School of Business
Upper Montclair, New Jersey 07043

The Role of Risk in the Choice of Optimal State-Market Relations

A presentation at the 6th International Conference
on Global Business and Economic Development,
"States and Markets: Forging Partnerships for Sustainable Development"
Bratislava, Slovakia, November 7-10, 2001

August 2001

Phillip LeBel, Ph.D.
Professor of Economics
Department of Economics and Finance
Lebelp@mail.montclair.edu
http://alpha.montclair.edu/~lebelp/plebel.html

Abstract

Optimal roles of the public and private sectors to achieve sustainable economic growth depend on the level and distribution of risk across agents. In this paper, we build on the framework of general equilibrium to incorporate the role of risk in the determination of relative prices. Where risk is abnormally distributed by level across agents in time and space, market prices will deviate from a Pareto-optimal allocation. Whether this justifies public sector intervention depends not just on the specification of the level and distribution of risk, but also on the transactions costs of correction. We provide some preliminary evidence on the role of risk as it relates to property rights and economic growth to support the notion of growth as dependent on property rights and economic flexibility. In turn, we find that property rights depend on the level of judicial independence and the underlying degree of confiscation and contract repudiation risk. Economic reform in developing and emerging market economies thus depends ultimately on establishing civil society institutions that provide a consistent framework for the allocation of property rights. Where risk is explicitly considered in the formation of property rights, market prices will be closer to a Pareto-equivalent allocation of resources.

The Role of Risk in the Choice of Optimal State-Market Relations

Introduction

For some time, underlying perceptions of risk and uncertainty have shaped public attitudes toward the role of the state in economic decisions. Interestingly, explicit measures of risk often are absent in such discussions. Consequently, public policy choices often are framed in some larger ideological context in which neither markets nor the public sector could be held consistently accountable for outcomes[1]. Such is the debate that has taken place regarding structural adjustment in developing and in emerging market economies[2]. In this paper, we propose a framework that incorporates risk in the evaluation of traditional economic functions of the public sector. We contend that it is not risk *per se* that determines the roles of states and markets, but rather the abnormality of the underlying probability distributions associated with the allocation of resources. With this framework in mind, we provide some empirical evidence regarding the direction of optimal state-market relations. In so doing, we seek to clarify the choice of optimal public and private sector partnerships for sustainable economic development.

Competitive General Equilibrium

With due allowance for distributive justice, Pareto optimality traditionally serves as the first best standard for economic efficiency.[3] For a given distribution of assets, economic efficiency is achieved in an environment by an institutional structure of prices that produces the maximum level of production at the lowest social cost. In turn, dynamic sustainability embodies the selection of a set of economically efficient prices such that growth occurs as a weighted function of the prevailing rate of interest and technical change.

Figure 1

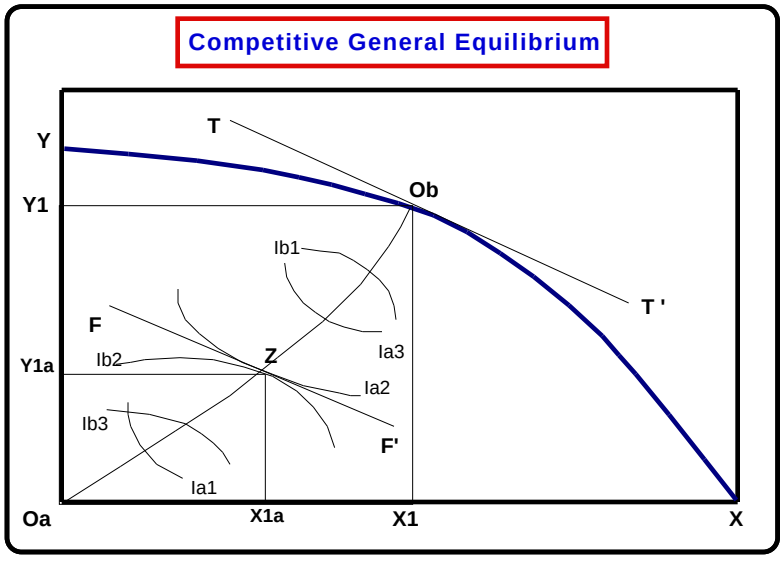


Figure 1 illustrates static economic efficiency within a competitive general equilibrium framework[4]. In a world of perfect information and in which there are neither externalities nor economies of scale or scope, all possible outcomes are known at the outset, including those over time. Society's production possibilities frontier YX defines the range of output choices under a given technology and degree of input specialization. Selection of a particular output combination such as at Ob determines Y1 and X1 levels of goods Y and X. In turn, individuals a and b arrive at a particular distribution of income through an established social contract, which in turn determines the maximum level of social welfare, shown here at point Z, the tangency of the respective highest indifference curves for the respective goods for the respective individuals[5]. All other combinations are inefficient in that they are either non-intersecting or do not intersect on the social contract curve. The line FF' defines the equality of the marginal rates of substitution for the respective goods for the respective individuals. This marginal rate of substitution is equal in turn to the opportunity cost of production, or marginal rate of transformation, at point Ob, and is defined by the line TT'.

Competitive general equilibrium also requires equality of the respective marginal products to their corresponding input prices across producing units, as well as the distribution of input utilization across producers. To do so, one could replicate figure 1, but in the box OaY1ObX1 specify the respective isoquants of the respective producers where the rays OaYa and OaXa specify the corresponding inputs used in production, which for purposes of geometric simplicity, are limited to two. The slopes of these respective isoquants portray the marginal rates of technical substitution in the use of inputs for a given level of output. Taken together, competitive general equilibrium produces for a given income distribution and distribution of inputs across producers an equality of the respective marginal rates of substitution, the respective marginal rates of technical substitution, and the marginal rate of transformation.

In a dynamic world of certainty, the above conditions are modified through the use of discounted present values of utility in consumption and with discounted net benefits of investment equated at the opportunity cost of capital and other inputs in production. In turn, the economy's expansion path is determined by the rate of capital accumulation at the current rate of discount and by the rate of technical change in production[6].

Risk in the Context of General Equilibrium

Risk arises in both a static and dynamic context when a probability distribution of alternative possible events replaces the certain outcome of a decision in space and time. In the framework of Arrow-Debreu-MeKenzie, or ADM, a Pareto-equivalent allocation of resources can be achieved through use of contingent spot and forward markets that reflect relevant events of various underlying probability distributions. Although the same physical good delivered in different

states of nature or time is treated as a different commodity, as long as the number of markets corresponds to the number of contingent outcomes, and as long as the level of information on the underlying probability distributions is known in equal degree among all agents, the ADM framework suggests that there is no *a priori* basis for public sector intervention.

Adoption of a continuous-time environment, as illustrated, for example, in the option price models of Merton (1973), and Black and Scholes (1973), does little to alter the basic propositions of the ADM framework. In continuous-time, effectively complete markets are achieved by trading extensively and continually in space and time. As long as the number of markets corresponds approximately to the number of contingent events, a Pareto equivalent, or constrained, equilibrium will be achieved on a continuous basis.

As appealing as the contingent continuous-time framework may be, it does not follow that it automatically will produce a Pareto constrained competitive general equilibrium. The basic context for such failure is the presence of incomplete markets, a notion dating back to Bator (1958).[7] In its more recent formulation (Magill and Quinzii, 1996), incomplete markets exist as long as there are incomplete contracts to cover all commodities in time-contingent space.[8] Incomplete contracts produce deviations from the standard Pareto requirement of equality of respective marginal rates of substitution, marginal rates of technical substitution, and marginal rates of transformation. As such, they result in a lower level of output that could be achieved with a more efficient set of prices. At the same time, even in the presence of incomplete markets, it does not follow that public sector intervention automatically can restore conditions to a Pareto constrained competitive general equilibrium, for reasons which we will set out subsequently[9].

Why do incomplete markets exist? The simplest explanation is the presence of significant transaction costs. If transaction costs exceed the perceived benefit of creating contracts that cover all possible contingencies, then markets will be incomplete. Contracts thus contain both explicit and implicit commitments since the marginal cost of perfect information may approach infinity. Coase (1937, 1960) and Williamson (1975) emphasize the role of transaction costs in determining not only the shape and structure of market institutions, but also the extent to which they determine whether public sector intervention may be warranted.[10] Even in the presence of externalities, Coase (1960) argued that as long as transaction costs are not relatively high, agents might find a way to arrive at an efficient allocation of resources without public sector intervention. The question is what determines the level of relatively high transaction costs and under what conditions is public sector intervention warranted.

Transaction costs depend partly on the institutional efficiency of contracting and partly on the level and distribution of risk. In turn, the institutional efficiency of contracting depends on the degree of transparency and consistency in the specification and allocation of property rights. At the same time, transparency and consistency in property rights depend on the actual and perceived level and distribution of risk. Pareto optimality thus depends on a sequential hierarchy of institutions and decisions. Simply stated, efficient prices are a function of both production and transaction costs. In turn, transaction costs are a function of the degree of transparency and consistency in the specification of property rights. Transparency and consistency in the specification of property rights are a function of the perceived level and distribution of risk. In our view, the challenge of defining Pareto efficient prices turns ultimately on the measurement of risk and uncertainty in a dynamic setting through the above-defined sequence of causality. How well risk is measured and incorporated into prices thus determines the appropriate boundaries of public and private sector roles in the allocation of resources.

What do we know about risk and do market prices incorporate risk sufficiently to achieve a Pareto allocation of resources? Most risk management models are based on the assumption of standard Gaussian normal distributions. Whether for spot, forward, or contingent markets, asset prices typically contain a risk premium that reflects understanding and assumptions regarding the underlying probability distribution of alternative events. Insurance markets exist to hedge against risk, while risk premia compensate agents for taking additional risk. However, if the true probability distribution of an event is non-standard, or idiosyncratic, and agents hold heterogeneous perceptions, then the resulting structure of prices is likely to be inefficient. Skewness and kurtosis typify non-standard distributions, and can exist in the presence of insufficient sample size, relatively unique events such as economic innovation, and under conditions of asymmetric information across agents. In turn, for both standard and non-standard distributions, where perceptions of the underlying form differ across agents, then the resulting Pareto inefficient prices will produce a misallocation of resources.

We add further that consumer preferences may not be consistent over time, thus presenting an aggregation problem. Prospect theory, which Kahnemann and Tversky (1979) propose as an alternative to the standard expected utility model, draws on insights developed by Friedman and Savage (1948)[11]. Non-expected utility theory suggests that we may not be able to draw on classical statistical models to explain human behavior, which suggests that markets may not follow the standard rationality assumption. This becomes particularly difficult in the context of heterogeneous expectations across agents, and provides a basis of why markets may fail in the presence of asymmetric information.

Failure to achieve homogeneous perceptions of a probability distribution across agents arises in the case of adverse selection and moral hazard. Both cases illustrate the principal-agent problem when incentive compatible contracts may be difficult to conclude. Under such circumstances, agents face the problem of Simon's (1957) bounded rationality, leading to second-order satisficing choices rather than first-order Pareto-maximizing conditions.[12] As such, satisficing behavior does not constitute evidence of market failure.

Bounded rationality involves three types of limitations: 1. Limits on the knowledge that an agent has regarding the environment; 2. Limits on an agent's ability to envision what the future may hold; 3. Limits on an agent's ability to calculate optimal strategies to respond to a complex decision environment. Asymmetric information is embodied in the first. Incomplete contracts define the second and the third. All contracts embody both explicit and implicit elements. Because no agent has perfect foresight and because the marginal transactions cost of perfect foresight approach infinity, effective execution and monitoring of contracts relies in the last instance on implicit rules. For this reason, most agents prefer to rely on contracts with limited commitment about the future, and to execute complex decisions through sequential actions, relying on the outcome of one stage to redefine the level of knowledge for the next, much as is suggested in Bayesian rather than in classical distribution theory.

The above framework holds true not just in a static decision environment. It holds as well for asset price fluctuations. If information is limited and agents are information bound in sequential decision-time, then asset price fluctuations can be considered rational (Garber, Woodward).[13]

As long as risk is symmetric, there is no a priori reason for public sector intervention in the allocation of resources to achieve a Pareto efficient allocation of resources. The problem is that imperfect information rarely is symmetric, and it is at this level that the case for public sector intervention becomes relevant. Moreover, we can use asymmetric information to evaluate standard arguments involving the extent of market versus government failure.

The Role of Risk in Public Sector Economic Functions

Standard arguments for public sector intervention can be grouped under five basic functions[14]. They are: 1. Rules for an orderly operation of markets; 2. Intervention in support of an efficient allocation of resources; 3. Intervention in support of an equitable distribution of income; 4. Fiscal and monetary policies to achieve macroeconomic stabilization and economic growth; and 5. Taxes and subsidies to promote an efficient composition of production in the presence of externalities. We contend that each function depends on the nature of risk and on the institutions for its efficient pricing. Historical arguments invoking these functions typically have

not provided explicit measures of risk, which have made problematic the question of accountability and efficiency.

The first function relies on public sector rules that define the level and allocation of property rights. It includes the economics of contracts in general (Salanié, 1997), and in particular the assignment of rights and responsibilities for issues such as patent protection and product liability under different economic structures such as corporations, partnerships, and proprietorships[15]. The literature on this function is extensive, and covers the limits of contracts in the presence of asymmetric information, notably the presence of adverse selection and moral hazard[16]. The literature shows generally that where search costs are significant, asymmetric information is likely to lead to market failure. Regulation regarding disclosure may result in achieving Pareto-equivalent economic efficiency, but rarely are the costs of regulation measured against the perceived level of benefits. Moreover, as transaction costs fall, regulatory standards often fail to take into account the reputational consequences of mis-priced resources[17]. Even where risk assessments are undertaken to assess the role of regulation, little distinction is given to the normality or abnormality of the underlying probability distributions.

One difficulty with regulatory standards is that the level and distribution of information can change over time, thus leading to regulatory inefficiency. Where transaction costs are falling (and transparency is increasing), there is a reduced need for regulation. Regulatory processes often are slow to adapt to new information, in which case, continued regulation causes deviations from a Pareto-equivalent outcome.[18]. Finally, there is a trade-off between transparency that would lead to a reduction in information asymmetry and economic efficiency (Bordignon and Minelli, 2000)[19]. Simply put, the relationship between transparency and efficiency may be quadratic rather than inversely linear. Up to a point, regulation may provide Pareto-increasing equilibria, after which increasing deviations will occur.

Promoting competition, the second public sector function, focuses on the extent of imperfect competition in the presence or absence of economies of scale and/or scope[20]. While the tools put forth to promote competition, e.g. antitrust, regulation, taxes and subsidies, and public ownership, are extensive, they evolved in an environment in which transactions costs and the role of risk were not taken into consideration. Building on the framework of transaction costs developed by Coase (1937) and Williamson (1975), Tirole (1988) offers a more contemporary synthesis[21]. The modern theory characterizes firms as institutions that pursue the efficient allocation of resources under the constraint of incomplete contracts. This literature on market structure uses the foundation of transaction costs and demand to determine the number of firms, implying that quasi-economic efficiency will be achieved under a variety of market structures, depending on the internal and external transactions costs.

One basic finding of the literature is that government intervention built on principles of antitrust, regulation, taxes and subsidies, and/or public ownership will be inefficient in that it fails to take into account the role of transactions costs. Since risk is a transaction cost, as long as it is symmetrically distributed, the presence of imperfect competition *per se*, as measured by traditional indices of market power, does not constitute economic inefficiency. Moreover, the presence of imperfect information also may be a key characteristic to the innovation of firms and for which economic rates of return are justifiable, as Schumpeter (1912) long ago argued[22]. However, where information is imperfect and asymmetrically distributed and where transaction costs are relatively high, then the case for public sector intervention may be more compelling. Equally important, it may not depend on a given degree of market concentration, a conclusion at odds with conventional notions of monopoly[23].

The question of the optimal distribution of income illustrates more directly attitudes toward risk. At any given moment, the prevailing distribution of income (and wealth) is a function of some combination of skill and chance, and which may be reinforced or undermined by prevailing public policy as it applies to taxation and re-distributive spending. Absent a compelling case that imperfect competition is the principal cause of income inequality, a useful way of looking at the role of government in affecting the distribution of income is that in the aggregate, individuals display a higher degree of risk aversion than they do on an individual basis. Whether the distribution of income and wealth can be fairly characterized as a public good (Thurow, 1971), or whether it simply reflects differences in individual versus aggregate preferences is a question that economics may not be capable of resolving, as Bergson (1938) and Samuelson (1938) long ago pointed out[24]. What is known is that extremes of economic equality and economic inequality may impose social costs such as reduced rates of economic growth.

One approach to the question of optimal income distribution is to derive a model that explicitly incorporates the social aversion to risk. Drawing on the work of Pratt (1964), Atkinson (1970) proposed a model of income distribution in which society's rate of inequality preference could be modeled explicitly as a function of underlying attitudes toward risk[25]. Atkinson's formulation leaves open the question of the optimal degree of income inequality, though others, notably Rawls (1971) and Sen (1973) have offered philosophic reasons for reducing existing levels[26]. As we have noted, a Pareto optimal allocation of resources can be achieved under a variety of distributions. The question thus becomes one of individual and social degrees of aversion toward risk and the conditions that give rise to it. It also depends on the underlying social structure and sense of community interdependence. If an individual's utility depends directly not just on the own-consumption of goods but also directly on the consumption of other

individuals, whether public sector intervention may be needed to achieve a socially optimal distribution may be problematic.

The fourth function, public sector intervention to achieve stabilization and economic growth, embodies again underlying attitudes toward risk. Until recently, most discussions of economic stabilization focused on the respective roles of fiscal and monetary policy (Keynes, 1936; Friedman, 1956)[27]. However, once risk is taken into consideration, one can apply the notion of rational expectations (Muth, 1961; Lucas, 1972; Sargent, 1975), to formulate quasi-efficient outcomes[28]. Whether public sector intervention is efficient depends on the dynamic problem of measuring the benefits of reductions in fluctuations against the costs of public sector monetary and/or fiscal policy intervention through reduced levels of output over time.

At this macroeconomic level, the search has been for transparent rules that over time minimize instabilities of inflation and unemployment consistent with an economy's underlying potential rate of growth. Some (Friedman, 1960; Brunner, 1968; Lucas, 1980) have suggested a simple long-term money supply growth rule, compensating where necessary, for the offsetting effects of fiscal policy, to minimize the inflation-unemployment rate instability pattern. Where the debate between monetary versus fiscal policy was once highly joined, in more recent years, the trend has been to shift toward a greater reliance on monetary policy to achieve economic stability, leaving fiscal policy with greater emphasis on the questions of income distribution and externalities.

Even as most countries settle on some form of monetary growth rules to achieve economic stabilization, this leaves open is the extent to which public sector intervention is warranted in terms of an economy's rate of innovation. Here the question is whether market-driven investment, which by definition embodies a degree of risk about the future, can be efficient. Dixit and Pindyck (1994) suggest that as long as financial option contracts are available, firm's can shape investment decisions at least as efficiently as any degree of government intervention[29]. At a more macroeconomic level, Aghion and Howitt (1998) develop models of growth in which Schumpeterian uncertainty plays a role in the determination of rates of investment and growth[30]. What often is missing is how to establish suitable market institutions such as financial options contracts that can more efficiently fulfill the allocation of resources over time in comparison to traditional tools such as price controls or targeted and non-targeted subsidies. Unless one can make a credible case that state agents have more information than market agents do, then fluctuations in output and asset values may still be Pareto-superior to public sector intervention.

The fifth and final function, the use of taxes and subsidies to promote an efficient composition of markets, reflects the classic problem of externalities and public goods. Here,

markets may be incomplete in that the costs and benefits are not fully embodied in market prices such that there will be a socially optimal under or over-supply. Negative externalities in the form of environmental pollution and congestion typically have been addressed with both regulation and taxes. However, growing awareness of the stochastic nature of these externalities has given rise to the use of market tradable pollution permits, which provides decentralized flexible arrangements to evaluate and re-allocate them to achieve a socially efficient outcome.

On the opposite side is the question of positive externalities in the form of quasi-public and pure public goods. Here again, we can invoke the role of risk. For quasi-public goods such as health and education, the standard argument is that only through public sector intervention can the external benefits be internalized. In our view, how individuals perceive the level of risk shapes the response to the production of quasi-public goods. If agents are highly risk averse, then they will be less likely to engage in the production of public goods through market institutions, and prefer instead that they be provided by public sector intervention. In contrast, if agents are less risk averse, then they are willing to take on the risk of loss through positive externalities in exchange for the expected positive direct benefits that they expect to receive. While we do not claim that risk assumes away the problem of externalities, we contend that it governs it to a larger degree than is commonly assumed.

International Comparisons on Public-Private Sector Dynamics

Thus far, few studies examine the role of risk in the determination of optimal state-market relations. In practice, international financial markets regularly are forced to incorporate some measure of risk in the determination of contingent and future claims, but decomposition of the underlying probability distributions typically has not been undertaken and the question of aggregation is problematic. With these limitations in mind, we seek here to provide some indication of the various linkages thus far identified, and what this implies for state-market relations.

At the aggregate level, we first use a country composite risk index developed by Morgan Stanley to examine cross-section evidence on risk, using the World Bank database. A country composite risk index represents a weighted average of political, economic, and financial risk for each country. Unfortunately, weighting is not consistent across countries, and so this index is at best a proxy for some of the relationships we seek to examine.

Figure 2

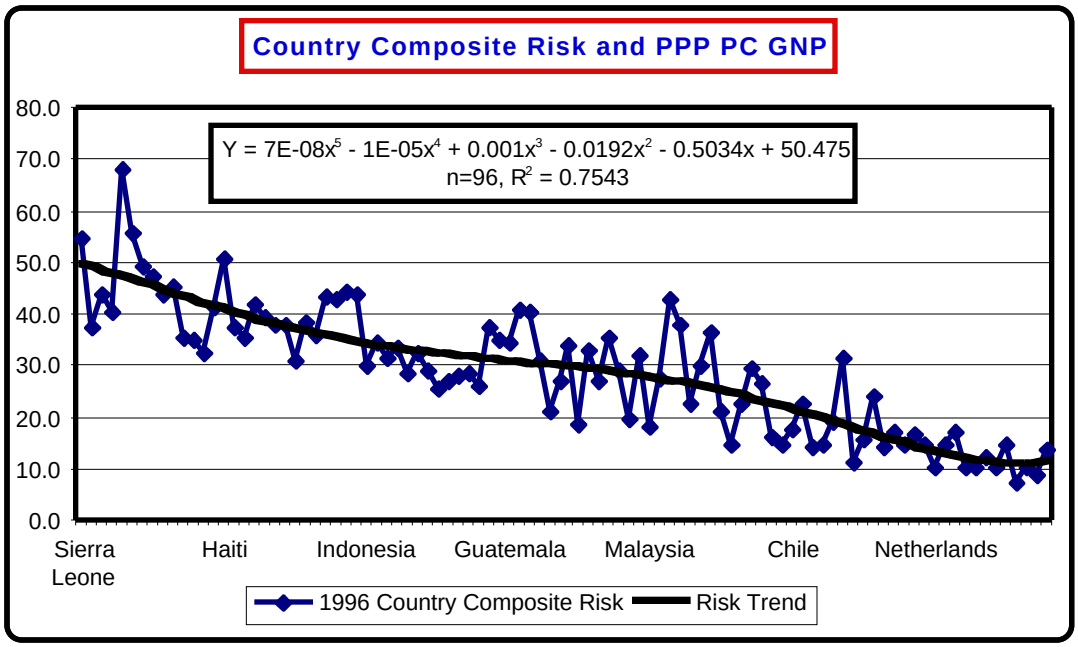


Figure 2 illustrates the basic inverse relationship between country composite risk and per capita income for a sample of 96 countries[31]. The question is why are some countries above or below the estimated relationship and does government intervention have anything to do with reductions in the level and distribution of risk as it affects transaction costs and efficient prices. In our view, for a given level of income, risk will be less the greater is the degree of flexibility in the formation of prices and the stronger is an economy's property rights regime.

Using the Heritage Foundation Index of Economic Freedom, we draw on a series of variables to explain country composite risk adjusted for a country's PPP per capita GNP. Basic correlations are summarized in Table 1.

Table 1

Determinants of Country Composite Risk

	1998 PPP Per Capita GNP	1996 Country Composite Risk Index	Government Regulation Index	Property Rights Index	Currency Convertibility Index	Price Control Index	Contract Risk Index	Confiscation Risk Index	Judicial Independence Index	Capital Freedom Index	Trade Share of GDP
1998 PPP PC GNP	1.0000										
1996 Composite Risk	-0.8113	1.0000									
Govt.Regulation Index	-0.4723	0.4475	1.0000								
Property Rights Index	0.6949	-0.8626	-0.3726	1.0000							
Currency Convertibility	0.5910	-0.6047	-0.6654	0.4981	1.0000						
Price Control Index	-0.5799	0.5036	0.7995	-0.4606	-0.5713	1.0000					
Contract Risk Index	-0.6319	0.8091	0.3510	-0.9316	-0.5012	0.4179	1.0000				
Confiscation Risk Index	-0.5048	0.7216	0.3255	-0.8610	-0.4182	0.3778	0.8373	1.0000			
Judicial Independence	0.6029	-0.6505	-0.2461	0.7374	0.3307	-0.3615	-0.5504	-0.3705	1.0000		
Capital Freedom Index	0.6479	-0.6623	-0.7405	0.5003	0.7523	-0.6275	-0.4899	-0.3995	0.3621	1.0000	
Trade Share of GDP	0.2818	-0.3133	-0.1902	0.1779	0.1927	-0.0919	-0.1609	-0.1356	0.1629	0.2768	1.0000

Source: The World Bank, *World Development Report 2000*; The Heritage Foundation, *2000 Report on Economic Freedom.*

Granger causality tests were used to test for exogeneity of variables. Single equation estimates were done separately for country risk and property rights, where property rights serves as an independent variable in the country risk equation. Three variables, the government regulation index, the price control index, and the capital freedom index, explained little of the variation in either a country risk or the property rights equation, and were dropped from the final estimates. As each represents a synthetic rather than an observed variable, there may be errors in specification aggregation, or multicollinearity across variables. Equation A uses the predicted value of property rights from equation B to estimate overall country risk. When risk is explicitly taken into account, equations A and B confirm the underlying relationships we have examined and underscore the need for proper sequencing of institutional reforms in transition and developing economies

Table 2
Regression Results for Country Risk and Property Rights

	A.		B.
	Country Risk		**Property Rights**
Intercept	**65.6985**	Intercept	**6.5932**
Property Rights	**-3.6850**	Judicial Independence	**0.3480**
	(13.1812)		(22.0700)
Currency Convertibility	**-1.0419**	Confiscation Risk	**-0.3211**
	(4.1033)		(14.8931)
Trade Dependency	**-0.0699**	Contract Repudiation Risk	**-0.3313**
	(2.9129)		(14.1854)
n	96	n	96
Adjusted R^2	0.7943	Adjusted R^2	0.9819
F	118.431	F	1722.5228
DW	1.8324	DW	2.0836

Implications and Conclusion

With the collapse of the Soviet Union in 1991, economic reform in developing and emerging market economies placed growing emphasis on a shift away from public sector intervention to greater emphasis on markets. The tools of this shift included a deregulation of output and input prices, capital market liberalization, foreign exchange convertibility, lower marginal tax rates, alongwith substantial efforts to privatize state-owned enterprises. While market liberalization did bring about success in some countries, it fell short in others. We find that the shift to market prices succeeds where civil society institutions can help in the formation of economically efficient prices that reflect the underlying degree of risk. Where property rights are weak, prices will fail to capture the underlying level and distribution of risk, which in turn leads to a mis-allocation of resources that reduces the rate of economic growth. While developed economies

already have put into place effective institutions for the specification and allocation of property rights, until developing and emerging economies can institute similar reforms, the shift to market-driven reforms is likely to fall short of expectations.

---

[1] Stiglitz (1998) illustrates this problem in the context of World Bank structural adjustment programs. See Stiglitz, J. (1998), "The Private Uses of Public Interest: Incentives and Institutions," *Journal of Economic Perspectives* 12:2 (Spring), 3-22. For a descriptive review of World Bank privatization initiatives, see Gabriel Roth (1987), *The Private Provision of Public Services in Developing Countries* (New York: Oxford University Press for the World Bank). For a more general treatment in the context of imperfect information, see Jean-Jacques Laffont and Jean Tirole (1993), *A Theory of Incentives in Procurement and Regulation* (Cambridge, Mass.: MIT Press).

[2] A good example is the contrasting behavior in China and Russia following the collapse of the Soviet Union. China has moved toward market liberalization, but with an explicit emphasis on controlled evolution associated with political stability, while Russia underwent a headlong process of liberalization that resulted in economic contraction and widespread corruption, leaving many skeptical about the virtues of a market-based economy. Institutions matter, but more importantly, they matter in terms of how various types of risk can be assessed in which economic agents can make rational decisions.

[3] A Pareto allocation in one in which any re-allocation that benefits at least one individual does so only by a reduction in the social welfare of another individual. It is a first order welfare criterion that seeks to avoid interpersonal comparisons of utility, and for which less restrictive criteria have since been proposed, e.g., Kaldor (1939), Scitovsky (1941), Bergson (1938), and Rawls (1971), among others. V. Pareto (1927), *Manuel d'économie politique*, deuxième édition (Paris: M. Giard).

[4] Bator, FM (1957), "The Simple Analytics of Welfare Maximization," *American Economic Review*, 47, 1, pp. 22-59. Bator's exposition builds on Walras' original formulations of general equilibrium in 1874 and provides the complementary geometry that has since become standard in most expositions of general equilibrium.

[5] Appendix A provides a formal statement of the standard model of competitive general equilibrium. As long as the respective marginal rates of substitutions across agents in a given equilibrium are equal, a Pareto-efficient allocation can be achieved under alternative patterns of income distribution. What this does not resolve is the social welfare ranking of various distributions of income, where interpersonal comparisons of utility become central to the discussion.

[6] Growth models in the 1950s and 1960s generally relied on an underlying assumption of economic certainty in which the expansion path could be derived through closed form solutions.

[7] Bator, F.M. (1958), "The Anatomy of Market Failure", *Quarterly Journal of Economics*, 72, 351-79.

[8] Magill, M. and Quinzii, M. (1996). *Theory of Incomplete Markets*, vol. I. (Cambridge, Mass.: MIT Press).

[9] We set aside for the moment of motivation. The literature on public choice provides substantial evidence that the behavior of agents in the public sector differs significantly from those in the private sector. Our concern remains with the underlying question of why public sector intervention may be necessary independent of individual public agent motivation.

[10] Coase, R.M. (1937), "The Nature of the Firm", *Economica*, n.s., 385-405. Coase's argument forms the basis of Williamson (1975), *Markets and Hierarchies* (New York: The Free Press).

[11] Kahnemann, Daniel and Amos Tversky (1979), "Prospect Theory", *Econometrica*, 47, 263-91; Milton Friedman and Leonard J. Savage (1948), "The Utility Analysis of Choices Involving Risk," *Journal of Political Economy*, 56 (August), 279-304. Friedman and Savage put forth the theory that at some levels of income individuals may be risk loving while at others risk averse. This is the core of the prospect theory argument which Kahnemann and Tversky report in "Prospect Theory".

[12] Herbert Simon (1957). *Models of Man*. (New York: John Wiley and Sons). Simon's notion of satisficing behavior under bounded rationality is linked to Ronald Coase's 1937 observations about the role of transactions costs in determining what actions are best made internally by a firm and which are best left to external market solutions. All of this is presented more systematically in Oliver Williamson's (1975) framework put forth in *Markets and Hierarchies.* (New York: The Free Press).

[13] Garber, Peter (2000), Famous First Bubbles: The Fundamentals of Early Manias, (Cambridge, Mass.: MIT Press); Manuel S. Santos and Michael Woodward, (1997), "Rational Asset Bubbles", *Econometrica*, 65:1 (January), 19-58).

[14] This taxonomy is as much a product of historical observations and comparisons as it is of economic theory. We seek here to link the historical context to economic theory.

[15] Bernard Salanié (1997), *The Economics of Contracts* (Cambridge, Mass.: MIT Press).

[16] Akerlof, G. (1970), "The Market for Lemons: Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84, 488-500. See also Diamond, P., and M. Rothschild (1989), *Uncertainty in Economics* (San Diego: Academic press); J-J Laffont, *The Economics of Uncertainty and Information* (Cambridge, Mass.: MIT Press), and J-J Laffont and J. Tirole (1993), *A Theory of Incentives in Procurement and Regulation* (Cambridge, Mass.: MIT Press).

[17] A classic example is the asymmetric information environment portrayed in Upton Sinclair's 1906 book, *The Jungle*, (New York: New American library Signet edition published in 1960), which led to the creation of the Food and Drug Administration in 1908. In contrast, the relatively transparent information in the mid-1980s Tylenol poisoning case produced corrections with no government intervention.

[18] Michael Spence (1973), "Job Market Signaling," *Quarterly Journal of Economics* 87, 355-74. Spence notes the importance of signals in conveying information, thus reducing some of the apparent imbalance in markets with incomplete information.

[19] Massimo Bordignon and Enrico Minelli (2001), "Rules Transparency and Political Accountability," *Journal of Public Economics* 80, 73-98. Bordignon and Minelli offer a model in which transparent, or flat, rules, can increase political accountability more easily than contingent rules of allocation and redistribution. The cost of doing so is some loss in economic efficiency where contingent rules are designed to correct for given levels of market failure.

[20] Ironically, any argument for public sector intervention to promote competition implies that competition is an un-natural and unsustainable market structure, a position first put forth by Karl Marx.

[21] Jean Tirole (1988) *The Theory of Industrial Organization* (Cambridge, Mass.: MIT Press), p. 29; Ronald Coase (1937), "The Nature of the Firm," *Economica*, n.s. 4, 386-405; Oliver Williamson (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*. (New York: The Free Press).

[22] Joseph A. Schumpeter (1934, 1912). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle.* (Cambridge, Mass.: Harvard University Press 1934 translation from the original 1912 German publication, *Theorie der wirtschaftlichen Entwicklung*). Schumpeter's theory of evolutionary economics is analogous to the theory of imperfect markets in which agents engaged in sequential trading with limited commitments, reflecting a given level of risk aversion at a given moment in time.

[23] No where is this perhaps clearer than in the U.S. government's antitrust case against Microsoft, in which Microsoft is charged with predatory behavior in operating systems and applications software. Because the rate of change in computer technology is so rapid, it may be impossible to predict the direction, let alone the number of firms as some new innovation may rapidly displace existing ones unless otherwise anticipated by existing firms.

[24] Lester Thurow (1971), "The Income Distribution as a Pure Public Good," *Quarterly Journal of Economics* 85, 327-336; Abram Bergson (Burk) (1938), "A Reformulation of Certain Aspects of Welfare Economics," *Quarterly Journal of Economics* 52 (February), 310-334; Paul A. Samuelson (1938), "A Note on the Pure Theory of Consumer's Behavior," *Economica* (February), 61-71. One solution suggested by Nicholas Kaldor (1939), "Welfare

Propositions of Economics and Interpersonal Comparisons of Utility: A Comment," *Economic Journal* 49 (September), 549-552, is that if the gains of the gainers exceed the losses of the losers, then there will be a net gain in social welfare. The problem remains on how to make such comparisons in a non-dictatorial way and in which some compensatory mechanism is established.

[25] J.W. Pratt (1964), "Risk Aversion in the Small and the Large," *Econometrica*. 31, 122-136; A.B. Atkinson (1970), "On the Measurement of Inequality," *Journal of Economic Theory* 2, 244-63.

[26] John Rawls (1971), *A Theory of Justice* (Cambridge, Mass.: Harvard University Press); Amartya K. Sen (1992), *Inequality Re-Examined* (New York: Oxford University Press). For a review of measures of income distribution, see, for example, Nanak C. Kakwani (1980), *Income Inequality and Poverty: Methods of Estimation and Policy Applications*. (New York: Oxford University Press for the World Bank)

[27] John Maynard Keynes (1936), *The General Theory of Employment, Interest, and Money* (New York: Harcourt Brace); Milton Friedman (1956), "The Quantity Theory of Money – A Restatement," in *Studies in the Quantity Theory of Money*, (Chicago: University of Chicago Press). These two works provide foundation arguments regarding the role of fiscal and monetary policy to achieve economic stabilization, and on which most traditional macroeconomic theory has been pursued. Neither work gave primary emphasis to the theory of risk bearing, though Keynes did develop a theory of risk as a basis for using discretionary fiscal policy to achieve a full-employment equilibrium.

[28] John F. Muth (1961), "Rational Expectations and the Theory of Price Movements," *Econometrica* 29 (July), 315-335; Robert E. Lucas (1972), "Expectations and the Neutrality of Money," *Journal of Economic Theory*, 4, 103-124; T. J. Sargent and N. Wallace (1975), "Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule," *Journal of Political Economy*, 83, 241-254.

[29] Avinash K. Dixit and Robert S. Pindyck (1994). *Investment Under Uncertainty* (Princeton: Princeton University Press).

[30] Philippe Aghion and Peter Howitt (1998). *Endogenous Growth Theory*. (Cambridge, Mass.: MIT Press).

[31] The country composite risk index is for 1996. Per Capita Income is the 1998 PPP Per Capita GNP. Both series are from the World Bank database.

Appendix 1
Conditions for a Competitive General Equilibrium

Given two inputs, two firms, and two individuals, achievement of a competitive general equilibrium in the absence of transactions costs, economies of scale or scope, and complete contracts, we specify the following for the production of two goods, X and Y:

(1.) $X = f(K_x, L_x)$, the production function of good X

(2.) $Y = f(K_y, L_y)$, the production function of good Y

(3.) $\bar{L} = L_x + L_y$, the allocation constraint of resource L

(4.) $\bar{K} = L_x + L_y$, the allocation constraint of resource K

Given the above, the object is to maximize total output subject to the respective production functions and resource constraints. The corresponding Lagrangean expression is:

(5.) $Z = f(K_x, L_x) + \lambda\left[\bar{Y} - f(\bar{L} - L_x, \bar{K} - K_x)\right]$. The respective first-order conditions are:

(6.) $\frac{\partial Z}{\partial K_x} = \frac{\partial X}{\partial K_x} + \lambda\frac{\partial Y}{\partial K_x} = 0$,

(7.) $\frac{\partial Z}{\partial L_x} = \frac{\partial X}{\partial L_x} + \lambda\frac{\partial Y}{\partial L_x} = 0$. In turn, these expressions can be further reduced to:

(8.) $\frac{\partial K/\partial K_x}{\partial Y/\partial K_x} = -\lambda = \frac{\partial X/\partial L_x}{\partial Y/\partial L_x}$, and which in turn, is equal to:

(9.) $MRTS_{kl}^{Y} = \frac{MP_l^Y}{MP_k^Y} = \frac{\partial Y/\partial L_x}{\partial Y/\partial K_x} = \frac{\partial X/\partial L_x}{\partial X/\partial K_y} = \frac{MP_l^X}{MP_k^X} = MRTS_{kl}^{X}$, where MP is the respective marginal product.

Beyond production, the equilibrium of consumers is defined by:

(10.) $U^A = f(X, Y)$

(11.) $U^B = f(X, Y,)$ where X and Y are outputs as above. The corresponding Lagrangean function is:

(12.) $L = f\left(X^A, Y^A\right) + \lambda\left[\bar{U}^B - f\left(X^B, Y^B\right)\right]$. The corresponding first-order conditions are:

(13.) $\frac{\partial L}{\partial X} = \frac{\partial U^A}{\partial X^A} - \lambda\frac{\partial U^B}{\partial X^B} = 0$

(14.) $\frac{\partial L}{\partial Y} = \frac{\partial U^A}{\partial Y^A} - \lambda\frac{\partial U^B}{\partial Y^B} = 0$, which reduces to:

(15.) $\frac{MU_X^A}{MU_X^B} = \frac{\partial U^A/\partial X^A}{\partial U^A/\partial Y^A} = \lambda = \frac{\partial U^B/\partial X^B}{\partial U^B/\partial Y^B} = \frac{MU_X^B}{MU_Y^B} = MRS_{xy}^{B}$, where MU is the corresponding marginal utility.

In terms of the production possibilities frontier, selection of any point on the frontier requires that:

(16.) $Q = f(X, Y) = f\left(X^A + X^B, Y^A + Y^B\right) = 0$, such that:

(17.) $\frac{\partial T}{\partial X} dX + \frac{\partial T}{\partial Y} dY = 0$, and

(18.) $\frac{dY}{dX} = -\frac{\partial T / \partial X}{\partial T / \partial Y} = MRT_{xy}$. This is now added to equation (12.) to yield:

(19.) $L = f\left(X^A, Y^A\right) + \lambda\left[\overline{U}^B - f\left(X^B, Y^B\right)\right] + u[0 - f(X, Y]$. The corresponding first-order conditions are:

(20.) $\frac{\partial L}{\partial X^A} = \frac{\partial U^A}{\partial X^A} - u\frac{\partial T}{\partial X} = 0$,

(21.) $\frac{\partial L}{\partial Y^A} = \frac{\partial U^A}{\partial Y^A} - u\frac{\partial T}{\partial Y} = 0$

(22.) $\frac{\partial L}{\partial X^B} = -\lambda\frac{\partial U^B}{\partial X^B} - u\frac{\partial T}{\partial X} = 0$

(23.) $\frac{\partial L}{\partial Y^B} = -\lambda\frac{\partial U^B}{\partial Y^B} - u\frac{\partial T}{\partial Y} = 0$. Re-arranging,

(24.) $MRS^A_{xy} = \frac{\partial U^A / \partial X^A}{\partial U^A / \partial Y^A} = \frac{\partial T / \partial X}{\partial T / \partial Y}$

(25.) $MRS^B_{xy} = \frac{\partial U^B / \partial X^B}{\partial U^B / \partial Y^B} = \frac{\partial T / \partial X}{\partial T / \partial Y}$. Re-arranging further, we have

(26.) $MRS^A_{xy} = MRS^B_{xy} = MRT_{xy}$.

Further, we specify the utility maximization conditions of the two consumers in terms of the following Lagrangean:

(27.) $L = f(X, Y) + \lambda\left(I - p_x X - p_y Y\right)$. Differentiating, we have:

(28.) $\frac{\partial L}{\partial X} = \frac{\partial U}{\partial X} - \lambda p_x = 0$,

(29.) $\frac{\partial L}{\partial Y} = \frac{\partial U}{\partial Y} - \lambda p_y = 0$. This further reduces to the standard optimization conditions:

(30.) $\frac{MU_x}{p_x} = \frac{\partial U / \partial X}{p_x} = \lambda = \frac{\partial U / \partial Y}{p_y} = \frac{MU_y}{p_y}$, and

(31.) $MRS_{xy} = \frac{MU_x}{MU_y} = \frac{\partial U / \partial X}{\partial U / \partial Y} = -\frac{p_x}{p_y}$.

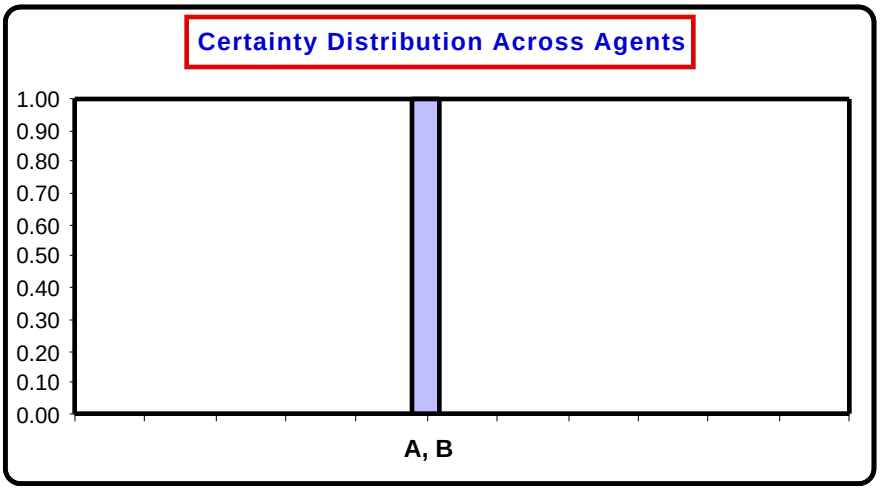
Finally, efficiency requires that the relative factor price ratio also be equal to the marginal rate of substitution in consumption, to the marginal rate of transformation, and to the marginal rate of technical substitution. This condition can be expressed as:

(32.) $\frac{MU_x}{MU_y} = MRS_{xy} = \frac{p_x}{p_y} = \frac{MC_x}{MC_y} = MRT_{xy}$

Appendix 2
Alternative Probability Distributions and Economic Efficiency

Consider two individuals, A and B, within the framework of general equilibrium, and in which there are no joint probability distributions. In a world of perfect certainty, each individual makes choices within a universe of perfect certainty. This is equivalent to the distributions portrayed in Figure 1, with the expected value of an asset identical to all agents, and in which the probability is 1 with a standard deviation of zero.

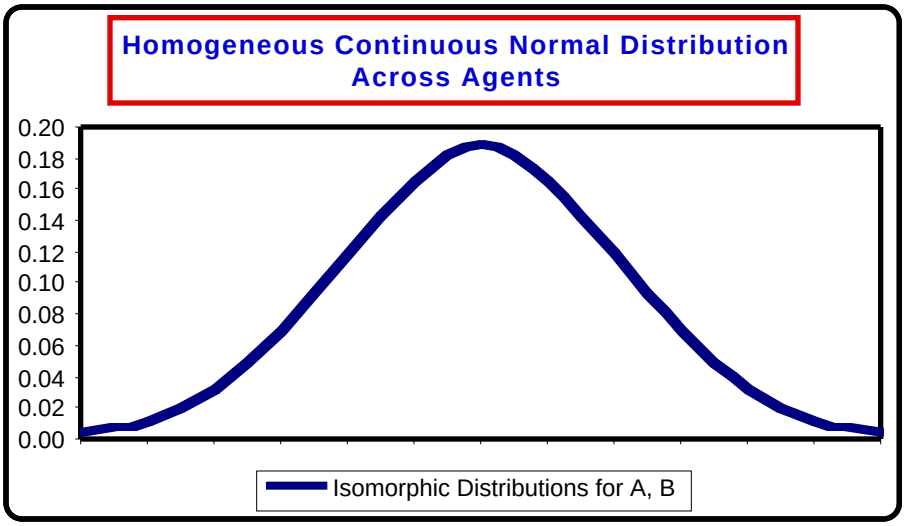
Figure 1



This is the framework implied for the framework outlined in Appendix 1. All agents face certainty outcomes and Pareto-efficient prices. No public intervention is warranted.

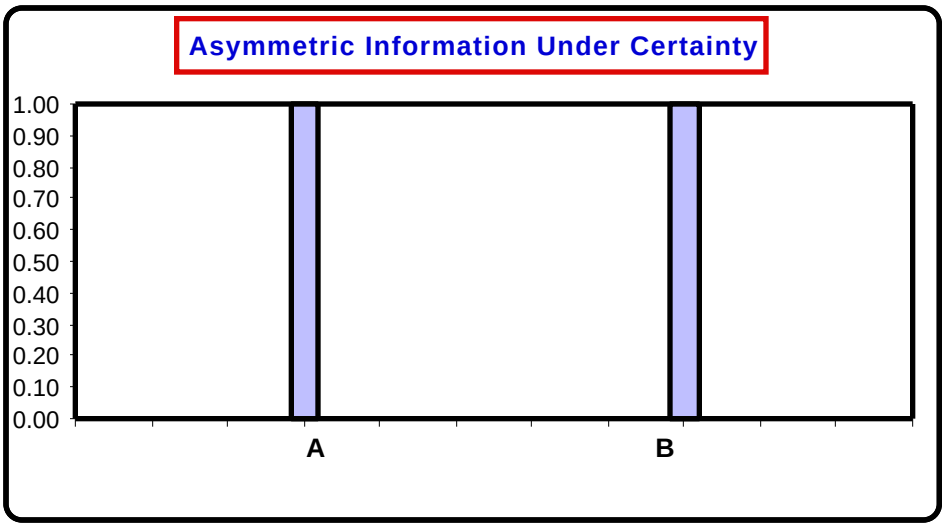
Now consider a universe in which risk is present. As long as the distribution of risk is normal and homogeneous across agents, relative prices will again be Pareto efficient. This is the case of competitive general equilibrium in the presence of risk as portrayed in the Arrow-Debreu-MacKenzie framework. Continuous normal distributions are homogeneous across agents and prices, as shown in Figure 2. As long as the distribution of risk across agents is homogeneous and the number of contracts equals the number of contingent events in space and time, no public intervention is warranted.

Figure 2



Now consider a universe in which there is certainty at the level of each agent, but that the distribution of information across agents is asymmetric, as is shown in Figure 3. In this case, the higher valuation in distribution B relative to distribution A will lead to an inefficient allocation of resources.

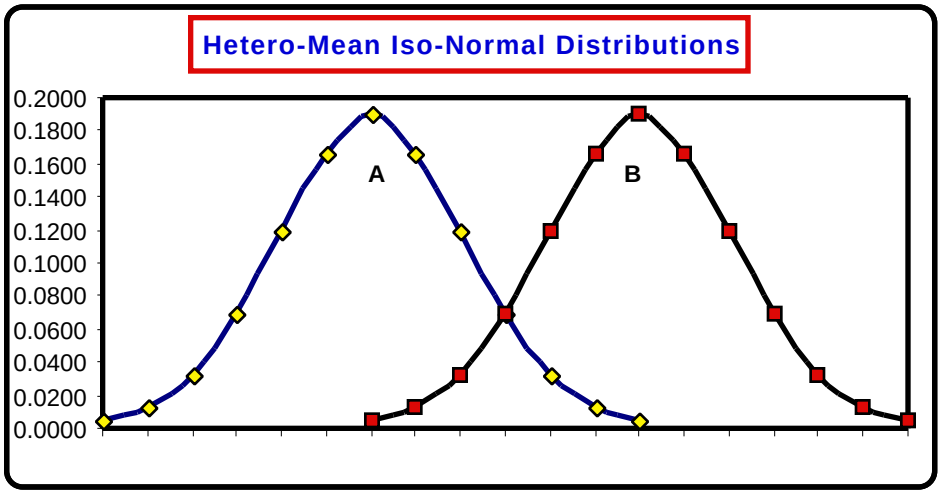
Figure 3



While asymmetric information across agents with individual certainty is possible, it is more likely that there will be an uncertain probability distribution for each agent, A and B, as is shown in Figure 4. Here the expected value for agent B exceeds that of agent A, in which case the resulting market price will be inefficient. This can be thought of in the context of Akerlof's

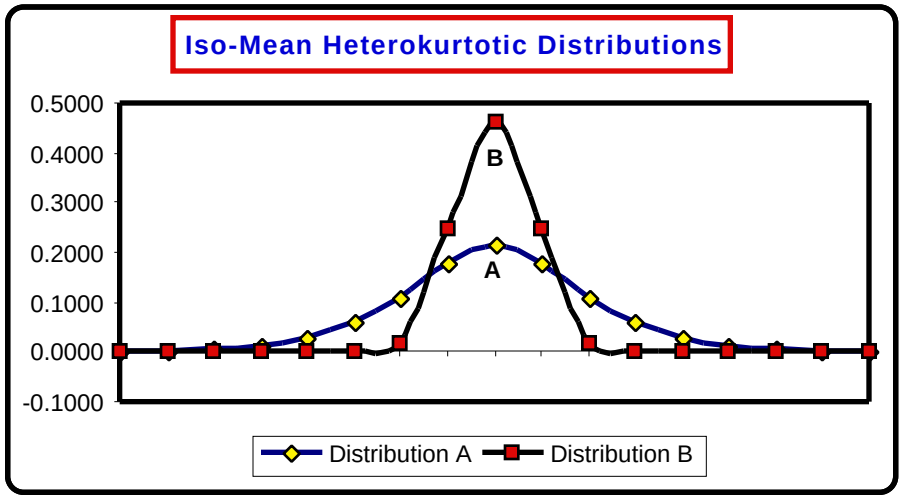
(1970) market for lemons problem of imperfect information, in which agent B places a higher value on an asset than agent A.

Figure 4



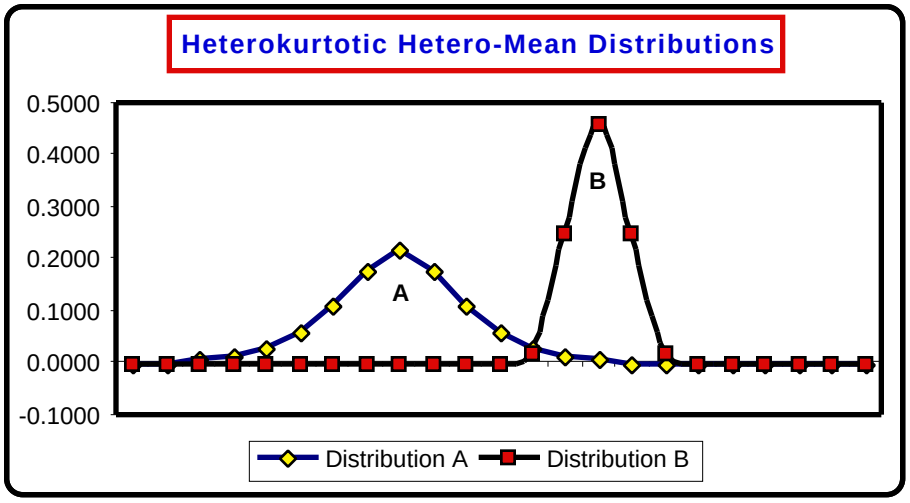
Asymmetry of information across agents is the most likely reason for market prices to be inefficient. However, there is an additional problem. In figure 5, two agents may assign different values to an asset based on different perceptions of the underlying probability distribution. Distribution A corresponds to a normal distribution, while distribution B is leptokurtotic. If zero probability values are excluded, then distribution B clearly is less risky than distribution A. In most risk management models, the assumption of normality in the underlying probability distribution rules out kurtosis although this may lead to a mis-allocation of resources. An example is the case of the dynamic hedging option pricing model of Merton and Scholes that led to the collapse of Long Term Capital Management in 1998. The underlying probability distribution was assumed to be normally distributed, when in fact the tails of the distribution contained higher probabilities than were allowed in their model.

Figure 5



Market prices can be further distorted in the presence of both kurtosis and differences in the expected values of the underlying probability distributions, as is shown in Figure 6. This extends the asymmetric framework illustrated in Figure 4.

Figure 6



Finally, we come to the cases of right and left skews in the underlying distributions of individual agents, as is shown in Figure 7 and 8. When we combine skewness, kurtosis, and asymmetric information, prices will deviate substantially from the Pareto-efficient level.

Figure 7

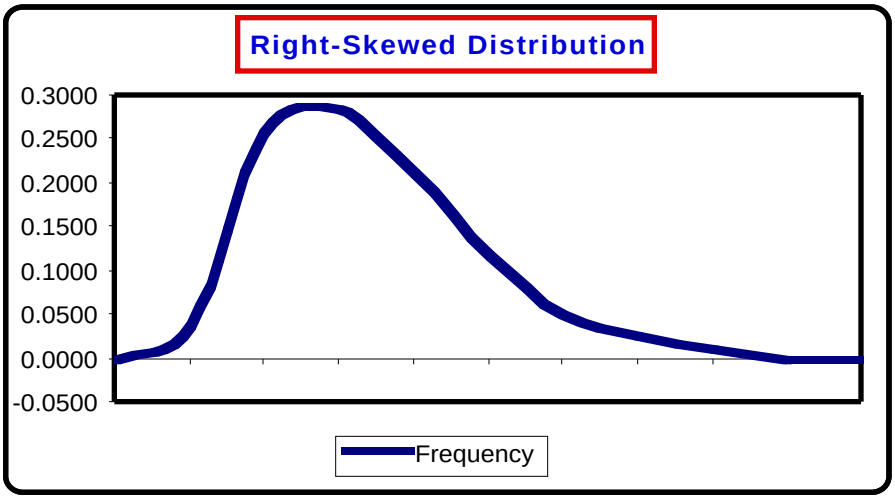
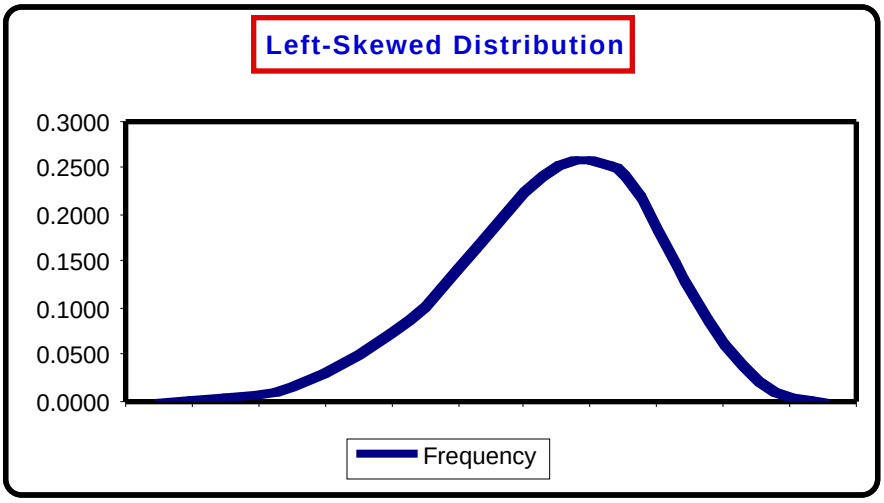


Figure 8



Whether public sector intervention is warranted depends on the costs of correcting for deviations in the underlying probability distributions, and on the consistency of preferences across agents over time.

Bibliography

Aghion, Philippe, and Peter Howitt (1998). *Endogenous Growth Theory*. (Cambridge, MASS.: MIT Press).

Akerlof, George. (1970). "The Market for Lemons: Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84, 488-500.

Allen, Franklin, and Douglas Gale (2000). *Comparing Financial Systems*. (Cambridge, Mass.: MIT Press).

Arrow, Kenneth J. (1967, 1951). *Social Choice and Individual Values*. (New Haven, Conn.: Yale University Press for the Cowles Foundation).

Arrow, Kenneth J., and Gerard Debreu (1954), "Existence of Equilibrium for a Competitive Economy," *Econometrica*, 22, 265-290.

Atkinson, Anthony B. (1970), "On the Measurement of Inequality," *Journal of Economic Theory* 2, 244-63.

Bator, Francis M. (1958). "The Anatomy of Market Failure," *Quarterly Journal of Economics*, 72, 351-79.

Bator, Francis M. (1957), "The Simple Analytics of Welfare Maximization," *American Economic Review*, 47:2, 22-59.

Bennett, John and James Maw (2000), "Privatisation and Market Structure in a Transition Economy," *Journal of Public Economics*, 77, 357-382.

Bergson, Abram (1938), "A Reformulation of Certain Aspects of Welfare Economics," *Quarterly Journal of Economics* 52, 310-334.

Binswanger, Mathias (1999). *Stock Markets, Speculative Bubbles and Economic Growth*. (Cheltenham, U.K.: Edward Elgar Publishing Company).

Bordignon, Massimo, and Enrico Minelli (2001), "Rules Transparency and Political Accountability," *Journal of Public Economics* 80, 73-98.

Brunnermeier, Markus K. (2001). *Asset Pricing under Asymmetric Information: Bubbles, Crashes, Technical Analysis, and Herding*. (Oxford ,U.K.: Oxford University Press).

Buchanan, James M., and Richard A. Musgrave (2000). *Public Finance and Public Choice: Two Contrasting Visions of the State.* (Cambridge, Mass.: MIT Press reprint of 1999 edition).

Buchanan, James M., and Gordon Tullock (1962). *The Calculus of Consent*. (1962). (Ann Arbor, Michigan: The University of Michigan Press).

Coase, R.H. (1937). "The Nature of the Firm," *Economica*, n.s., 386-405.

Coase, R.H. (1960). "The Problem of Social Cost," *Journal of Law and Economics* 3, pp. 1-44.

Diamond, Peter and Michael Rothschild (1989). *Uncertainty in Economics*. (San Diego: Academic press).

Debreu, Gerard (1959). *Theory of Value: An Axiomatic Analysis of Economic Equilibrium*. (New Haven, Conn.: Yale University Press Cowles Foundation monograph).

Dixit, Avinash K., and Robert S. Pindyck (1994). *Investment under Uncertainty*. (Princeton, NJ: Princeton University Press).

Effinger, Matthias R., and Mattias K. Polborn (2001), "herding and Anti-Herding: A Model of Reputational Differentiation," *European Economic Review* 45, 385-403.

Fischoff, Baruch, et.al. (1981). *Acceptable Risk*. (Cambridge, U.K.: Cambridge University Press).

Friedman, Milton (1956). The Quantity Theory of Money – A Restatement," in *Studies in the Quantity Theory of Money*. (Chicago: University of Chicago Press).

Friedman, Milton, and Savage, L.J. (1948), "The Utility Analysis of Choices Involving Risk," *Journal of Political Economy* 56 (August), 279-304.

Froot, K.A., ed. (1999). *The Financing of Catastrophe Risk*. (Chicago: University of Chicago Press).

Garber, Peter (2000). *Famous First Bubbles: The Fundamentals of Early Manias*. (Cambridge, Mass.: MIT Press).

Gollier, Christian (2001). *The Economics of Risk and Time*. (Cambridge, Mass.: MIT Press).

Grossman, S. (1981). "An Introduction to the Theory of Rational Expectations under Asymmetric Information." *Review of Economic Studies*, 48, 541-559.

Grossman, S., and Stiglitz, J.E. (1980). "On the Impossibility of Informationally Efficient Markets." *American Economic Review* 70, 393-408.

Jorion, Philippe (1997). *Value at Risk: The New Benchmark for Controlling Derivatives Risk.* (New York: McGraw-Hill).

Kakwani, Nanak C. (1980). *Income Inequality and Poverty: Methods of Estimation and Policy Applications*. (New York: Oxford University Press for the World Bank).

Kahnemann, Daniel and Amos Tversky (1979), "Prospect Theory", *Econometrica*. 47, 263-91.

Kahnemann, Daniel and Amos Tversky (1991). "Loss Aversion in Riskless Choice: A Reference-Dependent Model," *Quarterly Journal of Economics*, 106:4, 1039-61.

Kahnemann, Daniel, David Hirshleifer, and A. Subrahmanyam (1998), "Investor Psychology and Security Market Under-and Overreactions," *Journal of Finance*, 52, 1839-85.

Kaldor, Nicholas (1939), "Welfare Propositions in Economics and Interpersonal Comparisons of Utility: A Comment," *Economic Journal*, 49, 549-552.

Keynes, John Maynard (1936). *The General Theory of Employment, Interest, and Money*. (New York: Harcourt Brace).

Laffont, Jean-Jacques (1980). *Essays in the Economics of Uncertainty and Information.* (Cambridge, Mass.: Harvard University Press).

Laffont, Jean-Jacques, and Jean Tirole (1993). *A Theory of Incentives in Procurement and Regulation.*. (Cambridge, Mass.: MIT Press).

Lei, Vivian, Charles N. Noussair, and Charles R. Plott (2001), "Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality," *Econometrica* 69:4, 831-860.

Lucas, Robert E. (1972), "Expectations and the Neutrality of Money," *Journal of Economic Theory*, 4, 103-124.

Ljungqvist, Lars, and Thomas J. Sargent (2000). *Recursive Macroeconomic Theory*. (Cambridge, Mass.: MIT Press).

Machina, Mark (1989), "Dynamic Consistency and Non-Expected Utility Models of Choice under Uncertainty, *Journal of Economic Literature*, 27, 1622-1668.

Macho-Stadler, Inés, and David Pérez-Castrillo (1997). *An Introduction to the Economics of Information.* (Oxford, U.K.: Oxford University Press).

Magill, Michael, and Martine Quinzii (1998). *Theory of Incomplete Markets*. (Cambridge, Mass.: MIT Press).

Maskus, Keith E. (2000). *Intellectual Property Rights in the Global Economy*. (Washington, DC: Institute for International Economics).

McFadden, Daniel (2001), "Economic Choices," *American Economic Review* 91:3, 351-378.

Megginson, William L., and Jeffry M. Netter (2001). "From State to Market: A Survey of Empirical Studies on Privatization," *Journal of Economic Literature*, 39:2, 321-389.

Mueller, Dennis C. (1981, 1979). *Public Choice*. (Cambridge, U.K.: Cambridge University Press).

Mukerji, S. (1998). "Ambiguity Aversion and Incompleteness of Contractual Form." *American Economic Review* 88:5, 1207-1231.

Muth, John F. (1961), "Rational Expectations the Theory of Price Movements," *Econometrica* 29, 315-335.

Plott, C.R. (1996). "Rational Individual Behavior in Markets and Social Choice Processes: The Discovered Preference Hypothesis," in K. Arrow, E. Colombatto, M. Perleman, and C. Schmidt, eds. *Rational Foundations of Economics Behavior*. (New York: St. Martin's Press).

Olson, Mancur (1971, 1965). *The Logic of Collective Action*. (Cambridge, Mass.: Harvard University Press).

Pratt, John W. (1964), "Risk Aversion in the Small and Large," *Econometrica*, 31, 122-136.

Rawls, John (1971). *A Theory of Justice*. (Cambridge, Mass.: Harvard University Press).

Riley, John G. (2001), "Silver Signals: Twenty-Five Years of Screening and Signaling," *Journal of Economic Literature* 39:2, 432-478.

Roth, Gabriel (1987), *The Private Provision of Pubic Services in Developing Countries*. (New York: Oxford University Press for the World Bank).

Salanié, Bernard (1997). *The Economics of Contracts*. (Cambridge, Mass.: MIT Press).

Salanié, Bernard (2000). *Microeconomics of Market Failures*. (Cambridge, Mass.: MIT Press).

Samuelson, Paul A. (1938), "A Note on the Pure Theory of Consumer's Behavior," *Economica*, February, 61-71.

Santos, Manuel S., and Michael Woodford (1997), "Rational Asset pricing Bubbles," *Econometrica* 65:1 (January), 19-58).

Sargent, Thomas J. and Neil Wallace (1975), "Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule," *Journal of Political Economy*, 83, 241-254.

Schlee, Edward E. (2001), "The Value of Information in Efficient Risk-Sharing Arrangements," *American Economic Review* 91:3, 509-524.

Sen, Amartya K. (1992). *Inequality Re-Examined*. (Oxford, U.K.: The Clarendon Press).

Schumpeter, Joseph A. (1912). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. (Cambridge, Mass.: Harvard University Press 1934 translation by Redvers Opie).

Shiller, Robert J. (2000). *Irrational Exuberance*. (Princeton, NJ: Princeton University Press).

Shleifer, Andrei (2000). *Inefficient Markets: An Introduction to Behavioral Finance*. (Oxford, U.K. Oxford University Press).

Simon, Herbert (1957). *Models of Man*. (New York: John Wiley and Sons).

Sinclair, Upton (1906). *The Jungle*. (New York: New American Library edition of 1960).

Spence, Michael (1973). "Job Market Signaling," *Quarterly Journal of Economics* 87, 355-74.

Spender, Bruce D. (1997). *Statistics and Public Policy*. (Oxford, U.K.: Clarendon Press).

Starmer, Chris (2000), "Developments in Non-Expected Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk," *Journal of Economic Literature*, 38 (June), 332-382.

Thurow, Lester (1971), "The Income Distribution as a Pure Pubic Good," *Quarterly Journal of Economics*, 85, 327-336.

Tirole, Jean (1988). *The Theory of Industrial Organization*. (Cambridge, Mass.: MIT Press).

Viscusi, W. Kip. *Rational Risk Policy*. (Oxford, U.K.: Oxford University Press).

Von Neumann, John, and Oskar Morgenstern (1967, 1944). *Theory of Games and Economic Behavior*. (New York: John Wiley and Sons reprint of 1944 Princeton University Press edition).

Williamson, Oliver E. (1983, 1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. (New York: The Free Press).