

Real Estate through the Ages: The Known, the Unknown and the Unknowable

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*What can we reason, but from what we know?
Of Man what see we, but his station here,
From which to reason, or to which refer?*

Alexander Pope, "An Essay on Man,"

I. INTRODUCTION

Real estate and land are among the oldest asset markets with which humans have had extensive experience. The significance of agricultural, residential and commercial real estate assets in mankind's history can scarcely be exaggerated. Social structure, marriage institutions, inter-state relations and, more broadly, socio-economic organization have been affected by and simultaneously have influenced the nature and functioning of real estate markets. The complex interaction of real estate markets with social, political, cultural and economic institutions through the ages, combined with the impact of technological changes, makes the task of assessing what is or was known, unknown and unknowable in real estate economics and real estate investment a particularly daunting task. As a directing principle of our analysis, we shall follow the taxonomy of the known (K), the unknown (u), and the unknowable (U), or KuU, defined in terms of i) knowledge as a measurement issue, and ii) knowledge as a theoretical construct.²

¹ The authors would like to thank Samir Dutt, Richard Herring, Cynthia Kroll and Desmond Tsang for comments and suggestions.

² The notion of a measured or measurable probability distribution is critical in this framework. K signifies the distribution is specified, u where probabilities cannot be assigned to all events, and U where the events themselves are unknown in advance. The "theory" approach stresses the underlying conceptual model. Put slightly differently, K is when there is common knowledge about the underlying model, u occurs when

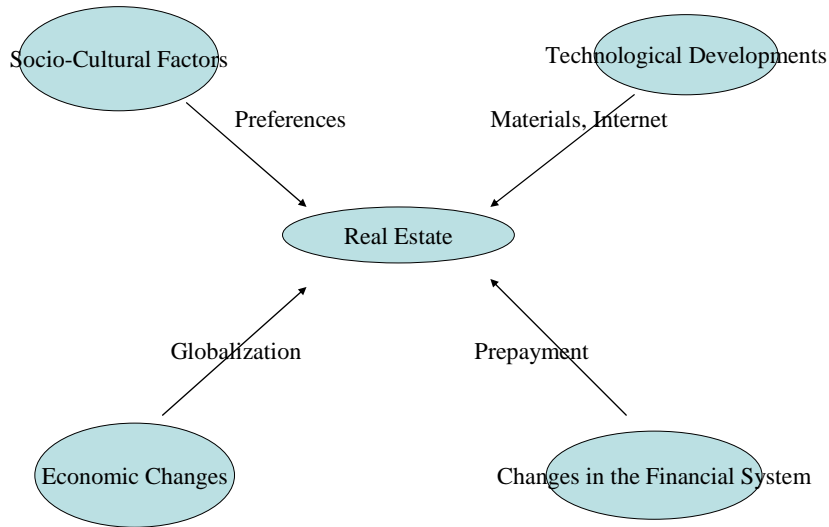
Both empirical and theoretical elements underscore the distinctive KuU nature of real estate. For example, real estate is lumpy, perhaps less so in the last decade with developments in securitization. Housing is a mixed consumption-investment good, and the attributes of commercial real estate are a function of derived demand. These real estate characteristics make its risk profile, the dynamics of uncertainty surrounding it, and the composition of K, u and U unique across the spectrum of asset classes. Among other distinguishing characteristics of real estate is the extent to which the interplay between real and nominal variables is reflected in prices, although some interplay is indicative for the pricing of many other assets as well; for instance, demographics and financial institutional arrangements have joint, interactive effects in the determination of real estate prices and outputs. The issue of what is known, unknown and unknowable is, of course, significantly different for demographics vis-a-vis financial variables, whether in the context of knowledge as a measurement or a theoretical issue. After all, demographics play a key role in virtually all real estate markets, and are considered to be one of the relatively “known” variables of our times.

Figure 1 provides a schematic overview of our application of the KuU framework to real estate. It suggests that a number of economic and non-economic factors are intertwined in the determination of real estate outcomes. The uncertainty, risk profile and “knowability” of the latter interact with, and are dependent upon the uncertainty of this mix of factors.

there is no accepted paradigm, but there are competing models/concepts, and U where there is an overall absence of a conceptual underpinning or model (See Herring, this volume).

Figure 1

Framework for Analyzing KuU and Real Estate



The reasoning applied to financial markets and the conclusions derived therein, using the KuU approach, are largely applicable to real estate finance and investing. We shall therefore analyze real estate markets, including real estate finance and investment, primarily through the historical prism of the shifting boundaries between what is known, what is unknown and what is unknowable, with a particular focus on what distinguishes real estate markets and real estate investing from the broader world of finance. The motivation for utilizing this framework is to examine both the epistemology of uncertain and risky elements associated with real estate, as well as to analyze the evolution of our understanding of real estate “risk.”

II. Historical Background, or The Evolution of the KuU Real Estate Frontier

The process of discovery is very simple. An unwearied and systematic application of known laws to nature causes the unknown to reveal themselves.

Henry David Thoreau, "A Week on the Concord and Merrimack Rivers" (1849), in *The Writings of Henry David Thoreau*, vol. 1, pp. 387-388.

Development of real estate markets, practices and institutions over time and space has impacted the evolution of the KuU path; from what was once thought to be unknowable, through the simply unknown, and into the realm of the known. Demand and supply factors have affected the relative composition of the three elements of KuU. Our historical approach sheds highlights how several non-economic sources of uncertainty have interacted with real estate markets through the ages.

Over time societal and civilizational advances outside the immediate ambit of real estate have significantly impacted the latter. For instance, the development of property rights for land created the first "defensible property" and marks a seminal moment in real estate markets, in terms of engaging a primary historical element of a fundamental uncertainty involving the trinity of a) usage, b) the benefits accruing from usage, and c) their appropriation. Bowles and Choi (2002) give us the general historical-economic context in which this breakthrough transpires: "...individual property rights provided a better system of coordination among members of groups only after the ambiguity of possession endemic to the hunter gatherer economy was attenuated with the domestication of crops and livestock. Thus it was by clarifying possession that the advent of agriculture may have permitted what we call the first property rights revolution....." It may be the first event in history that clearly enunciates the balance between costs and benefits, and the linkages to risk-taking at the basic level of food and habitat. In the words of Baker

(2003), "...Economists reason that land ownership emerges when the benefits to owning are greater than the costs of defense.the benefits to ownership occur because land use externalities are internalized when land is owned, and the costs of defense are understood as exclusion costs..."³

For many centuries, a major historical uncertainty revolved around the supply of real estate; to wit, the extent of habitable land available in the world. Indeed, we did not fully comprehend the extent of our ignorance of the worldwide supply/availability of land, until perhaps the late middle ages. In terms of our framework, the Unknowable was the completely unanticipated "discovery" of the additional "new world" land supply. Major land masses were being discovered, surprising as it may seem today, until just a few hundred years ago. In addition to this basic unknown/unknowable, as in, for example, the existence of the Americas, there were a few simple unknowns, such as the amount of habitable land in, say, Siberia. Over time, our understanding of the total supply of land has progressed from U to u to K.⁴

Geographic discoveries, war and social revolutions, as well as major socio-cultural developments, have impacted the universe of what was known and what was uncertain about real estate related issues. An illustration of how larger social and economic changes affected real estate markets in the Middle Ages and the composition of uncertainty surrounding them is provided by Fernand Braudel in a memorable passage about the

³ The existence of commons and fuzzy rights to land at various points in time in different countries further illustrates the importance and the impact of societal norms for real estate related issues.

⁴ However, as we discuss later, future environmental changes may affect the supply side in unexpected ways.

early stages of urbanization in Europe in the as yet pre-industrial 16th century –

“...landed estates ended up on the market. ...In Europe as a whole, there are some very revealing price series on land sales and many references to the regular rise in prices. In Spain in 1558 for instance, according to a Venetian ambassador...properties (i.e. land) which used to be sold at 8 to 10%, that is, 12.5 or 10 times their revenue, are now selling at 25 to 20 times their revenue ...they have doubled with the abundance of money...This movement was of course everywhere linked to the economic and social transformation which was dispossessing the old landowners, whether lord or peasant, for the benefit of the new rich from the towns.”⁵ At the time, future social upheavals, including the impending massive rural-urban migration, the changing feudal structure and industrial capitalism were unforeseeable, as was their impact on land and other markets, since the social structure and issues surrounding land ownership were so intricately intertwined.

At a micro-socio level, the evolution of the structure of the family and the household has been another source of unexpected changes on the demand for real estate, particularly in the sphere of housing. Living arrangements have changed dramatically over the centuries, albeit not always along a straightforward and foreseeable path, from a setup involving joint families and households to independent, nuclear families and households, with a concomitant impact on the number of housing units demanded as well as the space allocation per unit. Living space requirements have also been altered by the changing institutions of domestic servitude, which in turn are a function of social changes,

⁵ Braudel (Wheels of Commerce, 1982, p.51).

migration related factors, economic and social inequality, urban structure and the availability of job opportunities.⁶

The creation of specialized real estate was another development that impacted real estate markets in a non-foreseeable way. Separation of commercial and residential real estate was brought about by the rise of professionalization as well as by organizational imperatives. A craftsman's or an artisan's office/workshop and home were often the same, indeed as were the offices of a family business. The changing structure of work, brought about by task specialization and technology, and the re-organization of the workplace, engendered the need to operate cooperatively in a neutral space and provided the impetus for the genesis of warehouse, retail, and later, manufacturing as well as office real estate. The appearance of business organizations, such as partnerships and corporations, the growth of capitalism generally, and the subsequent mushrooming of a white-collar work-force gave the first fillip to demand for office space.

Conquests, discoveries and changing patterns of international trade have transformed the organization of real estate through the location, emergence and development of cities. As George Modelski claims, most of the major cities of the ancient world (between -3500BC to -1200 BC) have disappeared into the mists of time. None of the cities of the earliest civilizations of Mesopotamia, Egypt and the Indus River Valley have retained their importance; indeed, most do not exist today. Most ancient and

⁶ See Ray and Qayum (2007) on domestic servitude. As another example of social practices impacting living arrangements, and hence urban design, Chandler (1987) notes that in earlier days: "Chinese cities ... (had).. an especially low density because of the Chinese refusal to sleep below anyone, so their houses were ... nearly all of just 1 story. Hence, inland Chinese cities had a density of only about 75 per hectare, and even in seaports or the imperial capital the density hardly exceeded 100."

medieval empires were primarily land-based, whether in the case of the territorial campaigns of Alexander of Macedonia or of Chingiz Khan. Most of the major cities of the time were in the hinterland, controlling access to strategic land assets and straddling critical trading routes. On the other hand, for the sea-faring enterprise of relatively modern colonialism, and of modern global economic integration, the logic of trade and development required cities on the coast. The geographical distribution of major cities in pre-colonial and colonial/post colonial India serves as a vivid illustration of how wrenching economic and political changes can affect the urban landscape. Thus appeared the relatively recent Bombays, Calcuttas and Shanghais, replacing the Agras (Agra, where the Taj Mahal is located, was a major city under the Moghul empire) and the Xians (the ancient Imperial Chinese capital). Of course, not all ancient cities have withered away under the churning and dislocating impact of global capitalism. That path dependence is of crucial importance is borne out by examples such as Delhi and Beijing, both historic hinterland cities, yet still retaining their importance.

Apart from social, economic and political changes, technological advances have also modified the uncertainty frontier. The invention of new materials and development of advanced engineering techniques have allowed the construction of skyscrapers, breaking the bondage of building scale to plot size, and leading to intensive land usage. Similarly, developments in the field of finance, such as the creation of fiat money, banking deposits, and promissory notes, have severed the constraints of time and space, and connected those who save to those who invest, leading to the emergence of modern finance, including real estate finance.

A historical approach that embraces broader socio-economic trends is necessary for understanding real estate, which is an integral part of the “structures of daily life.” Such an approach helps us understand that events and circumstances that seemed unknowable or inconceivable, and not merely unknown at various times in history, were so largely because they were not part of the “system”, but dwelled in the realm of other aspects/branches of society, and were in turn impacted by a myriad other unidentified factors.

III. The Present State of Knowledge

This section deals with the present state of our knowledge of the known, unknown and unknowable in real estate, and the concomitant taxonomy of risk. In the general hierarchy of the risk-return dichotomy, it is widely acknowledged that real estate is either lower or on par with the risk-return profile of common stocks, and higher risk-reward than T-bills, municipal bonds, mortgage backed securities and investment grade corporate bonds, in that order. A number of risk attributes are common to real estate investments and financial assets. Some categories of risk that affect real estate are similar to risks for other classes of investment assets, whether it be in common stocks or government securities, and some are specific to real estate.⁷ We summarize these elements of uncertainty in terms of the KuU framework.

Environmental Risk: While some environmental factors may be unknown *a priori*, over time some other environmental parameters may become “apparent” with the advance of

⁷ See Brueggeman and Fisher (2001) for a list of commonly accepted real estate related risks.

medical or geological sciences. The dangers of asbestos, radon, other toxic materials, and seismic fault lines have become better understood over time. The long term risks posed by global warming to coastal communities are yet another category of risks that seem to have migrated from an “unknowable,” in the sense of the absence of any prior epistemological framework, to a mere “unknown” (both in terms of measurement and theory), or a somewhat accepted distribution of probabilities based on simulations, data and related scientific work. However, there may still exist in the realm of the unknowable the future genesis of new diseases and catastrophes that we cannot even imagine today, and which in turn may cause further alterations in migration patterns, living arrangements and urban spaces.

Location Risk: The “location, location, location” mantra can also be read as “risk, risk, risk.” The lumpy, sunk-cost nature of real estate, tied to a particular location, is a defining attribute of real estate, and as such exposes investors to unique multifaceted risks.

Changing demographics, tastes, commuting patterns, idiosyncratic economic shocks can all transform location from desired to shunned, and vice-versa. Of course, the desirability of some real estate locations does not necessarily need to change; there is also some constancy when it comes to a few neighborhoods, which seem to have remained fashionable for decades, if not centuries. While a number of these location drivers may be foreseeable to a certain extent, the overall interplay of myriad mini-uncertainties would suggest that location might be placed in the u category.

Liquidity and Lumpiness Risk: Real estate, being a lumpy asset, at least in its non-securitized form, is subject to more liquidity risk than most asset classes. Particularly in periods of feeble demand conditions, real estate location and product specificity exacerbate the liquidity risk and the expeditious coming together of buyers and sellers. The liquidity risk of residential and commercial real estate can be quite pronounced. For example, residential real estate in the growing California market has had episodes in the early 1980's and early 1990's where its value declined to the order of 20-30%. The most striking feature of these declines was both the reduced availability of traditional financing and significant downturn in sales volume. Much of the liquidity problem relates to the inability (e.g., the S&L crisis) and/or the unwillingness of financial institutions to lend. Paradoxically, these periods of diminished activity have happened during a rising trend for the securitization of real estate, as during the present ongoing subprime crisis of Fall 2007. Hence, the structure of real estate financial deals can sometimes precipitate a move from the realm of the known to the unknown.

Regulatory and Legislative Risk: Zoning regulations, property tax laws, eminent domain, rent control and other "interventions" by government and local authorities are always in a position to affect real estate operations and profitability. Examples abound of how changes in governmental regulations and policy affect the bottom line of real estate owners, lenders, and investors. At the Federal level, in 1982, a set of new income tax laws were introduced in order to stimulate the economy. One of the by products of these laws was a significant increase in depreciation allowances for real estate investments. In the office and apartment sectors, a tight market combined with these new, more generous tax laws created a surge in production of office and apartment buildings, and the

establishment of “tax efficient syndication vehicles.” This boom came to an abrupt halt, in part, because of Federal tax laws passed in 1986, which reduced depreciation allowances and created barriers to tax sheltering through syndications. Ultimately, there was a major and prolonged downturn in the commercial real estate markets.

Other examples of governmental intervention having an impact on real estate markets include local rent control regulations in such cities as San Francisco, Santa Monica, and New York City. To the extent that “*inscrutable are the ways of government, particularly local ones,*” it is debatable whether this category of risks fits under the rubric of an unknown or an unknowable!

Financial Risks: Real estate equity and debt investors confront termination risks caused by complex debt-related options for prepayment and default. Investors in mortgages and mortgage backed securities are subject to an almost unique form of uncertainty and risk, involving prepayment by mortgage borrowers that may alter significantly the future expected revenue stream. The importance of a correct assessment of the prepayment speed is underscored by the fact that unanticipated prepayment changes and incorrect pricing of the prepayment risk can lead to increased investor cash flow volatility, and uncertainty in mortgage security markets. Highly sophisticated models, both theoretical and empirical, have evolved to improve the evaluating of the prepayment risk, including callable bond models, compound options, hazard models and so-forth.⁸

Perhaps the most interesting dilemma for prepayment analysis is the apparent periodic breakdown of sophisticated statistical prepayment models. This, in part, is the result of the changing nature of the real estate financial system, i.e., a general easing of

⁸ For some examples, see Chinloy (1989), Hall and Lunstedt (2005).

the availability of credit for commercial real estate investing as well as for residential ownership. As the financial market changes, the “old” prepayment models, predicated upon statistical behavioral relationships of the past will tend to have major breakdowns. Dynamically, KuU in this context is a renewal process by which one moves from uncertainties to a better understanding of prepayment behavior, only to have your knowledge shattered by a world in flux driving you back to previous levels of knowledge about prepayment risk. However, a number of research advances in the field of prepayment modeling have generated a critical mass of insights for understanding the risk associated with prepayment; prepayment risk may therefore be slotted in the K and small u category.

In much of securitized real estate with credit enhancement, default risk is not an issue. However, for large financial institutions such as Fannie Mae or Freddie Mac, with significant portfolio positions, a “bust” in the housing market can expose them to significant credit risk. Similarly, in commercial real estate, yield maintenance for mortgages and/or defeasance clauses mitigate prepayment risks for the lender or debt investor. However, large scale single property real estate debt instruments create significant credit risk, as in the growing CMBS Commercial Mortgage-Backed Security market, and the more recent Commercial Real Estate Collateralized Debt Obligation market. These types of securitized debt instruments have been utilized with increasing frequency in large transactions for privatizing public REIT’s. Thus, the nature of credit risk is changing substantially in unanticipated ways, requiring constant dynamic updating

for investors, as they attempt to readjust knowledge about credit risk into the known category.

Business Risk: Commercial real estate demand is derived demand, ultimately emanating from the state of health of the user-business sectors. Unanticipated shocks to businesses, industries, sectors, occupations and regions may adversely affect rents and values, and hence real estate investor returns. The overall business risk of a real estate entity is a combination of economic market risk and financial risk. Put somewhat differently, if one were to construct an office building in a particular city or location, the economic markets that create derived demand for office space will determine the economic performance of your building. The heterogeneous nature of real estate and the complex linkages to different kinds of business activity, as well as the myriad variables that enter in forecasting business activity, squarely places the science of gauging this particular risk in the category of an unknown, since many of the “probabilities” are unknown and there is no universally accepted model.

Macro Risks: The nexus between the larger macro-economy and the real estate sector is magnified by the size of the latter, and its role in both the investment and consumption segments of the national accounts. The latter mitigates the risk element to the extent that even if the investment returns are under threat, the consumption benefits are vulnerable only in cases of catastrophic events (which are dealt with elsewhere in this volume). One of the most significant channels through which the macro- economy affects real estate is via credit markets and through the medium of interest rates. Obviously, interest rates

being an integral “cost element” of the economy tend to affect all economic activity; however, real estate is typically highly leveraged and is especially sensitive to interest rate changes. In other words, standard financial risk in the form of debt financing is a common, substantial component of the risk structure of real estate investments.

Unexpected inflation risk can adversely impact returns if the revenue streams do not compensate sufficiently to counter the negative effect of changing inflation expectations on interest rates, and required yields. While inflation is also a common risk shared with other kinds of investment, real estate lease indexation may allow operating income to adjust for unexpected changes in inflation. Like most other sectors, real estate is also vulnerable to unforeseeable, unanticipated, adverse supply shocks, whether originating in environmental/resource markets in the normal course or as a result of natural or manmade disasters.

The recently fizzled boom in housing markets in many countries and in certain regional markets in the US raised concerns about the unknown risks from a potential housing bubble. There is no clear consensus on the criteria for designating whether this was a bubble; some point at sound fundamentals, such as the backlog of an affluent home buying age cohort from the tech boom of the 1990s, the regulatory constraints on supply, the easy availability of credit, and the historically low mortgage rates. The inherently uncertain nature of social psychology and mass “psychosis” linked to fleeting interactions and possible arbitrary changes in household decisions make the “boom” a decidedly “unknown” category and perhaps an unknowable, *ex ante*.

Again, history has several interesting examples of financial bubbles, including in real estate markets. Seventeenth century Holland was perhaps the richest country in the world as a result of the lucrative trade between Europe and the spice and textile centers of Asia. The influx of goods, the spread of affluence, the development of financial markets, and the feverish speculative atmosphere led to an upward price spiral for real estate. The devastating impact of the plague and the sobering effect of the tulip mania combined to burst that bubble. “In the wake of these twin calamities, house prices dropped 36 percent”.. Piet Eichholtz says that this historical episode — in which unpredictable disasters combine unpredictably — has relevance for today. "It's true that economic and social conditions were different back then. But major crises do happen, and we can't necessarily predict them. Will bird flu be a major disaster? Will there be more hurricanes? I don't know. Nobody knows." (Amsterdam House; This Very, Very Old House; NYTimes, March 5, 2006, by Russell Shorto)

While the interaction of “real” and “nominal” variables insinuates itself into risk analysis for many kinds of investment, it is a distinguishing hallmark of real estate markets. Part of the dichotomy of nominal and real variables is the asymmetry between the rapid response (i.e., the almost instantaneous adjusting financial markets) and the slow or sluggishly adjusting markets (e.g., in real estate), particularly during declines. Observed transactions for housing prices, for example, do not decline as rapidly as they rise, with much of the downside risk being borne by occupants who choose to ride it out.

Globalization and Real Estate: The two major forces driving the new global economy are – i) increasing global economic and financial integration, seen in the huge upsurge of international trade and investment, and ii) the rapid development and dissemination of new technologies, particularly advances in information technology. Both have tended to influence real estate in unexpected ways, increasing the uncertainty about the potential impact on real estate in the future.

Economic research is beginning to take cognizance of the effect of global economic and financial integration on real estate markets. While non-tradable, localized real estate might seem immune to the forces of globalization, increasing integration of financial and economic activities has altered significantly both real estate investments and real estate markets. Global transactions have now extended their influence to the real estate sector, resulting in cross-border investments in real estate, international development projects, and multi-national real estate ventures, as well as internationally funded housing developments.

Bardhan, Edelstein and Leung (2004) show that openness has a positive impact on urban rents because of the relative supply inelasticity of real estate, emanating from its unimportable/non-tradable nature, and Bardhan, Edelstein and Tsang (forthcoming 2008) provide tentative evidence that excess returns (i.e., the risk premium) of publicly traded real estate firms decrease with openness, after adjusting for effects of global capital markets, domestic macro-economic, and firm-specific variables, as well as international currency arbitrage. The finding is consistent with increasing global financial integration and cross-border capital flows. Yet another evolving branch of literature analyzes the impact of global sourcing of industrial supply-chains on industrial clusters and agglomerations, and the consequent impact on urban space and real estate demand.

Globalization and technological changes have substantially reduced transportation and communications costs, and have led to increased labor mobility/migration connected to more efficient markets as well as greater integration of national real estate markets. Another indirect path by which global developments and integrated markets affect the evolution of urban space and real estate is through the impact of the secular rise in energy prices, caused in part by the increasing demand from the dynamic growing economies of Asia.

Technology and Real Estate: The Internet, and its related technological developments, are now being used by the real estate industry for purposes of marketing, as a communication medium, and as a platform for collaborative activity resulting in new firms creating new forms of value. The interaction and interplay of the Internet and the real estate industry has the potential to alter market composition, economic variables and

organizational structure in ways that are not entirely foreseeable. Much of our assessment is therefore of a speculative nature because of the “unknown” and perhaps even “unknowable” nature of the interaction of the many factors involved, as well as the paucity of available data, the relative novelty of the topic, and the unpredictable ways in which any new, general purpose technology can develop and impact the economy.

The lowering of transactions and search costs, the easier, instantaneous access to information, could possibly lead to a shortening of the transaction cycle and may perhaps even lead to a lower, “natural” vacancy rate, due to the lowering of the frictional component in matching buyers and sellers. The disintermediating effect of the Internet has led the brokerage community to restructure their operations, and there is tentative evidence that growth in E-commerce has led to a shift in demand from retail to warehousing space for certain goods and commodities. The greater geographic reach induced by the usage of the Internet in real estate transactions can lead to greater tradability and turnover, increase market depth and geographic mobility, and perhaps can mitigate differences in returns across regions. On the other hand, the informational and geographic disconnect brought about by globalization and complex securitization means that the ultimate owner-investors and lenders have little knowledge of the underlying characteristics of the originated loan, and in case of crisis, little possibility of cooperative restructuring.

The following figure summarizes the list of variables impacting real estate and classifies them in the KuU framework. Demographics are at one end of the spectrum, as a factor that is known (K) in terms of its future evolution and possible impact on real estate; and environmental and catastrophic shocks, the possibility of major global economic and

technological developments and socio-cultural trends occupy the other end of the spectrum.

Many aspects of uncertainty, as well as the specific risks enumerated earlier fit into a standard litany of real estate related risks. Demographics, for example, are a vital determinant of real estate demand, and are believed to be relatively deterministic. The magnitude of the home buying age cohort in the general population 20 years from now is known with reasonable certitude, and hence, its impact on real estate demand is “known”. Hedonic index models for real estate prices as functions of real attributes, such as the number of rooms and floor area generate “known” price distributions. Benchmarking models are another attempt at applying what is known for developed countries as a whole, say regarding the proportion of outstanding mortgage volumes or home-ownership rates as a function of demographic, economic, financial and real estate variables, to countries with embryonic real estate markets. Once a reliable, well behaved empirical relationship for the mortgage markets in developed countries is created, one can estimate mortgage market potential for developing countries with fledgling real estate markets. The implicit assumption of such analysis is that the structural relationships between the variables for emerging economies should be as in the developed countries. The intuition is that there are “universal” proportions or ratios, and that there is a stable relationship that implies a cross-country “known” phenomenon.⁹

This summary might be subjective and debatable; variables that we designated as U might be disputed by many economists as belonging to u. “There are few potential events that we cannot ascribe some heuristic level of probability to...,” seems to be the refrain among many of our colleagues. Also, as pointed out by scientists in other non-

⁹ See Jaffee and Levonian (2001).

social science disciplines, many events are in U space because of the “real time computing” constraints, such as in investment decisions, weather forecasting and so-forth.

Selective, Subjective Summary of KuU in Real Estate

- Demographics (K)
- New Materials and Engineering Advances can radically alter notions of space, affecting both supply and demand in a known, sometimes unknown, and perhaps unknowable manner (K, u, U)
- New Kinds of Financing - Reverse mortgages may affect legacy behaviour in unknown ways (this is probably u not U)
- Globalization and Tradability of real estate - It is still location, location, location but just not local, local, local any more! (u)
- Prepayment Related Issues (K, u)
- Environmental Shocks and Catastrophic Issues (some u some U)
- Social Trends (u, U)

IV. Concluding Remarks and Looking Forward: Dealing with the unknown and the Unknowable

There is a chasm between knowledge and ignorance which the arches of science can never span. Henry David Thoreau (1817–1862), U.S. philosopher, author, naturalist.

As Barrow (1999) points out, the sign of maturity in science has been the recognition of ultimate barriers, the attempt to find limits to its own usefulness, and for its formulas to "predict that there are things which they cannot predict, observations which cannot be made, statements whose truth they can neither affirm nor deny." The path-breaking works of Godel, Heisenberg and Turing have given us a series of theoretical insights and technical results dealing with impossibility, uncertainty, undecidability and intractability (see Merry, 1995). But as Traub (1997) suggests, these results concern formal systems and it is not clear what the implications are for the social sciences, in general, and

economics and finance, in particular – “Typically students learn what is *known* in science while scientists study the *unknown*. An area that is starting to be explored is what is *unknowable* in principle.” It does not necessarily follow that these circumscribing theorems limit our search for knowledge in any way. Perhaps, as in music, where it is only after one knows the constraints that one can be aesthetically creative, perhaps it is only after the unknowable is delineated in science that one can effectively probe the mere “unknown” in the universe, and, dare one say it – even in matters pertaining to the social sciences.¹⁰

In the context of the present research agenda it is imperative to delineate the factors that will guide us in this journey into the unknown, and to create solutions for modeling unknowable and unknown supply shocks and demand uncertainties in real estate markets in the future, as well as formulate long-term policies and strategies to deal with them. A number of issues arise when the future of real estate investing and management is explored through the KuU prism - how does one design and promote appropriate governance structures, new institutional arrangements, provision of insurance and a social safety net to better manage risk in real estate? The possibility of catastrophic environmental and geological events, as well as the emergence and spread of contagions of unknown origin bring to the fore the role of the state or government structures in preparing for, managing, containing and rolling-back their adverse impact on life and property. The rapid global dissemination and impact of local events and their negative fallout suggests that flexibility, dynamism and expeditious responsiveness by private and public authorities will be essential. Perhaps, there is role for joint public-private

¹⁰ The musical parallel is attributed to Isaac Stern, the violinist.

partnerships and cooperation in risk mitigation, particularly in preparation for major unforeseen occurrences. The high proportion of wealth held in real estate, as well as its wide and relatively more egalitarian ownership globally, compared to financial and other assets, may lead to calls for some modicum of social insurance for mitigating adverse effects of unpredictable events.

Many of the new approaches and techniques to risk mitigation and management that are being considered in an increasingly interconnected, and hence somewhat more uncertain world, are common to the universe of real estate, as well as to the world of finance. New kinds of contractual arrangements may arise in the face of the unknown and unknowable, as well as in response to new developments in risk sharing, global diversification, securitization, opening up of new markets and-so forth. Contractual incompleteness, while usually arising from transactions costs, and which can dwarf the benefits of contracting for each and every contingency, is also caused by the uncertain states of the world. As Scott (2006) argues, "...in reality, contracting parties confront a vexing problem: The future is unknown and unknowable. As a result, when the level of uncertainty is high, it simply costs too much for contracting parties to foresee and then describe appropriately the contractual outcomes for all (or even most) of the possible states of the world that might materialize." Economists and legal experts have made considerable contributions to the theory and practice of optimal contracting under the complex and uncertain conditions confronting businesses and investors today, whether it is in analyzing the pros and cons of soft and flexible contractual terms or issues of enforcement. Further developments in this field can provide methods for dealing with these contractual issues in an efficient and equitable manner, reconciling different

incentive structures, ownership schemes, range of contingencies, and the specifics of the real estate and real estate finance business.

Innovations arise both in the realms of technology and society. In the latter case, the wellspring of innovation could reside in preferences, social arrangements, the polity, or the panoply of social, political and economic rules that govern human societies. Interactions of mere unknowns can give rise to unknowables. The long-term impact of the one-child policy in China, which may lead to a unique situation in human history with future generations devoid of siblings, cousins, uncles and aunts, is unclear. New combinations of uncertainties may be precipitated by evolving financing arrangements, such as reverse annuity mortgages; these instruments are impacted by socio-cultural intergenerational developments, legacy issues and broader social security related matters. These factors in turn might provide scope for co-operative behavior (e.g., loss sharing or contingent financing) both for individuals and institutions in order to adjust to the unknown, and as potential arrangements that are seen as mutually beneficial.

Rapid economic growth in emerging economies and the entry of India and China into the global economic system has had an impact on everything from prices for natural resources to global interest rates; rising energy prices might yet hold interesting implications for location, density and sprawl in the industrialized world. As an aside, it may be mentioned that the field of study of emerging economies, particularly regarding economic and financial issues, is skewed in favor of the “known”, primarily because of the benchmarking method mentioned earlier. The understanding is that many of the features and structural attributes of developed economies will be adopted by emerging

economies, including trends, such as decreasing household size, and variables such as the proportion and weight of services sectors, the home-ownership rate and so-on.

There are, of course, some aspects in the search for the unknowable that might be classified as trivial: for example, the intrinsic unknowability of the future or the irreversibility of time. The question acquires an intriguing dimension only when we approach the boundary between the unknown and the unknowable, and can demarcate the two. That the present U.S. housing boom was unsustainable is certainly K after the fact, but an ex-ante separation of the factors, that go into the making of housing price levels into the known, the unknown but discernible, assessable and mediable through a probabilistic approach, and the unknowable, enhances effective management of risk in general. As Crockett (this volume) argues, risk management by and large tries to shift risks that are considered unknown into the category of known risks, and tries to mitigate the costs associated with things that remain unknown; one might add that the expanded taxonomy including the unknowable promotes the further mitigation of search costs and proper allocation of intellectual and financial resources. The complicated interplay of social, cultural, technological and other factors impacting real estate, a recurring theme of this paper, seems to complement Zeckhauser's analysis regarding the complementary skills determining who will be the winners among investors of the future. Generalist skills that can connect many fields and exercise judgement on "out of the system" probabilities in the sphere of society and polity may be prized more in the future, raising questions about how to inculcate such skills through training and education programs.

Apart from systematic scientific inquiry, as suggested by the Thoreau quotation earlier, it is not clear what kind of causal mechanism lies behind the progression from U to u and thence to K. If one accepts that there are two kinds of unknowables – U that are unknowable either in the trivial sense mentioned before, or as a matter of accepted scientific principles and reasoning; and U that are a result of the “barriers of age and technology,” then while the movement from the merely unknown to the Known is relatively systematic, the movement out of U would seem to be more a result of broad social evolution – the cross-pollination of ideas and activities in often unrelated human endeavors. In other words, it is very often the “law of unintended knowledge spillovers” that seems to mitigate the unknowable space. A broad-fronted social and ecological evolution can throw up surprises, such as the possibility of regression from K back to the unknown. For example, it is ironic that the knowledge of the total supply of land, mentioned at the beginning of this paper as having evolved from U to u to K, may have now partially reverted to that previous uncertain state. Although heavily debated, the possibility that global warming may negatively impact habitable coastal land availability cannot be completely discounted.

Part of the problem in applying the KuU framework to the social sciences could be that the subject matter itself gets affected by the process of our studying it through the agency of rational interacting actors. On the one hand, as Gomory says – “We are likely to build an increasingly artificial, and hence increasingly knowable, world...,” but on the other, technological developments and globalization of real estate and financial markets will lead to increased participation and interactions of large networks of organizations and

individuals, rendering many processes less governable and the issue of understanding outcomes more complex and unpredictable.

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