The equity premium puzzle and the privatisation paradox*

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Abstract

In our view, the most promising resolution of the equity premium puzzle observed by Mehra & Prescott (1985) is the suggestion by Mankiw (1986) that capital markets do not spread risk perfectly, and in particular that systematic risk is concentrated ex post on a small number of people. We argue that there is a close link between this and what may be called the privatisation paradox, that is, the fact that, although privatisation is widely seen as increasing technical efficiency, the savings in public debt are frequently smaller than the foregone earnings of government enterprises. In order to explore this connection we outline a simple general equilibrium framework in which capital markets operate to spread risk associated with physical capital but owing to an adverse selection problem risk associated with

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human capital cannot be insured. With such imperfect risk-sharing we show that public investment financed by government bonds can provide indirect human capital insurance benefits. This is because in the recession in which the public investment fails to generate a return, the revenue needed to pay the bondholders can be raised by levying a labour income tax. Hence the optimal size of the public sector is non-zero. Moreover, we show that the appropriate discount rate for public investments not only lies above the bond rate but is bounded above by the rate of return to private equity that would obtain if there were no market imperfections.
1 Introduction

Since its discovery by Mehra and Prescott (1985), the equity premium puzzle, that is, the fact that the premium between rates of return to equity and debt is much greater than can be explained on the basis of standard models of life-cycle optimisation, has generated a large literature. Although many candidate resolutions have been offered, the most promising is the suggestion by Mankiw (1986) that capital markets do not spread risk perfectly, and in particular that systematic risk is concentrated \textit{ex post} on a small number of people. When this idea is incorporated in a model with heterogeneous individuals (Constantinides and Duffie 1996) the results are consistent with the emergence of an equity premium.

Rather less attention has been paid to what may be called the privatisation paradox, that is, the fact that, although privatisation is widely seen as increasing efficiency, the savings in public debt interest obtained through programs of privatisation and debt reduction are frequently smaller than the foregone earnings of government business enterprises (Quiggin 1995), at least for developed countries such as Australia, New Zealand and the United Kingdom.

There is a close link between puzzle and paradox. Because the rate of return expected by holders of private equity is significantly greater than the rate of return to good quality public or private debt, the market value of an asset is significantly less than the present value of its expected future earnings, capitalised at the bond rate. Conversely, the annual saving in public debt interest associated with the sale price is less than the earnings foregone.

The privatisation paradox, in turn, may be linked with the debate over the appropriate rate of discount for risky public projects (Arrow and Lind 1970, Hirshleifer 1989). Reasoning similar to that of Mehra and Prescott may be used to support the view that only a small risk premium should be charged for public projects, and therefore that the appropriate rate of discount for public projects is close to the bond rate. On the other
This argument is concerned with pure risk and should be distinguished from the observation that the average profits of government business enterprises may be overstated as a result of failure to make an actuarially fair allowance for the cost of contingent guarantees.

For representative investments, the private rate of return is well above the bond rate. If the equity premium is the result of imperfections in the private capital market, there is a prima facie case to suggest that the appropriate rate of discount for public sector investments is that which would be generated by a perfect capital market, rather than the observed rate incorporating the anomalous equity premium.

On the same basis, it may be argued that privatisation of a given enterprise increases welfare if and only if the valuation of the enterprise generated by private capital markets exceeds the expected value of future earnings discounted at the socially optimal rate. This in turn will be true if and only if gains in efficiency arising from privatisation outweigh the excessive cost of capital associated with the equity premium. However, it may be argued that acceptance of this view would imply support for obviously inappropriate policies, such as comprehensive public ownership.

In view of the privatisation paradox, it is natural to ask whether public sector net wealth and social welfare are reduced as a result of privatisation. Defenders of privatisation, relying on the (implicit or explicit) assumptions of perfect capital markets and Ricardian equivalence, have argued that the apparent reduction in public sector net wealth arising from privatisation is illusory (Domberger 1995, Forsyth 1995). The argument is that risk borne by governments must ultimately translate into individual risk concerning tax liabilities. This is a strong form of Ricardian equivalence, since individuals must take account of the impact of government decisions, not merely on the expected value of future tax liabilities but of the state-contingent distribution of those liabilities.\footnote{This argument is concerned with pure risk and should be distinguished from the observation that the average profits of government business enterprises may be overstated as a result of failure to make an actuarially fair allowance for the cost of contingent guarantees.}

The Ricardian equivalence argument would be convincing if the equity
premium could be explained in manner that is consistent with the assumptions of capital market perfection. If, however, a substantial portion of the equity premium is explained by capital market imperfections, it is necessary to reassess the implications of public sector holdings of risky assets for individual welfare.

The purpose of this paper is to undertake such a reassessment.

2 The equity premium puzzle

Long data series generally show that the rate of return to buying and holding the market portfolio of stocks is considerably greater than the rate of return to government bonds. For example, Mehra and Prescott (1985) present data showing that over the period 1889-1978, the average annual yield on the Standard and Poor 500 Index was seven per cent, while the average yield on short-term debt was less than one per cent. Using a simple model of intertemporal optimization of consumption, and evidence on the growth and variability of aggregate consumption, Mehra and Prescott compute equilibrium asset prices for debt and equity under a wide range of parameter values. They show that the equity premium should be no more than half a per cent.

The Mehra-Prescott argument may be expressed more simply in terms of the analysis of Grossman and Shiller (1982) and Grossman, Melino and Shiller (1987). Suppose \( r \) denotes the return of a riskless asset. Then, either by taking a log-linear approximation or assuming asset returns and per capita consumption are jointly log-normally distributed, it may be shown that in an efficient capital market the equity premium, denoted by \( \rho \) is (approximately) given by

\[
E[\rho] = \sigma \text{cov}(\rho, \Delta \log C)
\]  

where \( \Delta \log C \) is the rate of growth of aggregate consumption. The term \( \text{cov}(\rho, \Delta \log C) \) plays essentially the same role as the beta coefficient in the Capital Asset Pricing Model, measuring the systematic risk associated with
the asset in question, while \( \sigma \) may be interpreted as the coefficient of relative risk aversion. Observe that no premium is associated with idiosyncratic risk, that is with risk that is uncorrelated with aggregate consumption.

The coefficient of variation of \( \Delta \log C \) is around 0.03 in most OECD countries, including Australia and the United States. Estimates of \( \sigma \) based on direct elicitation of risk preferences are typically around 1.\(^2\)

To approximate the expected rate of return to any given asset, only requires knowledge of the standard deviation of the rate of return for that asset and the correlation between returns and aggregate consumption. For example, the standard deviation of the rate of return to the market portfolio of equities in the United States is about 20 per cent, and the correlation with aggregate consumption is about 0.33. This implies that

\[
    \text{cov}(\rho, \Delta \log C) = 0.33 \times 0.20 \times 0.03 = 0.002
\]

so that for \( \sigma = 1 \), the implied premium over a riskless asset is about 0.2 per cent.

Mehra and Prescott coined the term ‘equity premium puzzle’ to describe the discrepancy between the observed equity premium and predictions derived from a standard model of intertemporal optimisation. The observed data constitutes a ‘puzzle’ because it seems to suggest that individual investors are not rationally optimizing and also that there are unexploited opportunities for arbitrage. Risk aversion in a complete markets setting does not seem an adequate explanation - although individual shares are risky, diversification should reduce risk greatly.

Moreover, if investors were sufficiently risk averse to account for the observed equity premium, their desire to ‘smooth consumption’ across states (because of their aversion to risk) would also imply a strong desire to smooth consumption over time (an ‘aversion’ to non-constant, including increasing consumption profiles). But this is then inconsistent with low government

\(^2\)Estimates based on observations of labour supply tend to be smaller. Some larger estimates have been derived from financial market data, but these are derived from solving for \( s \) on the assumption that a relation like (1) holds. They cannot be used to test whether (1) does in fact hold.
bond returns and savings rate sufficient to generate the observed per capita consumption growth of around two percent over this period. This is what Weil (1989) dubs the “risk free rate puzzle”.

Attempts to resolve the equity premium puzzle have fallen into three main classes. First, there have been claims that the economy is riskier than the Mehra-Prescott model would suggest, even though the data period for the model includes the Great Depression. Second, there have been arguments that the structure of preferences may be different from that assumed by Mehra and Prescott. Finally, there have been explanations based on imperfections in capital markets.

The first approach is developed by Rietz (1988) who argues that the equity premium may be explained by consideration of low-probability economic catastrophes. This explanation is dismissed by Mehra and Prescott (1988) who observe, among other points, that such catastrophic events frequently involve the expropriation of bondholders’ wealth either through repudiation or through unanticipated inflation. The same point may be made about the observation that the data presented by Mehra and Prescott ignores stock markets that have disappeared completely, such as the Russian stock market in 1917. Once again, bondholders fare no better than stockholders in cases of this kind. Whatever the significance of risks of this kind in assessing the desirability of financial assets as opposed to say, gold, they are irrelevant in considering the relative prices of equity and bonds. Attempts to explain the equity premium in terms of the risk characteristics of the economy appear to have little promise.

The second approach is to consider different preference structures. Epstein and Zin (1990) observe that, whereas in expected utility models, aversion to risk and aversion to intertemporal variations in consumption are both determined by the curvature of the utility function, this link is broken in more general models, such as rank-dependent expected utility (Quiggin 1982). Hence, the sufficiently large within period degree of risk aversion sufficient to accommodate the equity premium need not entail a low degree of intertemporal elasticity of substitution. However, Kocherlakota (1996)
notes that the Epstein-Zin model still can only accommodate the equity premium by requiring levels of within period risk aversion that economists generally deem implausibly high. Similar arguments apply to the analysis of Constantinides (1990), who relaxes the assumption of intertemporal separability, proposing instead that consumption levels at nearby points in time are complements.

The third approach is based on the observation that capital markets are imperfect in two major respects. First, because of moral hazard and adverse selection problems, individuals and non-corporate firms are unable to fully diversify systematic risks such as the possibility of suffering unemployment or bankruptcy during recessions. Second, whereas the perfect capital market is one of costless transactions, individuals face substantial transactions costs, particularly when borrowing to finance consumption.

Mankiw (1986) observes that faced with undiversifiable background risk, individuals will demand a higher risk premium to bear additional systematic risk than would be the case in a perfect capital market. Kocherlakota argues that this explanation of the equity premium is inadequate because individuals could use intertemporal consumption-smoothing as a substitute for diversification of systematic risk. However, as Quiggin (1998) observes, the existence of transactions costs for borrowers undermines Kocherlakota’s critique.

As Kocherlakota concludes, the equity premium remains a puzzle. No single approach has been fully successful. Nevertheless, it appears reasonable to suppose that market imperfections notably including the unavailability of insurance against income risk, transactions costs of borrowing and other capital market transactions play a major role in generating the equity premium.

### 3 The Arrow-Lind debate

Arrow and Lind (1970) argued that, in the absence of tax distortions, a ‘small’ public sector project yielding benefits uncorrelated with aggregate
consumption is beneficial if and only if the present value of expected benefits, evaluated at the real bond rate, is positive. This proposition, which will be referred to as the Arrow-Lind theorem may be summarised by saying that for projects meeting the stated conditions, no risk premium should be charged. This proposition sparked an extensive debate, which remains unresolved, although both sides have long since declared victory and pulled out.

The central difficulty in the debate was that the two sides argued at cross-purposes. The opponents of Arrow and Lind were not primarily concerned to refute the Arrow-Lind theorem, but to defend the proposition that, in the absence of distortions and capital market imperfections, the risk premium for public projects should be the same as for private projects.\(^3\) Central to the argument is the observation that, in the presence of perfect capital markets, rational individuals should be indifferent between bearing risk directly through financial markets or indirectly as taxpayers.\(^4\) The equivalence proposition is put most clearly by Hirshleifer (1989, p111):

“The market rate of interest is generated by an equilibrium between marginal time preferences of consumers and the marginal time productivity of resources. ...It is true that in a risky world there are many ‘impure’ time-plus-risk interest rates rather than one pure time-rate, but the way o take this into account is to use in the public sphere the rate employed for ‘comparable’ investments in the private sphere.”

There is no logical conflict between the Arrow-Lind and Hirshleifer propositions. Indeed, application of the capital asset pricing model yields the conclusion that a private enterprise meeting the Arrow-Lind conditions

\(^3\)Strictly speaking a simple adjustment to the discount rate is an adequate method of adjustment for risk only under special conditions, see Little and Mirrlees (1991).

\(^4\)In an intertemporal setting note that this requires Ricardian equivalence, where Ricardian equivalence is implied by the joint hypotheses of rationality and perfect capital markets
has a beta of zero and its expected future earnings should therefore be discounted at the real bond rate. Why then, was the debate so heated?

The difficulty is that, while the propositions themselves are logically consistent, policy implications derived from them depend upon the assumption that their conditions are approximately satisfied. But these conditions are inconsistent with the presence of a large equity premium. If most public projects satisfy the Arrow-Lind conditions approximately, in that their systematic risk is small relative to their expected benefits, then the risk premium for such projects should be small also. Computation of a risk premium for a project with returns having a coefficient of variation of 0.03 and plausible levels of risk aversion yields results similar to those derived by Mehra and Prescott, namely, a risk premium well below 1 per cent. On the other hand, if capital markets are nearly perfect, the risk premium for a public project should be the same as that for a private project with similar risk characteristics and, for a typical project, this premium will be large. It can easily be seen, in retrospect, that the conflict between these claims arises from the fact that the observed equity premium is much larger than the premium that would be expected on the basis of standard assumptions about preferences.

Although Arrow and Lind did not address the perfect capital market hypothesis in detail, their remarks clearly indicate that they did not consider it an appropriate basis for analysis. By contrast, both Hirshleifer and Bailey and Jensen took the view that prima facie any result inconsistent with the perfect capital markets hypothesis was not an appropriate guide to policy. Hathaway (1997) summarises the position of Bailey and Jensen as follows:

“The argument that governments have access to opportunities for risk diversification that are unavailable to private investors suggest that there is some impediment in risk diversification in the private sector. But there is no logical reason why this is the case, nor is there any evidence that it is.”
The debate remained confused partly because the problem of the equity premium was not recognised and partly because, in the absence of a well-developed analysis of agency problems, the issue of capital market imperfections could only be addressed in vague and general terms. With the aid of modern agency theory, and in the light of the equity premium debate, it is now possible to provide a framework for analysis of criteria for public investment criteria, based on two key propositions. We begin by saying that the capital market is ‘nearly perfect’ in risk-spreading if the equity premium it generates is close to that which would arise from a perfect capital market.\(^5\)

With this terminology, our first proposition is that, if the capital market is nearly perfect, the risk premium for public projects should be the same as that for private projects. The converse proposition is weaker. If the capital market is not nearly perfect, the optimal risk premium for public projects will not, in general, be that observed in the private capital market.

A natural conjecture is that whether or not the private capital market is perfect, public investments should be evaluated on the basis of the prices, including risk premiums, that would prevail in a perfect capital market. There are two reasons to doubt this conjecture. The first is a standard second-best argument. If the private sector allocation of capital is distorted, the adoption of the first-best set of public sector projects is unlikely to be desirable. The second objection is that any agency problems that prevent optimal risk-spreading through the capital market may also prevent optimal risk-spreading through the tax system.

These objections are likely to work in opposite directions. Assuming that private and public projects are substitutes, the second-best argument implies that the public sector should take on more risky projects than in the first best. The agency argument implies that the public sector risk premium should be larger than in the first-best and therefore that fewer risky projects should be undertaken. Of course, the fact that the objections

\(^5\)This definition allows for the possibility that deviations from the perfect capital market may be important in other contexts, provided they do not affect the equity premium.
work in opposite directions does not mean that they cancel each other out.

It is useful at this point to consider the distinction between moral hazard and adverse selection problems. A common, but not entirely satisfactory way of drawing this distinction is to say that moral hazard problems involve ‘hidden action’ while adverse selection problems involve ‘hidden information’. From a state-contingent choice perspective however, both classes of problems involve hidden information. The crucial distinction is that, in the case of adverse selection, private information is observed before contracting takes place, whereas in the case of moral hazard, information is observed after contracting takes place. The adverse selection problem arises because individuals whose private information indicates that they are unlikely to benefit from, say an insurance contract, will decline the contract, leaving the insurer with all the bad risks. The moral hazard problem arises because an insured party has an incentive to make a misleading report about the state of nature, and to supply less effort than is required under the contract.

Because of their coercive powers, governments can overcome adverse selection problems. Whereas private unemployment insurance schemes are likely to fail because of adverse selection problems, governments can require everyone to participate. By contrast, governments have no particular advantage in dealing with moral hazard problems. The moral hazard problems that would undermine a private unemployment insurance schemes reappear as adverse incentive effects of tax and welfare payments in the case of government insurance schemes.

4 Privatisation and nationalisation

Privatisation is the process of converting a government business enterprise to private ownership. Although some government business enterprises were created within the public sector, most privatisations represent the reversal of previous decisions to nationalise private enterprises. In a project evaluation framework, decisions on privatisation or nationalisation may be seen as a choice between incompatible projects, the project represented by the
public enterprise and that represented by the private enterprise. Hence, any general criterion for the evaluation of public and private projects also gives rise to a decision criterion for privatisation and nationalisation.

Private and public enterprises differ both in the streams of benefits to which they give rise and to the way in which those benefits are distributed among members of the community. Although there is little agreement in the literature, there is a majority view that private enterprises will, on average, achieve greater operating efficiency and be more responsive to changes in consumer preferences than will public enterprises in the same industry. This case is strongest for owner-managed firms, where the residual income recipients bear the consequences. Conversely, there has been, at least until recently, a majority view that it is less costly to deal with problems of monopoly and externality though direct control over public enterprises than through regulation of private enterprises.

If both propositions are accepted, it follows that there will exist a spectrum of enterprises. At one end of the spectrum (competitive industries with small-scale firms and no externality problems) the aggregate stream of benefits from private enterprises will be greater, on average, than that from public enterprises. At the other end of the spectrum (monopoly providers of pure public goods) the reverse will be true.

There remains the issue of how benefit streams from public enterprises should be evaluated, particularly with regard to risk. The analysis here is the same as that presented above for public projects. If the perfect capital market hypothesis is valid, public enterprises should be evaluated in the same way as private enterprises. If the perfect capital market hypothesis is invalid, it is necessary to determine an appropriate risk premium for public enterprises on the basis of second-best social optimality.

The issue can be made more concrete by considering an example of an enterprise where considerations of monopoly and externality are not relevant. If the perfect capital markets hypothesis is valid, a necessary and sufficient condition for privatisation to be desirable is that it should lead to a net improvement in operating efficiency. If the perfect capital mar-
ket hypothesis is invalid, it is necessary to weigh improvements in operating efficiency against any exacerbation of the consequences of capital market inefficiencies arising from privatisation. If a constrained optimal risk-adjusted discount rate for public projects is known, the necessary and sufficient condition for privatisation to be desirable is that the market value of the firm on privatisation should exceed the present value of expected earnings under public ownership discounted at the optimal public rate.

The consequences for the privatisation debate are significant. As has been shown above, the risk premium that would arise from a perfect capital market is very close to zero, so that the risk-adjusted discount rate is approximately equal to the riskless bond rate. As has been shown in Quiggin (1995, 1996, 1998) very few privatisations in OECD countries have yielded market prices greater than the present value of expected earnings under public ownership discounted at the optimal public rate. Hence, if the optimal discount rate for public projects is close to the rate which would arise from a perfect capital market, the case for privatisation would be gravely weakened. Conversely, the case for a mixed economy, and possibly for an extension of public ownership, would be strengthened.

5 Developing a framework for analysis

To determine the appropriate treatment of risk in public investment, it is necessary to develop a modelling framework within which the private capital market equilibrium is characterised by an equity premium comparable to that observed in reality. Since the problem is trivial if the equity premium arises in a perfect capital market, let us assume that the model is characterised by market imperfections. Assuming the existence of a set of possible public projects, there exists a subset of projects consistent with a (constrained) social welfare optimum. The problem is then to determine an evaluation criterion, preferably taking the form of a risk premium, under which only members of the optimal set are approved. Such a criterion will also provide a basis for the assessment of proposals for privatisation and
nationalisation.

In this section, we sketch an approach to the analysis, which is an elaboration of that considered by Mankiw (1986). As in Mankiw (1986), there are two global events, recession and boom. The boom is the same for all individuals, but only a subset of the population is affected by recession. Thus, a full specification of the set of states of nature contains a description of the effect of recession on each individual. The critical feature of the model is that individuals cannot fully spread the risk associated with recession and are therefore less willing to hold equity than they would be in a world of perfect capital markets. More formally, the payoff for securities can vary according to the global event (boom or recession) but must be independent of the state experienced by particular individuals. Thus, two securities are sufficient to span the set of possible securities. For simplicity, we consider a bond paying 1 unit in each event and a pure equity paying 1 in the boom event and 0 in the recession event.

We model an economy with two inputs to production, physical capital and human capital (or labour capacity). The production technology and the determination of returns to human and physical capital are not modelled explicitly. There are two types of firms, ‘risky’ and ‘safe’, but no-one in the economy can determine the identity of a firm before uncertainty is resolved in period 1. Hence, the risk associated with being employed by a risky firm cannot be diversified through insurance or other market mechanisms.

Risky-type firms generate higher revenue in booms, but go ‘bust’ and generate no revenue in recessions. Safe-type firms generate the same revenue in booms and recessions and pay a constant amount to their employees and non-employee claimants. In recessions, therefore, returns to physical capital decline by more, on average, than returns to human capital. However, whereas portfolio diversification ensures that the reduction in returns to physical capital is the same for all owners of physical capital, the payoff to human capital is unchanged except for the subset of individuals who become unemployed.\(^6\)

\(^6\)It would be straightforward to allow for differences in risk attitudes at the cost of
With this setup, it is possible to derive a securities market equilibrium and compare it to the first-best state-claims equilibrium arising when the risk associated with returns to human capital can be fully diversified. The difference between the expected rate of return to equity and the bond rate is higher in the second-best securities market equilibrium than in the first-best state-claims equilibrium. With plausible parameters, the equilibrium set of state-claim and security prices incorporates an equity premium comparable to that observed by Mehra and Prescott. Assuming all individuals have identical homothetic preferences yields the result that in the first-best, with the ability to pool idiosyncratic human capital risk, the equity premium is just under one percent. But without the ability to pool idiosyncratic risks the equity premium is almost seven percent.

The argument is most simply presented on the basis of prices for event-contingent claims. For any given individual there are three possible events.

1. boom,

2. recession without job loss, and

3. recession with job loss

A risk-averse individual will pay more than risk-neutral individuals for claims that yield income only in the third event and less than a risk-neutral individual for claims, such as pure equities, that yield income only in the third event. Provided risk preferences display the standard property of prudence (see Kimball 1990) the value of a security yielding a payoff in states (2) and (3) is greater when income differs between these states than when it can be pooled across the two states.

6 Introducing government enterprises

Under the perfect capital market hypothesis, shareholders will face a complete set of state-contingent markets and will therefore be unanimous in introducing distributional complications.
desiring value-maximisation. Hence only the aggregate stream of benefits is of interest. Similarly, any stream of benefits flowing from public projects has a unique market value, independent of its distribution across the community. However, in the presence of capital market failure, the distribution of benefits across the community is relevant. For example, if it is impossible to diversify the risk of becoming unemployed, then the marginal value of consumption in a state of nature where individual A becomes unemployed and individual B does not will be greater for A than for B.

In these circumstances public ownership of enterprises can increase their value by changing the distribution of returns. We consider a government with a balanced budget constraint and a single taxation instrument- a proportional income tax which may be levied at either positive or negative rates. We assume that in period 0, the government issues bonds and purchases equity at the competitively determined price with the proceeds. If period 1 turns out to be a recession event (that is, the event in which the equity the government holds has a zero payoff), then payment by the government for the bonds it issued in period 0, is achieved by levying a proportional labour income tax on the private sector. Conversely, any additional payoff from the equity the government holds in a booming period 1, over and above that needed to meet its bond payments, is remitted to the private sector by means of a negative proportional labour income tax.

Restricting the government to only levying proportional income tax rates, greatly simplifies the analysis in an economy with proportional endowments and homothetic preferences. Another motivation, for the restriction to proportional tax rates, is to abstract away any explicit redistributive role for taxation.

The use of a proportional tax to distribute the profits and losses arising from publicly owned government business enterprises provides insurance against the losses that would arise from unemployment relative to the alternative of direct private ownership. Hence, other things being equal, public ownership will raise economic welfare.

As usual, other things are not equal. For large classes of enterprises,
particularly those in which owner-operation is feasible, government ownership is likely to be associated with a loss of operating efficiency. On the other hand, government ownership may improve efficiency if production externalities or monopoly problems require extensive intervention. The fact that similar industries are found in public ownership in the majority of mixed economies is evidence that there exists a relatively stable ordering of industries, from those in which the costs of public ownership relative to private ownership are greatest (e.g. agriculture) to those in which the costs are smallest (e.g. police services).

We therefore consider a menu of public investment opportunities, with declining marginal returns. If the size of the public capital stock is denoted by $G$, the marginal investment is assumed to have returns which differ from those of the private sector by a proportional factor $(1 - \phi(G))$ in each state of the world, where $\phi'(G) \geq 0$. That is, it is assumed that the projects with the highest rates of return are implemented first. The problem of determining the optimal set of public investments is, therefore reduced that of determining the optimal choice of $G$.

An equivalent, and probably more useful interpretation of the solution arises if it is expressed in terms of the public sector rate of discount. Observing that the expected rate of return to private sector capital $r^*$ is a weighted average of the return to equity and the return to bonds, any solution for $G$ may be expressed in terms of the rule that public investments should be undertaken if and only if the rate of return exceeds $(1 - \phi(G))r^*$.  

$>\text{From the analysis of the case when public and private investments are equally efficient, it is obvious that the optimum must have } \phi(G) > 0, \text{ that is, that the appropriate discount rate for the public sector must be lower than the average rate of return to private capital. On the other hand, a straightforward stochastic dominance argument shows that public investments must have an expected rate of return at least as high as the riskless bond rate.}$

$\text{In terms of the state-contingent analysis presented above, we simply observe that from the viewpoint of a taxpayer-owner, a public investment}$
financed by the issue of debt has a positive payoff in event 1, a negative payoff in event 2 and a zero payoff in event 3. In the absence of differences in the expected rate of return, this is more attractive than ownership of private equity financed by debt which yields an equal negative return in events 2 and 3. On the other hand, if the expected return on the investment were only equal to the bond rate, an investment financed by debt would yield zero expected return but would reduce income in the unfavourable events 2 and 3 and would therefore reduce welfare.

Moreover, it follows from the state-contingent payoffs that the public sector rate of discount should lie between the bond rate and the first-best rate of return to private equity. This would imply a real rate of discount for public projects no more than 1 percentage point over the real bond rate.

7 Extensions

The model described above is designed to be as simple as possible, while showing how an equity premium can arise from the failure of capital markets to spread risk perfectly and how the risk associated with public ownership of capital may be spread more effectively through the tax system. The model could be elaborated in a number of ways.

First, the inclusion of agency problems would also have important implications for the analysis of government policies based on state-contingent taxes. The incentive effects of taxes on individual effort may be seen as analogous to the moral hazard problems associated with insurance against income losses. Such effects would need to be taken into account in analysis of the welfare effects of public ownership of equity. It should be noted, however, that public ownership of equity implies an increase in the state-contingent variability of tax rates rather than an increase in the average rate of taxation. Small increases in the state-contingent variability of tax rates will, in general, have second-order welfare effects.

More generally, there is no explicit modelling of the agency problems assumed to account for differences in the efficiency of public enterprises and
private corporations. While it is reasonable to suppose that these agency problems are in the class normally analysed in terms of moral hazard, there is no generally accepted way of modelling the agency relationship between taxpayers and the managers of government business enterprises or between shareholders and the CEOs of private corporations.\(^7\)

Extension of the analysis to take account of moral hazard would also yield a more complete account of the private sector equity premium. Moral hazard problems for individuals could be modelled, as in Grossman and Hart (1982), by assuming that \(\gamma\), the individual’s probability of loss in the global recession event, is not exogenous but depends on unobservable effort.\(^8\) Kahn (1990), using the Grossman-Hart approach, shows that moral hazard problems alone are not sufficient to explain the observed equity premium. However, the interaction between adverse selection and moral hazard problems might produce a richer set of results. It would also be desirable to allow for agency problems on the part of the managers of firms issuing securities. There is, however, no general agreement on the best way of incorporating such problems in a model of security market equilibrium.

Second, the analysis is based on a single-period of consumption and does not permit consideration of the possibility of smoothing consumption over time through borrowing, lending and the liquidation of assets. Kocherlakota (1996) argues that Mankiw’s solution to the equity premium problem is unsatisfactory because intertemporal consumption smoothing would overcome any difficulties associated with the absence of insurance markets. However, Kocherlakota’s argument is based on the assumption that individuals can borrow and lend freely at the bond rate. In practice, some individuals are credit constrained, and all face borrowing interest rates

\(^7\)It is straightforward to show that either class of enterprise will face agency problems that do not arise in the case of an owner-managed firm (Gans and Quiggin 1997, King and Pitchford 1998) and to observe that these agency problems must be offset by scale economies if large enterprises are to survive in competition with small owner-managed firms (Quiggin ?). However, since, by definition, owner-managed firms do not issue equity, this point is not relevant to analysis of the equity premium.

\(^8\)Alternatively, as in Quiggin and Chambers (1998) unobservable effort could determine state-contingent payoffs.
significantly higher than the bond rate, particularly where the purpose of borrowing is to fund current consumption. The existence of credit constraints and borrowing costs implies that Ricardian equivalence does not hold.

Since governments can borrow and lend freely at the bond rate, a dynamic analog to this model, where individuals face idiosyncratic and uninsurable human capital risks that are correlated with the systemic risk to equity that unfolds through time, would yield results at least as favourable to public investment as those derived above. As well as spreading consumption across states of nature through the tax system, governments could use borrowing and lending transactions to spread consumption over time.

8 Policy implications

Most privatisations in OECD countries have been undertaken primarily because of the resulting cosmetic improvements to budget aggregates. Governments have used the proceeds of asset sales to ‘finance’ increases in public expenditure or reductions in taxes. It is now generally recognised that this is inappropriate and for this reason ‘underlying’ measures of the budget balance, excluding the impact of asset sales have become popular. These measures are an improvement on the previous cash balance but are misleading because they treat government business enterprises solely as a source of dividends, with retained earnings being ignored. A number of recent privatisation proposals have been advocated on the basis that the interest savings from using sale proceeds to repay debt exceed the dividends foregone as a result of privatisation. In effect, this analysis values retained earnings at zero. For private enterprises, the Modigliani-Miller theorem shows that dividends and retained earnings are equally valid. Investor preferences for dividends are normally explained in terms of differential tax treatment or the idea that dividends are a signal that profit reports are accurate. Until recently, Australian advocates of privatisation such as the Department of Finance (1996) claimed that the Modigliani-Miller theorem
did not apply to public enterprises and that the retained earnings of such enterprises were ‘locked up forever and never used’.

The fallacious nature of this argument has now been recognised, as least in the Federal bureaucracy. The Office of Asset Sales, quoted in the majority report of the committee of inquiry into the proposal for the sale of Telstra (p13) correctly states the position in the absence of differences in operating efficiency

If perfect capital markets with full information exist the proceeds the government receives will be equal to the stream of dividends plus the retained earnings in Telstra. Therefore the net effect would be neutral.

As has been shown in this paper, the existence of the equity premium is evidence of capital market imperfections which raise the rate of return demanded by private holders of equity. It follows that, in the absence of efficiency differences, the proceeds the government receives will be less than the present value of the expected stream of dividends plus the retained earnings, discounted at the appropriate risk-adjusted rate derived above.

Note however, that, even if the public sector discount rate is lower than the rate for private enterprises with similar risk characteristics, a policy of complete nationalisation will not, in general, be optimal. Differences in operating efficiency must be weighed against differences in the risk-adjusted discount rate. In particular, there are some sectors of the economy, such as agriculture, where the efficiency advantages of private ownership and particularly those of owner-operated firms, are so great that public enterprises in those sectors have consistently failed to cover their variable costs. Obviously, no advantage with respect to the cost of capital can convert a stream of losses to a positive present value. Conversely, even under the perfect capital market hypothesis, externality and monopoly problems imply that public provision will be superior in some areas of the economy. Hence, the issue is one of drawing the boundaries between the public and private sectors and not a choice between pure communism and pure laissez-faire.
The analysis presented in this paper provides a market test for the benefits of privatisation (assuming that any environmental or other externalities have been appropriately internalised). Suppose that the expected profits and risk characteristics of a government business enterprise, assuming continued public ownership, are known. Then, using an estimate of the risk-adjusted cost of capital to government derived from a model of the kind developed here, it is possible to value the enterprise in public ownership. This value may be compared to the sale price realisable through privatisation. Other things equal, privatisation is desirable if and only if the sale price exceeds the value in public ownership.

In making calculations of this kind, it is necessary to emphasise that the expected value calculation should take account of the possibility of adverse or favourable shocks and should not be a ‘surprise-free’ projection. The expected value estimated, discounted at the bond rate would therefore be actuarially fair. The fact that taxpayers are risk-averse is taken into account through the use of a public sector discount rate higher than the real bond rate, but lower than the private sector cost of capital.

9 Concluding comments

The Arrow-Lind proposition on the public sector discount rate, the fiscal impacts of privatisation and the equity premium puzzle have all been the subject of lengthy, and often confused, debate. In this paper, it has been shown that the central issue in all of these debates is the same. If the observed equity premium is larger than that which would be generated by a perfect capital market, the optimal public sector discount rate will be lower than the private sector cost of capital and, in most cases, close to the real bond rate, as claimed by Arrow and Lind. Similarly, in the absence of differences in operating efficiency, privatisation will be welfare-reducing rather than neutral.

More significantly, in the case of privatisation, the analysis presented here shows that differences in operating efficiency associated with privati-
sation can be balanced against differences in the cost of capital to yield a straightforward test for the desirability of privatisation. Other things such as externalities being equal, privatisation is desirable if and only if the sale price exceeds the value in public ownership, calculated as the presented value of expected future earnings discount at the optimal public sector discount rate.

References


