

Forthcoming in *Capitalism and Society*, <http://www.bepress.com/cas/>

Center on Capitalism and Society at Columbia University
www.earth.columbia.edu/ccs

Working Paper No. 29, February 2009

Financial Markets and the State:
Price Swings, Risk, and the Scope of Regulation

Roman Frydman** and Michael D. Goldberg***

Prepared for the 6th Annual Conference of the Center on Capitalism and Society:
Emerging from the Financial Crisis

February 20, 2009

.
**Department of Economics, New York University roman.frydman@nyu.edu

***Department of Economics, University of New Hampshire michael.goldberg@unh.edu

TABLE OF CONTENTS

1.	Asset Price Swings in Modern Economies.....	5
2.	The Dream of Mechanical Markets.....	7
3.	The False Promise of True Values.....	10
3.1	Why Bubbles Should Not Be Pricked Early.....	10
4.	The Indispensable Role of Asset Price Swings in Allocating Capital	11
4.1	Price Swings as a Search Process for Worthy Investments.....	12
4.1.1	The Irreducible Diversity of Forecasting Strategies.....	12
4.1.2	How Imperfect Knowledge Drives Price Swings.....	13
4.1.3	How Price Swings Sometimes Become Excessive.....	14
4.2	Markets Do Self-Correct.....	15
4.3	Bounded Instability of Asset Markets: Historical Benchmark Levels and Risk.....	16
5.	IKE’s Rationale for State Intervention in the Financial System.....	20
6.	The Scope and Form of Policy Intervention in Financial Markets....	22
6.1	Key Features.....	23
7.	Prudential Policy Tools for Financial Markets.....	23
7.1	Official Announcements of the Guidance Range.....	24
7.2	Additional Steps.....	26
7.2.1	Currency Markets.....	26
7.2.2	Other Asset Markets.....	27
7.3	Bans on Short Selling, the Uptick Rule, and Other “Prudential” Measures.....	28
8.	Lessons for Regulating Banks and Other Financial Institutions....	29
8.1	Assessing Risks in the Financial System.....	30
8.2	Long Swings and Credit Ratings.....	31
	Appendix.....	32
A.1.	“Rational” Bubbles.....	32
A.2.	“Irrational” Bubbles.....	33
	References.....	35

Assets that trade freely in markets have a tendency to undergo swings away from and toward benchmark levels. As recent experience in housing, equity, currency, and commodity markets around the world has shown, asset price swings are sometimes excessive, and are followed by long and sharp reversals. Economists and policy makers generally agree that such excessive, boom-and-bust fluctuations in asset values can be costly, for they can lead to misallocation of financial capital and painful shifts in consumption patterns, trigger or prolong real economic downturns, and expose consumers and businesses to greater financial risks. Many have pointed to excessive upswings in house and equity prices as key factors behind the current financial crisis and its devastating effects on the real economy. There is also the real danger that reversals in these markets now underway could turn into excessive downswings and drag the economy and the financial system into an even deeper the crisis.

The connection between excessive price swings in asset markets and financial risk and crisis suggests that understanding these price swings must play a central role in shaping current efforts to re-regulate the financial system. However, for the most part this has not been the case.¹ Instead, the conceptual framework that underpins the current policy debate focuses on the lack of transparency, inadequate incentives, and weak competition that have come to characterize financial markets.

To be sure, woefully insufficient transparency and distorted incentives for key participants in the financial system have contributed significantly to the unfolding crisis. Many observers have emphasized the opaqueness of structured assets, the close relationship between investment banks and credit ratings agencies, and the dizzying rise of financial institutions' leverage ratios. Consequently, the measures for regulatory reform that have been put forth recently by the Basel Committee (Basel II), the Financial Stability Forum (FSF), the Group of Thirty (G30), and others tend to focus on rectifying these important failures.

But, the focus on eliminating market failures reinforces the widespread belief that if re-regulation could largely eliminate these failures, the market would set asset prices at their "true" fundamental values. As long as market participants are "rational" – according to the precise notion of rationality prescribed by economists (including those who rely on behavioral models) – the market can discover the "true" future values of assets.

Of course, economists recognize that markets undergo long swings. But the belief that unimpeded markets composed of "rational" individuals would get asset prices exactly right has led to the view that protracted departures from this *normal* state are "bubbles" that arise *only* because market participants fall prey to irrationalities, herding instincts, or reliance on technical rules.

¹ For example, see Basel Committee on Banking Supervision (2006), and the influential reports by the Group of Thirty (2009) and the Financial Stability Forum (2008).

Economists' bubble models thus lead to an extreme view of the role of swings in capitalist economies: they are unrelated to the movements of fundamentals and, as a result, serve no useful social function. Accordingly, extant bubble models place no limits on the scope and intrusiveness of state intervention in financial markets, which may go well beyond ensuring transparency, adequate competition, and incentives. Even if very strong measures were required to extinguish asset-price swings, the bubble models imply that implementing them as quickly as possible would unambiguously improve long-term capital allocation.

Policy makers, however, have not been inclined to heed the bubble models' guidance. Indeed, many officials, most notably Federal Reserve Chairman Ben Bernanke, have argued that the policy of pricking bubbles early is flawed, because no one knows the fundamental values. Moreover, such a policy would undermine markets' indispensable role in allocating capital as innovations and other changes shift fundamental values over time.

Viewing asset-price swings as bubbles that are completely unrelated to fundamentals has obscured the inherent connection between swings and the riskiness of portfolios held by individuals and financial institutions. Consequently, despite its obvious failure to capture risk prior to the current crisis, the so-called Value at Risk (VaR) method continues to underpin the main post-crisis reform proposals, such as Basel II.

The problem with VaR, which relates risk to standard measures of volatility, is that it ignores the effect of asset-price swings on riskiness. Arguably, this shortcoming was a key factor behind VaR's failure to signal the extraordinary riskiness of financial institutions' portfolios prior to the crisis. One astute observer goes as far as to argue that the failure of regulations based on measures like VaR was *not* due to the lack of transparency. In fact, information about financial institutions' asset positions was widely available prior to the crisis. Yet, "[t]he entire safeguards system, consisting of disclosure, regulation, and supervision, failed."²

Clearly, then, we need a new conceptual framework in order to assess the efficacy and potential effects of proposed regulatory measures, and to guide us in thinking about new policy tools that might be appropriate for dealing with excessive swings, both when prices reach levels that are "too high" and "too low." We also need new ways to assess risks that take into account price swings.

Some of the recent reform proposals aimed at curbing short-term "speculation" – including countercyclical capital and margin requirements in financial markets,³ and re-imposing the up-tick rule⁴ – are a case in point. Without a sound conceptual framework, it is difficult to assess whether any of these measures would help to dampen fluctuations in asset prices and how they might be implemented. Depending on the situation these measures could either help curb or exacerbate excessive fluctuations.

² See Pomerleano (2009).

³ See Group of Thirty (2009).

⁴ For commissioner's Shapiro testimony to the Senate Banking Committee, see Orol (2009).

There are also broader concerns that must be addressed by efforts at regulatory reform. To be sure, many now believe that the radical deregulation of financial markets in the late 1990's and early 2000's – underpinned by the view that regulation is neither effective nor helpful in improving the functioning of markets – was a primary cause of the current crisis. Nevertheless, there is still widespread agreement among policy makers that, while markets are not perfect, they are vastly superior to regulators in setting values and allocating scarce capital.

If so, what is the rationale for and appropriate scope of re-regulation, beyond ensuring transparency? How can we reconcile market regulation with preservation of capitalist economies' key feature – their ability to spur innovation and growth? Proceeding with a conceptual framework that misses what markets do in capitalist economies could unwittingly cause us to throw the baby out with the bath water.

1. Asset-Price Swings in Modern Economies

In his prescient critique that central planning must fail *in principle*, Friedrich Hayek emphasized that no mathematical model could mimic exactly what markets do. Remarkably, prevailing models of asset markets – even those based on behavioral considerations – ignore this key insight about capitalist economies. Instead, contemporary approaches to financial markets and risk presume that an economist can identify precisely the set of factors that determine market outcomes over the shorter and the longer terms.⁵ These models characterize as routine the way “rational” or “irrational” individuals forecast the future and make decisions, thus representing these decisions with mechanical rules that are *specified in advance by an economist*. Based on these individual micro-foundations, prevailing models imply that market prices also follow pre-existing mechanical rules.

In fact, as Frank Knight, John Maynard Keynes, and Hayek all emphasized, neither an economist nor the market can get asset prices exactly right in either the shorter or the longer terms.⁶ This seemingly uncontroversial claim goes a long way toward explaining contemporary models' gross failure in accounting for asset-price swings and risk. It may also help to explain why policy makers – who, after all, have extensive experience and intuitions about what drives market outcomes – have made scarcely any reference to economists' models in interpreting the crisis or in thinking about new ways to re-regulate financial markets in response to it.

To remedy this flaw, economic models should reflect modern economies' key feature: the fact that individuals and companies engage in innovative activities, discovering new ways of using existing physical and human capital and technology, as well as new technologies and new capital in which to invest. Moreover, the institutions and the broader social context within which this entrepreneurial activity takes place also change in novel ways. Innovation in turn influences the future returns from economic activity in

⁵ We use the terms “shorter” and “longer” to underscore that there is a continuum of forecasting horizons.

⁶ Over the last two decades, George Soros has emphasized that this presumption is the key reason why contemporary models fail to provide satisfactory accounts of outcomes in asset markets (Soros, 1987, 2008).

ways that no one can fully foresee,⁷ and thus that do not conform to any rule that can be prespecified in advance.

Indeed, the inherent imperfection of knowledge that Knight, Keynes, and Hayek so clearly recognized is crucial to understanding that financial markets are hard-wired to undergo price swings that revolve around historical benchmark levels. Although some market participants may fall prey to emotions or rely on technical rules, swings in asset prices arise from market participants' necessarily imperfect knowledge about *how* these prices will unfold over time. Indeed, once the inherent imperfection of knowledge is recognized, price swings may occur even if *all* market participants forecast future prospects *solely* on the basis of fundamentals.

The fact that market participants search for new ways to forecast the future and find profitable avenues to invest their capital neither suggests nor requires that the market does a perfect job in allocating scarce capital. However, placing imperfect knowledge at the center of one's analysis *does* suggest that swings in asset prices are an inherent part of how markets function in allocating capital. If swings lie at the heart of what markets do, then eliminating them or transforming them into mere random variations around "true" fundamental values would require the state to close markets down altogether or regulate them so heavily that they virtually cease to play any useful role.

History has witnessed attempts by the state to allocate investment capital with no or minimal reliance on markets. The massive failures of these non-market systems clearly indicate that financial markets play an indispensable role in appraising the *ever-changing* longer-term prospects of projects and companies, old and new, and in allocating capital based on this open-ended process of evaluation.⁸ Bubble models, even those based on behavioral considerations, likewise miss what markets do. Consequently, instead of delivering unambiguous social benefits, their policy prescription to eliminate asset-price swings may result in the gross misallocation of capital and the stifling of innovation and economic growth.

Our analysis and proposals for regulatory reform are based on a new approach to modeling asset prices and risk that places imperfect knowledge on the part of regulators and market participants at the center of the analysis. This approach, dubbed Imperfect Knowledge Economics (IKE), recognizes that an economist cannot specify exactly how

⁷ Phelps (2006a, 2007) emphasizes that the dynamism that accounts for the superiority of capitalist economies over other economic arrangements is inherently linked to the uncertainty that it engenders. Frydman *et al* (1999) provide empirical evidence of this view.

⁸ For an extensive analysis of why economic arrangements that wholly dispense with private property and market-based capital allocation result in minimal levels of productive innovation, see Frydman and Rapaczynski (1994) and references therein. This experience with the *wholesale* replacement of financial markets does not imply that partial measures, such as temporary nationalization of banks, may still be sensible, if the alternative is their absolute collapse or sinking tax payers' money into them without any public equity. However, the key problem is how to implement such a program in ways that minimize inevitable distortions in the allocation of capital. For arguments that temporary nationalization may be better than the other available options, see Kaletsky (2009) and Roubini (2009).

market participants forecast the future and how asset prices unfold over the shorter and longer term, even if he allows for external probabilistic shocks.⁹ We have showed elsewhere that IKE models of fluctuations and risk go a long way in accounting for the empirical record on asset prices and risk, a task that has confounded economists for decades.¹⁰

In this paper, we make use of IKE models to examine the rationale, scope, and implementation of prudential policies. We show that although markets are far superior in setting values, state intervention could, if done cautiously and sensibly, dampen excessive movements away from benchmark levels and thereby reduce the social costs when these prices go too high and end in a sharp reversal, or go too low and deepen the downturn in the economy.

We also consider an IKE-based package of prudential policy and regulatory measures, some of which are aimed at limiting excessive fluctuations in asset markets, while others focus on assessing the risks faced by financial institutions and strengthening the system's ability to cope with and limit these risks. The IKE framework not only leads to new policy tools; it also enables us to assess the usefulness of some of the prudential measures that have been recently proposed, and to suggest ways that they might be refined.

2. The Dream of Mechanical Markets

Asset prices and risk premiums reflect market participants' decisions to buy and sell, which depend crucially on individuals' forecasts of future market outcomes. To model fluctuations in asset prices and risk, an economist must account for market participants' strategies – the factors that they consider relevant and how they use them to forecast market outcomes. Because modern economies are defined by their capacity to innovate, individuals cannot afford to stick to one strategy endlessly to forecast the future. This feature of decision-making in real-world markets makes the task of modeling fluctuations an extremely daunting challenge.

Remarkably, the vast majority of economists presume the opposite: rational individuals forecast according to a fixed rule.¹¹ This bit of magical thinking relies on two premises, both of which underpin the so-called “Rational Expectations Hypothesis” (REH). The

⁹ Although IKE models leave room for imperfect knowledge, they can be rigorously confronted with empirical evidence. See Frydman and Goldberg (2007a), Frydman, Goldberg, Johansen, and Juselius (2008, 2009), and Johansen, Juselius, Frydman, and Goldberg (2008).

¹⁰ Allowing for imperfect knowledge is not only important on empirical grounds. In Frydman and Goldberg (2008a), we show rigorously that the epistemological flaws of both conventional and behavioral models can be avoided only by leaving macroeconomic models open to the imperfection of knowledge.

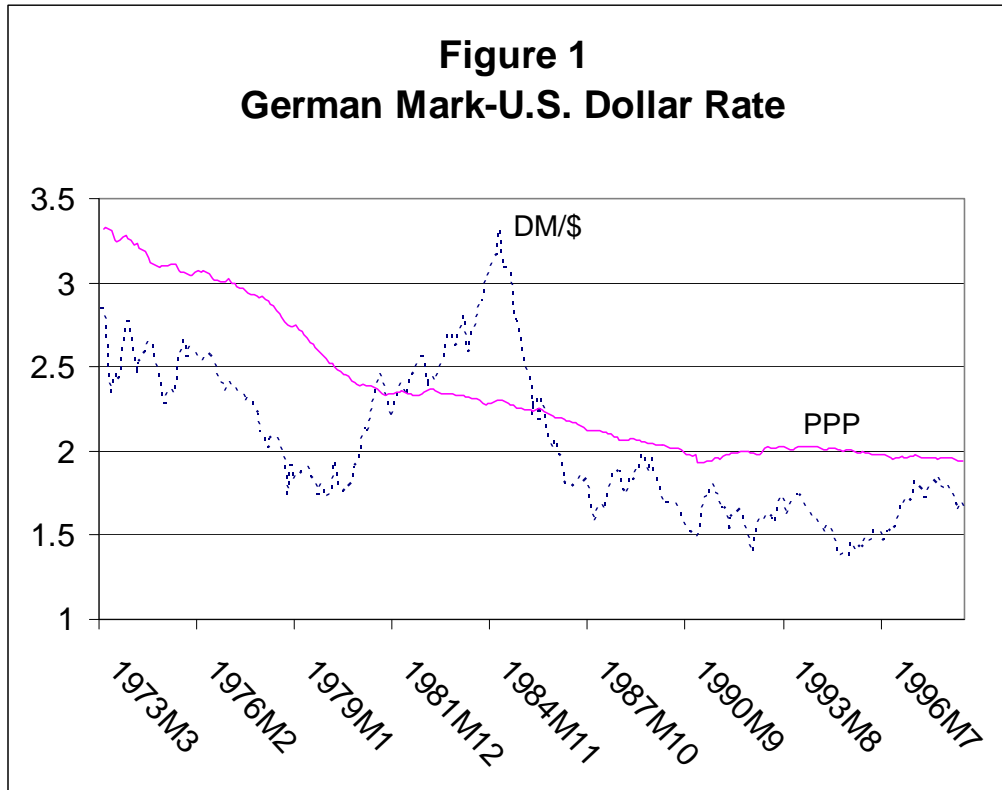
¹¹ Although a vast majority of REH models do not allow for any change in the way individuals forecast the future, the REH framework does not necessarily require it. However, to use REH and allow for change, an economist must *fully* prespecify the rule, deterministic or probabilistic, that governs change at any point in time, past and future. For seminal REH models that view change as a routine process that is governed by such rules, see Hamilton (1994). For a demonstration that such models of change are equivalent to assuming no change, see Frydman and Goldberg (2007a, chapter 6).

first premise holds that a rational individual bases her forecasts of future values of fundamental variables and prices *solely* on the same model that the economist himself writes down. What has made such forecasts seem “rational” to a vast majority of economists is the second, equally strong presumption: save for a random deviation that averages to zero, an economist’s model *exactly* characterizes how fundamentals unfold over time and how these variables translate into the “true” value of every asset. According to REH, then, *all* rational individuals forecast on the basis of the *same* understanding of the relevant fundamental factors and how they affect outcomes.

In an REH world, market participants’ forecasts of future values of fundamentals and prices are not only correct on average; their decisions to buy and sell also result in a market price that is exactly right, fluctuating randomly around its long-run fundamental equilibrium. In setting prices, the market correctly takes into account any change in the “true” fundamental value, as long as information about such changes is transparent and widely available.

Of course, market participants may *not* have sufficient access to relevant information for various reasons, such as the presence of highly complex derivative instruments, loose disclosure requirements and accounting standards, or fraudulent practices. Inadequate competition and misaligned incentives may also be a problem. In such situations, regulation should be introduced to eliminate the informational asymmetry and other market imperfections. In other words, if one assumes that REH models actually provide an adequate account of how asset markets function, fixing these problems is all that would be needed for them to price assets, on average, at their “true” fundamental values.

Assuring these ideal conditions, however, would not eliminate long swings in asset prices. After all, it can hardly be argued that these conditions do not obtain in most major financial markets, which are, in most respects, prototypes of the markets for which standard macroeconomic analysis was largely designed. They are characterized by a large number of buyers and sellers, few if any barriers to entry and exit, no impediments to price adjustments, and a plethora of available information that is quickly disseminated around the world. And yet asset prices often undergo long and wide swings that revolve around historical benchmark levels. Just one example is provided by a graph of the German mark-U.S. dollar exchange rate and the PPP rate, which is presumed by many REH models to be the “true” fundamental value.



The figure shows that in every decade of floating exchange rates (the 1970's, 1980's, 1990's, and 2000's), there is at least one currency swing away from PPP lasting three years or more and involving departures of more than 40%. The frequency and magnitude of these swings are too great to be explained by standard REH models.¹²

Although the figure portrays swings relative to one measure of the PPP level, other PPP measures are possible. Some have argued that the benchmark exchange rate also depends on current-account imbalances and productivity growth rates.¹³ There is thus a range of sensible benchmark levels. More importantly, the width of this range and how it changes over time cannot be precisely known by anyone. Indeed, this uncertainty is the central issue in justifying and formulating prudential policy for asset markets and in assessing their impact on the risks faced by financial institutions, and more broadly, on the rest of the economy.

¹² See Frydman, Goldberg, Johansen, and Juselius (2008, 2009) and Johansen, Juselius, Frydman, and Goldberg (2008).

¹³ For a review article, see MacDonald (2000).

3. The False Promise of “True” Values

The inability of REH models to account for asset prices and risk has not eroded REH’s special role as the cornerstone of rationality in macroeconomics. Despite its many empirical failures and demonstrable epistemological flaws, the vast majority of economists have steadfastly clung to the belief that an economist’s REH model *does* capture how rational individuals think about the future and how a market populated by these “rational” individuals sets asset prices.

This belief underpins the view that long swings in asset values stem from decisions by market participants who ignore fundamentals in forming their forecasts and instead respond mechanically to extraneous factors and bid an asset price increasingly away from its “true” fundamental value. To represent this outcome, economists construct two classes of bubble models: “rational” and “irrational,” which differ in the way they characterize the non-fundamental reasons that market participants join a bubble.¹⁴ Rational bubble models appeal to manias and crowd psychology, whereas behavioral models appeal to technical trading strategies that extrapolate past trends.

However, both “rational” and “irrational” bubble models are predicated on a common belief: an economist’s REH model fully captures the mechanism driving the “true” fundamental value of every asset. As a result, the bubble models lead to the extreme view that asset-price swings do not serve any useful social function and that ending them as quickly as possible would unambiguously improve the longer-term allocation of capital, even if this necessitates massive state intervention well beyond ensuring adequate transparency, competition, and incentives.

3.1. Why Bubbles Should Not Be Pricked Early

Economists necessarily must make many simplifying assumptions in modeling a complex reality. However, the assumption that an economist’s model can specify precisely an asset’s true fundamental value is unlikely to be useful in formulating sensible policies. The policy implications of both classes of bubble models are a case in point. They not only call for implementing measures that would prick bubbles early, but they also presume that officials can determine without difficulty whether price movements stem from shifts in the fundamental value or from a bubble. But, as Bernanke (2002) has reminded us,

the problem of a bubble-popping Fed is much tougher than just deciding whether or not a bubble exists....In my view, somehow preventing the boom in stock prices between 1995 and 2000, if it could have been done, would have throttled a great deal of technological progress and sustainable growth in productivity and output.

This and many other historical episodes of asset-price swings suggest that, at least to some extent, these fluctuations serve an essential economic purpose: they are the only

¹⁴ See the appendix for a sketch of these models.

effective process we know of to guide society in its search for ever-changing fundamental values and in allocating financial capital based on those values. Thus, pricking bubbles early is likely to have unambiguous social costs rather than the unambiguous benefits that the bubble models would lead us to believe.

Bernanke's argument against popping bubbles as soon as they get underway seems uncontroversial. However, it leaves open the question of whether, beyond a certain point, a price swing may become excessive: that is, its continuation is more likely to misallocate capital than to help society allocate it based on ever-changing long-term fundamental values. Indeed, many have described the last phases of the recent swings in equity and housing values as excessive.

Whether it might be desirable and feasible to implement such policies aimed at limiting such swings depends on one's view of what markets do, particularly the role that price swings play in society's attempt to ascertain changing long-term fundamental values in allocating capital. What drives price swings is also central for devising prudential policies and regulation aimed at reducing systemic risk. But, in order to address these thorny issues, we need a framework for understanding markets, particularly long swings and risk, that presumes that neither market participants nor policy officials and economists can get longer-term asset values exactly right.

4. The Indispensable Role of Asset-Price Swings in Allocating Capital

Bubble models critically depend on an economist's presumption that his REH model specifies exactly how the "true" fundamental value moves over time and how, in the absence of the bubble, "rational" market participants' forecasts track this movement. In fact, there are good reasons that REH should *not* be viewed as the way that rational individuals should forecast.¹⁵ Indeed, it seems uncontroversial on both epistemological and empirical grounds to suppose that no one, including economists, policy officials, and market participants themselves, has access to exact knowledge of the mechanism that will drive future asset prices.¹⁶

This observation opens up the possibility that swings could arise even if all market participants based their forecasts *solely* on fundamentals. This alternative view does not necessarily exclude a role for technical traders. But, even if such trading were absent, swings may arise from market participants' ever-imperfect knowledge about *which* fundamental factors drive asset prices and how they affect those prices over the shorter and longer terms.

¹⁵ For early arguments showing why REH does not characterize how rational individuals forecast the future, see Frydman (1982, 1983), Phelps (1983), and Frydman and Phelps (1983). Frydman and Goldberg (2007a, 2008a) show that in real-world markets, REH models are best interpreted as representing the forecasting behavior of grossly irrational individuals.

¹⁶ Even coming up with an exact model of the mechanism that drove past outcomes is problematic. Historians disagree about which factors mattered in the past. Even if one were to rely solely on rigorous statistical methods, neither the timing nor change in the past relationships governing outcomes could be pinpointed. For a discussion of this point in the context of modeling currency markets, see Frydman and Goldberg (2007a, chapter 15).

4.1. Price Swings as a Search Process for Worthy Investments

Financial markets allocate scarce capital to individuals and companies to build up an economy's productive capacity. They provide price signals to savers: higher prices attract financial capital, while lower prices deter it. For markets to perform this function in a way that is beneficial to society, price signals should reflect the prospects—private and social returns—of projects and companies. The fundamental problem is that these prospects unfold over time in ways that do not conform to any rule that can be prespecified in advance.

The very process by which financial markets perform their vital function compounds the uncertainty generated by innovative activities in the real economy. Market participants make decisions to buy and sell by forecasting future returns, and, like individuals in the real economy, they also find new ways to forecast. Markets translate these decisions into shifts in asset prices, which, in turn, lead to alternative allocations of capital and changes in the prospects of projects and companies. Contrary to REH and behavioral models, no one can know fully how this two-way interdependent process between market prices and prospects will unfold over time.

4.1.1. The Irreducible Diversity of Forecasting Strategies

Market outcomes are both driven by and shape the diversity of participants' forecasting strategies. Individuals rely on forecasts in their quest to allocate resources in ways that come as close as possible to achieving their objectives. This process may involve taking positions with a view toward returns over shorter as well as longer time horizons. For example, young people tend to invest based on forecasts of prices over longer horizons, while as they age, their time horizons usually become shorter. Market participants who work for financial institutions often hold speculative positions over shorter horizons, because their performance is evaluated on a monthly, quarterly, or annual basis. In over-the-counter (OTC) markets such as those for currencies, dealers mostly close out their positions by the end of the day.

Regardless of their speculative horizons, participants' strategies also vary because no one knows fully the process by which future returns will be generated. Some views are bullish and predict rising prices, while others are bearish and predict falling prices. In setting prices, the market weights participants' views by the wealth shares behind them, without regard to whether they are bullish or bearish, or whether they are based on shorter or longer horizons. As such, prices at every point in time reflect an invisible weighting of bullish and bearish views about shorter- and longer-term returns.

While some market participants may rely solely on technical rules, many trade on the basis of assessments of the prospects of investment projects or companies. To this end, they make use of their own knowledge and intuitions about how future market outcomes might be related to current and past information concerning a wide range of economic, political, social, and environmental developments. In equity markets, for example, well-known fundamental factors include corporate earnings, GDP growth rates, inflation rates, employment, productivity levels, interest rates, central bank

announcements, changes in the tax code, and other fiscal policies, to name just a few. Because knowledge is imperfect, the fundamental factors that participants deem relevant for forecasting at any point in time and the weights that they attach to them vary widely. Moreover, over time, participants revise their forecasting strategies, at least intermittently. Thus, which fundamental factors underpin swings in asset prices and how they impact prices vary over time.¹⁷

4.1.2. How Imperfect Knowledge Drives Price Swings

Contrary to what REH and behavioral bubble models assume, there is substantial evidence that market participants with shorter horizons also rely heavily on fundamentals in forming their forecasts.¹⁸ This makes sense, because current trends and relationships are likely to continue to have at least some relevance over the shorter term. Those with longer-term horizons also look at fundamental factors, like company business plans and the history of the market in which they are investing, as well broader tendencies for change in the economic and political environment. Given modern economies' capacity for innovation, it is much less clear how current information and knowledge can be used to appraise longer-term than shorter-term prospects.

REH and behavioral bubble models suggest that if market participants who focus solely on the shorter term were somehow to vanish, asset prices would cease to undergo swings. In contrast, the key implication of IKE is that swings based on fundamentals may arise *regardless* of whether market participants focus on the shorter- or longer-term prospects of the underlying assets.

Understanding this process is not difficult. Over time, new realizations of fundamentals become available. Based on this information, market participants may decide to revise their forecasting strategies. These revisions, together with the new information, lead them to change their price forecasts.¹⁹ If movements in fundamental factors involve trends that remain unchanged over some period of time, then participants' forecasts in the aggregate, and thus the asset price, might also tend to move in one direction. This would be the case if the revisions of forecasting strategies were moderate, so that their effects on price expectations did not outweigh from the effects of the trends in fundamental factors.²⁰ If these two conditions prevailed for an extended period of time, the asset price would tend to move in one direction over that period.

¹⁷ The empirical results of Goldberg and Frydman (1996a, b, 2001) reveal not only that exchange rates and exchange-rate expectations depend on macroeconomic fundamentals, but also that different sets of fundamentals matter in different ways during different time periods.

¹⁸ A look at the financial press makes this claim obvious. There are also many survey studies of professional traders, who tend to focus on short term returns, showing that they use a wide range of fundamental variables in forming their forecasts. The empirical studies cited in the preceding footnote, which are based on monthly data, also show that fundamentals matter over shorter time horizons.

¹⁹ The vast majority of economists ignore such revisions, but they are crucial for explaining the self-limiting nature of price swings.

²⁰ For a rigorous formulation of "moderate" revisions, see Frydman and Goldberg (2007a, 2008a). For further discussion and empirical evidence that individuals tend to revise their beliefs slowly, see Shleifer (2000) and Edwards (1968).

4.1.3. How Price Swings Sometimes Become Excessive

Consider the U.S. equity market in the 1990's. During this period, particularly before 1998, corporate earnings, GDP, employment, exports, and productivity levels were rising strongly, while inflation and interest rates were declining. Political and institutional developments, which were accompanied by loose monetary policy, were also conducive to growth. As these developments unfolded, they no doubt led market participants to reevaluate and possibly revise their forecasting strategies. Given the widespread view at the time that the U.S. and other economies were in the midst of an information technology (IT) revolution, it is likely that these revisions and the bullish trends in fundamental factors led many market participants, including those with shorter-term and longer-term horizons, to raise their forecasts of returns on stocks, thereby bidding up prices.²¹

Market participants rely on diverse forecasting strategies, so as the market entered the 1990's, individuals' assessments of the longer-term values of companies, both old and new, spanned a range of values. As the decade progressed, this range of values no doubt changed. Many would argue that it likely shifted up, and thus that the upward climb in stock prices, at least for a time, was not a swing away from the range of perceived longer-term values, but merely a reflection of its rise. Of course, this is Bernanke's point.

But, although these bullish perceptions of the IT revolution's longer-term benefits did – and still do – seem warranted, this does not mean that the market correctly appraised the effects on companies' longer-term prospects. Indeed, our IKE account of fluctuations suggests that time periods involving persistent trends in fundamental factors would be characterized by the tendency for stock prices to move in one direction if revisions of forecasting strategies were moderate. It seems plausible that these conditions prevailed in the 1990's. But, if they did, then asset prices reached levels toward the end of the decade that the market itself considered too high, because it did self-correct.

The possibility of an asset price reaching such high levels is substantially enhanced if participants who focus only on shorter-term prospects dominate the market. But an inconsistency between asset prices and participants' aggregate perception of longer-term prospects might emerge even if the entire market were to become composed only of participants who traded with a view to the longer term.

Like everyone else, participants with longer time horizons do not know how longer-term prospects will unfold, and trends in fundamentals may lead them to bid up prices. As time passes, new information about fundamental factors becomes available, and purposeful individuals may revise the way they interpret it. As the future becomes the present, the time may come at which the asset price level becomes excessive: it exceeds the market participants' *then* revised assessments of longer-term prospects.

²¹ A rise in the price forecasts of individuals implies neither that they hold the same forecasts, nor that they are all bulls or bears. Indeed, an upward price movement could stem solely from the bears becoming less bearish.

This implication of imperfect knowledge does not require that shorter-term traders are present in the market: it would still follow even if it were possible to banish them from the market, leaving the *entire* market composed of participants who trade with a view to the longer term.

There are, of course, many market participants who focus solely on shorter-term returns. These individuals, too, form their forecasts on the basis of imperfect knowledge. If they were to interpret trends in fundamental factors bullishly and revise their strategies in moderate ways, they would also push asset prices in one direction. If these conditions prevailed, asset prices would eventually move beyond the levels that participants who trade with a view to the longer term would *at that time* consider inconsistent with their assessments of the longer-term prospects of underlying assets. But, as long as participants with shorter-term horizons had a substantial influence on asset prices, and the trends in fundamentals and moderate revisions continued, the price swings away from the range of perceived longer-term values would also continue.

This process of how price swings become excessive also applies to downswings. Given imperfect knowledge, sharp reversals that follow excessive highs can turn into persistent downswings and result in excessively low prices. Indeed, this is a danger that we now face in stock and other asset markets.

4.2. Markets Do Self-Correct

Price swings arise in our IKE model if persistent trends in fundamental factors lead market participants to revise their forecasting strategies in ways that do not outweigh these trends' influence on their forecasts. To be sure, these conditions do not characterize a market at every point in time. Indeed, sustained price reversals are triggered when they do not.²²

The reversal of US stock prices in 2000 can be interpreted in such terms. Consistent with IKE's view that fundamentals matter, corporate earnings did change course and begin to fall by late 2000, and this likely contributed to the ensuing reversal in prices. If one were to adopt the view that the 1990's climb in stock prices was primarily spurred by participants who focused on the longer-term benefits stemming from the IT revolution, then our IKE model would imply that around 2000, these individuals revised their assessments of these prospects downward. Consequently, they bid the prices down.

Although the market reversed in 2000, the presence of traders with shorter-term horizons makes it plausible that at some prior point, prices moved beyond levels that participants at that time considered consistent with their assessments of the longer-term benefits of the IT revolution.

²² See Frydman and Goldberg (2007a, 2008a) for a rigorous analysis and extensive discussion of this key point.

A compelling account of this kind of dynamic in asset markets is given by Soros (1987, 2009), who emphasizes a “reflexive” relationship between asset price swings and the fundamentals that drive them. Evidence indicates that such a relationship was indeed operating in the 1990’s: rising equity and housing prices helped to fuel a debt-financed increase in business investment and consumers spending, which led to strong growth in GDP and earnings that in turn propelled market participants to continue to bid up asset values. Ultimately, such a reflexive process is not sustainable, as consumers eventually find themselves financially over-extended and firms begin to see that capital expenditures in key sectors went too far. At that point, the reflexive process would begin to unwind, with markets undergoing sharp reversals.

Interestingly, while the rate of private investment spending did fall dramatically from the beginning of 2000 to the end of 2001, the growth rate of consumption spending hardly fell at all. In fact, it remained positive throughout the shallow recession. Consequently, the U.S. experienced one of the mildest recessions ever. The fact that the reversal in stock prices in late 2000 coincided with the fall in investment spending, corporate earnings, and the broader economy, suggests that movements in fundamental factors played an important role in triggering and sustaining the market downturn.

Nevertheless, the reversal of the trends in fundamentals was too muted to account for the sharpness and size of the reversal in stock prices in 2000. Our IKE model suggests that dramatic revisions of participants’ forecasting strategies played an important role. This view is strengthened by a new model of risk, which recognizes that uncertainty about losses on speculative positions in financial markets stems not from standard measures of price variation, but from asset prices’ tendency to undergo long swings that revolve around historical benchmark levels.

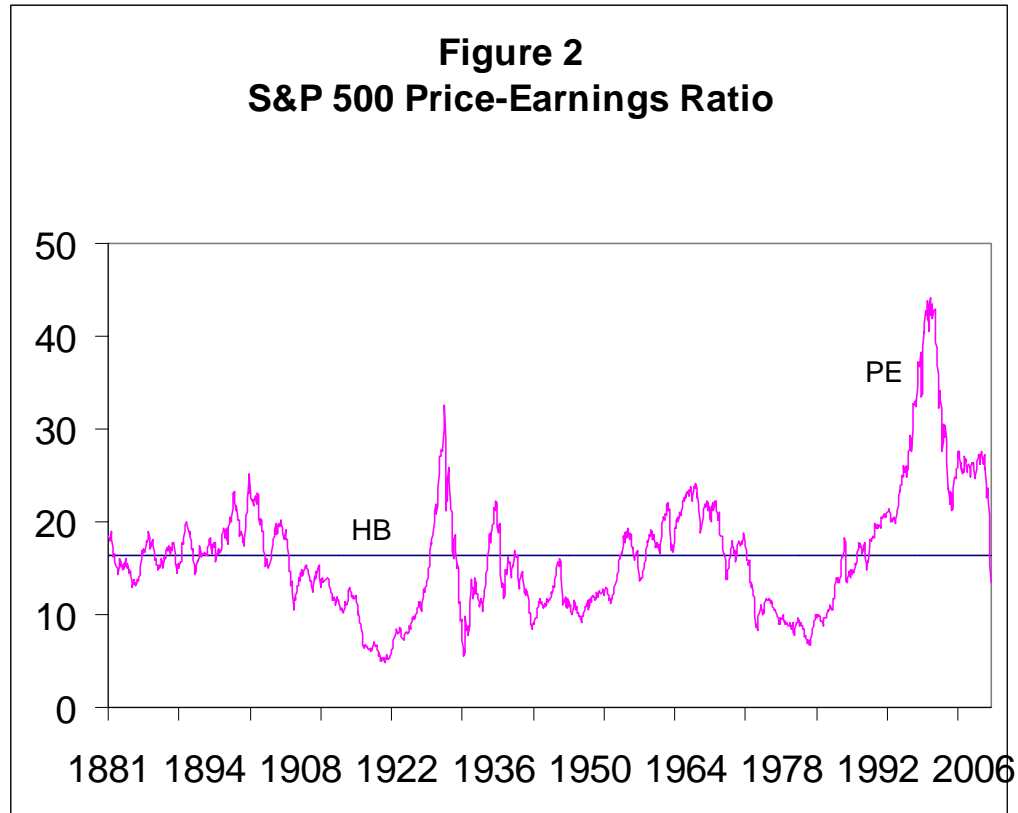
4.3. Bounded Instability of Asset Markets: Historical Benchmark Levels and Risk

The innovativeness of modern economies implies that however careful one’s analysis of a stock’s prospective value might be, any light that it may shed on the longer term will be dim at best. Who in the 1970’s could have predicted the growth of the personal computer and the Internet, let alone their impact on economic outcomes, in the 1980’s and 1990’s?

The difficulty of forecasting longer-term prospects leads many to make use of benchmark levels, which history indicates act as anchors around which price swings revolve. Common benchmark levels in equity markets are based on historical averages of price-earnings (PE) or price-dividend (PD) ratios. There is much research showing that stock prices tend to revert back toward levels consistent with such averages, especially when departures are large.²³ Such behavior is captured in figure 2, which plots the *Standard & Poor’s 500* stock price relative to a 10-year moving average of

²³ Campbell and Shiller (1988a, b) show that deviations from the average price-earnings ratio over their sample have predictive power: a historically high PE ratio at a given point in time tends to be associated with negative real returns in the market over the subsequent 10 years. Many other studies have found similar results. For a review, see Campbell, Lo, and MacKinlay (1997).

earnings and the historical average of the PE ratio for the sample.²⁴ As with PPP exchange rates, there are numerous ways that one could calculate a benchmark PE level.²⁵ And, of course, PD ratios and other indices would also deliver different benchmark values. Moreover, although stock prices may tend to revert to one's chosen benchmark level, *when* a price swing might begin or end cannot be predicted.



A market participant's assessment of longer-term prospects will generally differ from her assessment of the historical benchmark. After all, historical benchmarks are backward looking and, by design, cannot account for the longer-term impact of any innovation. At each point in time, a participant who trades with a view to the longer term devises her own forecast of the prospects. In general, this forecast makes use of historical information, including her assessment of the historical benchmark, current information on fundamentals, and any innovations and other changes in the social context that she deems relevant. Indeed, current information might – and likely does – lead individuals to think that future returns could turn out to be different from what is implied by their assessments of the historical benchmark.

It seems uncontroversial to suppose that the departure of an individual's forecast of longer-term prospects from her assessment of the historical benchmark is limited. After all, there is a floor and a ceiling to how low or high the value of US equities, as a whole,

²⁴ The time plots in figure 2 make use of data from Shiller (2000), which is updated on his website.

²⁵ For example, one might want to use a moving average of the PE ratio, rather than a fixed historical average, to account for structural economic changes that might alter the level toward which stock prices eventually revert.

could be 10, 20, or 30 years hence relative to current and past earnings. Similar limits, though based on different considerations, exist in other markets. Thus, if participants with longer-term time horizons have their way, we would expect that the price swings generated by imperfect knowledge would revolve around historical benchmark levels.

But, even if market participants who behave with a view to the shorter term have an important influence on prices, we would still expect swings to be self-limiting. Participants with shorter-term time horizons are aware of the tendency of prices to revolve around benchmark levels. They recognize, therefore, that, depending on which side of the market they take, they may suffer a capital loss if the price moves farther away from or closer to their assessments of the historical benchmark..

This insight, which is attributable to, is useful in modeling participants' assessments of the short-term riskiness of their open positions in asset markets. To this end, we have developed an alternative characterization of individuals' preferences that implies that both bulls and bears will not hold open positions in the market unless they expect a positive return – a premium – on their positions.²⁶ This premium compensates them for the possibility that their forecasts of future returns might be wrong, and that they might incur a loss.

We suppose that shorter-term bulls and bears look to the gap between an asset's price and their assessment of its benchmark level in forecasting the potential losses from their open positions.²⁷ As an asset price undergoes a swing, say, farther above participants' benchmarks, no one knows when it might end. A bull forecasts that it will continue over the shorter horizon, while a bear forecasts the opposite. Nonetheless, both contemplate the potential losses that they would incur if the asset price were to move against them. If movements in fundamentals persuaded bulls to raise their forecasts of the future price, they would want to increase their open positions, and the upward swing would continue. According to our IKE model of risk, bulls would also raise their assessments of the potential losses of being wrong, because the more the gap from their benchmark value widens, the more concerned they become about a reversal. Bears, on the other hand, respond in the opposite way to a further rise in price: they

²⁶ In Frydman and Goldberg (2007a, chapter 9), we develop what we call endogenous prospect theory, which builds on Kahneman and Tversky (1979) and assumes endogenous loss aversion: an individual is not only loss-averse (her disutility from losses is greater than her utility from gains of the same magnitude), but endogenously so (her degree of loss aversion increases with the size of her open position). More importantly, as Kahneman and Tversky themselves pointed out, their original formulation of prospect theory was based on an experimental setting that, by design, ignores imperfect knowledge. Remarkably, other behavioral economists do not acknowledge this fundamental difficulty. Endogenous prospect theory does and provides a way to formalize all of Kahneman's and Tversky's experimental findings without disregarding the imperfection of knowledge.

²⁷ Because every market participant arrives at her own determination of the benchmark value, these assessments will, in general, differ across individuals in each market. How individuals in a given context come to coalesce on a particular notion of the benchmark is an important question. Keynes suggests that conventions and the historical record play an important role. For example, PPP and PE ratios have long played a role in how market participants and others assess whether prices are misaligned in currency and equity markets, respectively. The empirical record suggests that such interpretations are reasonable.

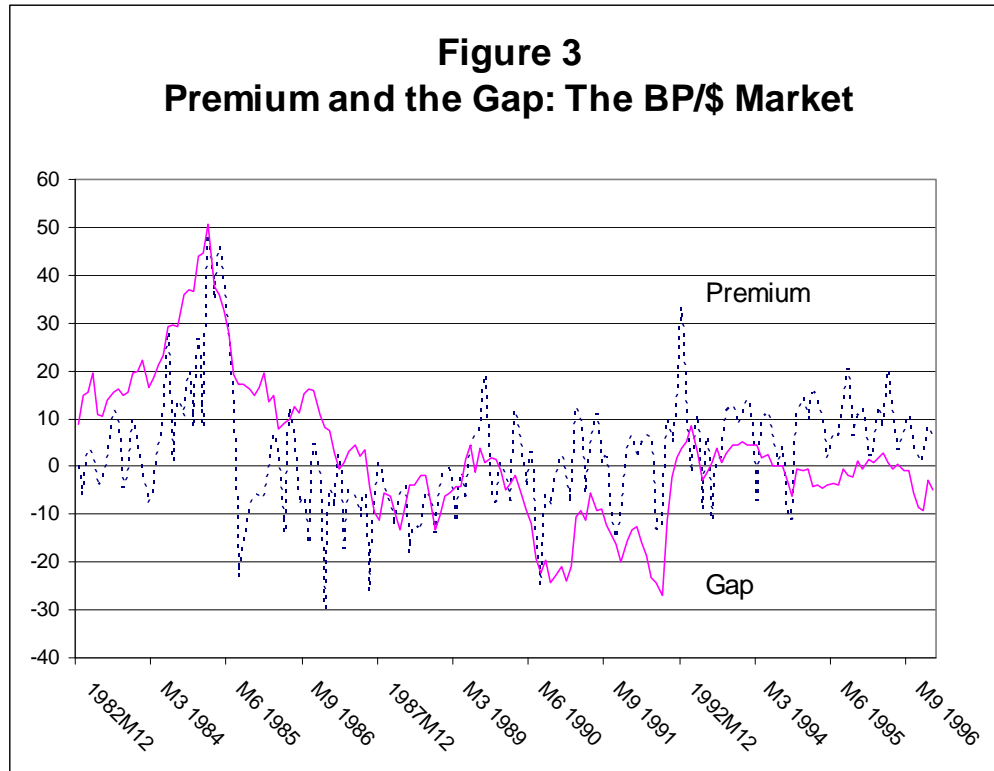
become more confident about an eventual reversal and thus lower their assessment of the potential losses from their open positions.

This way of modeling risk implies that a market participant's premium depends on the gap between her forecast of the future price and her assessment of the benchmark level. Consequently, during a price swing, participants alter their premiums – bulls in one direction and bears in the other. These premiums help to account for the fact that long swings in asset markets are ultimately bounded.

To see why, suppose that persistent trends in fundamental factors and moderate revisions lead bulls to raise their forecasts of the future price, that is, they expect that the return to buying the asset has increased. Acting on this belief, they increase their speculative positions and bid up the asset price, say, farther away from what most market participants consider its benchmark value. Although bulls expect a greater return, they understand that swings eventually end, so they increase their assessment of the risk of a reversal and capital losses. The resulting rise in their premiums acts to reduce their desire to increase their speculative positions. If fundamentals continued to trend, thereby prolonging the price swing, a threshold would eventually be reached at which bulls would become so concerned about a reversal that they would no longer revise their forecasting strategies in moderate ways. At that point, they would either reduce their long positions or abandon them altogether, which would precipitate a price reversal. Bears would also change their premiums, but in the opposite direction, likewise contributing to the self-limiting nature of long swings away from benchmark levels.

In the aggregate, the market premium is equal to the premiums of the bulls minus those of the bears. This has the implication that the market premium depends positively on participants' assessments of the gap relative to benchmark levels. In figure 3, we plot the market premium and a measure of the gap from PPP for the British pound-U.S. dollar (BP/\$) market, which suggests that this qualitative prediction is borne out in currency markets.²⁸ The figure clearly indicates that the

²⁸ We use survey data on exchange-rate expectations to measure the market premium and the Big Mac PPP exchange rate in obtaining a measure of the gap. The survey data are from Money Market Services International (MMSI), which contain median responses from market participants concerning their four-week-ahead point forecasts of the exchange rate. For more details concerning the time plots in figure 3, see Frydman and Goldberg (2007a, chapter 12). Other studies that have used survey data from MMSI include Frankel and Froot (1987a) and Froot and Frankel (1989).



market premium tends to move positively over time with the gap from PPP. Time plots for other major exchange rates show a similar pattern. Formal statistical analysis supports the conclusion of a positive relationship.²⁹

The IKE view of risk opens up a new channel for policy officials to limit the magnitude of long swings in asset markets. It also provides a new way for regulators to assess systemic and other risks in the financial system.

5. IKE's Rationale for State Intervention in the Financial System

Financial markets are hardwired to undergo price swings that revolve around historical benchmark levels. This is so because participants must cope with imperfect knowledge in connecting recent and past trends in fundamental factors of all kinds to future outcomes, regardless of the length of their forecasting horizons. The innovativeness of modern societies implies that economic, political, and social relationships unfold in ways that no one can fully foresee. Price swings emerge as the market appraises the ever-changing prospects of projects and companies, and allocates capital accordingly.

Policies and regulations aimed at achieving transparency of information are essential for markets to perform this role. Given imperfect knowledge, market participants have no hope of pricing assets well without good information. Indeed, because they must rely on information in evaluating whether to revise their strategies about longer-term values, transparency is more important when one recognizes the imperfection of knowledge. Only when information is transparent can markets perform their indispensable function

²⁹ See Frydman and Goldberg (2007a, chapter 12).

of adjusting *relative prices*, on the basis of which society allocates its capital to alternative uses.

However, even when all market participants have access to full information in assessing the relative prospects of alternative assets, their knowledge of how these prospects will unfold over time is inherently imperfect. IKE's account of asset price movements suggests that not only do relative prices move over time, but that the *aggregate* of these prices, such as S&P index in the US stock market, fluctuates as part of the market's normal functioning. Moreover, the swings in aggregate prices can sometimes become excessive, rising to levels that can cause misallocation of capital in key sectors, and such swings are often followed by sharp and costly reversals, leading to economic downturns and even, as we are now witnessing, financial and economic crisis. Moreover, these downswings can also become excessive.

A key question concerning the merits of any intervention to curb asset-price swings is whether policy officials can ascertain, with some level of confidence, that a swing has become excessive. Such swings can arise from the behavior of participants with longer time horizons. But, if so, excessive departures would be discernible mostly only after they began. We presume that officials' knowledge of how to connect the present and the past with the future is at most no better than the weighting of views provided by market participants who trade with a view to the longer term. Consequently, the ability of officials to spot excessive price swings *ex ante* is no better than the market's. One might argue that state intervention is warranted nonetheless, but we do not pursue this line of reasoning here.³⁰

Excessive price swings can also arise because of the trading behavior of participants with shorter time horizons. Unlike their longer-term counterparts, these participants may willingly and knowingly bid asset prices beyond a range of values that a majority of participants, including policy officials, would consider to be consistent with longer-term prospects. Although an asset price may already be beyond this range, participants may continue to bid it farther away; persistent trends in fundamental factors may lead them to revise their forecasting strategies in moderate ways and to believe that shorter-term returns will rise. Such behavior is rational for participants who focus on the shorter term, because even though a price swing may already be excessive, it can continue for some time, and no one can be certain when it might end.

IKE's account of asset price fluctuations suggests an important role for state intervention in markets beyond just aiming for transparency: officials should attempt to dampen excessive swings – price movements *in the aggregate* that are either too high or too low. This need arises because excessive swings in aggregate prices are often followed by sharp reversals that have substantial *systemic* consequences for the functioning of the financial system and the economy as a whole.

³⁰ For example, one could perhaps argue that the state has better information or is less prone to the emotional impact of high short-term returns.

History teaches us that the more excessive a price swing becomes, the sharper and more costly is the eventual reversal. But if official policy or regulatory measures could engender a reversal sooner, the social cost would be lower. Such swing-dampening intervention would not only benefit the society as a whole; it would also help markets to function better in allocating scarce capital across sectors.

IKE's account of asset markets also has implications beyond financial markets for government policies and regulations aimed at limiting instability. Excessive fluctuations create risks for financial institutions, such as banks, that officials must take into account in regulating how these institutions should assess risk and determining their appropriate capital requirements.

6. The Scope and Form of Policy Intervention in Financial Markets

In order to implement policies to dampen excessive swings in any asset market policy officials must ascertain with reasonable confidence a range of non-excessive values, that is, when prices have moved too high or too low from levels that are consistent with longer-term prospects.. If prices fluctuate within this *guidance range*, officials would allow them to do so freely, whereas if they trend away from this range, either above or below it, measures intended to dampen these excessive movements would be implemented.

Like market participants, officials must cope with imperfect knowledge about the longer term. But, in implementing swing-dampening policies, their task differs from that of market participants with longer time horizons. The aim is not to influence the price of any particular stock or house. Instead, the concern is with the overall market and whether aggregate measures of values, such as broad indices in stock markets, have departed excessively from assessments of longer-term values, implying that these values are likely to be unsustainable and followed by a sharp and costly reversal.

Unfortunately, contemporary economic theory, with its presumption that economists and policy officials know the true longer-term values of assets, has discouraged them from devoting sufficient resources to coming up with their own assessments of these values. Recent events and IKE's call for swing-dampening policies make clear that we can no longer afford to ignore this important task.

History shows that making use of historical benchmark levels is a good place to start. For example, by mid-1997, the long swing in the value of the S&P 500 basket of stocks relative to earnings rose beyond levels not seen since 1929. Based on the historical record, this swing was excessive and the likelihood that it was unsustainable and would be followed by a sharp and costly reversal was quite high.

6.1 Key Features

The fact that knowledge is imperfect implies that swing-dampening policies should possess four key features. First, the aim of these policies is not to replace markets, but to help them function better and thereby lower the social costs of excessive long-swing

fluctuations. This implies that officials should not attempt to confine prices to any “target zone.” Experience with such measures in currency markets shows that these policies almost always collapse into crises.

Second, the guidance range of non-excessive values needs to be wide; no one knows exactly the longer-term values in a market, and officials need to be confident that when their prudential measures kick in, they do not cut off a price swing that stems from movements in these values. Moreover, any measures that are triggered when asset prices begin trending beyond the government’s guidance range should be imposed only gradually.

Third, the government’s guidance range should not be based solely on historical benchmark levels. Although such levels are a useful guide, the future does not unfold from the past in a mechanical way. Like market participants themselves, officials must consider the possibility that new technologies and other structural economic, political, and social changes may imply longer-term values that differ from those given by the historical record.

Finally, although modern economies change in new ways all the time, there are occasional periods in which change is particularly great. During these time periods, it might be especially difficult to know how much to deviate from historical benchmark levels in setting a guidance range. This suggests that the width of the range should not be static: officials should have the discretion to increase or decrease it as knowledge, information, and intuition about longer-term prospects becomes more or less uncertain.

7. Prudential Policy Tools for Financial Markets

Many of the major reform proposals—G30, FSF, and Basel II—recognize the need to guard against systemic risks arising from within the financial sector. These proposals call for measures that address the systemic problems, including the tendency toward over-leverage, the phenomenal growth of off-balance-sheet structured assets, as well as the size of financial institutions, the scale of their interconnectedness, and the degree to which they provide trading and other services critical to market operations.

No one would deny the important role that the boom-and-bust fluctuations in housing and stock markets played in triggering and fueling the financial crisis. Yet the major reform proposals are largely silent about how to address this major source of systemic risk. They also disregard the dangers of downswings becoming excessive. With the stock market hitting new lows, this is something the policy officials need to be ready to respond to.

The G30 report does call on “central banks [to] accept a role in promoting and maintaining financial stability.” It also mentions countercyclical collateral and margin requirements “across a broad range of financial asset markets and instruments in which leverage is typically employed.” But it does not endorse such measures; nor does it suggest how they might contribute to limit to the instability or how they should be implemented.

Our IKE model of fluctuations and risk in asset markets suggests how changes in margin requirements and other prudential policies should be fashioned to dampen excessive prices swings:

- Policies should moderate the trading behavior of those market participants whose forecasting leads them to bid assets prices beyond the officially announced guidance range of non-excessive values, and strengthen the trading behavior of those who forecast a movement back to this range.

This straightforward idea follows from the recognition that with imperfect knowledge, the market will, in general, be characterized by bulls and bears who want to bid prices in opposite directions. This obvious fact is disregarded altogether by the vast majority of academic economists' models, which attempt to account for asset price fluctuations with the behavior of a "representative agent."

The IKE framework also indicates how prudential policies would work:

- They may coordinate market participants' views about longer-term prospects.³¹
- They may encourage participants with shorter time horizons to place greater weight on benchmark levels in their assessments of the riskiness of holding speculative positions.

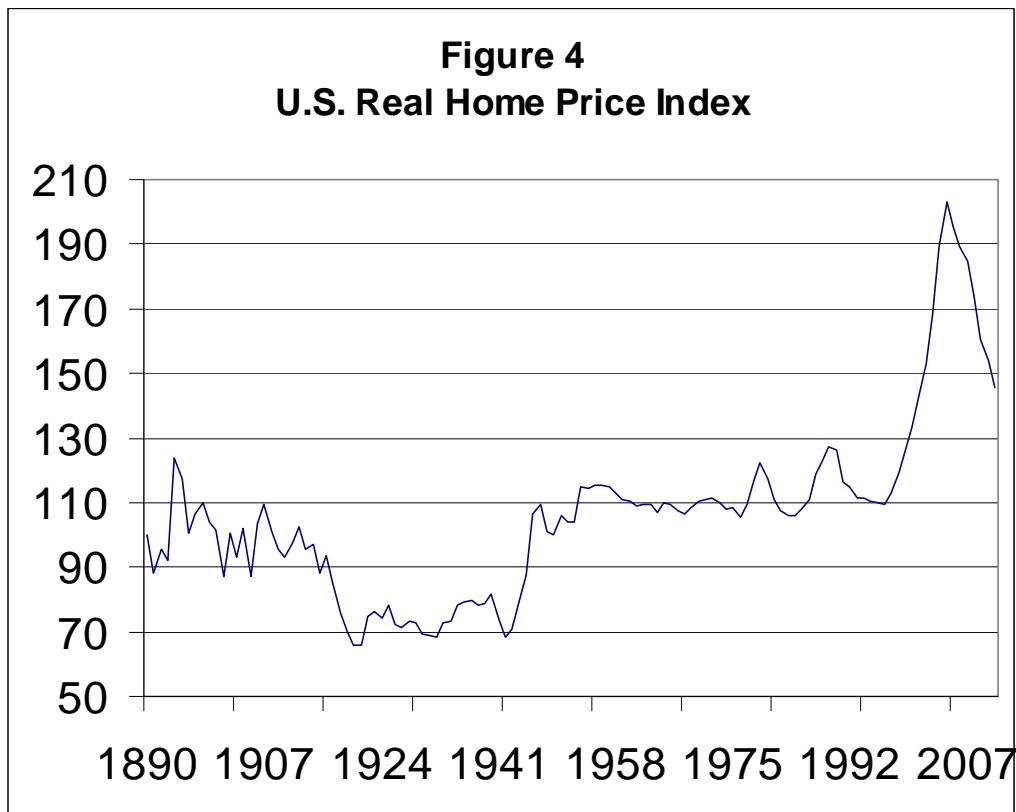
We make use of these ideas in considering several prudential measures.

7.1 Official Announcements of the Guidance Range

A first step in dampening excessive swings in financial markets would be for the central bank (or other institution charged with limiting instability) merely to announce on a regular basis a range of non-excessive values in these markets. Because market participants must cope with imperfect knowledge in forecasting longer-term prospects, regular policy announcements may help coordinate their views about these prospects around official assessments. Greater coordination would lead them to bid prices to levels more consistent with the guidance range. To be most effective, officials' regular announcements of a range should include detailed explanation of the underlying analysis. This would reduce the confidence of participants who bet on a continuation of an excessive swing and increase the confidence of those who bet on its reversal. Assessments of the riskiness of open positions would then change, leading bulls to moderate their positions and bears to strengthen theirs if prices were above the official range, and *vice versa* if prices below it. Both bulls and bears would act to dampen the excessive price swing.

³¹ Because REH and bubble models presume that participants know true longer-term values, they do not allow for such a coordination channel.

Such a policy could be extremely effective, for example, in housing markets, which comprise many participants who are first-time buyers and lack experience and sophistication. Figure 4 plots the Case-Shiller index of real house prices in the U.S. going back to 1890.³² The graph makes clear that by the early 2000s, price fluctuations had likely become excessive. There is little doubt that if the government had announced on a regular basis a range of non-excessive values in key regions of the country, many participants would have re-thought their decisions about whether to buy or how much to bid. This, in turn, would have dampened the excessive increase in housing values.



Participants with shorter time horizons may knowingly bid asset prices beyond levels consistent with longer-term values. But, as they do, they increase their assessments of the risk of losses, implying that if the swing were to continue, a threshold would eventually be reached beyond which they would consider their positions' riskiness too great. At that point, they would begin bidding prices back toward perceived benchmark levels. The problem is that this threshold could be a long way off if shorter-term players' assessments of risk rose slowly with the swing—that is, if the weight they placed on departures from longer-term considerations were small.

This opens up the possibility that official announcements of benchmark levels in a market may lead individuals to place greater weight on departures from these levels in assessing risk and thus moderate their willingness to bid prices farther away. These announcements would also give greater confidence to those participants who, having shorter time horizons, nonetheless bet on a reversal. The resulting fall in their

³² We are grateful to Robert Shiller for making his data on housing prices available to us.

assessment of the riskiness of their positions would lead them to strengthen their positions, which would help to dampen an excessive swing.

7.2 Additional Steps

Our IKE model indicates that the ability of governments to dampen excessive price swings in financial markets would be significantly strengthened if their regular announcements of ranges were supplemented with additional measures. Such measures depend on the asset market that one contemplates.

7.2.1 Currency Markets³³

Currency markets are notorious for long swings that lead to large shifts in competitiveness and market share, huge adjustment costs, and trade frictions between countries. A country that chooses to float its currency can dampen excessive exchange-rate swings by announcing a range of benchmark levels and declaring its concern about departures from this range. It should then stand ready to intervene, at unpredictable moments, to sell its overvalued currency.

The possibility of unpredictable interventions would reinforce the effect of the bank's regular announcements on participants' perceptions of risk. Such action has real potential to create losses for those who bet on a short-term continuation of the swing, while benefiting those who bet on its reversal.³⁴ Consequently, the former would raise and the latter would lower their assessments of the riskiness of their open positions. Both actions would help act to dampen the excessive swing. It is important to emphasize that the aim is *not* to confine the exchange rate to a target zone, but to dampen excessive movements.

International coordination would substantially strengthen the impact of this swings-dampening policy of regular announcements and unannounced interventions to push a currency back toward the official range. Indeed, we argue in Frydman and Goldberg (2009) that this policy could serve as the basis for a new Bretton Woods-type agreement of floating but managed exchange rates. Unlike its predecessor, it would not force countries to agree to a set of single parity levels or to defend a band around them. Agreement on a wide range of non-excessive values could accommodate many differing views about the appropriate benchmark. Asking countries to intervene only to dampen overvalued currencies rather than to defend chosen exchange-rate bands also would be much easier for them to accept.

7.2.2 Other Asset Markets

³³ This section draws on Frydman and Goldberg (2004).

³⁴ There is much research showing that official intervention does push exchange rates in the desired direction over the short term. For references, see footnote 52 in the appendix.

There have been calls recently for central banks or other regulatory bodies to buy and sell directly in other asset markets, such as those for stocks.³⁵ While this type of intervention is commonplace in currency markets, it is not for equities. Using this policy may also make sense in equity markets, although doing so raises obvious political and other concerns that are not present in currency markets. We leave this matter for another paper.

There is, however, another way to strengthen the impact of official announcements of benchmark levels in other asset markets, which is mentioned in passing in the G-30 report. Instead of buying and selling assets on the open market, regulators could rely on changes in margin and capital requirements. To do so, they would regularly announce, along with their analysis and assessment of a guidance range of non-excessive values, a schedule of gradual changes in these requirements. Both the range and the schedules would be subject to periodic revisions.

Our framework suggests that, to be effective, these schedules should be set differently for bulls and bears: they should call for *increases* for those who want to continue to bid prices away from the guidance range, and *decreases* for those who are betting the other way. Such swing-dampening adjustments in margin and capital requirements would raise the costs to the former and lower them for the latter, and, as before, participants' assessments of risk would move in ways that would dampen the excessive swing.

This prudential policy would not be difficult for the SEC and its counterparts elsewhere to implement in stock and derivatives markets, which already set fixed margin and capital requirements. Indeed, it would be easy to reset margin requirements in the US to implement such distinct schedules for bulls and bears. By 1998, many observers, most notably Alan Greenspan, Robert Shiller, and John Campbell,³⁶ had characterized the long swing in US equities as excessive. If the Federal Reserve had had the research and operational procedures needed to announce a guidance range, it could have announced schedules of gradually rising and falling margin requirements on long and short positions, respectively, as soon as stock prices began exceeding its range. Such prudential measures would likely have dampened the swing during the 1990s.

³⁵ See, for example, Muelbauer (2008) and Farmer (2009).

³⁶ See Greenspan (1996), Campbell and Shiller (1998), Shiller (2000).

7.3 Bans on Short Selling, the Uptick Rule, and other “Prudential” Measures

The 1990s long swing in equities prices, and other such episodes, suggests that short selling may play an important role in limiting the excess, particularly if accompanied by policies that encourage such trading when it can do so and discourage short selling when it is likely to exacerbate the excess. This point provides an alternative perspective on the existing regulatory approach to short selling.

In 1938, the SEC adopted a provision, called the uptick rule, which restricted the short selling of any stock to a price that was no lower than the price of the preceding sale. This rule remained in place until July 2007. In their attempts to cope with the financial crisis last fall, the SEC and regulators in other countries opted to implement a complete ban on the short selling of many stocks, mostly those of financial institutions. At a recent hearing of the Senate Banking Committee, Mary Schapiro, the Obama administration’s nominee to chair the SEC, testified that “we need to reexamine the entire area of short selling, and we need to look at whether the uptick rule should be reinstated.”³⁷

The key principle of prudential policy is to moderate the trading behavior of those who bet on the continuation of an excessive price swing and to strengthen the behavior of those are betting on a reversal. Thus, the uptick rule and ban on short selling would only contribute to this objective if the asset price were already below the guidance range, that is, levels that were perceived to be consistent with longer-term values. In fact, if the price was excessively high, restrictions on short selling would work to moderate the trading behavior of precisely the *wrong* participants, thereby prolonging the excessive upswing and leading to a sharper reversal and higher costs.

This reasoning also applies to many recent calls to prop up housing prices – for example, by lowering mortgage rates. Such efforts to reduce the cost of home ownership appear unassailable, and measures to help prevent foreclosures are surely a step in the right direction. Nevertheless, figure 4 shows that, although house prices have come down by 25% since their highs in 2006, they are likely still well above levels that are consistent with longer-term values. Consequently, strengthening the ability to buy only prolongs the market’s attempt to self-correct to sustainable levels.

Although the housing prices may now be too high by historical standards, history also tells us that downswings can sometimes become excessive. If such a situation were to transpire, measures to prop up the housing would be appropriate. Because this is a distinct possibility, officials need to implement such measures now. Having them in place would enable them to dampen the excessive downswing and reduce the danger of deepening the crisis.

In fact, improving financial markets’ ability to self-correct to sustainable values is the entire point of prudential measures. Depending on the situation, the uptick rule, a total ban on short selling, and other measures that pay no regard to whether an asset is over- or undervalued may be beneficial in some circumstances and counterproductive in

³⁷ As reported in Orol (2009).

others. Our IKE framework suggests that denying policymakers any discretion in assessing whether a particular prudential policy might serve its intended goals – which would be the case if short sales were either unconditionally banned or unconditionally allowed – could render useful tools either ineffective or counterproductive.³⁸

8.0 Lessons for Regulating Banks and Other Financial Institutions

The near total collapse of the financial system in 2008, and the continued near or actual insolvency of major banks around the world, despite massive injections of public capital, has focused reformers' attention almost exclusively on repairing problems in the banking and credit system. Regulators' recognition, well before the sub-prime crisis in 2007, that they needed to rethink how banks assessed risk and how capital adequacy was determined led to Basel II. The greater flexibility afforded by its three pillars for banks and regulators in assessing risks, and its emphasis on more risk-sensitive capital requirements and consolidation of off-balance sheet assets, are important steps in the right direction.³⁹

The crisis has revealed, however, that these steps were insufficient. Recent reform proposals place much blame on the originate-to-distribute (OTD) model of finance,⁴⁰ which led to poor incentives for loan originators and credit-rating agencies, a lack of transparency, and increased use of leverage. These defects contributed to greater systemic risks, and many of the measures currently being proposed are aimed at strengthening Basel II's pillars in order to address them.

Unfortunately, these measures overlook the importance of imperfect knowledge and asset price swings for assessing risks in the financial system and for reforming the credit rating system. To be sure, the immediate concern is returning the banking and credit system to health in the short term, which may even involve temporary nationalization of banks. But rethinking the regulatory framework for the long term needs to begin by acknowledging that market participants – including financial institutions – and regulators alike have only imperfect knowledge of the fundamental processes that drive asset values, risk, and the broader economy.

8.1 Assessing Risks in the Financial System

On the most basic level, the recent financial crisis is not difficult to comprehend. OTD financing and a world awash with U.S. dollars led banks and other financial institutions

³⁸ In Frydman and Goldberg (2009), we examine the efficacy and consequences of following fixed rules in other areas of policy making. As is well known, since Kydland and Prescott (1977), economists have presumed that fixed rules are *the* way to constrain officials from interfering with the markets in ways that diminish their ability to achieve optimal outcomes. See Phelps (2006b) for an argument that fixed rules, notably that of Taylor (1993), which is widely used in policy analysis, may, in fact, be “dangerous” for macroeconomic activity. In contrast to Kydland and Prescott and Taylor, who use REH to argue against discretion, Phelps makes his case on the basis of imperfect knowledge.

³⁹ Pillar 1 covers the assessment of credit and other risks and determines minimum capital requirements, while pillars 2 and 3 concern supervisory review and market discipline through standards for disclosure.

⁴⁰ The OTD model involves originators of loans, such as Countrywide, who sell them to investment banks that securitize them into asset-backed securities, which are then sold on open markets.

to become increasingly leveraged, so much so that much of their capital was vulnerable to loss even by moderate reversals in asset prices, especially for housing. The upswings in asset prices, however, were not only excessive, but unprecedentedly so in the housing market. The subsequent reversals were thus particularly large. When they came, financial institutions were forced to de-leverage, but when everyone runs to the door at once, crisis follows.

This thumbnail sketch implies that containing systemic risks requires not just managing leverage in the system, but also recognizing that these risks vary as the values of institutions' asset portfolios vary. The run-up in housing and equity prices should have led financial institutions whose portfolios were heavily exposed to these markets to increase their measures of risk and raise their capital buffers.

Of course, this did not happen. Pillar 1 of Basel II, which outlines how banks should assess credit risks and determine the size of capital buffers, makes no explicit allowance for long-swing fluctuations in asset markets. It does give banks flexibility in calculating their risk-adjusted capital requirements, but the internal-ratings-based (IRB) approaches rely on VaR measures that connect risk to standard measures of short-term market volatility.⁴¹ The problem is that these measures implicitly assume that risk declines when markets are doing well: they demand less capital during calm periods and more capital during volatile periods. By thus presuming that capital losses are random, these measures disregard the fact that sharp reversals and losses often ensue after excessive upswings in prices.

There has been much concern about the implications of IRB approaches for how capital requirements may move over the business cycle.⁴² Because IRB measures of default probabilities fall when the economy is doing well and rise when it is not, capital requirements based on them tend to be pro-cyclical. This increases systemic risk, rather than reducing it. Some are calling for revising the Basel II standards to lessen their pro-cyclical effects. The FSF report suggests that capital requirements should be made countercyclical. Indeed, Spain's experience with such countercyclical requirements suggests that doing so would be a step in the right direction.

But such revisions to Basel II do not go far enough. Banks' portfolios are vulnerable to the risks stemming from long-swing fluctuations in asset markets, and this is especially true of international banks that have large trading books. In addition to building in countercyclical features, banks' capital requirements should vary inversely with boom-and-bust fluctuations in the asset markets to which they are heavily exposed. As with the prudential policies outlined for financial markets in the preceding section, capital requirements would begin to increase only after prices have moved above the guidance range set by policy officials. The idea is that banks' defenses need to be fortified during excessive upswings in asset prices.

⁴¹ In addition to the "standard approach" for calculating risk weights for assets, which makes use of the ratings of external credit assessment institutions, Basel 2 allows banks to rely on their own internal methods of determining these weights. The accord provides for two IRB approaches, "foundation" and "advanced." See Cornford (2005) for details.

⁴² See, for example, Heid (2007) and Repullo and Suarez (2008).

8.2 Long Swings and Credit Ratings

Lehman Brothers Holdings declared bankruptcy on September 18, 2008. Yet Standard & Poor's had maintained its solid investment grade of A until six days earlier, when it abruptly downgraded the firm to "Selective Default." Moody's waited even longer, downgrading Lehman one business day before it collapsed. How could the most reputable ratings agencies and an investment bank so experienced in issuing securities look so bad?

In searching for clues to this breakdown, much attention has been focused on predatory practices in originating mortgages, and on investment banks' "cozy" relationship with the rating agencies entrusted to rate their structured assets. To be sure, these are important defects that need to be addressed. But there is a further, more basic, cause: the agencies' procedures for rating assets have clearly not allowed for the potential severity of swing reversals. Thus, even if the agencies relied solely on state-of-the-art practices, rather than following their narrow commercial interests, their ratings would have substantially underestimated the risk of the securities that they rated.

This so because the statistical models on which the ratings agencies rely projected historical default patterns to continue into the future. These patterns showed very low loss rates, thanks to ever-rising house prices. With low loss rates, AAA ratings appeared to be justified. But these models ignored the very nature of price swings in asset markets: they eventually reverse themselves, and the more excessive they are, the sharper that reversal is.

The longer the boom lasted, the more the ratings agencies trumpeted the superiority of structured finance over loans to businesses – and the more investors came to rely on these ratings. Brave new models, which largely ignored the changing structure of the processes driving risk, together with radical deregulation, tempted the mortgage industry into abandoning proven prudential procedures that combined their own judgment and more formal criteria. Instead of lending to "the man who shaved this morning" (to use Albert Camus' wonderful phrase), they lent mechanically to a FICO score.⁴³ And homebuyers responded by learning how to manipulate their FICO scores. Of course, nobody knew when the reversal would begin. Had the ratings agencies been required to make explicit how their ratings would change under the alternative assumption that housing prices might fall dramatically once the inevitable reversal arrived, projected loss rates on the securities that the investment banks were selling would have been much higher – and their ratings and prices would have been much lower. Instead, by assigning single ratings to assets, the agencies failed to convey the necessarily contingent character of the models and assumptions that underpinned them.

⁴³ We thank Richard Robb for this wonderful metaphor.

This leads to a simple proposal.⁴⁴ Ratings agencies should be required to report at least two ratings of securities, along with the methodology used to arrive at each: one assuming that historical patterns will continue, and at least one other assuming reversals in the trends of major variables and the prices of the underlying assets. To be sure, Moody's, S&P, and Fitch apply "stresses" to their current procedures. But these stresses are hidden in ratings reports, and, as recent events have painfully demonstrated, are woefully inadequate. Furthermore, requiring the agencies to rate securities under one or more pessimistic scenarios would make it harder for them to deliver rosy ratings in return for business from the investment banks.

No single individual or institution can render a definitive judgment on the riskiness of securities. Friedrich Hayek showed that only markets can aggregate knowledge that is not given to anyone in its totality. The new regulatory regime should require rating agencies and issuers of securities have to help markets perform this function.

APPENDIX: "Rational" and "Irrational" Bubbles

A.1. "Rational" Bubbles

Although standard REH models cannot account for swings, they can be modified to generate bubble movements. "Rational" bubble models retain REH as a characterization of market participants' forecasting strategy during a bubble. In these models, a bubble is formed if, for some reason unrelated to fundamentals, market participants somehow all decide to base their forecasts on some extraneous factor, and this leads them to believe that the price will increase exponentially at some predetermined rate. By design, REH presumes that this belief is self-fulfilling: the asset price would also move away from its "true" fundamental value at the same predetermined rate.

Rational bubble models recognize that although asset-price swings away from benchmark levels may be wide, they do not last forever: eventually asset prices start moving back toward benchmark values. As with a price swing away from the benchmark, bubble models attempt to capture this reversal with a mechanical rule: in forming their REH forecasts, market participants assume that the bubble will eventually burst, and all place the same exact probability on this outcome. When the bubble does burst, the market is assumed to return instantly to its "true" fundamental value.⁴⁵

⁴⁴ We advanced this proposal, together with Edmund Phelps, in Frydman, Goldberg, and Phelps (2008).

⁴⁵ In REH currency models with sticky goods prices, the bursting of a bubble causes the exchange rate to jump to a level below its long-run fundamental value. The mechanical nature of the movement away from benchmark levels, as well as the sudden reversal all the way down to or below the long-run equilibrium value, is grossly inconsistent with the swings that we actually observe. In real-world markets, price swings are uneven in duration and magnitude, both away from and back toward benchmark levels. Moreover, in contrast to REH bubble models, they often involve only partial reversals: an asset-price swing changes direction, but resumes its movement away well before returning to the benchmark. See Frydman and Goldberg (2007a) for a presentation of an REH bubble model and extensive discussion of its epistemological and empirical difficulties.

Rational bubble models leave unexplained how and when market participants all come to believe that an asset price will rise at some predetermined rate. Despite REH's mechanical nature, the bubbles that it produces are often interpreted in psychological terms. Such informal interpretations usually appeal to "crowd psychology" or "market sentiment," and invoke episodes of spectacular price rises fueled by social manias.⁴⁶

But appealing to manias to explain long swings in asset prices suggests that these movements are an aberration from otherwise "normal" times, during which the market sets asset prices at their "true" fundamental values. In fact, long swings in asset prices are the norm, not the exception. Figure 1 provides just one example of this regularity.⁴⁷ The figure also shows that even when asset prices ultimately return to some notion of the benchmark, they *do not* settle there, as standard REH models imply. Instead, they often shoot through the benchmark and trend away from the other side.

Rational bubble models provide unambiguous guidance for policy officials: leave markets unimpeded, except when a bubble forms, at which point act decisively to cut it off as early as possible. Acting early is important, because even relatively moderate swings signal that the market is misallocating capital.

A.2. "Irrational" Bubbles

Over the last two decades, economists have uncovered massive evidence that casts serious doubt on REH-based accounts of long swings: REH is grossly inconsistent with how individuals form forecasts in real-world markets. There is also much evidence of the empirical failure of other components of the standard notion of rationality, such as its specifications of preferences.⁴⁸ This evidence has led to the emergence of behavioral economics, which makes use of empirical observation to motivate its assumptions about individual decision-making.

Behavioral economists have contributed valuable empirical insights into how individuals behave. However, despite their emphasis on empirical realism, they have continued to retain REH's empirically and epistemologically flawed conception that markets discover the "true" fundamental value of every asset, and that an economist can exactly specify these values with his model. Behavioral models portray bubbles as swings away from these "true" values.⁴⁹

⁴⁶ Classic examples include the 1636-37 Dutch "tulip mania" and the 1720 South-Sea bubble, which involved company stock and government debt. For these and other episodes, see Kindleberger (1996).

⁴⁷ We do not contend that bubble-like manias do not sometimes grip isolated markets. However, the price swings that we see in major asset markets are much too frequent and uneven to be explained by an REH bubble model.

⁴⁸ See Kahneman and Tversky (1979) and Barberis and Thaler (2003).

⁴⁹ The seminal work in this field is Frankel and Froot (1987b) and DeLong, Shleifer, Summers, and Waldman (1990). For a recent extension of these models, see DeGrauwe and Grimaldi (2006). DeLong, Shleifer, Summers, and Waldman (1990) assume that a subgroup of market participants is ignorant of the true long-term value of the asset.

Like their REH counterparts, behavioral models presume that an economist can specify precisely the mechanism – the factors, fundamental and non-fundamental, and their effects – driving prices during the swing. Market participants who join the bubble are typically assumed to forecast according to a “chartist rule” that merely extrapolates past price trends into the future. To capture reversals of swings, the models rely on an external shock, or a predetermined rule that eventually leads market participants to begin abandoning the chartist rule in favor of the “fundamental rule,” and this causes the asset price to undergo a sustained countermovement. Unlike REH bubble models, these reversals are not constrained to involve an immediate jump back to the “true” fundamental value.

In motivating their approach, behavioral economists usually appeal to empirical observations that participants in financial markets use trend-following rules. Because behavioral economists retain REH as a cornerstone of economic rationality, they interpret forecasting following chartist and other non-REH strategies as evidence of participants’ “irrationality.”⁵⁰ As with “rationality,” they specify “irrationality” with mechanical rules that are supposed to capture how an individual’s forecasting strategy will be revised between now and a distant future.

In contrast to occasional manias, technical trading is an enduring and pervasive phenomenon in markets.⁵¹ But, in bubble models, price swings arise only when technical trading dominates the market. Given the relatively frequent occurrence of long swings, this would suggest that fundamentals often play no role in moving asset prices, and that financial markets are merely casinos that, at least as often as not, misallocate capital.

Like their REH counterparts, “irrational” bubbles are unrelated to fundamentals and serve no useful social function. If policy officials could eliminate them, the market would return to setting asset prices at their “true” fundamental values, and the allocation of capital would thereby be unambiguously improved. The policy guidance that emerges from this approach is thus the same: leave markets unimpeded, except when a bubble forms, at which point act decisively to cut it off as early as possible.

But, unlike REH models, behavioral models suggest that such a policy is relatively straightforward. Instead of the formidable task of fighting crowd psychology and manias, all policy officials need to do is start a short-term price trend back toward the “true” fundamental value. According to behavioral models, this would lead both chartists and fundamentalists to respond mechanically to the new trend and bid the price back to this value. But this implication is contradicted by experience and research.⁵²

⁵⁰ Some behavioral economists, notably De Grauwe (2008), suggest that the use of technical trading does not presume irrationality on the part of market participants. For a rigorous argument to the contrary, which makes use of Lucas’s (2001) inconsistency criterion, see Frydman and Goldberg (2007a, 2008a). We also show how IKE overcomes this problem.

⁵¹ See Schulmeister (2006, 2008).

⁵² For example, research on the efficacy of official intervention in currency markets also shows that policy officials face difficulty in influencing asset prices in any sustained way. Researchers generally find that although official intervention is effective in the near term at moving exchange rates in the desired

One well-known example of the difficulty that policy officials face in engendering sustained counter-movements in asset prices is given by former Fed chairman Alan Greenspan's attempt to warn U.S. stock markets on December 5, 1996, of "irrational exuberance." Initially, this pronouncement led to a sharp drop in equity prices. But if the behavioral bubble models really captured the mechanism driving equity values, this change in trend would have been more than sufficient to trigger a sustained reversal. Instead, U.S. stock prices resumed their long upward climb, which lasted another four years.

REFERENCES

- Barberis, Nicholas C. and Richard H. Thaler (2003), "A Survey of Behavioral Finance," in Constantinides, George, Harris, Milton and Rene Stulz (eds.), *Handbook of the Economics of Finance*, Amsterdam: North-Holland.
- Basel Committee on Banking Supervision (2006), "International Convergence of Capital Measurement and capital Standards," June.
- Bernanke, B. (2002), "Asset-Price 'Bubbles' and Monetary Policy," Speech at the New York Chapter of the National Association for Business Economics, October 15. <http://www.federalreserve.gov/BoardDocs/Speeches/2002/20021015/default.htm>
- Bernanke, B., and M. Gertler (1999), "Monetary Policy and Asset Price Volatility," in Federal Reserve Bank of Kansas City, *New Challenges for Monetary Policy*, 77-128.
- Bernanke, B., and M. Gertler (2001), "Should Central Banks Respond to Movements in Asset Prices?," *American Economic Review*, 253-257.
- Campbell, J. Y., A. Lo, and A. MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton, NJ: Princeton University Press.
- Campbell, J. Y. and R. J. Shiller (1988a) "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *Review of Financial Studies*, 1(3): 195-228.
- Campbell, J. Y. and R. J. Shiller (1988b), "Stock, Prices, Earnings, and Expected Dividends," *Journal of Finance*, 43, 661-676.
- Campbell, J. Y. and R. J. Shiller (1998), "Valuation Ratios and the Long-Run Stock Market Outlook," *Journal of Portfolio Management*, Winter.

direction, it is usually not capable of generating a sustained counter-movement. For example, see Dominguez and Frankel (1993) and Fatum and Hutchison (2003, 2006).

- Cornford, A. (2005), "Basel II: The Revised Framework of June 2004," Discussion Paper 178, United Nations Conference on Trade and Development, April.
- De Grauwe, P. and M. Grimaldi (2006), *The Exchange Rate in a Behavioral Finance Framework*, Princeton: Princeton University Press.
- De Grauwe, P (2008), "Macroeconomic Modeling When Agents are Imperfectly Informed," CESifo Working Paper Series No. 2318.
- DeLong, B.J., Shleifer, A., Summers, L. H. and R. J. Waldman (1990a), "Noise Trader Risk in Financial Markets," *Journal of Political Economy*, 98, 703-738.
- DeLong, B.J., Shleifer, A., Summers, L. H. and R. J. Waldman (1990b), "Positive Feedback Investment Strategies and Destabilizing Rational Speculation," *Journal of Finance*, 45, 375-395.
- Dominguez, K. and J. Frankel (1993), *Does Foreign Exchange Intervention Work*, Institute for International Economics: Washington, DC.
- Edwards, W. (1968), "Conservatism in Human Information Processing," in B. Kleinmuth (ed.), *Formal Representation of Human Judgement*, New York: John Wiley and Sons.
- Farmer, R. (2009), "A New Monetary Policy for the 21st Century," *FT.com*, January 12.
- Fatum, R. and M. Hutchison (2003), "Is Sterilized Foreign Exchange Intervention Effective After All? An Event Study Approach," *Economic Journal*, 113, 390-411.
- Fatum, R. and M. Hutchison (2006), "Effectiveness of Official Daily Foreign Exchange Market Intervention Operations in Japan," *Journal of International Money and Finance*, 25, 199-219.
- Financial Stability Forum (2008), "Enhancing Market and Institutional Resilience," Report, April, and Follow-up, October.
- Frankel, Jeffrey A. and Kenneth Froot (1987a), "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations," *American Economic Review*, 77, 133-53.
- Frankel, J. and K. Froot (1987b), "Understanding the U.S. Dollar in the Eighties: The Expectations of Chartists and Fundamentalists," *Economic Record*, December, 24-38, and reprinted in J. A. Frankel (ed.), *On Exchange Rates*, The MIT Press: Cambridge, Mass., 1995, chapter 14, 295-316.
- Froot, Kenneth and Jeffrey A. Frankel (1989), "Forward Discount Bias: Is it an Exchange Risk Premium?," *Quarterly Journal of Economics*, 104, 139-161,

reprinted in Jeffrey A. Frankel, ed., *On Exchange Rates*, Cambridge, MA: The MIT Press, 1995.

- Frydman, R. (1982), "Towards an Understanding of Market Processes: Individual Expectations, Learning and Convergence To Rational Expectations Equilibrium," *American Economic Review*, 652-668.
- Frydman, R. (1983), "Individual Rationality, Decentralization and the Rational Expectations Hypothesis, in Frydman, R. and E. S. Phelps (eds.), *Individual Forecasting and Aggregate Outcomes: "Rational Expectations" Examined*, New York: Cambridge University Press, 97-122.
- Frydman, R. and M. D. Goldberg (2004), "Limiting Exchange Rate Swings in a World of Imperfect Knowledge," in P. Sorensen (ed.), *European Monetary Integration: Historical Perspectives and Prospects for the Future. Essays in Honour of Niels Thygesen*. Copenhagen: DJOEF Publishing.
- Frydman, R. and M. Goldberg (2007a), *Imperfect Knowledge Economics: Exchange Rates and Risk*, Princeton, NJ: Princeton University Press.
- Frydman, R. and M. D. Goldberg (2007b), "Can Anything Slow the Dollar's Fall?," Project Syndicate, <http://www.project-syndicate.org/commentary/frydman16>, op-ed published in 55 newspapers around the world, November.
- Frydman, R. and M. D. Goldberg (2008a) "Macroeconomic Theory for a World of Imperfect Knowledge," *Capitalism and Society*, 3, 3, Article 1. <http://www.bepress.com/cas/vol3/iss3/art1>
- Frydman, R. and M. D. Goldberg, M. D. (2008b), "Obama and Asset Prices," *FT.com*, November 14.
- Frydman, R. and M. D. Goldberg, M. D. (2009), *Financial Markets, the State, and a New "Bretton Woods": Price Swings, Risk and the Scope of Prudential Policies*, book manuscript, in preparation.
- Frydman, R. and Goldberg, M. D. and E. S. Phelps (2008), "We must not rely only on the rosier ratings," *Financial Times*, October 20.
- Frydman, R. and E.S. Phelps (1983), "Introduction," in Frydman, R. and E. S. Phelps (eds.), *Individual Forecasting and Aggregate Outcomes: "Rational Expectations" Examined*, New York: Cambridge University Press, 1-30.
- Frydman, R. and A. Rapaczynski (1994), "The Paradoxes of Communist Reform," Chapter 4 in *Markets by Design*, mimeo.

- Frydman, R., Goldberg, M., S. Johansen, and K. Juselius (2008), "A Resolution of the Purchasing Power Parity Puzzle: Imperfect Knowledge and Long Swings," December 2008, under review.
- Frydman, R., Goldberg, M., K. Juselius, and S. Johansen (2009), "Imperfect Knowledge and a Resolution of the Purchasing Power Parity Puzzle: Empirical Evidence," in preparation.
- Frydman, R., Gray, Ch., Hessel, M. and A. Rapaczynski "When Does Privatization Work? The Impact of Private Ownership on Corporate Performance in Transition Economies," *Quarterly Journal of Economics*, 114, 1153-92.
- Goldberg, M. and R. Frydman (1996a), "Imperfect Knowledge and Behaviour in the Foreign Exchange Market," *Economic Journal*, 106, 869-93.
- Goldberg, M. and R. Frydman (1996b), "Empirical Exchange Rate Models and Shifts in the Co-Integrating Vector", *Structural Change and Economic Dynamics*, 7, 55-78.
- Goldberg, M. and R. Frydman (2001), "Macroeconomic Fundamentals and the DM/\$ Exchange Rate: Temporal Instability and the Monetary Model," *International Journal of Finance and Economics*, October, 421-435.
- Greenspan, A. (1996), "The Challenge of Central Banking in a Democratic Society," Speech at the American Enterprise Institute, December 5:
<http://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm>
- Group of Thirty (2009), "Financial Reform: A Framework for Financial Stability," January 15.
- Heid, F. (2007, "The cyclical effects of the Basel II capital requirements," *Journal of Banking and Finance*, 31, 3885-3900.
- Hamilton, J.D. (1994), *Time Series Analysis*, Princeton: Princeton University Press.
- Johansen, S., Juselius, K., Frydman, R. and M. Goldberg, "Testing Hypotheses in an I(2) Model With Piecewise Linear Trends. An Analysis of the Persistent Long Swings in the Dmk/\$ Rate," forthcoming in *Journal of Econometrics*.
- Kahneman, D. and A. Tversky (1979), "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica*, 47, 263-291.
- Kaletsky, A. (2009), "Radical Surgery Is Required To Save This Patient," *The Times*, February 12.
- Kindleberger, C. (1996), *Manias, Panics, and Crashes*, John Wiley & Sons: New York, NY.

- Kydland F. E. and E. C. Prescott (1977), "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy*, 85, 473-491.
- Lucas, R. E. Jr. (2001), "Professional Memoir," mimeo. <http://home.uchicago.edu>.
- MacDonald, Ronald (2000), "Concepts to Calculate Equilibrium Exchange Rates: An Overview," Discussion Paper 3/00, Economic Research Group of the Deutsche Bundesbank.
- Muellbauer, J., "The World's Central Banks Must Buy Assets," *Financial Times*, November 24.
- Orol, R.O. (2009), "SEC Chairwoman to Reform Enforcement Bureau," *Market Watch*, February 6: <http://www.marketwatch.com/news/story/SEC-chairwoman-reform-enforcement-bureau/story.aspx?guid=%7B74170053-6320-482B-9228-1B63552F9F59%7D>
- Phelps, E. S. (1983), "The Trouble with 'Rational Expectations' and the Problem of Inflation Stabilization," in Frydman, R. and E. S. Phelps (eds.), *Individual Forecasting and Aggregate Outcomes: "Rational Expectations" Examined*, New York: Cambridge University Press.
- Phelps, E S. (2006a) "Macroeconomics for a Modern Economy," *Nobel Prize Lecture*.
- Phelps, E S. (2006b), "Global Change Needs Flexibility, Not a Fixed Rule," *Financial Times*, May 24.
- Phelps, E.S. (2007). "Foreword," in Frydman, R. and M. Goldberg (2007a), *Imperfect Knowledge Economics: Exchange Rates and Risk*, Princeton, NJ: Princeton University Press.
- Phelps, E. S. (2008), "Commentary: Revolutionary Times, Then and Now," *Capitalism and Society*: 3, 3, Article 5. <http://www.bepress.com/cas/vol3/iss3/art5>.
- Pomerleano, M. (2009), "The Failure of Financial Regulation," *FT.com*, January 15.
- Repullo, R. and J. Suarez (2008), "The Procyclical Effects of Basel II," manuscript.
- Roubini, N. (2009), "Time to Nationalize Insolvent Banks," *Project Syndicate*: www.project-syndicate.org, February.
- Schulmeister, Stephan (2006), "The Interaction between Technical Currency Trading and Exchange Rate Fluctuations," *Finance Research Letters*, 3, 212-33.
- Schulmeister, Stephan (2008), "Components of the Profitability of Technical Currency Trading," forthcoming in *Applied Financial Economics*.

- Shiller, R. (2000), *Irrational Exuberance*, Princeton: Princeton University Press.
- Shleifer, Andrei (2000), *Inefficient Markets*, Oxford: Oxford University Press.
- Soros, G. (1987), *The Alchemy of Finance*, New York: Wiley.
- Soros, G. (2008), *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, New York: Public Affairs.
- Taylor, J.B. (1993), "Discretion versus Policy Rules in Practice," *Carnegie Rochester Conference Series on Public Policy*, 39, 195-214.
- Tobin, James (1958), "Liquidity Preference as Behavior Towards Risk," *Review of Economic Studies*, 25, 15-29.