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Faith, Science and Religion

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24

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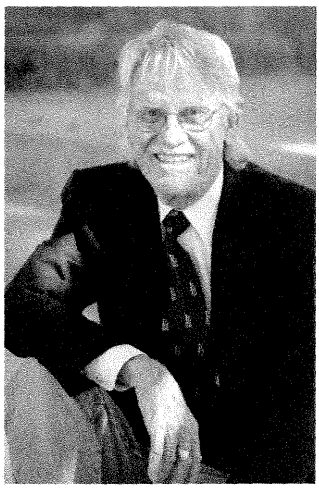

Vernon L. Smith

> Science has outgrown the "modern mistake" of discounting invisible realities.
>
> Houston Smith, *The Soul of Christianity* (2005: 41)

INTRODUCTION: WHAT IS FAITH?

Faith in invisible realities, once considered the exclusive province of religion, has pervaded physics since Newton, has created a counterintuitive new reality since Einstein, and was at the core of how Adam Smith viewed both human sociality in *The Theory of Moral Sentiments* (1759; hereafter

I am grateful to the editors of this volume, who have encouraged me beyond my original intention to revisit and revise my "Postscript on Faith in Science and Religion," written for *Discovery – A Memoir* (Smith 2008), melding it with my thoughts on experimental economics and the Great Recession, and thus meeting their charge to include "some perspective on the nature of life and of the universe."

TMS) and national economies in *The Wealth of Nations* (1776; hereafter WN). The story I will tell of invisible realities from Newton though the Scottish Enlightenment to the Great Recession is the story of the physical world, then human social and economic systems, all subject to unannounced but discoverable rules of order.

But what is faith and how might it be relevant to science, economics, and religion? I propose to build upon a positive New Testament definition. It is expressed in the inimitable style of the anonymous learned author of Hebrews (11.1): "Now faith is the substance of things hoped for the evidence of things not seen." The meaning expressed here, I believe, applies just as appropriately to science as to religion. My elaboration will be dispersed throughout the essay: briefly, for now, the idea is that, in science, theory provides the substance of hope; evidence is always indirect and in this sense is not seen.[1]

Let me preface my explorations, however, with some autobiographical background. My early exposure to religion was powerfully conditioned by the prevailing materialist-agnostic interpretation represented by the ascension of science at the time. My mother and her father, both skeptics, had been attracted to Unitarianism before I was born. Although Unitarians had a very strong naturalistic and scientific bent, this was the fashionable face of reason that was always tempered and qualified by an inner private experience emanating from deep secular and Judaic-Christian sources of poetic inspiration.

Although materialism breaths with vigor in the rhetoric of scientists and other intellectuals today, I think the truth-seeking processes of science have undermined this belief system, making it obsolete. Truth seeking is, of course, one of the guiding principles of Christian theology, as well as of science, as in John (8.32): "And ye shall know the truth, and the truth shall make you free." Hence, I see no inherent conflict between science and religion. Each can be at peace one with the other, although I am far from predicting that they will be.

Public debates are polarized on the issue of design versus a naturalistic rule-governed order, particularly as it affects public education, much controlled from top-down bureaucratic directives to which all are expected to conform and therefore destined to generate heated controversy. Each side in this controversy fears that some child somewhere will have her mind permanently corrupted by not being properly indoctrinated in its version of what it passionately considers to be the "truth."

In my day, by written parental consent, public school pupils attended a weekly local church Bible school for a couple of hours – at my school, when

I was in the third or fourth grade, it was every Thursday. Separation of state and religion did not mean that such voluntary contacts were prohibited. My mother approved, but only after asking me if I wanted to attend. The fact that, as a lefty, she heartily approved of Clarence Darrow's 1925 "Monkey Trial" defense of Scopes for teaching evolution in Tennessee did not mean that she would intervene in my decision in order to impose her views. After an elapse of time my mother asked how I liked Bible school, and I replied, "Fine." She asked why, and I replied that I liked all those stories about God and Jesus. I was comparing them with my early reading of the classic tales of Grimm, Anderson, and, my favorite, *Tal* (1929) by Paul Fenimore Cooper, great-grandson of the acclaimed wilderness novelist, James Fenimore Cooper.

My mother was not a believer, but neither was she threatened by believers; in retrospect I often think that this was her most precious gift to me. Ultimately, I came to understand that people comfortable in their own search for meaning live well with those whose search leads to different outcomes.

FAITH AND PHYSICS

Returning to my thought trail, the basic materialist faith was that physical science would determine the ultimate reductionist elements from which matter was built, and in that discovery humankind would come to understand our universe at a depth that would subvert and replace any need for appealing to some spiritual or mystical entity to comprehend human existence. In the meantime we may as well suspend traditional religious values in anticipation of that liberating day of salvation!

This materialist expectation was implicit in my naive childhood belief that everything was knowable, once you became an adult. I had yet to learn that along with the answer to any question came a host of deeper questions created by the answer. This state of our knowledge is illustrated by the observation that in any epoch a child can force you to the outer limits of knowledge by asking why three times in a row following each of your attempts to answer. When you do economics experiments, unanswered questions arise in the pursuit of every topic, but you stop long enough to write about the answers, leaving the new questions for their day in the sun.

In my view this materialist conception of the universe started to unravel with two of Einstein's four famous 1905 papers: one on the special theory of relativity (actually entitled "On the Electrodynamics of Moving Bodies"), the other on the photoelectric effect. One of the implications of the first was

the equivalence of matter and energy (the equation was actually derived in another of Einstein's 1905 papers), leading to a revolutionary understanding of classical physics as well as to practical nuclear engineering; it also led to his 1916 general theory of relativity, which reinterpreted our concept of gravity, space, and time, later forming the cosmological basis for an expanding universe in which time started with the Big Bang of creation and also accounting for the black holes of collapsed stars, where (local) time ends.

Einstein's second 1905 paper established that energy came in discrete packets that were governed by uncertainty; this paper, cited when he won the Nobel Prize in 1921, jump-started the field of quantum mechanics. As Einstein put it in 1905, "[W]hen a light ray is spreading from a point, the energy is not distributed continuously over ever-increasing spaces, but consists of a finite number of energy quanta that are localized in space, move without dividing, and can be absorbed or generated only as a whole." The new breakthrough quantum physics would later be discovered to imply an ethereal reality of "spooky action at a distance" that troubled Einstein, as it collided with his far more intuitive modifications of classical physics. The trouble continued with increasing experimental support for quantum physics down to the present. He saw quantum physics as only provisionally correct until the theory had been modified and become more "complete," but the substance of this hoped-for rescue has receded ever further from view, much as has the materialist expectation mentioned earlier.

In 1929 Hubble's observations revealed that the stars and galaxies of the universe are expanding in all directions at velocities that increase in proportion to their distance from us. The most prominent implication was that our space-time universe had a single region of origin. Originally, the idea had been proposed by Lemaître in the year of my birth (1927), but in 1949 the astronomer Fred Hoyle dubbed it appropriately "the Big Bang," a label that stuck. For perhaps thirty years after Hubble's observations, scientists were resistant to the idea that all matter and energy in the universe must have once emanated from a particular historical region in space-time: mathematicians called it a "singularity," massive compared with the singularities sprinkled in all directions throughout the universe like Swiss cheese and associated with local imploded stars, or black holes.

Why this resistance? I think it emanates from the Newtonian idea that the universe had always existed, which seemed psychologically more comforting and natural – no beginning, no end. If there was a beginning, then science – the search for truth in physical phenomena – had to face up to the psychologically overwhelming fact that before the beginning there was nothing: no matter, no energy, no space, no time, just a monstrously

pervasive *nothing*! I am using "nothing" here in the sense of classical and relativistic physics, not necessarily in the sense of quantum physics, which I will come to later. But if the universe had always existed, then it seemed that there was room aplenty for Einstein's impersonal God, the deism of natural rules, order, and beauty, to say nothing of agnosticism and atheism.

Our Judaic-Christian ancestors had understood their world in terms of Genesis (1.2). Before creation there "was a formless void and darkness covered the face of the deep," while in our day, the time of the Big Bang, we have come to understand our world, technically, as originating at a massive singularity at which the equations that chart everything from stars and dark matter to particles have no finite solution when extrapolated backward in time.

The ancient question of human existence, "Why is there something rather than nothing?" could be avoided if this *something* that we observe everywhere was thought to have always been – in direct contradiction to Genesis and to Hebrews (11.3), where it is stated that "[t]hrough faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear." But the new question for science, implicit in the Big Bang theory, "Why was there nothing that became something?" seemed to deepen the state of our ignorance and mystery. This is because the *mystery of origins is beyond any conceivable science* and the whole apparatus of hypothesis testing. Creation – that is, the beginning – could be located in history and, backward in time, the limiting state of equations that have again and again proved to have enormous experimental and astrophysical predictive power when they were used to locate events in our observable world of space-time, energy, and matter.

At its best, these developments, and those in quantum physics, can only be described as embarrassing for classical materialism. That the materialist rhetoric is little changed tells you how deep its belief system penetrated.

Also beyond science is a personal experience shared by all humans, the sense of awe and mystery of existence. For me this experience must count as an observation even if it is incommensurate with our rhetorical vision of the objective tests of science.[2]

Materialism ignored, denied, or marginalized any references to experiences of awe and mystery. Kahlil Gibran may have had such dismissals at heart in his book *The Madman* (1918): "[W]e heard a voice crying, 'This is the sea. This is the deep sea. This is the vast and mighty sea.' And when we reached the voice it was a man whose back was turned to the sea, and at his ear he held a shell, listening to its murmur. And my soul said, 'Let us pass

on. He is the realist who turns his back on the whole he cannot grasp and busies himself with a fragment.'"

What spooked Einstein about quantum theory was that two quantum particles could interact instantaneously no matter where they were located. In experiments in Switzerland, such particles are studied at a separation of 18 kilometers (*Nature*, August 14, 2008). Thus, if one particle is perturbed, there is an instantaneous synchronous effect on the other. This seemed to violate special relativity by allowing physics to embrace speeds greater than that of light. The best verbal description that could be mustered was the concept that two such particles are "entangled" – the term introduced by Schrödinger in 1935 – a phenomenon subsequently found over and over again to be consistent with indirect experimental observations. But let me here emphasize that all perception, and all scientific observations, are indirect and are therefore necessarily the "evidence of things not seen," as in Hebrews (11.1).

So, even if quantum theory is "incomplete" and due to be improved upon, scientists now harbor the faith that quantum-spooky interconnectedness will be retained. Indeed, what does it mean to say that two entangled particles are subject to simultaneous effects independent of their distance from each other? It actually means that the time required by any postulated signal passing between the two particles is below the detection limit of (classical) instruments. The Swiss measurements showed that any supposed signal passing between entangled particles must be traveling at least 10,000 times the speed of light!

Earlier I used the phrase "objective tests of science," which carries the ring of "reality" but is a rhetorical distraction. "Reality," when penetrated by new, deeper instrumental probes, is never what it seems, and no one was a greater champion of this principle than Einstein. For example, he used the term "ponderable matter" in contrasting elements of classical physics with his new space-time physics. His general relativity theory created a counter-intuitive space that curved back on itself in a four-dimensional space-time continuum, its analogue being the infinite number of great circle (distance-minimizing) paths through a point on a sphere. Incredibly, as he and others would show, that space curvature allows for the theoretical possibility of "wormholes" through which various points in space are accessibly connected by shortcuts that, if traversable, do not violate special relativity but simply bypass it. In particular, gravity is not instantaneous, but is mediated by a finite signal that, through the warping of space-time, travels only at the speed of light. Keep in mind that we are talking of theory some of the implications of which have survived experimental tests, at least where

observations could be brought to bear on certain of its predictions, beginning with the eclipse experiments by Eddington in 1919.

Contemporary theorists have learned to take such incredibility at equation, if not face, value. After all, in less than a hundred years after the special theory and the photoelectric effect we encountered engineering miracles like atomic energy and lasers that are manifestations of the new relativity and quantum mechanical theories. So we should not shoot from the hip in rejecting wormholes, entangled objects, and teleportation as the stuff only of science fiction. Indeed, teleportation in the sense of information transfer has been achieved in atoms and molecules, and seems likely to be achieved soon in elementary life forms. At quantum levels if you have copied all the information in an object, you have teleported that object. As with atomic energy and lasers, the challenge of teleporting a more complex object is in the engineering, not the principle. These fairytale-like stories are now serious physics, at least for some, within the framework of contemporary science.

The point I want to emphasize is that science is about physical and biological mechanisms; about discovering how things work; about engineering; about theories that describe and can predict observations that we experience entirely through instruments. It is the instruments of science that supply us with the indirect "evidence of things not seen." They can be likened to Plato's Allegory of the Cave, in which reality can be experienced only as shadows on a cave wall – what casts the shadows is always beyond our direct experience, though not beyond faith, the imagination that we call "theory." An experimental physicist says that he measures the "spin" of an electron – a mathematical concept – whereas the engineering reality is that he records certain anomalies on a screen and has used the theory to calculate their implication and help him locate it, calling it a measurement. Carl Anderson discovered the positron, but in reality merely photographed a streak (caused by its energy) in a cloud chamber, which was an implication or predictable consequence of the theory. Instruments are classical physics machines. Science keeps getting better exponentially in this instrumental task, on a scale beyond anything that could be believed possible in 1905, let alone at the beginning of the Christian era. That success easily breeds the belief and even the pretense of deeper understanding than is justified.

In science we observe nothing directly, only indirectly through instruments that record the secondary effects implied by conceptual models of objects – particles, waves, energy – whose postulated existence in the theories that fulfill our hopes is not violated by our indirect observations. But you cannot derive the existence of those objects and the richness of the

theory from the sparse indirect effects and measurements we record – theory is resolutely committed to being underdetermined by observation, the gap always an unexplained mystery. You can only do the reverse: deduce from those constructed objects and models their implications for what we can expect to observe. The constructs come from unidentified flights of the imagination, from scientific intuition comprehended mathematically. That undergirding substance, the theory, the hope that drives imagination, is something you accept on faith, whose origin is itself beyond science, its believability reinforced by the occasional tests that one is lucky and ingenious enough to perform, until that faith is disturbed by contrary observations or a more comprehensive construct able to account for new shadows that we can experience.

Hence, what is inescapable is the dependence of science on faith, as in Hebrews. The conceptual and theoretical constructs of science constitute the "substance of things hoped for" whose evidential support depends on instruments that record the "evidence of things not seen." Einstein once said, "It is theory which first determines what can be observed."

This unseen reality of theory brings an operating understanding of how our world works and enables us to accomplish engineering miracles by trial, error, tinkering, and adjustment. But science cannot identify, nor can it disprove, *purpose*. Some prominent scientists and philosophers have claimed – somewhat intemperately, it seems – that science shows that there is no purpose in the universe. But failing to find something does not allow one to conclude therefore that it does not exist. *The lack of observable evidence for purpose does not constitute evidence for the absence of purpose.* Religions everywhere have sought to comprehend a universal purposeful human experience: a longing born of high yearnings that come welling and surging in, that do indeed come from a mystic ocean on whose rim no foot has trod.

The ancients confounded their mystical experience and religious faith with explanations of everyday events. Science has invaded that everyday world of explanation and created marvels out of the new understanding of how things work. That success should not, however, be extrapolated arbitrarily beyond the bounds of what science is capable of investigating.

I want to close this half of the essay by returning to my claim that our sense of awe and mystery should count as an observation consistent with the religious faith of our fathers. Our experience of that sense (emanating from that we call "Spirit"),[3] like shadows on the cave wall, is the evidence of things not seen. In religious inquiry, people have compared notes on that experience and thereby given it an intersubjective commonality – controversial

to be sure, but so is the interpretation of theory and observation in science. When confronted by new observations, scientists ask each other, "Do you see what I see?" The answers are often controversial for extended periods but, in time, the discussion may settle on provisional agreement – a temporary equilibrium.

INVISIBLE REALITIES IN ECONOMICS

The leading Scottish Enlightenment figures, such as David Hume, Adam Smith, and Adam Ferguson, were all inspired by the fundamental idea that the social and economic order that they observed everywhere around them was "the result of human action but not the execution of human design" (Ferguson 1767: 102). I think a good case can be made that their program was a consequence of the intellectual influence of Isaac Newton, their immediate intellectual forebear,[4] who had astonished the scholarly world by accounting for our natural physical environment using only a handful of rules invisible to human awareness but bringing order to humans' sensible experience. The Newtonians predicted the appearance of a certain comet in 1758. This is referenced by Adam Smith in his "History of Astronomy," which was published posthumously in 1795 but had been written sometime before 1758, as is indicated by Smith himself when he records, "His [Newton's] followers have, from his principles, ventured even to predict the returns of several of them [comets], particularly of one which is to make its appearance in 1758" (Smith 1795: 103). Then, explaining in a footnote: "It must be observed, that the whole of this Essay was written previous to the date here mentioned; and that the return of the comet happened agreeably to the prediction." Smith is referring to Halley's Comet, which has returned on schedule about every seventy-six years since 1758.

Imagine, if you will, that this prediction and its confirmation must have been a truly mind-bending experience for those living in the mid–eighteenth century. Newton's modeling of invisible reality provided an orderly account of observations from the physical world. The Scottish Enlightenment search was on for the emergent rules underlying the observed socioeconomic order – except that Newton had applied reason to modeling nature's physical order, whereas the socioeconomic order could not have resulted from the "execution of human design." Now reason would be used to understand how such rules might have arisen.

Economics, in the form imputed to it by Adam Smith, began with the proposition that wealth creation in the emerging national economies of the time had been the unintended consequence of a single process axiom:

"the propensity to truck, barter and exchange one thing for another" (WN, 25). This axiom of commercial sociality generated market prices, whose existence facilitated the discovery, through a slow and gradual process, of those forms of specialization ("division of labor") that individuals found it was in their own interest to choose. From the perspective of experimental economics, Adam Smith's process axiom was central to the finding that naive subjects are quickly able to discover, through trial-and-error adjustment, the abstract equilibrium of supply and demand, although that equilibrium was entirely unknown to the subjects.[5] The invisible hand metaphor was right on, although it is so often maligned by many who never read WN, never heard of TMS, and had not a clue as to Smith's scientific program.

The formal equilibrium underlying the experiments had not been part of Smith's thinking: its comprehensive articulation, based on subjective utility theory, had to await the passage of nearly 100 years in the person of W. S. Jevons (1871). Jevons, however, failed to benefit from Smith's comprehension of an invisible reality of specialization and wealth creation that ordinary people, characterized by his market process axiom, could discover. Indeed, Jevons – a rational constructivist – believed the opposite: "A market, then, is theoretically perfect only when all traders have perfect knowledge of the conditions of supply and demand, and the consequent ratio of exchange" (Jevons 1871: 87). Jevons needed perfect knowledge for his model, but his traders in the world, armed with Smith's axiom, did not. What the experiments reveal is that traders need have knowledge only of their own private values (costs), not that of others and of the entire supply and demand. Over time subject traders in experiments tend to converge stochastically to a shrinking neighborhood of the price that equates supply and demand. Unfortunately, Jevons's important contribution to the concept of market equilibrium displaced rather than supplemented Smith's concept of a market exploration process. Indeed, the profession is still weak in its capacity to model discovery processes, while expanding to the ends of the economic earth the things that we model as a static, inert Nash equilibrium.

But for Smith's axiom to perform its miracle, civil society also needed the rights of property – people must play the game of trade, not steal, if the game is to do the world's work.[6] He said little, however, on this subject in WN; for example, "Every man, as long as he does not violate the laws of justice, is left perfectly free to pursue his *own interest* his *own* way" [Emphasis added] (WN, 687). He said little of it in WN because he already had said much about the origin of property in TMS:

> Among equals each individual is naturally, and *antecedent to the institution of civil government*, regarded as having a right both to defend himself from injuries, and to exact a certain degree of punishment for those which have been done to him." (TMS, 80; emphasis added)
>
> As the greater and more irreparable the evil that is done, the resentment of the sufferer runs naturally the higher; so does likewise the sympathetic indignation of the spectator. (TMS, 83–84)
>
> The most sacred laws of justice, therefore, those whose violation seems to call loudest for vengeance and punishment, are the laws which guard the life and person of our neighbour; the next are those which guard his property and possessions; and last of all come those which guard what ... is due to him from the promises of others. (TMS, 84)

The reason broken promises (contract violation) carry smaller punishments than robbery – unlike the latter, the former are not criminal – is that Smith thoroughly understood the asymmetry between losses and gains in human behavior,[7] affirmed more than two centuries later by the experiments of Kahneman and Tversky (1979).[8] Smith argued that robbery deprives us of that which we have already obtained, while contract violation only frustrates our expectation of gain (TMS, 84).

Although markets are central to understanding the sources of wealth creation and their high-efficiency performance was affirmed in laboratory experiments beginning in the 1960s, I want to make clear that the market miracle image was significantly qualified in Smith's WN, as it was in the laboratory in the 1980s. For twenty years I had thought and believed that the supply and demand experiments, and the many variations that followed, probably illustrated how well *all* markets function. But as it turned out not all markets are born equal.

In the early 1980s there entered into research the idea that it would be interesting to study a simple transparent asset environment, one in which people would have complete information on the fundamental dividend value of share assets. The objective was to develop a baseline in which people, trading over a fifteen-period horizon, would confirm "rational expectations theory" by trading at fundamental value which declined over the horizon as fewer dividend draws from the distribution remained from time t to the end. The program plan then called for seeing if we could create bubbles by manipulating/controlling the information given subjects by the experimenter. Well, the baseline, the anchor for this grand research scheme of "best-laid plans," didn't come close to converging as quickly as had the earlier supply and demand markets: right off the starting blocks we had enormous, enigmatic bubbles on the way to equilibrium (Smith et al. 1988). Our first idea was to squelch the bubbles by a heavy-handed instructional

treatment in which we would remind everyone at the end of each period, over and over again down to the last period, what the declining dividend holding value of a share would be in the next period. That did not work, as the new experiments made it clear that subjects were doing what they wanted to do and it had nothing to do with any initial and repeatedly updated notion of true fundamental value that we informed them about.

While we found that markets consisting of individuals who were twice previously experienced finally converged, they reliably generated substantial bubbles on the way to that fundamental rational expectations equilibrium. Although baffling at first, the results were replicated with widely different groups of traders – college students, small-business owners, corporate-business executives, and over-the-counter stock traders in Chicago – and by skeptical new experimenters.

Initially, we had been skeptical about our own findings and did not believe them, but the phenomena turned out to be at the hard core of human behavior. Twenty-five years of experimental research on asset market bubbles showed clearly that under a wide variety of treatments, asset prices initially deviate substantially from those predicted by the rational expectations market model (see Postrel 2008, who reports her interview with Charles Noussair, a prominent contributor to the experimental asset market literature). Our explanation was that in accordance with the theory people ultimately came to have rational expectations of equilibrium, but it was an *experiential learning process*, not an inference from economic logic (the flaw presumed by theory) applied by the individual to herself and others based on given information: "What we learn from the particular experiments reported here is that a common dividend, and common knowledge thereof is insufficient to induce common expectations.... With experience, and its lessons in trial-and-error learning, expectations tend ultimately to converge and yield an REM (Rational Expectations Muth) equilibrium"[9] (Smith et al. 1988: 1148).

Looking back over fifty years, in the first twenty-five years we had to overcome the shock that laboratory markets, like those of daily consumer life, proved the "wisdom of crowds" and converged very quickly (in minutes) where people are informed only of their private individual values or their private costs, and items bought are consumed, with that process replicated over time. Then we had to adapt to the shock that asset markets were a case in which that wisdom failed decisively in the absence of three to four hours of experience in three repeat sessions.

An invisible equilibrating reality existed in these asset markets, but it took longer than we had come to believe was necessary. I will claim that the Great Recession was and is still subject to the same unanticipated slow process of equilibrium restoration.

What eventually dawned clear was the key difference in the two kinds of markets: the prospect of resale in asset markets, with no immediate end-point consumption. There are no bubble troubles in markets where the items exchanged *are not re-traded later*, but rather are produced, purchased, consumed, and disappear and this process is repeated over and over and people learn it unmindfully like they learn spoken language. In the national economy these properties predominate in the composition of total output: some 75 percent of the private gross domestic product consists of nondurable goods that are bought to consume (hamburgers), not re-trade, and services, in which delivery by specialist producers is synonymous with consumption (haircuts). But houses and securities are routinely re-traded, unlike hamburgers, maintenance repairs, haircuts, commercial airline seats, and all manner of consumer services. Moreover, people are strongly specialized as either buyers or sellers of perishable goods and services. When you or I investigate the hamburger or haircut market, we already know that we will be buyers for immediate consumption – sellers have the same personal knowledge as specialized producers. But securities and houses are routinely re-traded. With securities on any given day an investor may be a seller or a buyer and must decide on the basis of market information. Similarly, house owners may over the course of their lives sometimes be buyers and sometimes sellers, depending on price information generated in the market. Both securities and houses are bought with the knowledge that the purchase is not final, that resale is always an option. These differences help to account for why all markets are not born equal – why some may be bubble prone, and others never.

The crisis in 2007–2008 brought home to me the relevance of these two kinds of market experiments – demand and supply for nondurables versus asset markets – to shedding light on the crash and the subsequent recession. There was no instability problem in the ordinary markets of daily life. It was housing that was the trouble – a big-time bubble – leveraged by low (or zero and even negative) down payments, easy loan money, and financial wizardry (mortgage-backed securities "insured" by derivatives). People easily can get caught up in self-sustaining expectations of rising asset prices in the lab and – if only occasionally –in rising housing prices in the world, and both are sustained longer if there is a lot of liquidity, but ultimately they must end in long-run rational expectations style equilibrium!

The long housing price run-up after 1997 engendered the sense that prices would continue to rise; here is an example:

> Cassano agreed to meet with all the big Wall Street firms ... to investigate how a bunch of shaky loans could be transformed into AAA-rated bonds ... with Park and a few others, Cassano set out on a series of meetings with Morgan Stanley, Goldman Sachs, and the rest.... "They all said the same thing," says one of the traders present. "They'd go back to historical real-estate prices over 60 years and say they had never fallen all at once." (Michael Lewis, *Vanity Fair*, July 2009)

These were not the blindsided economic experts, but the practitioners on the firing line who were failing to reexamine what they thought they knew and finding justifications that protected the state of their presumed knowledge from invisible and surreptitious realities.

A feature of national housing bubbles not studied in the experiments, however, is the asymmetry between the upswing and the downswing in its impact on household and bank balance sheets. Consumption demand and the supply of credit are broadly buoyed by expectations on the upside with new debt incurred at rising price levels. On the downside, expectations and existing asset prices adjust freely, while mortgage debt outstanding is fixed ratchet-like as housing prices fall against fixed loan obligations. Households (22 percent of them as of 2011) get stuck in the black hole of a negative equity loop, and far more are in a gray hole not much above water. Since the banks hold the mortgages, the banks are stuck in the same negative equity loop. The effect is the same on both: households are reluctant to spend, and banks are reluctant to lend, and the economy awaits the resulting painful process of deleveraging.

The balance sheet damage wrought by the crash of the credit-fueled house bubble is why monetary policy is so ineffective – now and in the Great Depression. Calling such ineffectiveness the "liquidity trap" is merely providing a name for the ineffectiveness that is experienced; the name helps us not a whit to understand why it occurs. It is caused by the black hole of household/bank negative balance sheet equity.

Moreover, the mainsprings of the Great Recession were not unique to it. Steven Gjerstad and I were surprised, even dismayed, to discover that we were observing a very old story, going back at least ninety years (Gjerstad and Smith 2009a, 2009b, 2010). For example, let's compare the Great Recession with the Depression:

> Housing construction expenditures started increasing in 1998, briefly flattened out in 2001–2002, and rose sharply to a peak in early 2006. Remarkably, at their 2006 peak housing expenditures were 79 percent higher than when the recession began in Q4, 2007, but then proceeded to fall another 60 percent by Q2, 2009.

These data are just a rerun of comparable movements in new housing expenditures before and during the Depression, when the investment boom in housing was shorter-lived than in the recent run-up: starting in 1922 it rose to twin peaks in 1925 and 1926, when expenditures stood almost 60 percent above their 1929 level. By 1933 new housing expenditures had cratered to more than 85 percent below their 1929 level.

The seventy-nine years from 1929 to 2008 are bounded on each end by downturns arising from similar housing-financial market collapses, with twelve recessions in between. In eleven of these fourteen downturns, the percent decline in housing and in consumer durables expenditure occurred earlier and exceeded in magnitude the percent decline in every other major component of GDP. Thus, consumer durable goods expenditures sometimes join housing in leading recession downturns, but in the Great Recession, durables as well as firms' fixed investment declined in coincidence with GDP; most likely this was due to the outsized collapse of the housing mortgage market and the banks, taking everybody – consumers, producers, and policy makers – by surprise.[10]

In addition to their role in leading most downturns, housing expenditures lead in every recovery. It is not an exaggeration to say that if there is no recovery in housing, there is no recovery in the economy (Gjerstad and Smith 2010). The current weak recovery may qualify as a technical exception. As of 2011, the housing recovery had not occurred in spite of federal tax subsidies to new home buyers or programs designed to refinance mortgages at lower rates and stretch payment terms to allow people to stay in their homes.

These programs were well intentioned, but more artificial kiting of the demand for housing – the original driver of the problem – surely cannot suddenly now be the solution. House prices relative to other prices have been driven far too high by credit expansion, not by the ordinary money income growth reflected in other prices. The adjustment needed to rejuvenate housing demand is for house prices to be restored to levels in line with current income; artificially propping up the price of a house stock bloated by borrowing from future housing demand with mortgage credit is the wrong policy for a return to sustainability.

From this brief economic history it is evident that "business cycle" is a misnomer in economic parlance; pure and simple, it's a "consumer housing-durables cycle" driven by volatility in consumer expenditures, aided and abetted by fickle private and politicized credit terms. The rest of the real economy then does its level best to adapt to these dynamic surges.

The problem of economic instability arises from episodes of housing expansion financed not by rising incomes, but by an unsustainable inflow

of credit to home buyers. From 2000 to 2005 the ratio of median home price to median family income rose by 30 percent (4 to 5.2), and according to the National Association of Realtors (2006), 45 percent of first-time home buyers in 2005 paid no money down! As Adam Smith put it:

> [B]eing the managers rather of other people's money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which … [they] frequently watch over their own. (WN, vol. II, 741)

An important puzzle is why stock market crashes like the dot-com crash leave the banking system and economy whole, while a bursting housing bubble can devastate both The answer informs us of the critical role of houses in household and bank balance sheets during recessions.

The dot-com stock market crash, December 1999 to September 2002, wiped out approximately $10 trillion in market value, but the financial system was unscathed. When Gjerstad and I wrote our *Wall Street Journal* article of April 6, 2009, we noted that by mid-2007 the value of homes had declined by only about $3 trillion, but the financial system had been devastated, ultimately requiring the largest Fed intervention in history. This difference in impact is not due to a discrepancy in sector size: housing and all listed public securities each accounted for about one-third of all US wealth.

This contrast reiterates an important lesson from the 1920s and 1930s. Whenever stock bubbles burst, the combination of tough margin requirements and callable loans serves well to confine the damage to investors and speculators; but when housing prices decline, mortgages extended to home buyers with inadequate cash buffers (strict minimum down payment and amortization rules) threaten the banking system and the economy. In housing markets, when banks lend long against inadequate asset collateral, and home buyers borrow long against uncertain wage income, it is hazardous not only for individual borrowers and lenders, but – through interdependent leverage in the banking system – for the innocent and profligate alike.

Beginning in 1928 and culminating in 1934, we fashioned the right rules for containing the fallout from stock bubbles and never deviated from those rules; soon thereafter we found, then ultimately lost, the correct set of mortgage market rules. Why?

Significantly, the housing boom in the 1920s was fueled by credit. Although savings and loan associations had long amortized practically all mortgage loans and were the major source of housing finance, in commercial banks and insurance companies the practice of balloon repayment of all or part of the original loan accounted for more than 85 percent of their mortgage lending from 1925 to 1929. The wave of mortgage foreclosures in 1930–1934 did little to change these conventions, as political pressures (much like today) overwhelmingly sought to prevent foreclosures and allow people to stay in the homes they had hoped to own.[11] This tide of debtor and political resistance to tightened standards had changed by 1935–1939, when banks and insurance companies were amortizing 70 percent or more of their mortgage loans. As noted in an important 1956 monograph by the National Bureau of Economic Research:

> [T]he change during the last two decades is … one from unamortized and partially amortized mortgage loans to regular, periodic amortization calculated to retire the loan in full during its term. Much of this change came during the late thirties when the adoption of fully amortized loans in HOLC and FHA operations increased the popularity of this type of mortgage. (Glebler et al. 1956: 232)

High mortgage standards for both public and private home finance remained the norm for decades but began to erode in the 1990s with the growing political consensus – and widespread private financial accommodation – that US society should be more aggressive in mortgage lending to low- to middle-income families.

The political reasons for the differential treatment of stock and house purchase loans are transparent: there is no political constituency for enabling those of modest means to improve their lot by investing in stocks, as has existed for those who buy homes. Tough margin rules have not and will not prevent stock market crashes, but they have demonstrably controlled collateral damage to the banks and the economy. Laxity in mortgage standards can and has brought great unintended harm, even to those it was hoped would be made to prosper; righting the rules will be difficult if blame is sought in men rather than in property right constraints on the excesses that all must agree to live by. As Adam Smith understood, it's a problem of too much of "other people's money."

From 1997 through 2006 the median national price of homes rose 85 percent faster than the consumer price index. Restoring that equilibrium will require either a further decline in home prices or an increase in other prices. But the Fed's massive expansion of excess reserves – on the order of a trillion dollars – has yet to produce any wage inflation and therefore has had little impact on the general price level. Gradually, with a slowly rising CPI, and perhaps further declines in home prices, this equilibrium will be restored.

But a further decline in home prices exacerbates the negative equity loop that has entrapped the banks and households. Restoring these stressed

balance sheets requires home mortgage principal to fall to the current market price level of houses – ever so gradually that deleveraging is happening as people use current income to pay down their mortgages. A faster solution is for banks to renegotiate loans, lowering the loan principal; this is much more important than stretching the term of loans and lowering interest for any given reduction in monthly payments. Banks are reluctant to recognize these true losses; instead they resist mark-to-market accounting standards, show phantom profits, and stretch the losses into the future.

Public and private policy is unlikely to address both the relative home price disequilibrium and the need to restore damaged household and bank balance sheets. The stimulus spending by the two most recent administrations addressed neither of these core problems, and the economy continues to be stuck.

Houston Smith's invisible realities, from their origins in religion to science – physical and social – have always been at the core of human attempts to understand their world. Faith has often led to false understandings in the light of the evidence, the dim shadows on the cave wall of the reality we perceive, and launched new searches. But the wisdom in Hebrews and its prior traditions define the thread connecting all those searches.

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Notes

1 The quote from Hebrews and any to follow are from the King James edition. But other translations, if in my view less poetic, support this interpretation. In the New International edition, we have: "Now faith is being sure of what we hope for and certain of what we do not see" (Hebrews 11.1)

2 That power to inspire awe is magically expressed in Carruth's moving lines:

> Like tides on a crescent sea beach,
> When the moon is new and thin,
> Into our hearts high yearnings
> Come welling and surging in,
> Come from the mystic ocean,
> Whose rim no foot has trod,
> Some of us call it Longing,
> And others call it God.

3 Skeptics, as is their wont, press for an explanation of "Spirit." I am always reminded of one of James Thurber's cartoons. A client is sitting at a table with a Medium, who is staring into a crystal ball. The caption: "I can't get in touch with your uncle, but there's a horse here that wants to say hello."

4 David Hume was born in 1711, Adam Smith and Adam Ferguson in 1723; Isaac Newton died in 1727.

5 See Smith (1991: Part I) for many of the early papers on equilibrium discovery in repeat-trade supply and demand markets organized under various exchange institutions.

6 For experiments motivated by the proposition that exchange, specialization, and property rights must be discovered simultaneously, see Kimbrough et al. (2008).

7 Smith's formal statement of this asymmetry is in TMS, paragraph VI.i.6, p. 213.
8 Unlike Kahneman and Tversky, Smith would not have seen the loss-gain asymmetry as irrational any more than he saw deviations from the pursuit of self-interest as irrational. He wrote rather of one's "own interest," which required each person to "humble the arrogance of his self-love, and bring it down to something which other men can go along with" (TMS, 83).
9 Recent experiments report treatments showing that instructions and context (shares in a depleting gold mine) can substitute for experience in inducing trading prices that on average track declining fundamental value Kirchler et al., 2012).
10 Maybe it was because my parents lost their Kansas farm to the bank in 1934 that I found the financial and economic collapse in 2007–2008 so riveting (Smith 2008). Much more compelling, I think, was the stunning inability of the experts to anticipate its approach, recognize its arrival, or believe in and accept its severity. Observing the absence of subsequent expert confessions of this human frailty, any exceptions deserve to be recognized. Here is a refreshing example by the Fed's number 2, Donald Kohn, who retired in 2010: "Although I was concerned about the potential fallout from a collapse of the housing market, I think that it is fair to say that these costs have turned out to be much greater than I and many other observers imagined. In particular ... the degree to which such a decline would create difficulties for homeowners, and, most important, the vulnerability of the broader financial system to these events" (Kohn 2009: 33).
11 The bank's foreclosure on my parents farm in 1934 would have included their house in Wichita, via recourse, but that prospect had been avoided earlier by its having been deeded to my mother's father.