck and Saar (2011)]
- Increased volatility of certain stocks that are the focus of HFT. [Zhang (2010)]
- Examination of intense quoting activity during defined periods. [Egginton, Van Ness, and Van Ness (2012)].

Each of these studies either explicitly or implicitly relies on the assumption that the best measure of the performance of a financial market system is transaction cost. The weight of evidence is that the per transaction cost in the financial markets has decreased in recent decades. It is important to note that the cost per transaction does not necessarily reflect the performance of a financial market system as assumed in the studies.

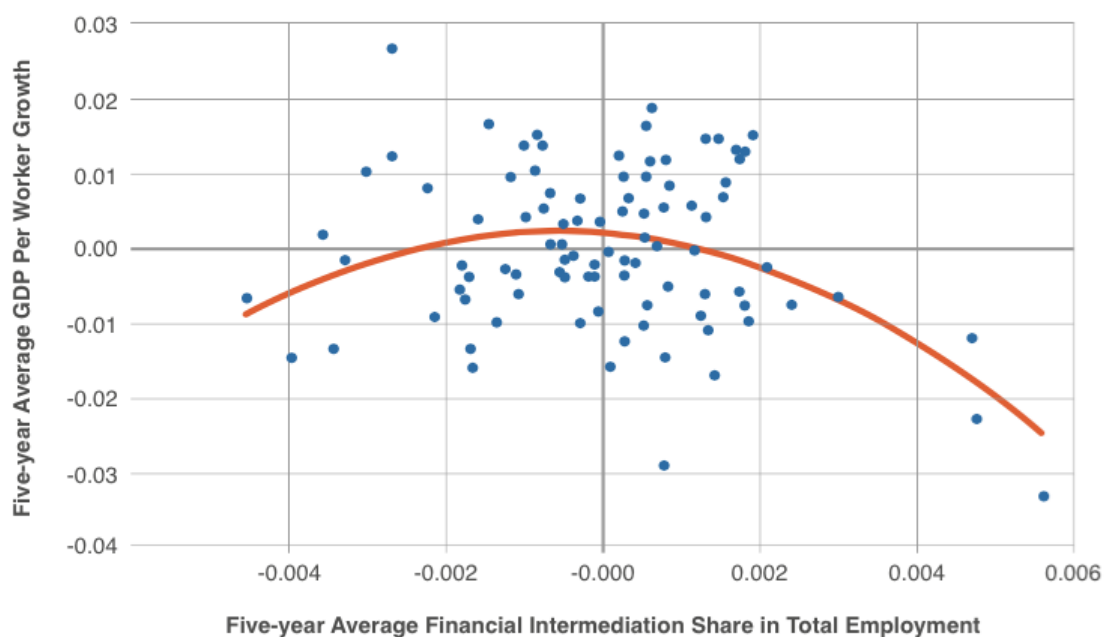
Not surprisingly, when the World Bank developed benchmarks for financial systems around the world,⁴² it generally followed the established literature. For each of the class of intermediaries and the financial market system for a variety of economies, the benchmarking system examined financial depth, access, stability and, importantly, efficiency. Efficiency as it relates to markets was described in the following way: *for financial markets, efficiency measures focus less on directly measuring the cost of transactions and more on measuring transactions. A basic measure of efficiency in the stock market is the turnover ratio, i.e. the ratio of turnover to capitalization in the stock market. The logic of using this variable is that the higher the turnover (the more liquidity), the more efficient the market. In the bond market, the most commonly used variable is the tightness of the bid-ask spread (with the US and Western European markets showing low spreads, and Vietnam, Peru, Qatar, the Dominican Republic, and Pakistan reporting high spreads) and the turnover ratio (although the measurement of the latter often suffers from incomplete data).*

Thus, efficiency was given a transactional focus. Interestingly, the authors were very aware of the limits imposed by this and similar decisions: *In focusing on these four characteristics of financial institutions and markets, the paper seeks to provide empirical shape and substance to the complex, multifaceted and*

sometimes amorphous concept of the functioning of financial systems. The paper recognizes that financial depth, access, efficiency, and stability might not fully capture all features of financial systems and it makes no attempt to construct a single, composite index of financial systems. Rather, the paper uses these four characteristics as a basis for describing, comparing, and analysing financial systems around the world and their evolution over the last few decades.

Moreover, important new research sponsored by the BIS clarifies these relationships.⁴³ The researchers compared a large number of economies for the relationship between the per-employee growth of productivity and the size of the financial sector measured by total employment devoted to financial intermediation, all as described in the principal chart from their work.

Figure 2: Financial Sector Share in Employment and Growth



Source: Cecchetti and Kharroubi (2012)

The study finds a direct benefit to productivity growth as intermediation increases, but only up to a point. Thereafter, more intermediation (that is to say, more liquidity) does not spur growth in productivity and appears to actually decrease it. In the second instalment of their study,⁴⁴ the researchers conclude that the reason is that when an economy is saturated with liquidity (that is to say the financial sector grows very large), the financial sector seeks more profit by favouring financial instruments that are based on simple underlying credit and risk structures, but that can be structured for trading at high profit margins.

These findings are reinforced by work of the International Monetary Fund, which examined the development of financial sectors and markets as reflected in a Financial Development Index (FDI) and the relationship between the FDI and economic growth rates.⁴⁵ The finding is that high development, as measured by the FDI, is associated with lower economic growth rates.

These findings have important implications for sustainability and inclusiveness. The underlying credit and risk/return relationships for sustainable and inclusive investments are relatively complex and uncertain. The Cecchetti and Kharroubi studies and the IMF study suggest strongly that large and sophisticated systems of intermediation may be particularly ill-suited to investment in these areas. They will tend to be

less efficacious in delivering all of the investment that they could and also less efficient in doing so (i.e. these investments will cost more than they should or simply will go unfunded).

Thus, past the inflection point on the curve, there is no longer a high correlation between growth, on the one hand, and increased size and sophistication of intermediation. Before this inflection point is reached, the World Bank benchmarking and all of the other studies cited use a perfectly reasonable measure for assessing whether a financial system provides social and economic benefits. After that point, growth in size and sophistication may well inhibit the realization of social and economic benefits. The measurement standards for the Inquiry must then transcend transactional efficiency and be responsive to socio-economic efficiency so that an increasingly large and efficient financial system that lowers transaction cost can mask substantial inefficiencies in delivery of the greater social good of sustainability and inclusiveness.

4.1.2 Overall Implicit Intermediation Cost

The alternative way to look at intermediation cost is to calculate the per intermediation unit profit of intermediaries. If they make more per unit of service provided, intermediation is less efficient.

To examine this, New York University economist Thomas Philippon constructed an intermediation index for the US financial system.⁴⁶ He finds that financial intermediation costs have remained constant but high, with a “unit cost of financial intermediation remaining relatively constant at 1.87% on average, despite advances in information technology and changes in the organization of the financial industry in general.” In fact, Philippon goes back to 1900 on this measure. Financialization through derivatives and other forms of relatively new market instruments, as discussed below, is not part of his calculations of intermediate assets, which is perhaps a bit surprising, but he considers that the “benefits of derivatives are already taken into account.” Having not considered costs of derivatives and related products, the explanation of his findings is at least incomplete and may omit significant costs.

Philippon has estimated that the misallocation of resources related to the US financial sector has reached US\$280 billion per year.⁴⁷ He also states that his methodology assumes efficiency of the intermediation process. This is puzzling in that the co-existence of two facts — that intermediation is the reconciliation of inefficiencies and that compensation that is higher than it should be — infers a great deal about inefficiency. Based on Philippon’s findings, the costs extracted by intermediaries in the execution of their function (intermediation compensation) in the marketplace exceed the aggregate single transaction bid/ask spreads. Moreover, the recovery of those costs by investors increases the overall return they require to invest their funds. High compensation means one of three things: there is more inefficiency in the market that requires reconciliation, perhaps even inefficiency that is a result of intermediation; there are profit-making activities that appear to serve intermediation but do not; or there is market power that facilitates profit that is not disciplined by competition. At a minimum, a further analysis of “efficiency” in light of Philippon’s findings is required.

4.1.3 Derivatives

One category of capital intermediation activity that is rarely considered in that context is derivatives contracts. About US\$120 trillion per year in notional amount is executed each year on a worldwide basis. As they relate to the alignment of the financial system with sustainability and inclusiveness, derivatives should be examined as components of the modern system of capital. Generally, in order to optimize capital raising, risks that traditionally were borne by investors are transferred to derivatives counterparties (mostly banks) in exchange for the mirror image reward associated with that risk (for

example, the risk that oil prices will go down exchanged for the mirror image reward if they go up). This is generally a debt optimization device because debt investors, unlike equity investors, have no interest in upside reward. Therefore, debt investors value elimination of the risk of downward prices and do not value the reward of price rises, in our example. It also is a credit rating improvement device, since ratings are based on risk of default, not profitability, and derivatives are often used to reduce the risk of default by transferring to another party the value of potential profit from operations.

Derivatives are fundamentally different from equity and debt securities (and indeed from commodities). They are contracts between two parties that require performance in the future. A market participant does not buy or sell a derivative. If the participant enters into a derivatives contract, he or she cannot shed the obligation unless the other party agrees. Instead, the participant enters into an offsetting mirror image contract with some other market participant. Thus, the risk of non-performance becomes a daisy chain and the market relationships become very complex.

In a derivative, the parties exchange an obligation equal to today's price for a referenced security, commodity or conceptual value (for example the implied value of oil to be delivered on a date in the future in a specified location) for the price of that same referenced item on the date of performance under the derivatives contract.⁴⁸ If the price goes up, one of the parties pays the net difference (the price on the date of performance less today's price) and if it goes down the other party pays the net difference (today's price less the price on the date of performance). The contractual relationship can have a floor or a cap price beyond which performance is excused (or beyond which performance is required). This is achieved through an option contract. As one might imagine, the terms can be almost infinitely complex in reality so that the categories of derivatives contracts on a given referenced price are nearly limitless.

Derivatives are often characterized as risk transfer or risk management devices, but this is far too simplistic. They are fundamentally distinct from insurance.⁴⁹ They conditionally transfer consequences of price change over time from one party to another, subject to the ability to perform. The contract simultaneously does two things: it exchanges the value of an adverse price change to counterparty for a credit exposure to that counterparty until actual performance occurs; and it exchanges the value of an equally probable beneficial price change in exchange for an extension of credit from the counterparty until actual performance.

Derivatives can be thought of as an element of a deconstructed capital investment. For example, an energy generating company is exposed to power price changes, meaning that, all other factors being equal, it will have higher profits if the price goes up and lower profits if the price goes down. Lenders to, and equity investors in, the generator are then exposed to the same price change. But if the generator enters into a swap on the power price, this exposure is carved out and price change consequences are transferred to the swap counterparty, typically a bank. The transfer assumes, of course, that the bank performs under the contract. This has a number of consequences in terms of capital financing. One example is that the generator can increase its leverage and reduce the equity component of the capital structure. Thus, the generator will have more direct debt from investors relative to equity, and equity value will go up. It also takes on either (a) more derivatives-based debt to the swap counterparty if the price goes up since the counterparty is at risk for future performance by the generator based on current prices, or (b) an asset represented by a mirror image credit extension to the swap counterparty if the price goes down. So long as the cost of debt (interest rate) is lower than the cost of equity (required equity expected return), the value offered to equity investors is higher.

This points up the fact that derivatives are a form of hidden leverage in the economy: the increased direct leverage of the company “hedging” a risk plus either increased company leverage under the swap or increased counterpart leverage, depending on the price outcome. Derivatives may or may not make the overall cost of capital lower, but they represent a very large cost of the capital intermediation system. To the extent that the costs of derivatives exceed the reduced cost of capital, *efficiency* is diminished. To measure the transaction cost of intermediation, even aggregate transaction cost allocable to investment, without considering the costs paid for derivatives contracts omits a very large cost from the calculation. Derivatives may be an important factor in Philippon’s calculation of misallocated capital.

4.2 Effectiveness

Of course, the social value of the financial system is not simply to act as a provider of liquidity to buyers and sellers of securities in primary and secondary markets and to lenders and borrowers. The value provided to society by its financial system is to facilitate the flow of capital between savers and investment consumers (businesses, governments and households) for the benefit of society as a whole.⁵⁰ If we are to evaluate the quality of a financial system solely by measuring its efficiency in terms of transaction costs, we would risk inferring that there is an identity between transaction efficiency and social and economic value. In other words, we would ignore whether society is getting the best deal for the direct and indirect costs incurred.

Therefore, the Performance Framework employs a principle that is separate from *efficiency* and that principle is *effectiveness*. *Effectiveness* measures the performance of intermediaries in prioritizing allocation of investment resources to uses that benefit society most. A financial system with low transaction cost could also allocate capital in ways that generate high costs to society over time. That would be the case, for example, if a system with low transaction cost is inadequate or dis-incentivizes investments that were crucial to sustainability related to the climate and the environment.

One factor in *effectiveness* is the ability to accommodate the quantity of investment demand. The question is whether there is enough intermediation of capital to move savings into investment. The available capital may be too restricted. In addition, if the intermediation sector, most importantly the banks and information traders, is not sufficiently well capitalized, staffed and equipped, the transmission of funds from savings to productive will be frustrated and financial flows to fulfil capital requirements will suffer. In such circumstances, governments in economies with deficient intermediation might intervene to increase prioritization of investments that stimulate rapid economic growth in order to meet near-term objectives.

In more developed, efficient financial systems, with relatively plentiful capital to intermediate, effectiveness might suffer if, for example, either:

- a) On the margin, the cost to investors of the number of transactions in the secondary market is not justified by the quality of the liquidity provided to investors (in other words the marginal liquidity premium that accrues to businesses, governments and households in terms of a lower cost of capital is less than the marginal increase in cost of capital to compensate investors for costs incurred as a result of those transactions); or
- b) As a result of the number and types of transactions, significant benefits (or costs) to society and the broad economy of all or certain categories of investment are not reflected in the prices of those investments so that the financial system allocates investment away from socially beneficial investments (or toward socially detrimental investments).

Especially in more developed financial systems, *effectiveness* is a function of the capital pricing mechanisms of the marketplace. A user of capital investment can afford more capital if its cost is lower. If an investment that has great social value can attract investor interest at a lower cost as a consequence of that value, the system is effectively allocating capital in the interest of society.

Therefore, effectiveness is a matter of capital liquidity. In less developed financial systems, there may be a deficiency of capital liquidity to fund the financial flows needed to fulfil capital requirements. In contrast, in highly developed financial systems, there may be liquidity that causes capital pricing to be non-reflective of social value. This excess liquidity represents financial activity that does not aid and may actually impede investment that serves the interests of society. This is often referred to as “financialization”.

In analysing the implications of effectiveness for market design, questions to answer include:

1. Is there an ideally efficient level and configuration of financialization which can be designed and achieved?
2. Is there a level of financialization which can be understood in so far as the ideal proportion of which can be counted against both the real economy and sustainable finance?
3. Is there an ideal overall cost of intermediation and ideal proportion of which the value of the financial sector overall can be represented?

5 Market Design

As discussed above, a *market design* that aligns with sustainability and inclusiveness must be sufficiently *efficient* and *effective* to generate *financial flows* that fully fund *capital requirements*. The interrelationships among these principles are extraordinarily complex. However, approaches can be readily identified for each so that a given financial system can be evaluated so as to describe historical, current and future performance.

5.1 Outcome-based Principles

The outcome-based principles — *capital requirements*, *financial flows* and *resiliency* — measure the historic, current and projected/forecasted consequences of a financial system rather than specific processes of the system itself. However, each provides the fundamental markers of the quality of the market design it is associated with.

5.1.1 Capital Requirements

This element has been examined, at least in part, for a number of jurisdictions, though there is much room for improvement. Overall capital investment requirements are most often reported based on the achievement of milestones over time. Most analysis focuses on investments needed to achieve climate-related goals. Even this work is incomplete for most jurisdictions because of data deficiencies. Even more fundamentally, differentiation between fiscal investments and investments made by the private sector is not well developed.

Capital Requirements associated with other categories of sustainability and inclusiveness are, for the most part, not well developed. As with climate-related investment, distinctions between public and private investment are not well formed.

Until *capital requirements* are identified and catalogued by type and arrayed to match with milestones, performance of financial systems cannot be fully evaluated.

5.1.2 Financial Flows

As with *capital requirements*, *financial flows* have been identified in a number of jurisdictions. The quantification of these will be somewhat easier as a result of recordkeeping practices of and requirements for private sector firms and investors.

The major conceptual impediments involve definitions and categorization. Data can be gathered, but it is important that the results can be compared from year to year and across jurisdictions. Initiatives like green bonds can be very useful in this regard.

5.1.3 Resiliency

The potential for catastrophic failures is, by definition, difficult to measure in absolute terms. Nevertheless, two approaches are very useful: resilience under assumed conditions and resilience relative to other financial systems. Both are based on the development of stress tests, similar to those that have been used for financial institutions in the wake of the 2008 financial crisis. These tests are models that identify likely outcomes under “extreme but plausible” assumptions in multiple combinations. “Extreme but plausible” has been used to denote conditions that may occur without reference to conventional statistical techniques. They are based on the application of possible conditions rather than statistically probable conditions.

A central question concerns the nature of resiliency. Events that would be extraordinarily devastating to sustainability and inclusiveness may not first manifest as catastrophic financial market failure. Financial markets may adapt sufficiently to avoid failure, depending on the sequence of events.

Nonetheless, stress testing is important beyond simply modelling failures. The models can identify market design elements that are relatively better than alternatives. This can be useful for the evaluation of financial market designs and can also inform public policy and private sector planning and response to sustainability and inclusiveness.

5.2 Process-based Principles

The process-based principles, *efficiency and effectiveness*, involve the workings of the financial system so that they are directly responsive to market design.

5.2.1 Efficiency

The cost of individual transactions is relevant in less developed financial systems and less so in more developed financial systems.

- In less developed financial systems, investment is more likely to occur through bank lending and direct equity investment. Banks aggregate deposits of households, businesses and governments and loan them to fund a variety of activities at a risk-weighted interest rate that exceeds their cost of funds. The primary, controllable transaction cost is that spread. Lending spreads are disciplined by competition or regulation. The primary market design factor relating to *efficiency* in financial systems dominated by bank lending will be competitiveness of the banking sector or, absent competitiveness, effective regulation of spreads and underlying interest rate.
- In highly developed economies, dominated by capital intermediation in the traded capital markets, measurement of *efficiency* is more involved. While competitive lending spreads are an issue, capital intermediation in more highly developed financial systems is also effected in the traded capital markets. Capital raising occurs in the primary markets, in which new issues of securities are offered. However, primary markets are heavily dependent on secondary market trading to provide ongoing price signals and liquidity for reliability of purchases and sales of previously issued securities. Therefore, secondary market trading involves its own transaction costs and it benefits the primary markets in which capital is actually raised in amounts that are not directly related to such transaction costs. In fact, some amounts and types of trading can actually burden primary markets, causing the underlying cost of capital, if not the per transaction cost, to be higher.

Thus, the market design issues related to *efficiency* should measure the following:

1. Bank competitiveness (and, if competition is weak, price oversight and regulation) to optimize lending spreads.
2. Per transaction costs in the traded markets.
3. A Philippon-style analysis of financial sector profitability to generate a unit cost of intermediation.
4. A dynamic and comparative analysis, similar to Cecchetti and Kharroubi's or the IMF's, that assesses whether the quantity and type of liquidity has exceeded the point at which liquidity no longer increases economic productivity growth, and may diminish it.

5.2.2 Effectiveness

As described above, *effectiveness* is a matter of price based prioritization of capital allocation that measures the effective transmission of information regarding the value of sustainability and inclusiveness into price. The related market design issues are particularly difficult to address. If a market is ineffectively transmitting the value of sustainability and inclusiveness into price, the nature of the impediments must be understood before addressing market design issues.

In less developed financial systems, shortages of capital stress priority decisions. Short-term economic growth options may be given priority by regulators and financial institutions causing allocation of capital away from activities that are essential to sustainability or inclusiveness. In other words, low basic capital liquidity can influence allocation according to short-term benefits and risk avoidance.

In more highly developed financial systems, the factor that distinguishes this type of information (sustainability and inclusiveness) from other, more familiar types of information relevant to risk and return (e.g. corporate earnings, market events, macroeconomic policy pronouncements) is timescale. The risks and values are realized beyond the horizons considered relevant by investors. This is exacerbated by the widening and deepening of liquid capital trading markets. If investors can liquidate (or acquire) holdings at a moment's notice based on discernible and reliable prices, they will be less concerned about risks and values that are realized in the distant future. These are simply beyond the scope of the criteria used by investors, or at a minimum less powerful than nearer in risks and values.

The central issue is the ability to make decisions that generate value over the long term in lieu of decisions that serve short-term interests, a question of prioritization. Therefore, the unifying market design element involves liquidity. Capital liquidity is in many circumstances beneficial, but market design can address misallocations that can occur at various levels of liquidity.

5.3 Liquidity

The BIS considers global liquidity to represent the ease of financing available in financial markets, which is broken down into funding liquidity (ease of raising cash by selling obligations to investors) and market liquidity (raising cash through the selling of assets), although a single measure remains a challenge to achieve, making a flexible approach desirable.⁵¹ We will discuss observed current levels of liquidity in this regard as well as exploring ideal levels of liquidity, to be fleshed out in future analysis.

Market liquidity, as it applies to financial assets, is closely related to funding liquidity. One characteristic of large and sophisticated financial systems is a high level of liquidity in secondary markets for securities and derivatives. Stocks and bonds issued by businesses and governments to raise investment capital (the "primary markets") are actively traded in secondary markets, providing investors with continuous price data and the expectation that these financial assets can be converted to cash predictably if need be. Because capital must be deployed in support of secondary market trading activity, a given investment funded in the traded markets in a highly developed system requires more capital from the economy than its notional amount.

Two BIS-sponsored studies by Cecchetti and Kharroubi, described above, have examined the relationship between the size and sophistication of financial systems and productivity. As discussed above, in their 2012 paper,⁵² they found that increasing size and sophistication benefited productivity up to a point. Thus, moving from a poorly developed system toward greater liquidity aided growth of the non-financial sectors of the economy. However, increasing size and sophistication, beyond an inflection point, was found to burden productivity growth.

In their 2015 study,⁵³ Cecchetti and Kharroubi explored reasons for this phenomenon. They identified the preferences of large and sophisticated financial sectors for financing of assets that are simple with instruments that are complex. One consequence that they suggested was a drain of highly skilled professionals from the non-financial sector as it becomes simpler to the more complex financial sector. But more to the point, their characterization of the preference for simple assets and more differentiated complex financing appears to describe a strong preference for valuation of liquidity in the larger and more sophisticated markets, in particular secondary trading market liquidity. The types of financial securities that they describe as preferred require of traders little analysis of issues related to the fundamental value of the underlying asset, but the complexity of the instrument itself offers the opportunity for trading profits. The authors have described the perfect securities for trading in the liquid secondary markets.

Most importantly, longer payback investments in activities such as research and development and expansion into new enterprises (for example, sustainability) are clearly less favoured under this analysis because they cause the assets to be more complex. The underlying factor may well be the excessive (in terms of overall growth of productivity and sustainability) value ascribed to liquidity in large and sophisticated financial systems.

The Cecchetti and Kharroubi studies can also be read together with Philippon's findings. The resistance of financial intermediation to the efficiencies of technological and quantitative advances could be tied to large, sophisticated and efficient financial sector agents that are greatly benefited by excessively (measured as above) liquid financial systems.

The Cecchetti and Kharroubi line of inquiry needs to be greatly expanded in relation to inclusivity and sustainability. It is notable that it distinguishes between developing and developed financial systems, suggesting the reasons that the two categories often view issues of sustainability and inclusiveness differently. Moreover, the fact that the curve reverses could yield insights into the recent failure of the Kuznets Curve (in which economic development is strongly correlated with increasing equality) to predict the direction of income and wealth inequality.

While Cecchetti and Kharroubi employ the size of the financial sector based on employment data as the independent value, their 2015 work connects size to sophistication by its discussion of financial instrument complexity and underlying credit simplicity. Moreover, the similar 2015 IMF study⁵⁴ mentioned above creates a Financial Development Index as the independent variable. The Framework suggests a simplifying assumption asserting that large, developed and sophisticated financial sectors are very strongly correlated with financial systems in which the amount of capital available for deployment per capita is high. A given investment or class of investments is more likely to be funded if large stockpiles of capital are accessible.

Understanding the dynamics of the inflection point of the productivity curve described above may be extraordinarily enlightening, perhaps providing a template for measuring optimal liquidity in the context of *Effectiveness*. We offer this hypothesis that is strongly suggested by the foregoing work by Cecchetti and Kharroubi as a potential architecture for measuring *efficiency*:

- As financial systems develop, funding liquidity is at first inadequate and then can grow to meet the need. Market liquidity may well exist, but it is not yet crucial to funding liquidity.
- Allocation processes can be stressed in early stages of funding liquidity growth. If the available capital funding is sufficient to meet some, but not all, pressing social needs, short-term pay off

investments, such as rapid GDP growth investments, can be prioritized over longer timescale investments by government policy and financial institutions.

- As funding liquidity approaches the point of adequacy, market liquidity increases in importance. This is because, as funding liquidity becomes adequate, its use must be prioritized and allocated. Market liquidity, which provides prices in the secondary market, generates price signals that allow more precise and reliable pricing of financial assets that are created in the primary markets via funding liquidity.
- Rising levels of market liquidity incentivizes agents that act within the secondary markets (i.e. financial sector agents that trade based on superior information and systems) to push for greater complexity of instruments and trading strategies, while encouraging simplification of assets. This is the environment that is most profitable for them. They can do so particularly successfully if the agents can deploy market power or are dominant in the primary markets and lending markets. This ultimately diminishes unit productivity and increases rents.

Under this analysis, the inflection point should be measured in terms of sustainability and inclusiveness. In other words, the question is what level of market liquidity improves funding liquidity and allows the inclusion of the value of sustainability and inclusiveness in price. Therefore, the programmatic framework for *effectiveness* would be described as follows: *effectiveness for a financial system is the proximity of its liquidity to the optimal point of market liquidity for pricing the value of sustainability and inclusiveness given a functionally sufficient level of funding liquidity.*

Appendix C provides a conceptual representation of the liquidity based analysis of the efficiency, effectiveness and system outcomes (capital requirements, financial flows and resiliency) for financial systems as described above.

Certainly, however, there is an argument to be made that the net effect of extreme levels of market liquidity help support the overall value being derived by the financial sector, and not only by the individuals involved, but also as is inherent in the valuation of the sector as a whole. Some public good needs to be generated from this activity, or the value extracted by the financial sector associated with the activity cannot be justified. This kind of financial market activity is never just neutral because it always adds risk to the financial system that is essential to functioning economies.

6 Conclusions

This Performance Framework provides insight into the analytical superstructure of the Inquiry. It is intended to be helpful to a variety of Inquiry readers, including policymakers, regulators, academics and others interested in the approach taken.

Moreover, several hypotheses are set forth in this Performance Framework. It is hoped that these hypotheses will be questioned and tested and that further research and analysis will better describe the relationship between market design of the financial systems and sustainability and inclusiveness.

To this end, the Performance Framework lays out the basic principles underlying the Inquiry's analysis of market design in the context of sustainability and inclusiveness. Specifically, these principles are

- Capital requirements
- Financial flows
- Resiliency
- Efficiency
- Effectiveness

The Performance Framework puts forward conceptual models for assessing a given financial system. In these models, the primary driving force and dependent variable is the size, development and sophistication of the financial sector. To simplify the model, the Framework suggests that the size, development and sophistication of the financial sector are together described in terms of the availability of capital to the economy, or capital liquidity. The simplifying assumption is that large, developed and sophisticated financial sectors are very strongly correlated with financial systems in which the amount of capital available for deployment per capita is high. A given investment or class of investments is more likely to be funded if large stockpiles of capital are accessible.

Accessibility is a function of price (*efficiency*) and the ability of the system to incorporate the value provided by the investment opportunity into the evaluation process (*effectiveness*). Thus, if a sufficient amount of capital can be deployed (*capital liquidity*), and if pricing is *efficient*, then *financial flows* should be sufficient to meet *capital requirements* provided that the *market design* provides *effectiveness* so that value of sustainability/inclusiveness is incorporated in the valuation process.

APPENDIX A

Sustainability Factor

The Framework employs the concepts of capital requirements and funding flows (together with resiliency) in describing financial system outcomes. Appendix A is intended to provide a model for to gauge the interaction between capital requirements and funding flows so as to assess the outcome based quality of a financial system in terms of the level of funding of capital requirements from funding flows. The goal is to measure to what extent the intermediation of capital in the financial market results in all consequences of unfunded externalities being priced into the investment of global savings in productive assets. If all externalities are priced in, funding flows will be adequate to meet capital requirements.

“Externalities” or “E” means the negative consequences of climate change assuming no funding of measures to avoid or mitigate the consequences of climate change, measured by loss of productivity (which may be caused by direct financial cost and the decline of health and increase of mortality of populations).

“Net Externalities” or “NE” means, in each time period during the calculation period,

- The excess of
 - E, over
 - Reductions in E by assumed direct investment by governments, equal to the investment that cannot be derived from private capital

[The underlying logic is that the most efficient role of governmental investment is to fund investments that cannot be funded from private capital sources.]

Reduced by the sum of

- An amount equal to a breakeven amount (an acceptable E such as that associated with a 2 degree increase in average temperature).
- The positive consequences of funding investment to eliminate or mitigate E, either by government or through capital investment of savings.
 - These consequences should include the value of increased employment
 - It should also include the return on private investments

“Externality Private Investment Requirement” or “EPIR” means the net present value of investment needed to eliminate all NE, calculated at the Discount Rate.

“Discount Rate” or “DR” means the risk-free rate in the currency of calculation over the calculation period plus HR and plus UF.

“Uncertainty Factor” or “UF” means the probability that E will be less than or equal to an amount equal to a breakeven amount (an acceptable E such as that associated with a 2 degree increase in average temperature).

“Hurdle Rate” or “HR” means the weighted average (leveraged) cost of capital within the economy, assuming a duration equal to the calculation period.

“Privately Funded Externality Investment” or “PFEI” means the reduction in EPIR from all investment by non-government investors with returns (including direct and tax expenditure subsidies) in excess of the HR and meeting investor requirements for liquidity and convexity of returns.

“Externality Funding Factor” or “EFF” means EPIR *divided by* PFEI.

The Sustainability Efficiency Factor assigned to a given financial market regime is stated as follows:

$$\text{SEF} = 1 - \text{EFF}$$

Appendix B

Inclusivity Index

The World Bank Global Findex is used to compare inclusivity of financial systems. It is based on an extensive survey (150,000) respondents and questionnaires developed over years of research. The Framework would rely on this index. It would also supplement this information with data from central banks. A supplemental inclusivity index would incorporate the following data points:

- Percentage of population having bank accounts.
- Bank branches per capita.
- ATMs per capita.
- Percentage of small and medium sized firms with credit facilities.

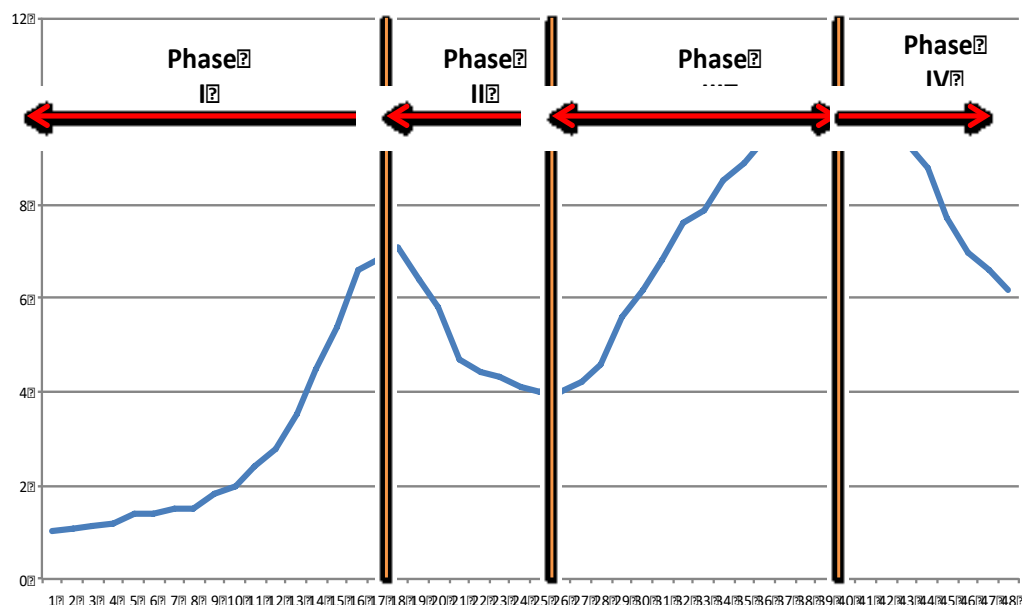
The supplemental data could be compared with the Global Findex results and could identify anomalies that merit further inquiry. After a period of testing, the central bank data could be incorporated into the survey data for a third form of measurement.

Appendix C

Analytical Framework

Market Design and Efficiency, Effectiveness and System Outcomes

Below is a conceptual chart intended to illustrate a hypothetical framework tool for universal applicability in measuring the quality of various market designs in terms of sustainability and inclusiveness. As with all hypotheses, it may be disproved. Until it is disproved, it seems to explain available information derived from academic analysis and observations.



Y Axis: The percentage of the amount of investment in sustainability/inclusiveness that is currently being fulfilled from financial flows.

X Axis: The amount of financial liquidity available in the markets.

- One might infer this from the number of workers employed in the financial sector, similar to Cecchetti and Kharroubi.
- Instead, one might use the aggregate national savings less the amount of domestic wealth invested in government debt.
- Alternatively, one could create an index, something like:
(the household and business loan balances for all banks, *plus* the market capitalization of all company shares in equity markets, *plus* the market value of outstanding debt in corporate debt markets, *plus* market value of all existing derivatives contracted by corporations and financial institutions) *divided by* population.

Phase I: Intermediation is dominated by banks and liquidity is largely in the form of loans but capital markets are formed over time. Policy is focused on the growth of intermediation and the accumulation and aggregation of savings as well as the initial growth of inclusiveness. Financing of basic infrastructure that enhances sustainability is prioritized.

Phase II: Capital liquidity is sufficient (meaning the accumulated capital that is deployed through term transforming intermediation) that GDP per capita growth for at least identifiable sectors of the population is significant. The political and public opinion stake in this growth is sufficient that investment in rapid GDP growth is emphasized over sustainability.

Phase III: Capital liquidity is increasingly provided by traded capital markets and markets in sophisticated financial derivatives contracts, as capital market *efficiency* increases based on the demands of the private and public sectors. Pools of savings are increasingly aggregated and deployed using sophisticated management and optimization techniques. As a consequence of the immediate effects of GDP growth driven investment of Phase II and its continuation into Phase III, and the policy demands associated with issues such as climate change, capital deployment in service of sustainability and inclusiveness is increasingly *effective*.

Phase IV: Two phenomena arise: the social benefits of increased capital market *efficiency* reach a point of diminishing, and eventually negative, returns; and the capital market liquidity exceeds the amount that provides social value. Investment management tools are able to measure liquidity in very fine units. Continuing use of such tools in pursuit of *efficiency* introduces poor relative valuation of longer time horizon investment opportunities, most significantly those that enhance sustainability. As a consequence, *effectiveness* declines and capital is misallocated from a social value perspective. Private sector investment of retained earnings in research and development and expansion, a primary source of investment in sustainability and inclusiveness, may even decline as it is undervalued in terms of long time horizon analysis by investors.

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- ⁴⁵ See IMF (2015). *Rethinking Financial Deepening: Stability and Growth in Emerging Markets*. Staff Discussion Note. Available at <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1508.pdf>.
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- ⁴⁸ For example, on the agreed date of performance (say 31 May 2016), Party A will pay Party B today's price for a barrel of oil to be delivered in June 2016 at Cushing, Oklahoma; and Party B will pay to Party A the price, as of the date of performance, of a barrel delivered in June 2016 at Cushing, Oklahoma. Thus, the contract captures the change in price up to 1 June 2016 of a barrel of oil delivered in June 2016 at Cushing, Oklahoma.
- ⁴⁹ Insurance is "A contract in which one party agrees to indemnify another against a predefined category of risks in exchange for a premium." (Legal Information Institute, Cornell University Law School, available at <https://www.law.cornell.edu/wex/insurance/>.) A derivative has not quantifiable premium but is an exchange of future consequences relative to a current condition.
- ⁵⁰ In addition, the financial system provides payment systems and risk transfer in the form of insurance. Philippon, T. (2011). *The Size of the US Finance Industry: A Puzzle*. Available at http://www.newyorkfed.org/research/conference/2011/NYAMP/Fed_Philippon_v1.pdf.
- ⁵¹ Mehrotra, A. and Yetman, J. (2015). *Issues for Central Banks*. BIS. Available at https://www.bis.org/publ/qtrpdf/r_qt1503h.htm.
- ⁵² See Note 43.
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