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Primer on Reforms in a Second-Best Ambiguous Environment: A Case for Gradualism

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Primer on Reforms in a Second-Best Ambiguous Environment: A Case for Gradualism

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Abstract

Ambiguity, as opposed to uncertainty, reflects lack of sufficient information about distribution and payoffs of infrequent events. Reforms are infrequent events, undertaken in ambiguous second-best environments where bad reform outcomes are feasible. A general case for the gradualist reform strategy is that it may pay to defer some reforms until relevant information about possible reform outcomes and associated probabilities is revealed, and ambiguity is reduced over time. Gradualism may dominate the big bang strategy, if some of the reforms in a reform sequence are not sure bets and waiting costs do not dominate reversal costs under some information sets forthcoming over time. The relation to Ellsberg's Paradox is discussed. Some cases for and against gradualism are reviewed.

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"For the fact that many of our hopes did not materialize. For things which to us seemed simple but turned out arduous. I want to ask forgiveness for the fact that I was not able to justify the hopes of some people who believed that we would be able to move forward in one swoop from a gray totalitarian and stagnant past to a bright, rich and civilized future. I believed it myself. But it did not work out like that. In some way I was too naïve" (Excerpt from President Boris Yeltsin's farewell speech on his resignation, as quoted in Soros, 2000).

"*(A)lmost all choices occurring in real life are sequential, 'piece-meal' choices between alternative ways of narrowing down the presently existing opportunity rather than 'once-and-for-all' choices between specific programs visualized in full detail. The mere passage of time cuts down a decision maker's opportunity set even in the case of inaction on his part. If we incorporate inaction among available alternatives, we can therefore look on economic choice at any one time as inevitable choice between several and many specific sub opportunities, that is, subsets of the opportunity set are available at that time provided a choice is made right then. As time proceeds, a sequence of such choices will need to be made at successive moments in time*" (Koopmans, 1964, p. 245).

I. Introduction

Reform is a process that takes place in a second-best environment of ambiguity about its intended and unintended consequences. Both the pre-reform (status quo) and post-reform environments are second-best as a rule. However wide the range of reforms may be, their implementation cannot remove *all* the inefficiencies in the economy and make it move to *the* first-best equilibrium. Therefore, reform outcomes inferior to the status quo are feasible in the standard second-best sense. Also, like nearly all economic policies, reforms are public goods (or bads) that involve social decision-making in a political environment. Furthermore, the reformer has only imperfect information about the status quo equilibrium and about the possible equilibria (outcomes) after reforms and the probabilities associated with those equilibria. In reality, reforms have to be implemented in such an ambiguous second-best environment. In this proper context for evaluating the speed of reform implementation, the gradualist reform strategy may dominate the big bang strategy for a wide variety of reform packages.

There are examples of successful and unsuccessful reform experiences from the transition and developing countries that lend credence to both the big bang and gradualist strategies. However, the strategic choice between a speedy *vs.* a slower-paced implementation of reforms is not confined to countries that are at early stages of reform. Higher generation reforms are an ongoing process in many advanced countries also. Thus, the decision to adopt the gradualist *vs.* the big bang reform strategy is an important social choice problem both in the case of first-generation and in the case of higher generation reforms.

This paper provides a first-order theoretical basis for distinguishing the gradualist reform implementation strategy from the big bang strategy in a second-best ambiguous environment. Motivated by the findings of some behavioral experiments that seem to contradict the standard Expected Utility Theory, the paper discusses the distinction between ambiguity and uncertainty, with an application to an important social choice problem: the choice between speedy *vs*. rapid reform implementation. The paper argues that the appropriate context for deciding on the speed of reform implementation is a second-best ambiguous environment. In such a context, a general case for gradualism can be made, if some reforms in a reform package are not sure bets and passage of time reveals important information about possible reform outcomes. In some cases, the expected cost of bad reform outcomes may outweigh the cost of delaying some reforms until later. Under the gradualist reform strategy, delaying some reforms until more information is revealed provides the flexibility to act on those reforms without the obligation to do so.

An introductory discussion of the underlying arguments from the literature on ambiguity in the reform context and a review of the literature on gradualism *vs*. big bang reform strategies will be useful for motivating the formal analysis that follows.

A. Uncertainty, Ambiguity, and Reforms

The conceptual difference between ambiguity and uncertainty has important implications for decision-making. The standard Expected Utility Theory axiomatically posits that the possible outcomes and probabilities associated with a decision are well defined. Frequent bets with a large number of repeated observations result in objective or market determined assessments of possible payoffs and probabilities. Such bets characterize the cases of uncertainty.

Reforms, however, are infrequent bets. An exhaustive *ex ante* evaluation of possible reform outcomes based on an objective assessment of the associated probabilities is an impossible task in reality. Infrequent bets with under-defined payoffs and probabilities characterize the cases of ambiguity.[1] An early systemic discussion of ambiguity is by Ellsberg (1961). Ellsberg's Paradox inspired interesting experimental and behavioral studies, especially in the area of insurance.[2] For example, natural catastrophes (earthquakes, floods, hurricanes) are relatively infrequent events. Ambiguity about the probability of occurrence and size of damage of such events reflecting the lack of a large number of repeated observations plays an important role in the analysis of catastrophe insurance. Lack of adequate reinsurance for natural catastrophes even in developed insurance markets (for example, the United States) may be attributable to ambiguity.[3]

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[1]Early discussions of ambiguity go back to Frank Knight and J. M. Keynes. Ambiguity is often referred to as *Knightian uncertainty*.

[2]Ellsberg's Paradox is discussed in Section II. In the insurance area, Hogarth and Kunreuther (1985) and Kunreuther and others (1995) provide some experimental models and results. Schoemaker (1982) and Camerer and Weber (1992) provide reviews of the debate on the applicability of the standard expected utility analysis under ambiguity.

[3]See Dacy and Kunreuther (1969, Chapter 3) and Froot (1999, Introduction).

Two broad sources of ambiguity have been discussed in the literature: ambiguity due to the lack of point estimates for outcomes, and, ambiguity due to the lack of point estimates for the probabilities associated with those outcomes. Ambiguity about possible reform outcomes can be attributable to the second-best environment in which reforms take place. Even in theoretical analysis, the comparison of improved—but nevertheless second-best—possible reform outcomes to the n^{th}-best status quo is precarious. When such comparisons can be made, this necessarily involves many restrictive (and sometimes unrealistic) assumptions. In reality, with a large array of constraints—some unknown, some unknowable *ex ante*—it is not possible to make a point estimate for *the* reform outcome. Many credible reform outcomes are feasible, some better, some worse than the status quo, as predicted by various actuaries (economists, domestic and international technical experts, politicians). The reformer needs to heed at least some of those predictions before making the decision to adopt a reform package.

Ambiguity about the probabilities associated with possible reform outcomes can be attributed to the relative infrequency of reforms. For infrequent events like reforms, a large number of repeated observations on the distribution of good and bad outcomes are not at the disposal of actuaries. Even when actuaries provide probability estimates, those estimates may be divergent, even contradictory.

Ambiguity in the case of reforms is present even when similar reforms are tried and tested in other countries, successfully or unsuccessfully. Although the lessons learned from those experiences set precedents for an assessment of possible reform outcomes, they are seldom directly applicable to a country contemplating similar reforms. This is mainly due to the differences in context between a country contemplating reform and countries with similar reform experiences. These differences are determined by the diversity of competing interests of those who may benefit or lose from reforms, the degree of competitiveness of markets, institutional arrangements and their effectiveness, and so on. Such differences with imperfect information place the *ex ante* evaluation of reforms in a state of ambiguity as opposed to uncertainty, even when there are reform precedents.[4]

In this paper, ambiguity is modeled in the context of a simple dynamic compound lottery. It is a simple variant of Ellsberg's Paradox. This approach is along the lines of Segal's (1987) approach, which views ambiguous games as dynamic compound lotteries. The present model also reflects a preference for flexibility similar to the model analyzed by Jones and Ostroy (1984). It is also similar to the options approach to investment theory developed by Dixit and Pindyck (1994). The paper argues that if the decision maker has the *option to dynamically split* a compound lottery at a price, under some general conditions, he may opt to do so. If the reformer perceives a compound reform lottery as ambiguous and the simple

[4]On the general impossibility of a complete *ex ante* evaluation of reform outcomes, see Murrel (1992). Murrel argues that the existing information stock evolves over time through experimentation.

dynamically split lottery as uncertain (or less ambiguous), then he may make a deliberate decision to avoid ambiguity and defer the decision to adopt some reforms in a reform package until later.[5] This is because deferring the implementation of some reforms until later periods may enable the reformer to observe additional information about reform outcomes. Waiting until additional information is observed allows for the policy flexibility of not adopting some reforms and avoiding reversal costs, if updated projections in light of new information indicate that some reforms will not pay off relative to the new status quo. This, in essence, is a Bayesian learning process. In the present model, this process takes time. This means that the reformer may prefer the gradualist strategy to the big bang strategy of playing the compound lottery represented by a given reform sequence in the initial period when a sequence of reforms are being contemplated.

B. Options, Private Investment, and Social Investment

As such, the gradualist strategy is similar to financial market options that enable buyers and sellers to hedge against uncertainty that will be resolved over time. This strategy is also relevant for investment decisions under uncertainty.

Dixit and Pindyck (1994) have extended the options theory to investment theory. Those authors note that most investments take considerable time to implement and—like most reforms—investment decisions are often irreversible; at least, significant costs are associated with reversal, which may well exceed the costs of waiting, or, costs of delaying investment decisions until a future period. Thus, delaying an investment decision may pay off, if economically significant information (for example, price information) is expected to be forthcoming at a future date. Therefore, an investor who chooses to defer an investment decision until later is reserving the option without the obligation to act on an investment in the future; this is analytically equivalent to a financial call option.

Dixit and Pindyck (1994) further extend this approach to multi-stage investment decisions, similar to multi-reform packages considered in this paper. They underline that multi-stage investment decisions may not be implemented all at once, and such investments can be stalled for a duration or even be abandoned. Those possibilities reflect new information forthcoming at each stage of the investment project. Thus, investments are analogous to compound options for decision makers facing dynamic compound lotteries; implementing multi-stage investments gradually gives the investor the option to undertake or halt or abandon the next stage of investment. In other words, compound investment lotteries call for compound options to hedge against uncertainty over time, and firms may be willing to pay for them by foregoing, for a duration, the expected cash flow from the multi-stage investment project as a whole. Dixit and Pindyck (1994) conclude with the observation that investment may be much less sensitive to interest rates and tax policies than to volatility and uncertainty in the economic environment. In this paper, such an economic environment is characterized as ambiguous.

[5] Ambiguity aversion has been documented in many behavioral studies; see Section II.

However, while technically illuminating, the similarities between the gradualist strategy, financial market options and investment decisions under uncertainty cannot be extended into the realm of social choice. Reforms are social investments. Unlike financial option payoffs, reform outcomes are public goods (or bads), and there is no market where the "sellers of reforms" can enter into efficient contracts with the "buyers of reforms" to hedge against the risks of incurring bad reform outcomes. Unlike private investment decisions, public losses from bad outcomes for reforms cannot be internalized through the market process. Individual winners and losers are not rewarded or punished at the risk of their own private decisions. The gradualist reform strategy as a social investment policy can provide flexibility and securitize against bad reform outcomes and possible reversal costs.

C. Gradations of Reforms and the Status Quo Bias

In the context of a second-best ambiguous environment, I propose two criteria for grading reforms, which are by no means exhaustive but adequately general for the purposes of this study. The first is the degree of ambiguity about reform outcomes. The second is the degree of ambiguity about the immediacy with which reforms need to be implemented, as dictated by the exigency of the circumstances that necessitate reform under the status quo.

Some reforms exhibit relatively smaller ambiguity in most countries; for example, basic price, exchange, and budget reforms. Actuaries can assess expected outcomes and associated probabilities in the case of such reforms relatively easily, analytical conclusions of actuaries converge to a great extent, and policymakers understand these conclusions relatively easily. Furthermore, a wide range of successful reform outcomes in a wide variety of countries provide supporting empirical precedent for such reforms and serve to lower ambiguity in the minds of policymakers. Such reforms may be identified as *first-generation* or less ambiguous reforms.

On the other hand, many reforms exhibit great ambiguity as to their outcomes and associated probabilities; for example, health reform, civil service reform, legal reform, price deregulation, anti-trust interventions, environmental regulation and deregulation, privatization, labor market reforms, financial sector liberalization, and so on. Although such reforms may be less ambiguous in some countries than in others, by and large, they fall into the category of *second-generation* or more ambiguous reforms. They are not only confined to the reform agendas of developing and transition countries. The social and political debate on the second—and higher—generation reforms is an ongoing process in the industrial countries also.[6] The assessments of possible outcomes and probabilities of second-generation reforms are far more dispersed, often diverging on even the most fundamental aspects, riddled frequently with

[6]The energy crisis in California following price deregulation indicates that bad reform outcomes are feasible even in most advanced market systems with equally sophisticated regulatory back-up. On January 8, 2001, the Governor of California declared energy price deregulation a failure and subsequently committed large public funds to remedy the situation.

adversarial political posturing and attempts to justify one assessment over the other with conflicting data, contradictory quantitative results, even apocryphal historical and international comparisons.

Barring obvious cases, the status quo is not immune to ambiguity, either, even though it is an observed event. This is because the costs and benefits of the status quo may also be difficult to assess in a second-best environment. Various actuaries, including those who may have a stake in the status quo, may have divergent assessments of it, some of which may well be credible. As supported by IMF program experience, the exigencies under the status quo tend to accelerate adoption of reforms. When a country is in an acute balance of payments crisis, it is more likely to accept conditionality predicated on some reform measures. The more acute the status quo exigencies are, the more prone the policymakers appear to be to undertake reforms in ambiguity. The less affordable the status quo and less ambiguous the cost of the status quo are, the more likely it is that reforms are adopted in ambiguity. For example, a currency crisis may make the inadequacy of the prevailing financial system less ambiguous and prompt a speedy adoption of financial sector reforms.[7] However, as reform measures are implemented over time, better outcomes than the status quo become the new status quo, and this apparently serves to reinforce the status quo bias in adopting higher generation reforms.[8]

In conclusion, reforms may be graded on the basis of the degree of ambiguity they exhibit about their outcomes and the degree of ambiguity about the status quo. As argued below, ambiguity favors the status quo relative to reform and it favors gradualism relative to big bang. Consequently, the gradualist reform strategy may dominate the big bank strategy under rather general conditions and successive reform measures may become more difficult to adopt.

D. Political Economy of Reforms: Heterogeneity Among Economic Agents

Under ambiguity, the reformer needs to resort to a subjective evaluation of reform outcomes and probabilities. Altruism on behalf of the reformer is a frequent assumption in theoretical analysis. However, the reformer needs not be altruistic. The policymaker can be self-seeking as he weighs the losses and gains from reform to himself, to his constituency, to his political party, and to his opposition. This assessment process is usually politically adversarial, and adversity may increase the number of constraints in the formulation of a reform package,

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[7]Drazen and Grilli (1993) provide a supporting analysis; they argue that economic crises may have welfare-improving effects because they produce social consensus about the need for drastic stabilization and reform measures. Tommasi and Velasco (1996) argue that crises may accelerate the Bayesian learning process about the "right" economic model of the world.

[8]During a recent IMF conference on *Second-Generation Reforms* (November 1999), it was noted that a fundamental reason why second-generation reforms were more difficult to adopt than first generation reforms was that country authorities were less convinced of the benefits from second-generation reforms than they were of the benefits from first-generation reforms.

hence increase ambiguity. Alesina and Cukierman (1990) argue that, in some circumstances, politicians may even have an incentive to create ambiguity about their policy preferences in order to be reelected.[9] Alesina and Drazen (1991) examine adversarial political interactions in reform processes. Those authors argue that the burden of reform is distributed unevenly between social groups, which motivates them to enter a "war of attrition" that delays the adoption of imperative reforms (stabilization). Along similar lines, Fernandez and Rodrik (1991) argue that uncertainty about who will be the winners and losers from reform favors the status quo.

It has also been recognized in the literature that the big bang policy strategy may not be politically credible. Blanchard (1985) has argued that a big bang disinflation program can result in high unemployment, and this may push the policymaker out of office. However, the gradualist disinflation strategy may produce lower and politically acceptable unemployment rates and increase the chances of the policymaker to stay in office and conclude the disinflation program. Thus, the big bang strategy may be self-defeating. Along similar lines, Coricelli and Milesi-Ferretti (1993) underlined the irreversibility of the big bang reform strategy and argued that the big bang strategy in transition countries could undermine the credibility of such a reform program because of its large adverse impact on output and unemployment (as it turned out to be the case in many transition countries). In this regard, Calvo's (1989) argument is also to the point; indeed, large scale reforms implemented in a big bang fashion may not be credible and be vulnerable to time inconsistency, that is, to reversal. Similarly, Wei (1999) showed that a desirable reform program may not be implemented if the big bang strategy is followed because of political resistance; but the gradualist strategy may make this reform program politically viable.

A counter-argument is by Martinelli and Tommasi (1997); those authors argue that in some cases (Latin America) the big bang strategy may have been preferred because gradualism is vulnerable to abandonment of reforms at each point in time when a reform measure is being implemented as a result of resistance by those who stand to lose from reform; therefore political opposition to reforms may be overcome by the big bang approach.[10]

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[9]On the policymaker's preference for creating ambiguity about monetary policy, also see Cukierman and Meltzer (1986); these authors argue that such ambiguity enables the policymaker to generate positive policy shocks to stimulate the economy.

[10]For a review of the political economy literature, see Rodrik (1993), Drazen (1996, 2000), and Tommasi and Velasco (1996). Additional related literature is reviewed in Section VI.

E. Analytical Focus

The focus of the present paper is not delays in adoption of reforms due to political conflict between potential winners and losers from reform.[11] This paper maintains the assumption that the policymaker—reformer—is altruistic and that economic agents are homogeneous in order to focus on a first-order evaluation of the big bang *vs*. the gradualist reform strategy. Political conflict, the voting behavior of potential winners and losers (for example, of the median voter, or, of those voters who are "more median than others"), self-interests of the reformer, the institutional background, and the degree of market competitiveness are all subsumed in an ambiguous second-best environment. The reference to imperfect information here is not uncertainty about outcomes of reform for individuals who may stand to win or lose from reform, as emphasized in the literature cited above. Here the reference is to ambiguity, or, the lack of sufficient information about the distribution and payoffs about possible reform outcomes. It appears that this aspect of the speed of reforms has not been addressed in the literature.

This focus is the same as Dewatripont and Roland's (1995), who made a case for gradualism in a model of aggregate uncertainty about large scale reforms. Those authors have noted that a somewhat fallacious understanding has been that reform outcomes will always be better than the status quo; they have further emphasized the option value of gradualism to avert high reversal costs that may be incurred in the event of bad reform outcomes under the big bang strategy. The analytical value added of the present paper is to rationalize the gradualist strategy in the context of the violation of a fundamental axiom of the standard expected utility analysis, namely, the reduction of compound lotteries axiom. This issue is related to the literature on ambiguity, which is discussed in the next section.

F. Expected Value and Expected Utility Analysis

The paper distinguishes between gradualism and sequencing and provides an alternative explanation for delays in reform processes, loss of momentum over time, and even reversals of reforms. The paper evaluates the big bang and gradualist strategies first in the context of expected values and then in the context of expected utilities. The general results from both approaches are compatible. Importantly, however, expected utility analysis reveals that the reformer behaves *as if* he is more risk averse under the big bang strategy relative to the gradualist strategy. This result is consistent with the empirical findings on ambiguity aversion. It indicates that, for the same expected payoff from reforms, the risk-averse reformer prefers gradualism to big bang. Consequently, it is feasible that the utility of the certain payoff of the status quo is higher than the expected utility from big bang but lower than the expected utility from gradualism. Therefore, the gradualist strategy may at least facilitate the initiation of a

[11]That is, the focus here is *not* the heterogeneity of interest or information, emphasized in the literature cited in the foregoing section, to invoke an economically meaningful context for the choice between gradualism and big bang strategies.

reform process in a given, preferred reform sequence, whereas the reformer may not undertake any reforms if he does not have the gradualist option and must follow the big bang strategy. These insights are not confined to economic reforms but are also useful in discussing many policy issues, including social and political ones.

G. Some Cases For and Against Gradualism

Within the analytical context of the paper, some arguments for and against gradualism are revisited, including cases on enterprise restructuring and budget constraints; tax reform and quasi-fiscal policy instruments; price liberalization; tariff reforms; stabilization; and financial sector reform.

H. Main Conclusion

The gradualist reform strategy may dominate the big bang reform strategy, if some reforms in a reform package are not sure bets and waiting costs do not dominate reversal costs under some information sets forthcoming over time. Gradualism provides the flexibility without the obligation to act on some reforms, whereas the big bang strategy does not have that flexibility and may entail costly reversal and loss of welfare under possible bad reform outcomes. Flexibility under gradualism comes at a price in the form of postponing, at least for a duration, the expected benefits from possible good reform outcomes.

I. Paper Outline

Following this introduction, a brief review of the research emanating from Ellsberg's Paradox is provided in Section II, and its relation to this paper's analytical framework is discussed. The conceptual differences between sequencing and gradualism are discussed in Section III. In Section IV, the big bang and gradualist reform strategies are compared in the context of expected values, and the conditions under which one strategy dominates the other are delineated. A model of the gradualist strategy with a long implementation lag is also provided in that section. Section V extends the analysis to the expected utility framework. In the context of the analytical results, some cases for and against gradualism are reviewed in Section VI. Section VII concludes.

II. Ellsberg's Paradox: Ambiguity vs. Uncertainty in Reform Processes

A. Ellsberg's Paradox and Ambiguity Aversion

Like the Allais Paradox, the Ellsberg Paradox is a critique of the Savage-von Neumann-Morgenstern expected utility axioms. Ellsberg's (1961) contribution—with commentary by Fellner and Raiffa—is one of the early systemic expositions of ambiguity.

A simple variant of Ellsberg's problem is the following. Suppose there are two urns: U_1 contains 5 black and 5 red balls and U_2 contains 10 balls; U_2 may contain from 0 to 10 black balls, or, obversely, from 10 to 0 red balls. If you were to place a bet on a given color, from which urn would you choose to draw? The probability of winning for both urns is ½. Ellsberg argued—as supported by later experimental evidence—that most people would prefer to draw from U_1 (the urn of uncertainty) and not from U_2 (the urn of ambiguity).

Ambiguity aversion has been documented by many behavioral experiments. An early empirical study is by Becker and Brownson (1964). In their experiment, those authors defined ambiguity as the lack of point estimates for the probabilities of outcomes of a bet in the Ellsberg context. They found that some subjects' decisions violated the expected utility axioms, some subjects showed aversion to ambiguity, and they were willing to pay to avoid it. In the insurance area, Hogarth and Kunreuther (1985) presented evidence that consumers were more willing but firms were less willing to insure under ambiguity than under uncertainty for a given price structure. Evidence provided by the same authors (1992) showed that the prices for a warranty assessed by actuaries were significantly higher under ambiguity than under uncertainty. Kunreuther and others (1995) found further empirical evidence that the more ambiguous the risk was, the less likely an insurer would underwrite that risk. Those authors also found support for status quo bias under ambiguity along the lines of the results provided by Samuelson and Zeckhauser (1988). The latter authors emphasized transaction costs of giving up the status quo, which may include the psychological cost of giving up a commitment and regret.[12] As discussed by Bell (1982) and Loomes and Sugden (1986), if regret (alternatively, elation) due to a realization of an outcome after committing to a decision is incorporated in the utility function, this may explain why experimental results on some decisions seem to violate the expected utility axioms and lend analytical support to the observed instances of status quo bias. Kahn and Sarin (1988) presented additional evidence that the consumers were willing to pay a premium to avert ambiguity and that context mattered in the size of premia.[13] Schoemaker (1982) and Camerer and Weber (1992) provide reviews of the literature, and commentaries on the essentials of the theories and evidence on behavior under ambiguity.

In summary, empirical evidence suggests that decision-makers tend to avert ambiguity by choosing *uncertain* Savage-type lotteries to *ambiguous* Ellsberg-type lotteries. Furthermore, they are willing to pay in order to avert ambiguity. Although most experiments in this area have been cast in a static context, they provide empirical support for a dynamic reflection in comparing the gradualist and big bang decision-making alternatives. There may indeed be a behavioral preference for gradualism in dynamic decision-making situations because this

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[12]Interestingly, Samuelson and Zeckhauser (1988) also found empirical support for *status quo* bias in choosing plant capacity (size of airline fleet) along the lines of the classical analysis of the same issue by Stigler (1939). Also see Marschak and Nelson's (1962) commentary on the Stigler problem in the context of flexibility. For more on flexibility, see Koopmans (1964), Henry (1974), Jones and Ostroy (1984), and Dixit and Pindyck (1994).

[13]For example, the subjects were willing to pay a higher premium to avert ambiguity about the side effects of some drugs during pregnancy than they were for electronic appliance warranties.

strategy reduces ambiguity over time. In essence, gradualism is a Bayesian learning process. As better information becomes available, prior beliefs about the distributions and payoffs are updated by incorporating posterior observations.[14] In the present model, this process takes time.

B. Compound Lotteries and Ambiguity

According to the reduction of compound lotteries axiom of the Expected Utility Theory, a compound lottery can be reduced to a simple lottery (Figure 1). However, empirical evidence suggests that this fundamental axiom may not hold.[15] In view of the observed violations of this axiom, Segal (1987) argued that ambiguity aversion in the Ellsberg-type lotteries might be due to the possibility that the decision-maker views the ambiguous lottery as a two-stage (multi-stage) dynamic compound lottery. If sufficiently long time passes between the two stages of the lottery, then the reduction axiom may not hold. Playing the first stage of the compound lottery makes the second stage more clearly distinguishable.[16]

Along those lines, in the present context, a version of the Ellsberg Paradox may be cast as follows (Figure 1).[17] This version of the Ellsberg game uses the standard expected utility analysis, however, with the departure that the reduction axiom may be violated, if the decision-maker has the option of *dynamically splitting* the compound lottery.

There are two alternative games. In *Game I*, there are three urns: U_1 contains 5 black and 5 red balls; U_2 contains 15 black and 5 red balls; and, U_3 contains 5 black and 15 red balls. This game involves drawing from U_1 first to determine whether you draw from U_2 or U_3 subsequently. Drawing from U_1 pays and costs nothing, and whether you win or lose on the color you bet depends on the second drawing.[18] Given your bet on the color of your choice, if you draw black from U_1, you are required to draw from U_2; if you draw red from U_1, you are required to draw from U_3. In the alternative game, *Game II*, there is only one urn, which contains 10 black and 10 red balls. If you were to make a fair bet on a color, would you choose to play the first or the second game? Simple comparison of the two alternative games shows that

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[14]For formal models, see Gilboa and Schmeidler (1993) and Epstein and Le Breton (1993).

[15]For example, see Kahneman and Tversky (1979).

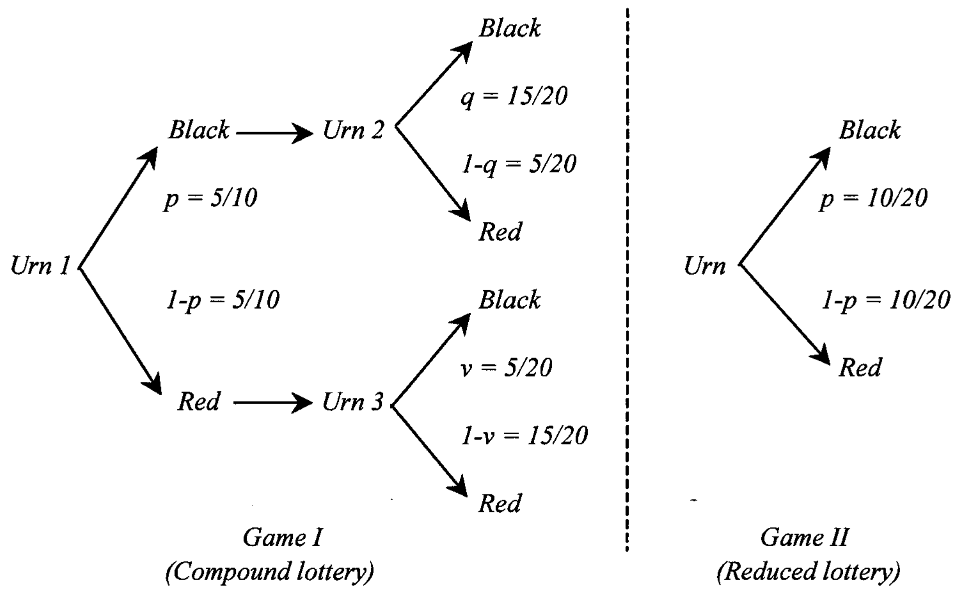
[16]For an empirical evaluation of Segal's thesis, see Bernasconi and Loomes (1992). These authors have conducted an experiment using an explicitly two-stage analogue of an Ellsberg-type problem and found that this design significantly reduced Ellsberg-type ambiguity aversion.

[17]The example is similar to the model posited by Jones and Ostroy (1984).

[18]We may conveniently assume that the expected gain from the first stage is zero.

the chance of winning in either game is 50 percent.[19] Under the standard Expected Utility Theory, the two games are analytically equivalent both under risk neutrality and for a given degree of risk aversion (with more than fair payoffs).

Figure 1. Ellsberg's Paradox: Ambiguous and Uncertain Games Compared



But the empirical evidence suggests that the two games are not equivalent because the first game, a compound lottery, cannot be reduced to a simple lottery. I think that the two games are not equivalent because of the *availability* of the second game as a simple lottery alternative to the first game. If the second game is available, then the decision-maker compares ambiguity (risk on risk) in *Game I* to uncertainty (risk) in the *Game II* and prefers *Game II* to *Game I.* If *Game II* is *not* available, however, and the decision-maker *must* play, then he might resort to the reduction axiom to evaluate payoffs, as posited by the standard Expected Utility Theory. But most experimental findings, which indicate that decision-makers are willing to pay more to avert ambiguity than they are to avert uncertainty, rest on the experiment design that makes an alternative like *Game II* available to *Game I.* Furthermore, if the decision-maker is confronted with *Game I* with no alternative game, he still may have an alternative, namely, *inaction*, or, not playing at all (Koopmans, 1964). This is indicative of the status quo bias, as supported by

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[19]In the first game, probability of betting on black and winning is $(\frac{1}{2})(\frac{15}{20}) + (\frac{1}{2})(\frac{5}{20}) = \frac{1}{2}$, which is also equal to betting red and winning. In the second game, the same probabilities are also equal to ½.

Samuelson and Zeckhauser (1988) and other findings. If the decision-maker were given three alternatives, *Game I*, *Game II*, and inaction, the availability of *Game II*—even with a lower expected payoff than *Game I*—as an alternative to the ambiguous *Game I* may break the status quo bias and induce the decision-maker to play. Similarly, if *Game II* is not available, playing *Game I* in stages with the option of not playing the second stage may also break the status quo bias.[20]

Is there a preference to play the compound lottery in stages with the option of not playing the second stage? This paper's position is that there may be a preference for such flexibility, if that option is available. It is easy to surmise that inaction is an option available to the reformer in many reform cases. Models of Ellsberg's Paradox have been usually cast as static games, and there is ample behavioral evidence that most players choose the urn of uncertainty as opposed to the urn of ambiguity in static games. I think that the feasibility of dynamically splitting the compound lottery offered by the urn of ambiguity in the Ellsberg experiment brings a new angle to evaluating behavior under ambiguity. The empirical results provided by Bernasconi and Loomes (1992) shed some light on this question; however, I am not aware of experimental results on dynamically split choice situations like the reform experiment posited in this paper.

C. Irreducibility of Dynamic Compound Lotteries and Gradualism

Observed violations of the expected utility axioms (in particular, the reduction axiom and the independence axiom) have elicited *non-expected utility models*.[21] However, the basic results in this paper are obtained by using the standard expected value and expected utility analysis. The main departure is that compound lotteries in a dynamic setting may not be reducible to simple lotteries. Indeed, in Figure 1, if *Game I* is reducible to *Game II* in utility terms as under the standard Expected Utility Theory, then there is no room for gradualism; the decision maker's evaluation of *Game I* is equivalent to his evaluation of *Game II*, and his choice is restricted to playing *Game I* or not; if he decides to play, he will play the big bang strategy. But if *Game I* is not dynamically reducible to *Game II* in expected utility terms, then there is

[20]Bet on a color; draw from U_1 first; wait and see the outcome. If you bet on black and draw black from U_1, play U_2; if you draw red from U_1, do not play. If you bet on red and draw red from U_1, play U_3; if you draw black from U_1, do not play.

[21]The main characteristic of these models is that the utility function is not separable over its arguments, hence the probabilities do not sum up to unity; for a review, see, for example, Machina (1989). Einhorn and Hogarth (1986, 1990), among others, have argued that, in the process of forming subjective probabilities in ambiguous environments, decision makers exhibit ambiguity aversion by behaving as if Nature will deal against them: they assign lower weights to the probabilities associated with good outcomes and higher weights to those associated with bad outcomes. This implies that probabilities may be *sub-additive*, that is, the sum of the (subjective) probability of winning and probability of losing may be less than unity.

room for gradualism, or, playing *Game I* in stages over time. This paper argues that the standard expected utility analysis is sufficient to show that dynamic compound reform lotteries similar to *Game I* are *not* reducible to simple static lotteries like *Game II.*[22]

The present model for comparing the big bang and gradualist strategies is constructed on the foregoing premise. I argue that there is an incentive to dynamically split the big bang lottery, that is, to opt for the gradualist strategy in reform processes. If the reforms in a given sequence are not independent of each other, and if it is feasible to dynamically split the compound reform lottery at a cost, then the reformer can make an economically meaningful decision to defer some reform actions to later periods; but then, this is gradualism. The reformer may choose the *dynamic* gradualist strategy over the *static* big bang strategy because the dynamic gradualist lottery serves to reduce ambiguity and provides policy flexibility. Moreover, the reformer may be willing to pay to have that option.

III. Sequencing and Gradualism

It is possible that unless one or more reform actions are taken in the initial period, t, no significant information relevant for the remaining reform actions can be revealed at the end of t. On the other hand, extraneous information may be forthcoming at the end of the initial period independently of whether any reform action is undertaken in that period. In general, both of these informational conjectures will apply. I first discuss the case of no extraneous information.

Consider two reform actions, R_1 and R_2. In general, these reform actions are *not* independent of each other; the outcome of one action affects the outcomes and associated probabilities of the other. How to interpret the payoffs in the reform context? An interpretation may be that the reformer starts from a given income level, Y, as in the game depicted in Figure 2a. The new income levels, G_i, represent the possible outcomes of the first reform, and the income levels W_j represent the possible outcomes of the second reform (the possible final outcomes of the reform package). However, it is also possible that reforms may be effected to improve the level of welfare for a given income level; for example, tax efficiency may be improved for the same level of net income (tax revenue) before and after reforms. The first interpretation is more suitable for an analysis of the speed of reform implementation using expected values and the second more suitable for an analysis using expected utilities. Following this section, the simpler case of expected values is discussed in Section IV, and the more complicated case of expected utility is discussed in Section V.

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[22]Of course, dynamically, *Game I* might be cast as a more ambiguous one; for example, it may contain "hidden nodes," that is, some eventualities that are unknown or unknowable *ex ante*; see Machina (1989). Along with Segal's (1987) and Jones and Ostroy's (1984) approach, I think the design of *Game I* in Figure 1 is sufficient to invoke ambiguity in dynamic choice situations.

The term sequencing has been frequently used synonymously with gradualism in the literature. Sequencing may have even become a euphemism for gradualism. Such usage, apparently, has somewhat blurred the conceptual difference between these two issues.[23]

An appropriate way to distinguish between the two concepts is to underline that, dynamically, sequencing refers to the economically "simple" passage of time in the sense that, once reform actions are properly sequenced, it takes calendar time to implement them one after the other. But possible information flows over time do not critically affect the reformer's economic decisions over time; therefore, resolution of uncertainty over time is economically insignificant. In this context, sequencing may be viewed as an *atemporal* (timeless) or a *static* game.[24]

In a simple reform package with two reforms, if R_1 and R_2 do not reveal any information about each other, or, if they are independent, sequencing is a simple random draw between the two reform actions. When the two reform actions reveal some information about each other, the alternative to the reform sequence $R_1 \rightarrow R_2$ is the sequence $R_2 \rightarrow R_1$, which requires that the second reform also reveal some information about the possible outcomes of the first reform.[25] If this is the case, the information structure in Figure 2a may be reversed, as shown in the example in Figure 2b.[26] Now, $(G_i^{'}, p_i)$ are associated with R_2 and $(W_j^{'}, q_j)$ are associated with R_1. Comparing the expected outcomes under the preferred strategies in the sequences $R_2 \rightarrow R_1$ and $R_1 \rightarrow R_2$, a judgment can be made about which sequence to follow. It is possible that, under one sequence, big bang dominates gradualism and, under the other, the opposite is true. Then, the comparison of expected values under these two preferred strategies reveals which sequence should be chosen.[27]

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[23]An acknowledgement in this regard is in Martinelli and Tommasi (1997, p. 116).

[24]For more on the distinction between static and dynamic games, see Machina (1989).

[25]In some cases, sequencing may be obvious; for example, it is most plausible that reform of tax administration should precede implementation of a new tax system. However, even then, learning-by-doing in the process of implementation of tax reform may reveal valuable information for administrative reform.

[26]Of course, the reversed information structure in the $R_2 \rightarrow R_1$ sequence may be more complicated than the one shown in Figure 2b, even if the information structure applying to the sequence $R_1 \rightarrow R_2$ is the same.

[27]An example along these lines is by Husain and Sahay (1992). A more recent analysis with a review of the literature is by Bhattacharya (1999).

Figure 2a. Reforms With No Extraneous Information (R_1-R_2)

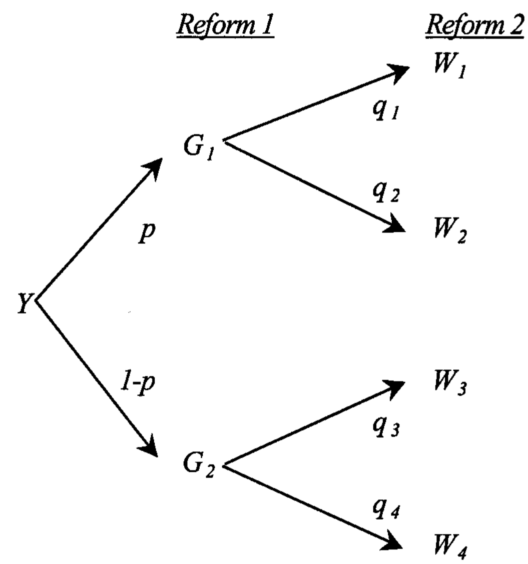
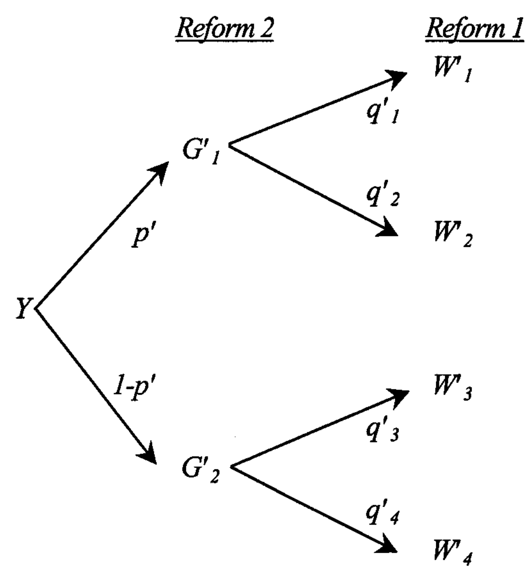


Figure 2b. Reforms With No Extraneous Information (R_2-R_1)



However, even as the appropriate sequence is chosen, the dynamic problem remains. Is the passage of time economically "simple" in the course of implementation of the chosen sequence? If so, then the reformer can presumably make a full and maybe even an irreversible strategy implies that the reformer is somehow able and willing to make such a commitment. Of course, as a natural physical constraint, time passes in the course of implementation of the adopted sequence, but this is economically "simple" passage of time. The reformer has played out his hand in the initial period, and somehow the reformer does not need to or cannot make economically significant decisions through the implementation of the sequence over time. Hypothetically, if the implementation of the sequence could be accomplished at the instant the appropriate sequence was determined and the decision to play the game was made, then the outcome of the reforms in the sequence would be known immediately. Passage of time does not matter in an economically significant way; it only matters in a "simple" way, as a physical constraint, because in reality the sequence cannot be implemented instantaneously. Consequently, at the conceptual level, the big bang strategy is a *static* game.

In contrast, gradualism means that, even after the appropriate sequencing of reform actions is determined and thus a reform package is adopted, the policymaker takes a "wait-and-see" approach and does *not* commit to adopting all the reforms *ex ante*.[28] Under the gradualist strategy, therefore, passage of time is *not* "simple" in the sense that passage of time involves information flows, which critically determine whether the reformer will undertake all the reforms in the reform package. The reformer wishes to observe the outcome of some of the reforms that are slated ahead of others in the preferred sequence in the earlier periods. The decision to defer some reforms to later periods must be of some economic value, or the reformer would choose the big bang strategy. Under gradualism, the reformer values the information revealed by the outcomes of the reforms effected in the earlier periods, and he deliberately defers the decision to implement the remaining reforms to later periods. Therefore, gradualism needs to be viewed as a *temporal* or a *dynamic* game.

Although sequencing is embedded in gradualism, it is distinct from gradualism in the sense that gradualism must be couched in a dynamic context whereas sequencing need not. If sequencing is meant to be effecting reforms over time because it takes more than one period to implement a sequence, then the reference is to the "simple" passage of time. In view of exorbitant transactions costs and for a reasonably short time period, it is not possible to implement a given reform package in one period in reality. But even though time passes during the implementation of the sequence, the game is still static.[29] On the other hand, if sequencing is

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[28]This important distinction has been noted by Borensztein (1993) and Johnston (1994).

[29]For example, even if a prospective homeowner has fully committed to a given project that fully specifies the costs, floor plan, quality of materials, and so on, it takes more than a month but less than a year to build a house. The preferred sequence in building a house is to start from the foundation. At exorbitant transactions costs, it may be technologically possible to build a house in one month by having all the necessary materials and labor lined up and waiting—if the weather does not cooperate, the circus tent is ready to pitch. In view of the large transactions costs, the homeowner decides to have the house built in ten months, but the homeowner is not allowed to make any alterations in the specifications during those ten months. Having the

(continued...)

meant to be choosing to effect a set of reforms over time in some preferred order because delaying or deferring some reforms until later periods has a perceived economic value, then what is meant by sequencing is actually gradualism; in this sense, the two terms may be used synonymously. For the same reasons, gradualism should *not* be viewed as "dynamic sequencing," either. Because, under gradualism, the initially preferred sequence of reforms is not irreversible in the static sense. That sequence may also be subject to change depending on the outcome of the reforms first in the sequence and other relevant information flows over time. Under gradualism a deliberate, dynamically significant economic decision is made to defer some reform actions until later periods, when the initial sequencing plan may also be subject to change.

Under which circumstances does the decision to defer some reform actions to later periods have economic value? The next section addresses this question in a simple model with expected values.

IV. Big Bang vs. Gradualism: Expected Value Analysis

A. No Extraneous Information Over Time

The game in Figure 2a is a *compound* lottery, with the probabilities and payoffs associated with R_1 and R_2 as shown. The expected values of the sub-lotteries are

$$E(R_1) = pG_1 + (1-p)G_2\,;$$

$$V_1 = E(R_2/G_1) = q_1 W_1 + q_2 W_2\,;$$

$$V_2 = E(R_2/G_2) = q_3 W_3 + q_4 W_4\,;$$

$$q_1 + q_2 = q_3 + q_4 = 1;$$

where $E(\,)$ is the expectations operator for the expectations formed at the beginning of the initial period, t, when the reformer chooses between the big bang and gradualist strategies.

The preferred reform sequence is assumed to be $R_1 \rightarrow R_2$, that is, R_1 is effected first. A stringent interpretation of this assumption is that only R_1 reveals information about R_2, and R_2 reveals no information about R_1. As noted, the opposite sequence may be preferable, if R_2 also

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flexibility to make some alterations in the specifications as the house is built is somehow not valuable to the homeowner.

reveals information about R_1. It is further assumed that it is feasible to implement the chosen reform sequence in the initial period, the time periods being sufficiently long.[30]

The policymaker's problem is whether to undertake both reforms in the initial period, t, or, effect R_1, wait until it is played out in t, and then decide whether or not to effect R_2 in the next period, $t+1$. I interpret the expeditious or the big bang reform strategy to mean that both reform actions are implemented in the initial period. In the big bang lottery, reform process is played out, and the outcome of the reform package is realized at the end of t. Under this strategy, the expected payoff to the game at the beginning of t is

$$E(R_1^t, R_2^t) = pV_1 + (1-p)V_2. \tag{1}$$

For the reformer to consider undertaking both reform actions, one of them must pay off. It is possible that, in the preferred $R_1 \rightarrow R_2$ sequence (as assumed), R_1 is expected not to pay off ($Y \geq ER_1$) but R_2 is expected to pay off; that is, the reformer may sacrifice some income in order to reap the larger benefits from R_2.[31] However, in the preferred sequence $R_1 \rightarrow R_2$, if the first reform does not pay off, then the second reform must pay off, because otherwise the reformer will not adopt either reform.

Finally, since there are no extraneous information flows over time and there are only two reforms in the reform package, when the reform package is implemented under the big bang strategy in period t, the expected value in *(1)* remains unchanged in the later periods; however, beginning in $t+1$, expected values in the future periods are discounted at the rate δ. Therefore, the discounted expected value of the big bang strategy over time can be expressed as[32]

$$\begin{aligned} EV(big\ \ bang) &= [pV_1 + (1-p)V_2](1 + \frac{1}{1+\delta} + \frac{1}{(1+\delta)^2} + \ldots) \\ &= \left(\frac{1+\delta}{\delta}\right)[pV_1 + (1-p)V_2] \ . \end{aligned} \tag{2}$$

[30]As argued, this simplifying assumption is useful in conceptually differentiating gradualism from sequencing. Thus, the time periods are sufficiently long so that both reforms may be implemented in the initial period in the given sequence, but the passage of time in one period is "simple" to be of any dynamic significance. At the same time, the time periods are sufficiently short so that the reformer may realistically delay the second reform until the next period.

[31]For example, reform of tax laws and administration, training of personnel, and computerization (R_1) involves only a cost without any expected pay-off, unless tax reform (R_2) is implemented.

[32]Therefore, for either reform to be adopted, it must be true that $EV(big\ bang) \geq \left(\frac{1+\delta}{\delta}\right)Y$.

The reformer may also follow the gradualist strategy, that is, he may adopt R_1 in t, observe the outcome, and then decide whether or not to adopt R_2 in $t+1$. In the gradualist lottery, the uncertainty about R_1 will be resolved in period t, but the uncertainty about R_2 will be resolved in period $t+1$, only if the policymaker decides to effect R_2 after the outcome of R_1 is observed. Since the reformer does not commit to adopting R_2, suppose for simplicity that he pays no penalty if he chooses not to adopt R_2 in $t+1$.[33] However, for the reformer to consider adopting the gradualist strategy and delay the implementation of R_2 until $t+1$, it is necessary that one of the outcomes of R_1 is the bad outcome for R_2, and the other is the good outcome for R_2. Accordingly, let us assume that $G_1 < V_1$ and $G_2 > V_2$, that is, G_1 is the good outcome of R_1 for R_2, and G_2 is the bad outcome of R_1 for R_2. Contrarily, if $G_1 > V_1$ and $G_2 > V_2$, then the reformer will not adopt R_2; if $G_1 < V_1$ and $G_2 < V_2$, then the second reform is also a sure bet, and there is no reason to consider the gradualist strategy.

For the reformer to consider the gradualist strategy to allow himself the *flexibility* not to implement R_2 in $t+1$, it is further necessary that at least one of the outcomes of R_1 dominates the initial income level, because otherwise the reformer would not delay the second reform until $t+1$. For simplicity, I will assume that the first reform is a sure bet, that is, $G_1 > Y$ and $G_2 > Y$, so that there is no incentive to reverse the first reform under either the big bang or the gradualist strategy; therefore, $E(R_1) > Y$.[34] Similarly, I will also assume that, if the good outcome of R_1 is realized, then there is no incentive to reverse the second reform after it is played out, that is, $G_1 < W_1, W_2$, because, if $W_1 > G_1 > W_2$, the reformer may reverse R_2 with probability pq_2 in $t+2$; this means that the sub-lottery of the second reform under the good outcome of the first reform (G_1) is a sure bet.

The foregoing constraints and simplifying assumptions that enable a more focused comparison of the big bang and gradualist strategies are summarized below:

(a) $G_1 \geq Y$, $G_2 \geq Y$: R_1 is a sure bet; there is no incentive to reverse it under the big bang or the gradualist strategy;

(b) $G_1 < V_1 = q_1W_1 + q_2W_2$; $G_2 \geq V_2 = q_3W_3 + q_4W_4$: gradualism is *viable* (if both reforms were sure bets, then the reformer would choose the big bang strategy); and $G_2 < V_1$: big bang is *viable* (if $G_2 \geq V_1$, then the reformer would not adopt R_2);

[33]This intuitively appealing assumption is supported by Cukierman, Kiguel, and Liviatan (1992); these authors argue that reversal costs increase with the strength of the commitment.

[34]The results are not significantly altered if the first reform were also reversible ($G_2 < Y$). If $E(R_1) < Y$ were the case, the reformer would either adopt the big bang strategy or he would not adopt either reform. Notice that the condition that $G_1 < V_1$ and $G_2 > V_2$ imposes no restriction on the relative values of $(V_1 - G_1)$ and $(G_2 - V_2)$.

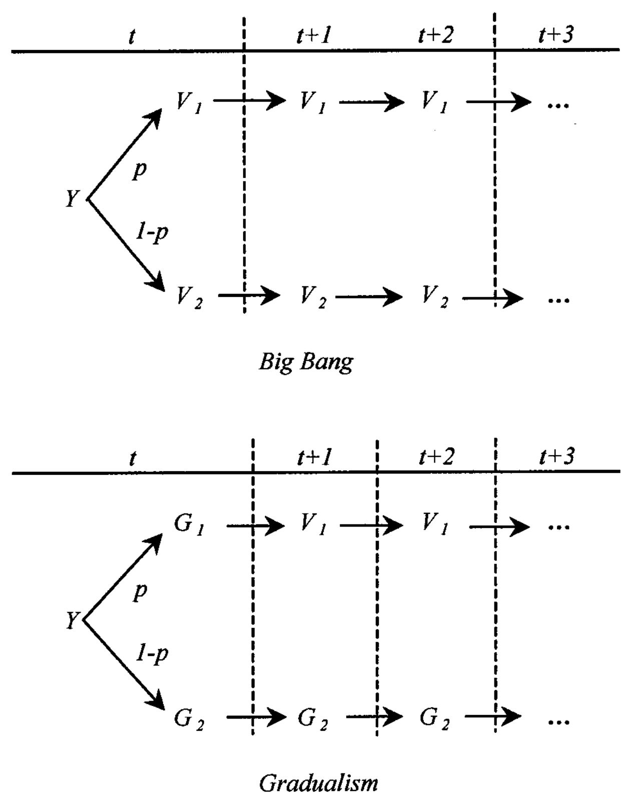
(c) $G_1 < W_1, W_2$: the sub-lottery of R_2 corresponding to the outcome G_1 of R_1 is a sure bet; there is no incentive to reverse R_2 for that outcome;

(d) $G_2 > W3, W4$: if G_2 is the outcome of R_1; the reformer has an incentive to reverse R_2 under the big bang strategy, and he prefers not to adopt R_2 under the gradualist strategy.

With these arguments and simplifying assumptions, the game in Figure 2a can be reduced to the game in Figure 3, and the expected payoff to gradualism in t and $t+1$ can be expressed as

$$E(R_1^t, R_2^{t+1}) = pG_1 + (1-p)G_2 + \frac{pV_1 + (1-p)G_2}{1+\delta}. \qquad (3)$$

Figure 3. Big Bang and Gradualism With No Extraneous Information: Reduced Game



Big bang and gradualism are viable: $V_2 < G_2 < V_1$; $G_1 < V_1$

This means that the reformer assesses the expected gain from R_1 in period t; then, he calculates the discounted gain from R_2, which he will delay by one period and implement with probability p in the next period, $t+1$; but with probability $(1-p)$, he will stay at G_2, that is, he will not implement R_2. Similarly, with two reforms and no extraneous information flows, the expected value of the gradualist strategy does not change in the future periods as of period $t+2$.[35] Thus, the discounted expected value of the gradualist strategy over time can be expressed as[36]

$$\begin{aligned} EV(gradualism) &= pG_1 + (1-p)G_2 + \frac{pV_1 + (1-p)G_2}{1+\delta} + \frac{pV_1 + (1-p)G_2}{(1+\delta)^2} + \ldots \\ &= pG_1 + \left(\frac{1+\delta}{\delta}\right)(1-p)G_2 + \left(\frac{1}{\delta}\right)pV_1 . \end{aligned} \tag{4}$$

Comparison of *(2)* to *(4)* indicates that the gradualist strategy dominates the big bang strategy, if

$$p(V_1 - G_1) \leq \left(\frac{1+\delta}{\delta}\right)(1-p)(G_2 - V_2). \tag{5}$$

The term on the left-hand side of *(5)* is *positive*, and it measures the expected gain from the good outcome of R_2 under the big bang strategy in period t. The term on the right-hand side of *(5)* is also *positive*, and it measures the expected cumulative loss from the bad outcome of R_2 under the big bang strategy, which is equivalent to the expected gain from avoiding it under the gradualist strategy. Gradualism may dominate the big bang strategy for a large enough expected loss from the bad outcome of R_2. At the extreme, notice that if the reformer does not discount the expected gain under the gradualist strategy $(\delta = 0)$, then the gradualist strategy dominates the big bang strategy unambiguously.[37]

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[35]If G_1 is the outcome in t, the reformer effects R_2 in $t+1$, and the outcome of R_2 carries over to $t+2$, $t+3$, ... If G_2 is the outcome in t, the reformer does not effect R_2, and the outcome G_2 carries over to periods $t+2$, $t+3$, ...

[36]For the gradualist strategy to be viable, it is necessary that $EV(gradualism) \geq \left(\frac{1+\delta}{\delta}\right)Y$.

[37]Recall that we made no assumption concerning the relative values of G_1 and G_2; therefore, $(V_1 - G_1)$ may be greater or smaller than $(G_2 - V_2)$. Therefore, *(5)* also indicates that, for the same values for p and δ, if $(V_1 - G_1) < (G_2 - V_2)$, then the case for gradualism is strengthened; if $(V_1 - G_1) > (G_2 - V_2)$, then the case for big bang is strengthened. The result in *(5)* is somewhat exaggerated in favor of gradualism because of the no extraneous information assumption. Information relevant for R_2 is revealed by the outcome of R_1 with one period delay, so the expected sacrifice due to waiting under gradualism lasts only one period. As shown below, with extraneous information, such sacrifice may last longer than one period, which tips the scale in favor of big bang.

B. Reversal

The simplifying assumptions in *(a)-(d)* for comparing big bang to gradualism have ensured that the reformer would not reverse the first reform in $t+1$ and go back to the status quo under either strategy. Similarly, if the good outcome of the first reform, G_1, were realized, the reformer would not reverse the second reform in $t+2$ and go back to the *new* status quo determined by the outcome of the first reform. The analysis is focused on the possibility of reversal if the bad outcome of the first reform is realized under the big bang strategy. Thus, the reformer may commit to adopting both reforms in the initial period, but he may reverse R_2 in $t+1$ after both reforms are played out in t.[38]

The big bang reformer is a "benevolent dissembling" reformer; he knows but does not reveal that, if the outcome of the reform process is bad, he will reverse the second reform in $t+1$; but if the good outcome of the first reform for the second reform (G_1) is realized, then he will maintain the second reform as promised. It is plausible that there will be a cost associated with reversal. The simplest way to formulate this cost is to assume that it is linear. Then, the expected value of the reversal strategy in t and $t+1$ can be expressed as

$$E(R_1^t, R_2^t; reverse\, R_2^{t+1}) = pV_1 + (1-p)V_2 + \frac{pV_1 + (1-p)G_2}{1+\delta} - (1-p)K. \qquad (6)$$

In *(6)*, the expected cost of reversal, K, may be discounted over time; without loss of generality, we may assume that K is incurred only once in $t+1$ when the reformer reverses R_2. Thus, the discounted expected value of the reversal strategy over time can be expressed as

$$\begin{aligned} E(reversal) &= pV_1(1 + \frac{1}{1+\delta} + ...) + (1-p)V_2 + (1-p)G_2(\frac{1}{1+\delta} + ...) - (1-p)K \\ &= \left(\frac{1+\delta}{\delta}\right)pV_1 + (1-p)V_2 + \left(\frac{1}{\delta}\right)(1-p)G_2 - (1-p)K. \end{aligned} \qquad (7)$$

Comparison of *(7)* to *(2)* shows that reversal dominates big bang, if

$$\frac{G_2 - V_2}{\delta} \geq K. \qquad (8)$$

Comparison of *(7)* to *(4)* shows that reversal dominates gradualism, if

[38]Again, the simplifying assumption is that the time periods are short enough that the reformer cannot renege on implementing R_2 after R_1 is played out in t; he has to wait until the next period, $t+1$, to reverse R_2.

$$p(V_1 - G_1) \geq (1-p)(G_2 - V_2) + (1-p)K \,. \qquad (9)$$

The results in *(8), (9)* and *(5)* can be interpreted as follows. First, *(8)* indicates that, for a reasonable value of δ (say, the treasury bill rate) and small K, the reversal strategy may dominate the big bang strategy. For example, if $K = 0$ reversal clearly dominates big bang because, if the bad outcome of R_2 is realized in t, the reformer can reverse R_2 in $t+1$ at no cost and recover the corresponding gain $(G_2 - V_2)$ indefinitely thereafter.

Turning to *(9)*, for a small K and large p, the reversal strategy may dominate the gradualist strategy because the chance of hitting the good outcome of R_2 is high, and the cost of reversal is low. So, why not go for instant gratification by using the reversal strategy instead of deferring the decision on whether or not to adopt R_2 until the next period? However, as *(9)* indicates, even if reversal dominates big bang, it need not dominate gradualism, so even if $K = 0$ gradualism may dominate the reversal strategy for a sufficiently large loss under the bad outcome of R_2.

Going back to *(5)*, for a reasonable value of δ, the term $(1+\delta)/\delta$ is large. Therefore, big bang is likely to dominate gradualism only for large values of p and $(V_1 - G_1)$ and small values of $(V_2 - G_2)$. This possibility may well induce the reformer to go for big bang, but big bang remains vulnerable to reversal for a small reversal cost. But, by *(8)* and *(9)*, for a large reversal cost, both big bang and gradualism are likely to dominate reversal. So, the appropriate focus of comparison remains to be between big bang and gradualism.

Nevertheless, the comparison of gradualism, reversal, and big bang is not necessarily as simple. Similar to reversal costs, *waiting costs* (in addition to discounting) may be associated with the gradualist strategy in the form of smaller payoffs to the reforms under consideration. For example, there may be some economies of scale to implementing both reform actions at the same time (G_i and W_j are higher when both reforms are implemented in t than when only R_1 is implemented in t). Furthermore, as noted earlier, with the no extraneous information assumption, the case for gradualism is exaggerated due to the fact that the second reform is effected with only one period delay under gradualism.

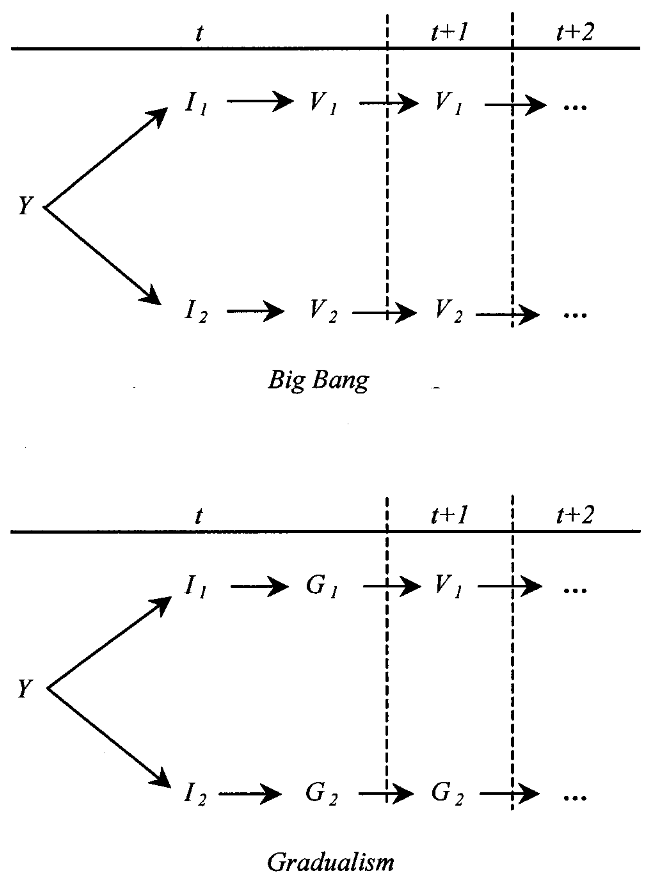
C. Gradualism With Extraneous Information Over Time

As already noted, extraneous information relevant for reform outcomes and the associated probabilities may be forthcoming over time, even if no reform is implemented.[39]

[39]For example, even if neither the reform of tax administration (say, toward adopting a VAT) nor the implementation of the more efficient new tax replacing the old inefficient taxes is adopted, information on whether the country's largest trading partner increases or decreases its VAT rate may be forthcoming at the end of t. Similarly, information on whether the trading partner will increase or decrease some tariff rates is an important piece of information for a country contemplating tariff reform.

A simple example is shown in Figure 4. For simplicity, it is assumed that the outcome of R_1 is known with certainty in period t but an information set, *(p, I_1; 1-p, I_2)*, relevant for R_2, will be revealed at the end of t. The same analysis discussed in *(1)–(9)* applies to this case as well, except that G is now known with certainty. As before, gradualism may dominate the big bang strategy.

Figure 4. Big Bang and Gradualism With Extraneous Information



Both of the above cases (absence and presence of extraneous information) help explain why some reform programs are only *partially* implemented (R_1 is implemented in t but R_2 is *not* implemented in $t+1$). They also explain why some reforms are reversed (R_1, R_2 implemented in t but R_2 is reversed in $t+1$). But the latter case also sheds light on why reform processes may *stall* over time. We can extend the example in Figure 4 supposing that additional information will be forthcoming in period $t+2$. In such a case, the reformer may choose to adopt the first reform in t, wait it out in period $t+1$, and then decide to implement the second reform in $t+2$; thus, the second reform may be stalled in the interim period, $t+1$.

In general, both informational conjectures apply. Adopting the first reform may reveal information about the second reform, while extraneous information flows relevant for both reforms are forthcoming over time. In all cases, gradualism may dominate the big bang strategy provided that all reforms are not sure bets under all information sets and waiting costs do not always dominate the reversal costs.

Importantly, however, extraneous information need not be forthcoming in period $t = 1$ but it may be delayed until period $t = n-1$. So, the conjecture may well be that, under gradualism, after the first reform outcome is observed in $t = 1$ the reformer may prefer to wait until $t = n-1$ to effect the second reform. This conjecture requires a more complicated but a more realistic comparison of big bang and gradualism; it is discussed in Section IV.E.

D. A Generalization

Now consider the case of a reform package comprising three reforms, R_1, R_2, and R_3. For better focus, reversal is ignored in this example. Without loss of generality, I make the following simplifying assumptions:

(i) the best reform sequence is determined to be $R_1 \rightarrow R_2 \rightarrow R_3$ on the assumptions that R_3 reveals no information about R_1, R_2; R_2 reveals no information about R_1 but R_1 reveals information about R_2, R_3; and R_2 reveals information about R_3;

(ii) there are no extraneous information flows pertaining to the three reform actions;

(iii) R_2, R_3 are *not* sure bets, so that $G_1 < q_1W_1 + q_2W_2$; $G_2 > q_3W_3 + q_4W_4$; $W_1 < v_1Z_1 + v_2Z_2$; $W_2 > v_3Z_3 + v_4Z_4$.

This game is depicted in Figure 5a, where (p_i, G_i), (q_j, W_j), (v_k, Z_k) are the probabilities and payoffs associated with the three reform actions, with $p_1 + p_2 = q_1 + q_2 = q_3 + q_4 = v_1 + v_2 = v_3 + v_4 = v_5 + v_6 = v_7 + v_8 = 1$.

Figure 5a. Reform With No Extraneous Information (R_1-R_2-R_3)

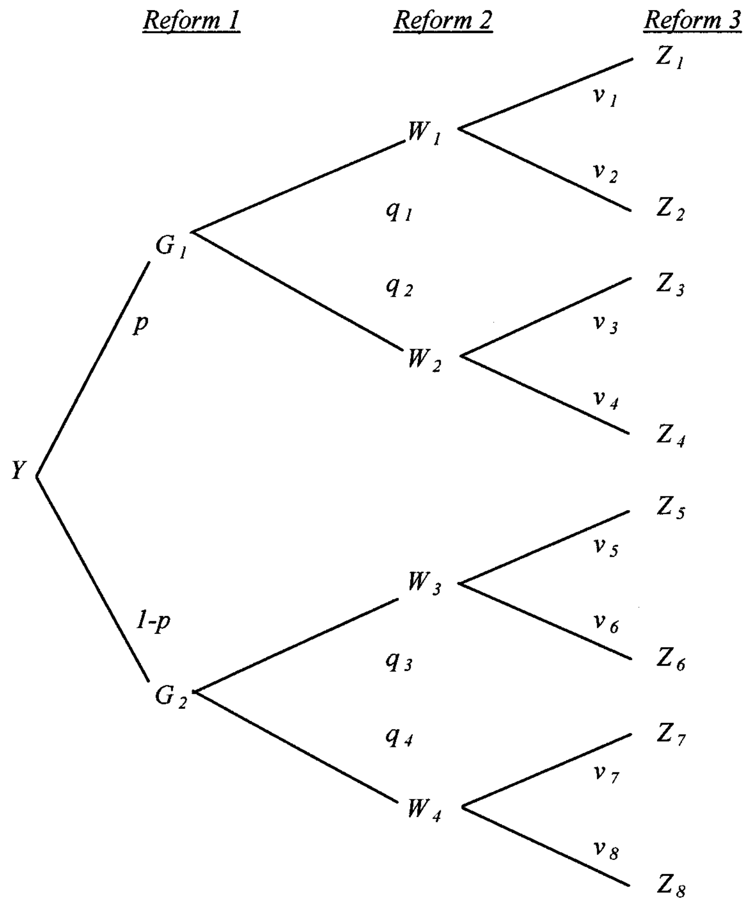


Figure 5b. Big Bang and Possible Gradualist Strategies (R_1-R_2-R_3)

t	*t+1*	*t+2*	
R_1, R_2, R_3	--	--	*Big bang*
R_1, R_2	R_3	--	*Gradualism*
R_1	R_2, R_3	--	*Gradualism*
R_1	R_2	R_3	*Gradualism*

The expected payoff under big bang is

$$EV(big\ bang) = \left(\frac{1+\delta}{\delta}\right)[pq_1(v_1Z_1 + q_2Z_2) + pq_2(v_3Z_3 + v_4Z_4)$$
$$+ (1-p)q_3(v_5Z_5 + v_6Z_6) + (1-p)q_4(v_7Z_7 + v_8Z_8)]\,. \tag{10}$$

The payoffs under gradualism over time, starting in period t, are

t	$pG_1 + (1\text{-}p)G_2$
$t+1$	$p(q_1W_1+q_2W_2) + (1\text{-}p)G_2$
$t+2$	$pq_1(v_1Z_1 + v_2Z_2) + pq_2W_2 + (1\text{-}p)G_2$
.	.
.	.
.	.

The foregoing payoff structure indicates that the reformer effects R_1 in period t with the corresponding expected value; after he observes the outcome of R_1, he will decide to effect R_2 in $t+1$ with probability p, but he will not effect R_2, R_3 with probability $(1\text{-}p)$; having effected R_2 in $t+1$ with probability p, after he observes the outcome of R_2, he will effect R_3 with probability pq_1, or he will not effect R_3 with probability pq_2. At the latest, all three reforms will be played out in $t+2$, and thereafter the expected value of the reform package will remain the same as in that period. Thus, the expected value of gradualism is

$$EV(gradualism) = pG_1 + \left(\frac{1+\delta}{\delta}\right)(1-p)G_2 + \left(\frac{1}{1+\delta}\right)pq_1W_1$$
$$+ \left(\frac{1}{\delta}\right)pq_2W_2 + \left(\frac{1}{\delta(1+\delta)}\right)pq_1(v_1Z_1 + v_2Z_2)\,. \tag{11}$$

Comparison of *(10)* and *(11)*, after some manipulation, shows that gradualism dominates big bang, if

$$pq_1(v_1Z_1 + v_2Z_2 - G_1) + \left(\frac{1}{1+\delta}\right)pq_1(v_1Z_1 + v_2Z_2 - W_1) \le$$
$$pq_2[\left(\frac{1}{\delta}\right)W_2 - (v_3Z_3 + v_4Z_4)] \tag{12}$$
$$+ (1-p)\left(\frac{1+\delta}{\delta}\right)[G_2 - q_3(v_5Z_5 + v_6Z_6) - q_4(v_7Z_7 + v_8Z_8)]\,.$$

The terms on the left-hand-side of *(12)* are *positive*, and they measure the expected gain from following the big bang strategy and enjoying the good outcomes of R_1 and R_2 in t and $t+1$. The first term on the right-hand-side of *(12)* is *positive* and it measures the expected gain from not implementing R_2 if the bad outcome of R_2 is realized; the second term is assumed to be *positive*[40] and it measures the expected gain from not implementing R_2 and R_3, if the bad outcome of R_1 is realized in t.

Figure 5b shows how the reform sequence $R_1 \rightarrow R_2 \rightarrow R_3$ may be effected over time. As before, if all reform actions are sure bets, the reformer may follow the big bang strategy, as shown in the first row. If R_2 is a sure bet but R_3 is not, the reformer may follow the gradualist strategy in the second row. If R_3 is a sure bet but R_2 is not, the reformer may follow the gradualist strategy in the third row. Finally, if both R_2 and R_3 are not sure bets, the reformer may follow the gradualist strategy in the fourth row.

Generalization to n reform actions is straightforward. A reform package with n reform actions may be effected all in the initial period (big bang) or may be spread over n periods (gradualism). Similar to Figure 5b, it is possible to lay out the possible gradualist strategies over the periods $t+1$, $t+2$, ..., $t+n$ and compare them to the big bang strategy. Assume that the preferred sequence is $R_1 \rightarrow R_2 \rightarrow ... \rightarrow R_n$. If some of the reforms are sure bets and some are not, after the previous sequence of reforms are effected in the early periods, some sure-bet reforms may be implemented in bundles in a later period, and so on. If none of the reforms are sure bets, then the reformer may prefer the most gradualist strategy, that is, effecting R_1 in t, R_2 in $t+1$, ..., R_n in $t+n$. Furthermore, extraneous information about some or all reforms may be forthcoming over n periods, which affects the choice between the big bang strategy and the gradualist strategy as well as the choice of sequencing.

The reform package could be cast as a far more complex one than the n-reform package described above. For example, each reform outcome or information set may reveal more than two outcomes with more than two probabilities for the next-generation reforms. Furthermore, it is also possible that the information available *ex ante* at each stage of reform exhibits further ambiguity in the sense that the outcomes and associated probabilities with the next generation reforms are known only partially and, for some reforms, even not known at all. Consequently, ambiguity may be resolved through a gradualist approach to reform, even though the big bang approach strongly favors the status quo. In all cases, the general lesson is the same:

> *Gradualism may dominate big bang, if some of the reforms are not sure bets, and waiting costs do not dominate reversal costs under some information sets forthcoming over time.*

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[40] As before, this assumption simply means that, under gradualism, the reformer cannot make a sacrifice by adopting R_2 toward obtaining large gains from R_3 later.

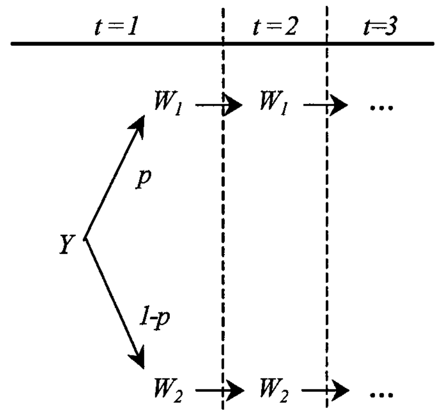
Conversely, big bang dominates gradualism if all reforms are sure bets under all information sets forthcoming over time and if the waiting costs are sufficiently large. In a complex reform package, intuition suggests that not all reforms are sure bets, and waiting costs do not dominate reversal costs under all information sets. Therefore, the analytical case for gradualism is quite general. Gradualism allows for resolution of ambiguity over time and insures against possible bad reform outcomes by providing policy flexibility. In this context, it is also possible to explain why reform processes are sometimes stalled and why some reforms are sometimes reneged on or even reversed over time.

E. Big Bang Versus Gradualism With a Long Implementation Lag

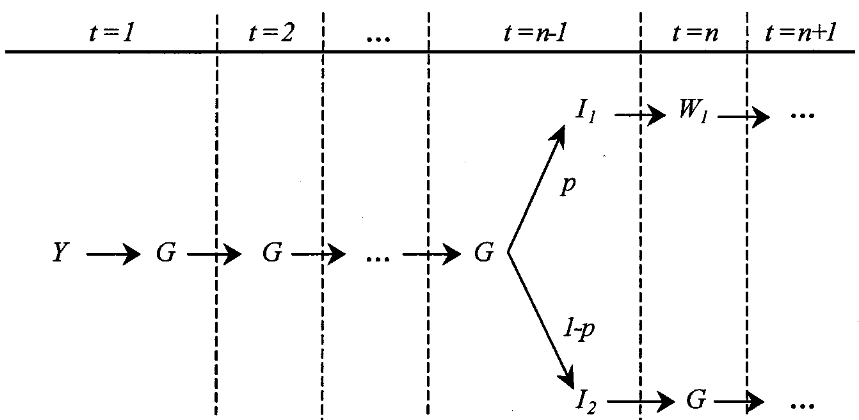
Consider the reform case depicted in Figure 6. The information structure of this reform process is a very simple one. The first reform pays G with certainty (G exceeds the initial income level); the payoffs associated with the second reform are (W_1, p), $(W_2, 1\text{-}p)$; the payoffs are such that $W_2 < G < W_1$; for big bang to be a viable strategy, it is necessary that $G < pW_1 + (1\text{-}p)W_2$, that is, the second reform must be expected to pay off.[41] In $t = n\text{-}1$, a piece of information about the outcome of the second reform will be forthcoming; let this information set be (I_1, I_2). If the information in that period is I_1, then the second reform will pay W_1 with certainty; if the information is I_2, the second reform will pay W_2 with certainty. For simplicity, assume that I_1 is expected to be realized with probability p and I_2 with probability $(1\text{-}p)$. Under the big bang strategy, both reforms may be adopted in the initial period, $t = 1$. Under the gradualist strategy, the reformer may adopt the first reform in $t = 1$ but wait until the relevant information about the second reform is revealed in $t = n\text{-}1$; if the outcome is I_1, then the reformer adopts the second reform; if the outcome is I_2, the reformer does not adopt the second reform.

[41]Consequently, reversal of the second reform is a possibility under the big bang strategy. However, this issue is secondary in the present discussion, and it is ignored.

Figure 6. Big Bang and Gradualism With an Implementation Lag of n Periods



Big bang



Gradualism

Expected values of big bang and gradualism are

$$EV(big\ bang) = \left(\frac{1+\delta}{\delta}\right)[pW_1 + (1-p)W_2];$$

$$EV(gradualism) = \left(\frac{1+\delta}{\delta}\right)[\theta W_1 + (1-\theta)G)];$$

$$\theta = \frac{p}{(1+\delta)^n} < p; \tag{13}$$

$$Big\ bang\ is\ viable: pW_1 + (1-p)W_2 > G;$$

$$Gradualism\ is\ viable: G > W_2\,.$$

Comparison of the two expected values in *(13)* will reveal whether gradualism dominates big bang. Importantly, now the timing of resolution of uncertainty *does* matter. As n is increased, the expected value of gradualism approaches to the certain payoff, G, which is less than the expected value of big bang. So, for example, if $n = 2$, the reformer may choose gradualism but if $n = 3$, he may choose big bang.

However, the comparison of expected values for a given n may not be the only criterion for the reformer in choosing between big bang and gradualism. Stability also matters, as in the commonly used "disutility from instability" (utility from small variance) approach of some macroeconomic models. We can show that the variances associated with the big bang and gradualist strategies are

$$\sigma^2(big\ bang) = \left(\frac{1+\delta}{\delta}\right)^2 p(1-p)(W_1 - W_2)^2;$$

$$\sigma^2(gradualism) = \left(\frac{1+\delta}{\delta}\right)^2 \frac{p(1-p)}{(1+\delta)^{2n}}(W_1 - G)^2. \tag{14}$$

Comparison of the variances in *(14)* shows that big bang has a larger variance than gradualism since $W_2 < G < W_1$. When n is increased variance under gradualism approaches to zero as the expected value approaches to the certain payoff, G.

Suppose that, for a given n, the expected values in *(13)* are *equal* so the reformer is indifferent between big bang and gradualism on the basis of expected payoffs. But when the two strategies have the same expected payoff, the reformer may opt for gradualism on the basis of variances. Thus, heuristically, the case for big bang is strengthened; there is a preference for an earlier resolution of uncertainty because, under gradualism, expected value declines relative to big bang as n is increased. On the other hand, the case for gradualism is strengthened because, under gradualism, income stream becomes smoother as n is increased. If the reformer values both the size and the smoothness of expected income, the choice between big bang and gradualism is influenced by the means and variance the reformer faces in comparing the two strategies.[42] While the case for gradualism is weakened by a preference for an early resolution of uncertainty, it is strengthened by a preference for more stable income. Of course, the reformer must make a decision for a given n. At that lag for uncertainty resolution, gradualism may well dominate big bang not only because its expected value is higher, but also because its variance is lower.

V. BIG BANG VERSUS GRADUALISM: EXPECTED UTILITY ANALYSIS

Until now, the big bang and gradualist strategies have been cast in the context of expected values. This context may not be suitable for a wide range of reforms that are intended to improve welfare without an appreciable impact on the level of income. For example, tax reform may lower the excess burden of second-best taxation without affecting the level of tax revenue, hence net income. Furthermore, income level may not be an adequate index of benefits from reforms. In order to make a more general case for gradualism, the analysis needs to be cast in terms of utility (welfare) functions. As a first step, I continue to interpret reform outcomes as income or wealth levels.

A. Reform Outcomes as Income Levels

The simple case of no extraneous information

For the simple case with *no extraneous information* (Section IV.A), let us go back to Figure 3 and the expressions in *(2)* and *(4)*, where the expected payoffs to big bang and gradualism are expressed. Casting reform outcomes in terms of utilities, it is possible to arrive at an expression similar to *(5)* and make the argument that gradualism dominates big bang, if

$$p[U(V_1)-U(G_1)] \le \left(\frac{1+\delta}{\delta}\right)(1-p)[U(G_2)-U(V_2)]. \qquad (15)$$

Recall that no assumption concerning the relative values of $(V_2 - G_2)$ and $(G_1 - V_1)$ has been made. Thus, if $(V_2 - G_2) < (G_1 - V_1)$, then risk aversion indicates that $[U(V_1) - U(G_1)] < [U(G_2) - U(V_2)]$; therefore, for the same values for p and δ, the risk averse reformer now demands a premium to favor the big bang strategy over gradualism; the case for gradualism is

[42] This argument is already familiar from the basic mean-variance models.

strengthened.[43] But it is also possible that $(V_2 - G_2) > (G_1 - V_1)$ so that $[U(V_1) - U(G_1)] > [U(G_2) - U(V_2)]$, and the case for the big bang strategy is strengthened under risk aversion; now the risk averse reformer demands a premium to favor gradualism over big bang.

Of course, with risk aversion, the status quo bias is evident from the comparison of the utility of the certain pre-reform income level of Y to expected utilities from reform, and this bias is now present under both reform strategies. As noted earlier, ambiguity favors the status quo. Moreover, the present model implies that a dynamic status quo bias may also be relevant, if subsequent reforms yield marginally lower payoffs. This helps explain why second-generation reforms appear to be harder to implement. This may be the case because the status quo bias increases as more and more reforms are implemented and the successive *new* status quos turn out to be better than the previous ones. Nevertheless, although intuitively appealing, this conjecture need not hold; up to a generation—perhaps up to the second generation—reforms may exhibit increasing returns to scale, implying a diminishing status quo bias.

The case with a long implementation lag

Let us return to the case where the implementation lag is n periods (Section IV.E). The structure of *(13)* and *(14)* remaining the same, now the utility levels replace the income levels. In line with the earlier assumptions, for big bang to be viable, it is necessary that $pU(W_1) + (1-p)U(W_2) > U(G)$, and, for gradualism to be viable, $U(G) > U(W_2)$. First, note from *(14)*—with utilities substituted for values—that the variance under gradualism is less than the variance under big bang. So, if both strategies yield the same expected utility, the reformer may choose gradualism on the basis of that strategy's lower variance.

Let us now see how the risk averse reformer behaves. For a given $n = \eta$, suppose the discounted expected flow of income under both strategies is the same, that is, let $pW_1 + (1-p)W_2 = \theta^{\eta}W_1 + (1-\theta^{\eta})G$. Given W_1 and W_2, this equality holds for

$$G^* = (p-\theta^{\eta})/(1-\theta^{\eta})W_1 + (1-p)/(1-\theta^{\eta})W_2;$$

$$W_2 < G^* < W_1 ;$$

$$(p-\theta^{\eta})/(1-\theta^{\eta}) < 1; \ (1-p)/(1-\theta^{\eta}) < 1; \ (p-\theta^{\eta})/(1-\theta^{\eta}) + (1-p)/(1-\theta^{\eta}) = 1.$$

Substituting G^* into *EU(big bang)* and *EU(gradualism)*, which can be obtained from *(13)*, and with some manipulation, it can be shown that

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[43]Similarly, the comparison of expected utilities from reversal strategy and gradualism in line with *(9)* indicates that the case for gradualism is also strengthened relative to reversal. At the same time, *(8)* indicates that reversal under the big bang strategy is now more appealing.

$$EU(big\ bang) < EU(gradualism)$$

because

$$\left(\frac{p-\theta^{\eta}}{1-\theta^{\eta}}\right)U(W_1)+\left(\frac{1-p}{1-\theta^{\eta}}\right)U(W_2) < U\left(\frac{p-\theta^{\eta}}{1-\theta^{\eta}}W_1+\frac{1-p}{1-\theta^{\eta}}W_2\right). \tag{16}$$

The result in *(16)* follows from the fact that, with risk aversion, the utility from the expected value of a lottery is greater than the expected utility from the same lottery. So, for the same income stream $pW_1 + (1-p)W_2 = \theta^{\eta}W_1 + (1-\theta^{\eta})G^*$ under both strategies, the reformer prefers gradualism to big bang. This result is consistent with empirical findings on behavior under ambiguity. For the reformer to be indifferent between the two strategies, big bang needs to pay a higher income stream than gradualism, $W^P = pW_1^P + (1-p)W_2^P > \theta^{\eta}W_1 + (1-\theta^{\eta})G^*$. Equivalently, the reformer requires a *risk premium* equaling $W^P - [\theta^{\eta}W_1 + (1-\theta^{\eta})G^*]$ on the big bang strategy to be indifferent between the two strategies. In order to avert the big bang lottery, the reformer is willing to accept an income stream with certainty that is *lower* than the income stream with certainty he is willing to accept in order to avert the gradualist lottery. Therefore, the reformer behaves *as if* he is more risk averse under big bang than under gradualism.

Alternatively, suppose for a given $n = \upsilon$, $\upsilon > \eta$, $EU(big\ bang) = EU(gradualism)$. But for $\upsilon > \eta$, it is necessary that $pW_1 + (1-p)W_2 > \theta^{\upsilon}W_1 + (1-\theta^{\upsilon})G$.[44] Since the two strategies yield the same expected utility, the reformer would be willing to accept an income stream with certainty, W, such that $W < \theta^{\upsilon}W_1 + (1-\theta^{\upsilon})G < pW_1 + (1-p)W_2$, or, equivalently, he would be willing to give up a smaller amount of income under gradualism than he would under big bang. Therefore, the risk averse reformer views the gradualist strategy as a *less risky* gamble than the big bang strategy. These arguments are illustrated in Figure 7.

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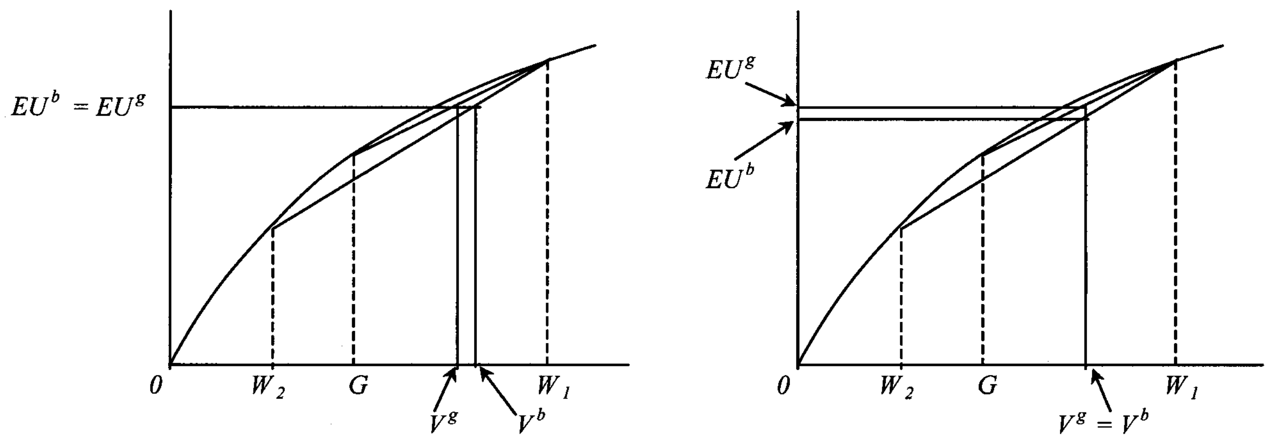
[44] At $n = \upsilon$, the corresponding value of G to ensure that $G^{**} = (p-\theta^{\upsilon})/(1-\theta^{\upsilon})W_1 + (1-p)/(1-\theta^{\eta})W_2$ is *greater* than G^* for which $n = \eta$.

Figure 7. Reformer Behaves As *If* He Is More Risk Averse Under Gradualism Than Under Big Bang



However, as n rises, the reformer behaves *as if* he is becoming more risk averse under gradualism because expected utility from gradualism declines as n rises, and the reformer would be willing to accept smaller and smaller income streams with certainty in order to avert the risk of playing the gradualist game. As n increases, the income per period the reformer is willing to accept with certainty to avert the gradualist lottery approaches G. But as n rises, the variance (the certainty equivalent fluctuations in utility over time) under gradualism declines. Therefore, for a sufficiently large n, although a more risk averse reformer may prefer big bang on the basis of expected utilities, a reformer with a preference for a smaller variance may prefer gradualism.

Faced with the two reform strategies, the more risk averse the reformer is, the more he is likely to choose the gradualist strategy. This is because a more risk averse reformer would require a higher risk premium to accept either lottery. Assume that an initial reformer with a given degree of risk aversion is indifferent between the two strategies, that is, *EU(big bang) = EU(gradualism)*; as shown above, in this case, the expected value of gradualism is less than the expected value of big bang, $\theta W_1 + (1-\theta)G < pW_1 + (1-p)W_2$. If the initial reformer were replaced by a more risk averse reformer, the latter would require a higher risk premium to accept either lottery, but he would always require a lower risk premium for gradualism than for big bang. Therefore, for the same expected value from both strategies, *EU(big bang) < EU(gradualism)* for the more risk averse reformer.

Of course, the opposite would be true, that is, *EU(big bang) > EU(gradualism)*, if the initial reformer were replaced by a less risk averse reformer. However, it is important to reemphasize that the risk averse reformer, irrespective of his degree of risk aversion, continues to view the big bang lottery as the more risky lottery than the gradualist lottery and continues to behave as if he is more risk averse under the big bang strategy than under the gradualist strategy.

If the gradualist option were not available, then the reformer might prefer to stay with the status quo because *EU(big bang) < U(status quo) < EU(gradualism)* is feasible. By construction, this is *not* feasible in the present model because of the simplifying assumptions that W_1, W_2, $G > Y$, so, in the present model, reform under either strategy dominates the status quo (Figure 6). However, without significantly affecting the foregoing results, we can readily relax the simplifying assumptions and assume that $W_1 > Y > G > W_2$. It is still feasible that $pU(W_1) + (1\text{-}p)U(W_2) > U(G)$ and $U(G) > U(W_2)$, so that both big bang and gradualism are viable strategies. But now *EU(big bang) < U(status quo) < EU(gradualism)* is also feasible. In the right-hand-side panel of Figure 7, the utility from a given status quo income level may fall between EU^g and EU^b.

Hence, an additional important result is that gradualism may weaken the status quo bias and result in at least an initiation of the reform process. Ambiguity favors the status quo, and it favors gradualism over big bang. In other words, *dynamically splitting the big bang compound lottery* by opting for gradualism may induce a risk averse bettor to play, and the bettor may be *willing to pay* to dynamically split the ambiguous lottery.

However, as noted earlier, the status quo bias may be compounded due to the fact that the outcome of the first reform represents the *new* status quo. When the new status quo that emerges after the first reform is implemented is an improvement over the initial status quo, then a higher payoff to the second reform is necessary for the risk averse reformer to adopt the second reform. With many reforms in a reform sequence, the status quo bias may increase over time. Therefore, although gradualism may result in at least an initiation of the reform process by lowering the initial status quo bias, it may also induce a gradual increase in such bias over time, if better outcomes are realized to become the new status quos through the reform process. This may engender complacency and a reluctance to undertake higher-generation reforms.

Finally, in the present two-stage reform example, under the gradualist strategy, the reformer is *time consistent*. If the decision in the initial period, $t = 1$, is to adopt the gradualist strategy, then this strategy will be maintained until the resolution of uncertainty in $t = n\text{-}1$. This is because in $t = 2$, n is now lower than it was in $t = 1$ (that is, as of $t = 2$, the resolution of uncertainty will take place in $t = n\text{-}2$); hence, the expected utility from gradualism in $t = 2$ is higher than it was in $t = 1$. When the relevant information about the second reform is revealed, the reformer will adopt that reform or he will not adopt it, as announced. Arguably, under the gradualist strategy, this flexible policy stance is announced before the reform process is initiated, that is, the reformer is "benevolent *un*dissembling". The cost of flexibility is deferring the expected benefit from the second reform, at least for a duration.[45]

[45]Clearly, this argument reflects the simplifying assumption that both outcomes of the first reform dominate the *status quo*. If it were not so, then gradualism would also be vulnerable to reversal, or, more generally, to time inconsistency (R_1 might be reversed if its outcome is worse than the *status quo*). However, if R_1 were *not* a sure bet also, under the gradualist strategy, the reformer may reverse *only one* reform (R_1). But under the big bang strategy he may reverse *two* reforms (both R_1 and R_2). So it is possible that the gradualist strategy is less vulnerable to time

(continued...)

B. Reform Outcomes as Utility States

Until now, reform outcomes have been interpreted as expected values or expected income levels. However, I have also argued that reforms need not have an appreciable impact on income but may be expected to improve welfare anyway. In such a case, reform outcomes need to be interpreted as "consumption bundles" corresponding to states of utility rather than income levels. As noted earlier, tax reform may improve the level of welfare for the same revenue level, hence for the same level of net income for the taxpayer. Prison reform may not change the cost of operating prisons (same cost to be borne by the tax-paying public), but it can make a great difference in the utility state of the prisoners and the public. Education reform may be accomplished without additional taxes and may improve the quality of education and move students and parents to a better state of utility. We can make similar arguments for health reform.

When reform outcomes are interpreted as utility states, a dynamic case for gradualism can be made as follows: With two reforms in the reform package, suppose the first reform, R_1, is tax reform and the second, R_2, exchange rate liberalization.[46] Prior to reform, the reformer derives a certain level of utility from meeting his budgetary foreign exchange needs (say, through surrender requirements) at the cost of inefficiencies resulting from exchange restrictions; let the utility state prior to reform be represented by $U(Y)$. Suppose R_2 is a sure bet, that is, when the exchange rate is liberalized, this will improve market efficiency and have a positive impact on the welfare level with certainty. However, R_1 is not a sure bet; after tax reform, revenue may be sufficient to finance the government's foreign exchange requirements at the free market exchange rate, but revenue may also fall short of this requirement. As in the case in Section IV.A (Figure 3), under big bang, in the initial period, t, the reformer may end up in two utility states after reforms are effected:

$(p, U(V_1))$: utility when tax reform *is* successful and exchange rate *is* liberalized;

$(1\text{-}p, U(V_2))$: utility when tax reform is *not* successful but exchange rate *is* liberalized.

Under gradualism, in period t, there are two utility states:

$(p, U(G_1))$: utility when tax reform *is* successful but exchange rate is *not* liberalized;

$(1\text{-}p, U(G_2))$: utility when tax reform is *not* successful and exchange rate is *not* liberalized;

---

inconsistency. This observation suggests that an evaluation of the time inconsistency problem under ambiguity may yield interesting results. This important issue remains outside the scope of this paper.

[46] See Section VI.B below.

In period $t+1$, there are also two possible utility states under gradualism, each realized with certainty:

$U(V_1)$: utility when tax reform *was* successful in period t and exchange rate *is* liberalized in period $t+1$;

$U(G_2)$: utility when tax reform was *not* successful in period t and exchange rate restrictions are maintained in $t+1$ (that is, the second reform is *not* effected in $t+1$).

Under the simplifying assumptions *(a)-(d)* in Section IV.A, the same analysis applies to the above example with utility states. Consequently, when $U(V_2) < U(G_2) < U(V_1)$ and $U(G_1) < U(V_1)$, for a given probability, a case can be made for gradualism without reference to income or wealth levels. For example, even though income level may be higher in the state $U(V_2)$ than in the state $U(G_2)$, the reformer may prefer the state $U(G_2)$ to the state $U(V_2)$ and therefore choose the gradualist strategy to the big bang strategy.

VI. Some Cases For and Against Gradualism

Formal examples in the context of specific models to compare the gradualist and big bang strategies are beyond the scope of this study. However, some studies, which formalize this comparison in specific cases, are reviewed and related to the arguments and findings of this paper.

A. Budget Constraints and Legitimacy of Reforms

Dewatripont and Roland (1992, 1994) have made a case for gradualism under certainty. The main conclusion of those studies most relevant to the foregoing results is the following: Gradualism may dominate big bang when the budgetary cost of reform (cost of maintaining income level of workers to be laid off from inefficient state enterprises) is a variable that determines optimality. For example, a high budgetary cost for large lay-offs along with inadequate tax revenue to pay for it may result in hyperinflation and leave the laid-off workers worse off than before.[47]

[47] In 1992, Dewatripont and Roland made the following warning: "*[...] it is doubtful whether the West is willing to pay for the high cost of rapid restructuring* [in the transition countries]. *Countries that would opt for* [rapid restructuring] *would thus have to face a heavy fiscal burden*" (p. 299). Along similar lines, Soros (2000) laments that the West's reluctance to pay for rapid reforms in Russia has contributed to economic chaos.

This argument can be easily adapted to the foregoing model. Suppose the first reform is tax reform and the second is enterprise restructuring. It is plausible to assume that tax reform to generate sufficient revenue should precede enterprise restructuring that involves large budgetary outlays. Low tax revenue and large layoffs resulting in hyperinflation leaves a large segment of the population worse off than before reform is a feasible outcome. The corresponding expected loss could be large enough that gradualism dominates big bang. Furthermore, such bad outcomes of reform may increase the reversal incentives—if a total reversal were possible in reality—resulting in further large costs.

Dewatripont and Roland's main focus is on the need for legitimizing reforms through a democratic voting mechanism. As a simple heuristic example along those lines, suppose that there are 50 old and 50 young workers in the economy; the old will live only in the first period but the young will live for two periods; the old do not have the bequest motive; to ensure legitimacy of reforms, majority vote will determine whether the reform package will be adopted and which reform strategy will be followed. The reform payoffs and probabilities are given in Figure 8. Under the given information structure, the old worker will vote for the big bang strategy, but the young one will vote for the gradualist strategy. If the policymaker insists on the big bang strategy, the reforms will not be undertaken at all because majority vote cannot be mustered. However, majority vote can be mustered to undertake reforms under the gradualist strategy. In this example, it is possible to tax the young workers in period t to make transfer payments to the old ones to make up for the loss of income to the old workers under gradualism. Then the gradualist reform strategy is adopted with unanimity; reform is legitimized.[48]

B. Tax Reform and Quasi-Fiscal Policy Instruments

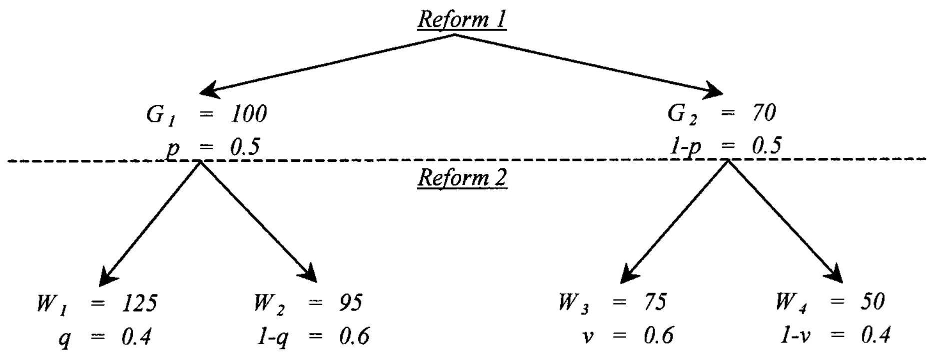
Tanzi (1998) provides an argument that may support gradualism. As an example, he argues that an important reason why governments resort to quasi-fiscal controls (exchange restrictions) is because of the inefficiency of the tax system in raising adequate revenue for the government to be able to meet its foreign currency requirements in the free exchange market. He identifies such a case as "institutional failure," which reflects the gap between the government's goals and the policy instruments at its disposal. Consequently, the final results of government actions may be at great variance with the intended results. As such, the analysis starts, appropriately, in a second-best environment, and bad policy outcomes are feasible.

Major tax (and expenditure) reform can restructure the budget in a sustainable manner so that exchange restrictions (and other economically inefficient quasi-fiscal policy instruments) can be abandoned to remedy the inefficiencies resulting from having to resort to them. When tax reform and exchange reform are viewed as two reforms in a reform package, the plausible implication of Tanzi's conjecture is that tax reform should precede exchange reform in the preferred reform sequence. In that sequence, the gradualist implementation of the reform

[48]This example also illustrates Wei's (1997) argument that the gradualist strategy may make a reform program politically viable.

package may have dynamic economic value because gradualism reveals a crucial piece of information about the outcome of tax reform, namely, the after-reform revenue capacity for a given level of foreign currency requirement (say, for a given level of budgeted subsidy for

Figure 8. Legitimacy of Reforms: Vote for Big Bang or Gradualism



Old

Population 50

	t	*t+1*	*EV*	*Vote*
Status quo	85.5	--	85.5	
Income before transfer from young				
Big bang	86.0	--	86.0	*Yes*
Gradualism	85.0	--	85.0	*No*
Income after transfer from young				
Transfer	0.5	--	0.5	*Yes*
Gradualism	86.0	--	86.0	*Yes*

Young

Population 50

	t	*t+1*	*EV*	*Vote*
Status quo	86.3	78.5	164.8	
Income before transfer to old				
Big bang	86.0	78.2	164.2	*No*
Gradualism	85.0	80.5	165.5	*Yes*
Income after transfer to old				
Transfer	-0.5	--	-0.5	*Yes*
Gradualism	84.5	80.5	165.0	*Yes*

Discount rate (old and young) = 0.10

imports of medicine). Bad tax reform outcomes are possible (say, due to lack of implementation capacity), and after-reform revenue capacity is inadequate to finance the foreign currency requirement at the market exchange rate. As argued in the simple comparison of the two reform strategies above, the feasibility of the bad outcome of tax reform is an economically significant piece of information for the reformer, which may induce him to adopt the gradualist strategy as opposed to the big bang strategy. The passage of time during the implementation of tax reform is not economically "simple". That is, the reformer may make an economically justified and deliberate dynamic decision to defer exchange reform until after the tax reform is played out.

In essence, this argument, posited within Tanzi's conjecture, is quite similar to Dewatripont and Roland's. In both cases, the budget constraint plays an important role in invoking a second-best environment and in making a case for gradualism.[49]

C. Price Liberalization

A case against gradualism has been made by van Wijnbergen (1991). In that study, the reform is price liberalization; the premise for gradualism is the possibility of prolonged low supply responses to price liberalization. However, intertemporal speculation in the form of hoarding (storable goods) is possible. Under these circumstances, gradualism may result in low supply responses because of hoarding; consequently, the credibility of the gradualist strategy is breached, the policymaker may be thrown out of office by anti-reformists, and reforms are abandoned.

First, van Wijnbergen's model makes the waiting costs of gradualism (in addition to discounting) appropriately explicit. The waiting cost of gradualism is the cost of lower supply responses due to intertemporal speculation or hoarding.[50] Second, the implicit assumption is that the markets are competitive for all goods whose prices are controlled before reform. This is a first-best environment for price reform and not a second-best one. But for some goods with controlled prices, markets may be monopolistic, or other such distortions may be present that may be revealed when price controls are lifted. The reformer may not have adequate information to assess *ex ante* which markets will be less competitive when price controls are

[49]Along the same lines, Lian and Wei (1998) emphasize the importance of efficient transfer mechanisms between the winners and losers from reform programs. In the absence of such efficient tax and transfer mechanisms, or, when "institutional failure" is present, the policymaker may prefer to establish such mechanisms first, observe their success in application, and then proceed with subsequent reforms.

[50]In my model, the simplest way to introduce such waiting costs to the expected payoff to the gradualist strategy is to subtract the waiting cost from the term in *(4)*; thus, by *(5)*, the gradualist strategy dominates the big bang strategy if $p(V_1-G_1) \leq (1-p)[(1+\delta)/\delta](G_2-V_2)-K^{wait}$, where K^{wait} is the explicit waiting cost of gradualism. The case for gradualism is weakened; for a high enough K^{wait}, big bang may be preferable.

lifted. Similarly, lifting price controls on some goods may have significant political costs. In such an ambiguous second-best pre-reform environment, bad outcomes for some markets are feasible when price controls are lifted under the big bang strategy. This would be especially likely if the institutions to regulate monopolies or institutions to administer cash subsidies to replace price controls are not in place or ineffective. However, under gradualism with appropriate sequencing (the reformer suspects some specific markets are likely to be less competitive), the gradualist strategy may facilitate the flow of valuable information about which markets to regulate, and it may allow for the flexibility of avoiding bad outcomes in those markets that might occur—perhaps irreversibly—under the big bang strategy.

D. Tariff Reform

Along similar lines, Auernheimer and George (1997) make a case against gradualist trade reform. Reform is moving from the second-best steady state with high tariffs toward the first-best steady state with low or no tariffs. The premise for gradualism is the inability to implement tariff reform instantaneously, apparently due to some physical constraints. Gradualism distorts the optimal combination of consumption and asset accumulation because it signals the wrong rate of return on asset accumulation that is higher than the true (steady-state equilibrium) market rate. However, lowering the tariff rate results in welfare gains or no change in welfare. So, the big bang strategy dominates the gradualist strategy. Consequently, for whatever reason, if the big bang strategy cannot be implemented and it takes time to prepare toward lowering tariffs, the strategy of waiting until such time the reformer is ready to implement the big bang strategy and announce it at that time as a surprise is better than the gradualist strategy.

In the context of my arguments, two observations can be made about these authors' results. First, there are no possible bad outcomes to tariff reform: lowering tariffs increases the welfare level or leaves it unchanged. Secondly, the implicit assumption in these authors' models is that gradualism reveals no economically significant information over time: passage of time is "simple" in the sense argued above for distinguishing sequencing from gradualism. So, the reason why the reformer may opt for the gradualist approach refers to the "simple" passage of time in the static sense. Therefore, the only difference between the big bang strategy and the strategy of preparing for a length of time and then implementing a surprise big bang tariff reform is the simple impossibility of effecting trade reform instantaneously. Although a realistic conjecture, such passage of time is not dynamically important to affect the reformer's choice between gradualism and big bang in an economically significant way.

However, if bad outcomes of tariff reform are feasible (say, predatory penetration of some domestic markets; administrative failures), then, like price reform, tariff reform may also be compartmentalized into tariffs on different baskets of goods. If the reformer does not have perfect information about the state of competitiveness in different markets after tariff reduction, then a meaningful sequencing problem arises, and gradualism acquires a dynamically significant economic value.

E. Stabilization

Cukierman and Liviatan (1992) provide a model of optimal gradual stabilization when economic agents have imperfect information about the degree of the policymaker's credibility, and the policymaker has imperfect control over inflation. Credibility problems may result in a policy preference for gradualist stabilization in order to build a "serious" anti-inflation reputation over time and to avoid a sharp and prolonged decline in economic activity resulting from lack of credibility due to imperfect information about whether the policymaker is a "serious" or a "frivolous" stabilizer.[51] The model is appropriately cast under imperfect information both on the side of economic agents and of the policymaker. Stabilization policy outcomes generally move in the direction of inflation reduction; however, enough uncertainty exists about the control of inflation at a desired level due to imperfect control over inflation. On the side of economic agents, there is ambiguity about whether the policymaker is a "strong" or a "frivolous" one. The economically valuable piece of information instrumental in justifying gradualism is to ascertain over time which type of stabilizer the policymaker is, whether he is "serious" or "frivolous". Furthermore, the degree of the policymaker's control over inflation is also revealed over time. However, such information becomes available with delay; ambiguity is reduced only after making an adequate number of repeated observations; hence the case for gradualism.

F. Financial Sector Liberalization

Financial sector liberalization is a desirable reform, because it increases financial depth and efficiency in investment allocation, attracts foreign investment, and may stimulate savings. However, financial liberalization carries the risk of making a country vulnerable to financial crises.

Williamson and Mahar (1998) provide a comprehensive review of the issues involved in the sequencing and speed of financial sector liberalization. As for sequencing, the basic observation is that financial sector liberalization should start from macroeconomic stabilization and improved prudential supervision, and capital account liberalization should be done last. As for the speed of financial sector liberalization, Williamson and Mahar note that countries that have proceeded rapidly with financial sector liberalization have tended to be more vulnerable to financial crises and consequent policy reversals. Those authors construct an index of the level and effectiveness of prudential regulation and supervision and apply this index to a sample of 33 developing and industrialized countries for the period 1973–95. They find that a higher level of effective prudential regulation and supervision has been correlated with less severe financial crises, and conversely.

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[51] As noted earlier, the credibility of the big bang strategy as a politically viable one is also an important consideration in the choice between the big bang and gradualist stabilization strategies; see Blanchard (1985).

Consequently, in a second-best world, a period of "mild financial repression" (maintaining a cap on the deposit rate) may be desirable.[52] Such a waiting period allows for the development of a more competitive financial market that draws interest rates down; it facilitates the development of transparent reporting, effective supervision, better prudential regulation, and elimination of barriers to free market entry, and also allows for a consolidation of bad debts accumulated during the previously controlled financial regime. In short, the waiting period removes many ambiguities about the effectiveness of the regulatory capacity of the reformer and the competitiveness of markets. Thus, capital account liberalization should be delayed until the liberalized financial system is well established. This amounts to following the gradualist strategy in financial sector liberalization.

VII. Conclusions

Using the basic Expected Utility Theory and some arguments from its critique, this paper has underscored that gradualism may dominate the big bang reform strategy under a rather general set of conditions, even in simple second-best ambiguous environments. The main vehicle that delivers this result is the informationally significant passage of time that serves to reduce ambiguity about reform outcomes and their distributions. Reforms are public goods (or bads), and there are no institutional arrangements to securitize reform outcomes through efficient contracts, as in the case of financial options and, to some extent, as in the case of private investment decisions in private markets. Gradualism as a social choice strategy may serve to securitize against bad reform outcomes and costly reversals. The commonsense of it is that it is best to get to the right place fast, but it is better to get to the right place slowly than to get to the wrong place fast.

I think the case for gradualism has general appeal because, as a rule, reform environments are second-best and ambiguous. This is true for all dynamic policy decisions. Passage of time may reveal valuable information relevant to all types of policy decisions. The case for gradualism this paper makes may be less strong for first-generation reforms, which I identified as less ambiguous reforms. However, higher-generation reforms remain vulnerable to failures even in advanced countries.

Availability of the gradualist option may induce at least an initiation of reforms, which might not be undertaken at all under the big bang strategy. This important result rests on the observation that the risk averse reformer views the big bang strategy as a more risky gamble than the gradualist strategy. Consequently, under circumstances that may be intuitively appealing, the present model implies that higher-generation reforms may be more difficult to undertake and slower paced, reflecting a dynamically increasing status quo bias compounded by

[52]For example, in a second-best world, moral hazard problems associated with banks that are "too large to fail" may push interest rates to levels that endanger bank solvency and may result in unwarranted risk taking or a "gamble for resurrection".

the good outcomes of first-generation reforms. I think that these results have a natural extension to other types of reforms, including social and political ones.[53]

This paper is not intended as a statement against the big bang reform strategy. As shown, the conditions under which big bang dominates gradualism are also quite plausible. Of course, the role of "the vision thing," or, the importance of enlightened political leadership, reinforced by strong institutional capacity and technical skills, cannot be underestimated. Such assets may help reduce ambiguity in social choice and make the big bang strategy preferable.

Non-utilitarian arguments that regularly shape the political economy of reform are not captured by the present analysis. As emphasized by Drazen (2000), such arguments need to be embedded in an environment of heterogeneity of interests and information. Heterogeneity implies that there are winners and losers from reform, not only within the same generation but also over many generations.[54] With heterogeneity, Aaron (1999) argues that even a measure of paternalism might have a role in deciding about social policies (health insurance). I think that Aaron's arguments reflect well on many non-utilitarian issues involved in major reform programs and the speed of reform implementation.

Many important and interesting empirical questions remain, which can be posed in the present context. There are instances of successful and unsuccessful reform experiences around the world that seem to lend credence to both the big bang and gradualist strategies. A review of those cases within the analytical framework developed in this paper may yield illuminating results. A retrospective analysis of successful and unsuccessful reform cases may shed light on the question whether the gradualist or the big bang approach might have been better in those cases. Are there cases where the initial conditions facilitated a less ambiguous environment for rapid reforms? Are there cases where rapid reforms (or, at least attempts thereof) resulted in disintegration of economic systems and contributed to subsequent collapse of output? If so, were the waiting costs (say, the looming prospect of a totalitarian comeback) too high not to take the plunge?

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[53]For example, countries selected for future European Union membership are facing a myriad of social, legal, political, and economic reforms, some of which are routine and some fundamental.

[54]In the context of long-run fiscal policy under uncertainty with overlapping generations, Auerbach and Hassett (1999) argue that there is little justification to delay corrective policies in the face of an anticipated fiscal imbalance. They also note, however, that early action means exercising the option to set policy later, and the impact of the corrective fiscal policy may be irreversible for a long time, with a possible deleterious impact on the elderly. Then, it may be optimal for the policymaker not to exercise the policy option, that is, prefer inaction for some time.

Similarly, there are countries that are still at early stages of reform and those that appear to be proceeding gradually. So, the question whether those countries should opt for the big bang or the gradualist strategy remains to be tackled.

For future theoretical research, I will highlight two important issues that are related to the present analysis. The first concerns the timing of resolution of uncertainty when "auxiliary" decisions need to be made during the reform process.[55] For example, while reforms are being undertaken, consumers need to make dynamic consumption/investment decisions. In the present context, the reformer was shown to behave as if he were more risk averse under the big bang strategy than under the gradualist strategy. Would the need to make "auxiliary" decisions tilt his preference toward the early-resolution big bang strategy?

The second issue is the vulnerability of macroeconomic policies to time inconsistency. In the present context, the big bang reformer is a "benevolent dissembling" one. On the other hand, arguably, the gradualist reformer announces that he will not adopt some reforms in the future under some circumstances; in other words, the gradualist reformer is "benevolent *un*dissembling". Then, should the more flexible gradualist strategy be construed as a time-inconsistent or a time-consistent policy?[56] Is the gradualist strategy *less* vulnerable to time inconsistency than the big bang strategy?

Finally, ambiguity with reversible investments in the countries where capital account is liberalized is likely to have important explanatory power in understanding financial crises in many cases.

[55]For seminal models of impatience and preference for an early or late resolution of uncertainty, see Koopmans (1960), Kreps and Porteus (1978). For a specification, see Weil (1992).

[56]See, for example, Cukierman, Kiguel and Liviatan (1992), Cukierman and Liviatan (1992), and Lohmann (1992).

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