

Principles of Tax Design, Public Policy and Beyond: The Ideas of James Mirrlees, 1936–2018*

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Abstract

Sir James Mirrlees, co-recipient of the 1996 Nobel Memorial Prize in Economic Sciences, passed away in August 2018. This article outlines how his work has transformed economists' understanding of their discipline – from the principles of tax design to the theory of contracts and beyond. By conceiving of policy questions in terms of information asymmetries between governments and taxpayers, Mirrlees demonstrated how to conduct convincing analysis of redistributive objectives together with incentive effects in the design of general tax systems and public policy more broadly. His ability to simplify complex problems in ways that reveal their tractable essence means that his work has yielded insights that have reverberated throughout the discipline. It has also proved highly fruitful for practical policy design.

* Submitted January 2019.

The authors are very grateful to Stuart Adam, Tim Besley, Peter Diamond, Peter Hammond, Gareth Myles, Nick Stern, Romesh Vaitilingam, John Vickers and Jim Ziliak for comments on earlier drafts. Most of all, they are grateful to Jim Mirrlees for his influence on the whole economics profession. All misunderstandings and misinterpretations of his work that remain are the authors' alone. An earlier draft appeared on VoxEU.

Keywords: Sir James Mirrlees, optimum taxation, contract theory, project analysis, growth.

JEL classification numbers: B21, B31, D82, D86, H21, H24, O22, O40.

I. Introduction

The work of Jim Mirrlees, who died in August 2018, transformed economists' understanding of their discipline – from the principles of tax design to the theory of contracts and beyond. He deepened knowledge of some of the most important issues in microeconomic policy by solving questions conceived in terms of the limited information of governments about taxpayers.

In so doing, he demonstrated how to conduct convincing analysis of redistributive objectives together with incentive effects in the design of general tax systems and, more broadly, of public policy. His ideas have proved fruitful for theoretical economics beyond their original context and for practical policy design.

II. Social welfare and public policy

Born in 1936 in a village in Galloway, near the southwest Scottish coast, Mirrlees excelled at mathematics, which he studied as an undergraduate first in Edinburgh then in Cambridge, where he was taught by Peter Swinnerton-Dyer and by the Fields Medallist and Abel Prize winner Michael Atiyah. An interest developed in philosophy and then in social science.

Finding in economics an opportunity to apply mathematical skills to questions of ethical significance, Mirrlees began attending economics lectures. The reduction of poverty in the underdeveloped world seemed to him to be 'what really mattered in the world'¹ and he wrote throughout his career on questions of growth and development.

He proceeded to graduate study in the subject under David Champernowne and Richard Stone and became involved in various economic projects on growth in Cambridge, working, for example, as research assistant to Nicholas Kaldor. Academic visits abroad to MIT and to India, and an advisory trip to Swaziland, deepened his academic and practical economic interests.

In 1963, he took up a teaching fellowship at Trinity College, Cambridge, and completed a doctoral thesis on optimal accumulation under uncertainty, which was examined by Kenneth Arrow. In 1968, he moved to Nuffield College, Oxford, where he became the Edgeworth Professor and remained until moving back to Trinity in 1995. A year later, he was awarded the Nobel Prize, jointly with William Vickrey. After retirement in 2003, he became Distinguished Professor-at-Large at the Chinese University of Hong Kong and Master of Morningside College.

There is a view of the proper role and nature of economic analysis running through Mirrlees's major contributions. 'Governments should do good and try

¹Mirrlees, 1997.

to work out how, specifically, they should do it'² and a good way to do that is 'to agree upon objectives, discover what is possible and optimize'.³

His view of that choice of objective drew him strongly towards utilitarianism: basing policy on maximising the sum of measures of the well-being of the individuals affected by the policy. He was far from being a naive utilitarian optimiser, but he did see the utilitarian and optimising approaches as crucial benchmarks. He wrote defending the coherence and attraction of that viewpoint, showing the depth with which he thought not only about what utilitarianism implied but also about why it made sense to him as an ethical framework.⁴

Utilitarianism as a basis for tax design has the potential for strong egalitarian implications. Redistribution through taxation can take income out of the hands of rich individuals, who benefit from it least, and put it into the hands of poorer individuals, who could gain from it more.

But that case for equalisation needed to be moderated to avoid discouraging economic production. That much has been understood since at least the work of late nineteenth century utilitarian political economists such as Francis Edgeworth and Henry Sidgwick.⁵ As Edgeworth puts it, 'the *acme* of socialism is thus for a moment sighted; but it is immediately clouded over by doubts and reservations'. Mirrlees's contribution helps to disperse those clouds and reveal how near or how far short of the summit the path reaches.

Government redistribution unavoidably distorts economic activity because the government is imperfectly informed. 'Public policies apply to individuals only on the basis of what can be publicly known about them.'⁶

If the government knew everything about the individuals it wanted to tax, then redistribution would take a very different form from what it does. The government would be able to design taxes to make the more productive work harder but without paying them in higher net income or consumption. It would be possible to have the more able work harder while still distributing income (and consumption) according to needs.

When the government only has imperfect information about an individual's productive capacity, it cannot follow such an apparently radical agenda. For example, it cannot encourage more economically productive individuals to reveal their higher earning capacity unless they are adequately rewarded for doing so.

That seriously constrains the options for redistributing away from them. Individuals will respond to government policy, whether that be taxation or whatever, by making the best they can of the options that the policy leaves open

²Mirrlees, 2006.

³Mirrlees, 1986.

⁴Mirrlees, 1982.

⁵Edgeworth, 1897; Sidgwick, 1883.

⁶Mirrlees, 1986.

to them. Public policy problems therefore take a characteristic form, which Mirrlees describes as ‘optimization subject to maximization constraints’.⁷

This is a perspective particularly suited to mathematical analysis. Indeed, it poses the central questions of public policy in a way that allows their solution to unfold in no other way. Mirrlees’s ability to frame questions of taxation in simple but general forms amenable to such analysis allowed unprecedented advances in understanding of how to handle them.

III. Commodity taxation

The case for designing commodity taxes so as to balance the distortions to consumption of different goods has been recognised at least since the 1920s when Frank Ramsey addressed and solved the problem of raising revenue through taxes on different commodities in the way least harmful to consumer welfare.⁸

Ramsey considered the effect on a single representative consumer only and showed that an optimal solution, if commodity taxes were the only instrument available to government for revenue raising, would mean ‘taxes should be such as to diminish in the same proportion the production of each commodity taxed’.⁹

The problem was revisited by Mirrlees in collaboration with Peter Diamond in the 1960s. Their set-up was more general than Ramsey’s in allowing for heterogeneous consumers and therefore ‘in considering the problem of income redistribution together with that of raising revenue’.¹⁰ Two results stand out from this work.

First, they show that in a wide variety of circumstances, there is no argument for distorting production (Mirrlees (1972) explores caveats). Distortion of consumption and labour supply decisions may be an unavoidable feature of the optimal tax policy, but there is no case for the economy to produce inefficiently. Whatever the most desirable allocation of goods to consumers, the economy should be producing at the frontier of what is possible.

This is not a result of merely theoretical interest; it has immediate practical implications. Taxes should be designed to fall on transactions between firms and households, but should leave transactions between firms untaxed. This is the way that value added tax is structured and one of the key arguments for its superiority as a way of collecting taxes on commodities.

Their second key result is that the simplicity of Ramsey’s solution needs to give way to more complex rules under which the discouragement of consumption of different commodities needs to be weighed against their

⁷Mirrlees, 1986.

⁸Ramsey, 1927; Samuelson, 1951; Stiglitz, 2015.

⁹Ramsey, 1927.

¹⁰Diamond and Mirrlees, 1971a.

distributional advantages. A case for discouraging the consumption of one good more strongly than another can be made if it is a bigger part of the budget of richer households. Diamond and Mirrlees establish the formulae under which this balance is struck optimally.¹¹

In practical terms, this suggests that if commodity taxation is the only tax instrument available for achieving redistributive ends – as could be the case, for example, in the context of a developing country – then there could be a case for higher taxation on goods that are consumed in larger proportion by the rich even if demand for those goods is relatively price-sensitive. The strength of that case is sensitive, however, to the unavailability of better means of redistribution.

As noted in the Mirrlees Review, discussed below, this result on the optimality of non-uniform indirect taxation is attractive advice for governments that cannot redistribute effectively through direct taxation, but the practical case for non-uniformity is less clear if income taxes can be non-linear.

IV. Non-linear income taxes

The nature of commodity taxation makes the problem of designing indirect taxes conceptually simpler than that of designing potentially more complex direct taxes. The way in which commodity taxes are typically collected at multiple points of sale means that the rates of taxation cannot typically be made to depend on how much of the good a person consumes. Commodity taxation cannot therefore be other than proportional to amounts consumed.

That simplifies things in two ways. For one thing, it means that there are only a finite number of tax rates to determine. More significantly, working out how consumers would respond optimally to those taxes and the resulting changes in prices is something that is well understood by economists, rendering the ‘maximization constraints’ in the Mirrleesian way of looking at the problem relatively straightforward to formulate.

With direct taxation, things are very different. Income tax schedules and systems of social security provision can be fiercely complicated. If we are asking how to design those optimally, then the nature of the problem is not only practically but conceptually challenging in a quite different way. Tax rates need to be determined at every possible level of earnings, and figuring out how to capture optimal taxpayer responses to the potentially highly irregular schedule under design is bewilderingly difficult.

How do we even describe such a problem? Mirrlees’s Nobel co-recipient William Vickrey wrote down the nature of the problem ‘somewhat

¹¹Diamond and Mirrlees, 1971b; Diamond, 1975; Mirrlees, 1975.

elliptically'¹² in 1945, but it was not until Mirrlees's (1971) breakthrough a quarter-century later that the issue was adequately conceptualised and solved.

The key is to see it as an information question. Governments can monitor how much people do earn, but they cannot know how much people could earn unless they design taxes in such a way that people's decisions will voluntarily reveal it. Whatever combination of work hours and after-tax income the government decides it wants someone to choose, it needs to make that combination more attractive to them than what such a person could get by posing as anyone less able.

Mirrlees worked through the implications of this – 'incentive compatibility' as it is called – showing how it can be seen as defining the rate at which taxpayer well-being needs to increase with unknown earning capacity, and how this can be used to derive the optimal schedule.

The formulae that describe the optimum separate out and clarify the considerations underlying the optimum pattern of marginal tax rates. Rates vary with earnings according to the local concentration of earning capacity, the responsiveness of people's decisions about their hours to economic incentives and the gains from redistributing earnings towards or away from the point in question.

As an intellectual achievement, this was a profound advance, establishing a framework for serious intellectual discussion and quantitative analysis. But as a contribution to practical policymaking, attention focuses on the concrete content of optimal schedules.

Simulations in Mirrlees's initial paper indicate that optimal rates are lower than expected and fairly flat. 'Perhaps the most striking feature of the results is the closeness to linearity of the tax schedules . . . I had expected the rigorous analysis of income taxation in the utilitarian manner to provide an argument for high tax rates. It has not done so.'¹³

These findings have encouraged a picture of him as someone whose natural egalitarian leanings were moderated under the pressure of economic realism. He was not averse to letting his opinions change with evidence and considered reflection, describing himself as someone who tried 'not to suffer from moral intuitions'. As he put it, 'if utilitarianism is to be a valuable moral theory, we had better be surprised sometimes by its conclusions'.¹⁴

He has said that his conclusions in the 1970s 'had changed, as a result to analysing economic models, which, at that time, seemed to have shown that redistribution should be less than I had thought earlier',¹⁵ but it is not true that the optimality of either low rates or approximate linearity was his settled view.

¹²Mirrlees, 1996.

¹³Mirrlees, 1971.

¹⁴Mirrlees, 1982.

¹⁵As quoted in Klein, Daza and Mead (2013).

His views responded to the great deal of work that followed on from his initial paper and explored sensitivity to alternative specifications of individual and social preferences and of the shape of the distribution of abilities.¹⁶ ‘Later work shows that marginal rates of tax should . . . be greater than they were in these first calculations. . . . In many cases, marginal tax rates were highest in the middle of the range of incomes, and fell towards higher incomes and lower’.¹⁷

One of the most well-cited and ‘notorious’¹⁸ results of the optimal tax literature is that the marginal tax rate on the topmost income should be zero. No distortion is needed where no one is more able. Moreover, if marginal tax rates are a continuous function of earnings, then it follows that they should be low near to the top.

It is obvious why such a finding should appeal to those who advocate low taxes on the rich. But note that this is a result about marginal rates; it does not mean that the optimal *average* tax rate at the top should be low, so it is compatible with taxation still being highly progressive, in the sense of taxing the rich on average at a higher rate. The result is not Mirrlees’s; it arose in the work of Phelps (1973) and Sadka (1976) building on the Mirrlees model. Its relevance relies on being able to identify in advance what the topmost ability is.

Mirrlees’s own view on the practical relevance of the finding was frank and not favourable: ‘My paper only considered models with an unbounded distribution of wage rates, and therefore did not have such a result. I believe that was the right strategy. . . . The zero rate is . . . practically irrelevant. Nor is it a good approximation to tax rates within, say, ten per cent of the highest possible’.¹⁹

In fact, the Mirrleesian framework for income tax design has been enormously influential in the practical redesign of tax and welfare systems across the income distribution. Papers such as Piketty (1997), Diamond (1998) and Saez (2001) have done much to facilitate a practical synthesis with the results of applied work.

A direct example is the contribution of Brewer, Saez and Shephard (2010) to the Mirrlees Review, discussed below, which, building on the work of Saez (2002), pointed to substantial top marginal tax rates and an integrated tax and transfer system similar to an EITC (earned income tax credit) with negative marginal tax rates at the bottom and a smaller guaranteed income for non-workers.

Mirrlees continued to work on optimal tax theory, leading to an eventual synthesis from which general principles emerge for a world in which we allow non-linearity not only in direct but also in indirect taxes.²⁰

¹⁶See, for example, the work of Tuomala (2016).

¹⁷Mirrlees, 1996.

¹⁸Mirrlees, 2006.

¹⁹Mirrlees, 2006.

²⁰Mirrlees, 1976a.

In this work as in the famous result of Atkinson and Stiglitz (1976), if incomes can be taxed optimally and with enough flexibility, then assuming individual preferences that are identical and that separate commodity demands from work decisions in the right sort of way can be enough to eliminate the case for differentiated indirect taxation. If we want to redistribute only between those with different earning ability, if we can tax earnings flexibly and if there is nothing we can learn from commodity purchases that could possibly help distinguish between the more and less skilled over and above what can be learnt from their earnings, then there is nothing to be gained by taxing different goods at different rates.

On the other hand, if these assumptions do not hold, then there are circumstances in which ‘marginal taxes should be greater on commodities the more able would tend to prefer’.²¹ It is attractive to think that radical simplification of commodity taxation might be possible without compromising redistributive objectives; this work clarifies how much and what exactly would need to be true to argue such a case convincingly.

V. Moral hazard and principal–agent models

The standard Mirrlees income tax model has a very particular form of information asymmetry. Taxpayers know their earning ability better than the government but face no uncertainty. When they decide their work hours, they know exactly what earnings that will imply. What if translation of effort into earnings is uncertain? What if it is still true that taxpayers alone know their work effort and government can base tax demands only on earnings but productivity is known, even to workers, only after work decisions are made?

This turns the optimal tax problem into one with a different sort of informational asymmetry: one where taxpayers are not characterised by hidden knowledge but by a hidden action. To use the usual term of art, it becomes a problem of moral hazard.

Mirrlees considered this problem too.²² The way in which marginal tax rates vary with earnings now needs to be designed not so as to encourage people to reveal their privately known ability but so as to discourage the temptation to low effort that comes from inability to distinguish its consequences from bad luck. The pattern of optimal rates that comes out can differ markedly from those in the model with hidden knowledge.

Both models are examples of what are known as principal–agent models. Here the government is the principal and the taxpayer the agent, the principal seeking to provide the agent with incentives to carry out actions on their behalf

²¹Mirrlees, 1976a.

²²See, for instance, Mirrlees (1974 and 1990) on taxation of uncertain incomes specifically and Mirrlees (1976b and 1999) on moral hazard more generally.

to meet some objective in the presence of information asymmetry that limits the principal's ability to monitor the agent's behaviour.

As recognised in the Nobel Prize lecture of a later laureate, 'Mirrlees was the first to study in generality the case where the agent provides a service to the principal and the issue is how to motivate the agent to work diligently'.²³ Such models have far broader applicability than to optimal tax problems, and Mirrlees's work consequently has major significance not only for questions of public policy but for the development of contract theory in general, concepts first introduced in his work proving to be fundamental to broader analysis.²⁴

Social insurance against inability to work has a moral hazard aspect. Working again with Diamond, Mirrlees looked at public policy questions related to optimal design of public retirement provision. Their work²⁵ puts the problem into a setting in which moral hazard problems related to the unobservability of true fitness for work prevent government from offering fully fair insurance. The optimal insurance scheme typically involves positive taxation of saving.

The bringing together of this sort of result on taxation of capital income with Mirrlees's analysis of optimum income tax design has provided the cornerstone for the modern analysis of dynamic public finance.²⁶

In these models, there is a combination of a static model that 'builds on the work of Mirrlees' and incorporates 'the insights of Diamond (1998) and Saez (2001) into how empirical estimates of the labor supply elasticity and the hazard rates of the income distribution can be used to obtain sharp qualitative and quantitative predictions about optimal taxes and transfers' with a dynamic analysis that sets this within a 'canonical life-cycle model with idiosyncratic shocks' so as to derive formulae that 'link the optimal labor and capital distortions with structural parameters of the model that can be estimated empirically'.²⁷

VI. The Mirrlees Review

Mirrlees was at home in the abstractions of economic theory, but he was also motivated by practical application. When the Institute for Fiscal Studies decided to convene a review of the entirety of the UK tax system, 30 years after the earlier similar review chaired by James Meade, Mirrlees was the obvious person to invite to chair it. The Mirrlees Review sought to base recommendations on 'a systematic conceptual approach that joins together our thinking across the whole range of taxes . . . rooted in economic theory

²³Holmström, 2017.

²⁴Dixit and Besley, 1997; Myles, 2008.

²⁵Diamond and Mirrlees, 1978.

²⁶Farhi and Werning, 2013; Golosov and Tsyvinski, 2015.

²⁷Golosov and Tsyvinski, 2015.

that models the constraints people face and the way they behave when taxes change'.²⁸

While optimal tax theory itself takes no position on how intrinsically desirable public spending or redistribution is, it does insist that however much revenue taxation raises and however much redistribution the system achieves, it should do it with as little cost to efficiency as possible. To achieve that, the tax system has to be seen as a whole. Nothing is gained by trying to get each element of the system to appear to promote every objective in isolation.

On direct taxation, the Mirrlees Review recommended that different components of the system should be better integrated and outlined how to achieve that objective. On indirect taxation, it pointed out that there need to be convincing reasons for departure from neutrality and that these are often lacking. As regards taxes on transactions in assets, it argued that these have no compelling economic logic and would be better replaced by a value added tax on the services yielded by the assets.

The Mirrlees Review has been influential in numerous finance ministries and treasuries. It has been translated into other languages and formed the basis for tax reform programmes around the world.

To quote Larry Summers, former Secretary of the US Treasury: 'Theory and practice rarely are brought together effectively. This volume is the best public economics has to offer. It should be read by anyone who cares about the future of taxation – that is anyone who cares about the future of government'. Mervyn King, the then Governor of the Bank of England, commented: 'Whatever view you take of tax reform, you will need to read this volume in order to participate in the debate'.

VII. Development and growth

Mirrlees's insights were important in fields beyond tax design. They were practically influential, for example, in the appraisal of public projects. His work with Ian Little aimed to bridge the gap between the abstract concepts of cost-benefit analysis and the practicalities of social investment decision-making in developing countries.²⁹

The Diamond–Mirrlees (1971a) result discussed earlier established the desirability of production efficiency in public policymaking. This implies that for small enough projects, resources used and outputs produced should be weighed against each other at 'shadow prices' reflecting trade-offs at the boundary of the economy's production possibilities.

The work of Little and Mirrlees is an extended and meticulous source of practical advice for performing project evaluations in settings of pervasive

²⁸Mirrlees et al., 2011.

²⁹Little and Mirrlees, 1969 and 1974.

market failures and weaknesses of policy. For example, where the goods in question are traded internationally, they propose that shadow prices should be the prices at which they are traded at the border, whereas for goods that are not traded, they should be appropriately constructed from those for traded goods and for labour.

As regards social costing of labour, which might often in the context of a developing country be drawn from underemployment in agriculture, they argue for a shadow wage lying between the marginal product of labour in agriculture and the market wage, so as to reflect the greater social value of public than private income. Their work justifies and elaborates at length on rules for dealing with the manifold issues and complications needing to be addressed in consistent application of these ideas.

Shadow pricing methodologies were adopted widely in donor agencies in the 1970s, particularly by the World Bank, and the Little–Mirrlees recommendations were highly influential. The steep decline in interest since the 1980s is described by them as a ‘shattering indictment’; reflecting on the contribution of poor investment choices to low growth, they regret this withdrawal from ‘an essential part of the business of avoiding these mistakes in the future’.³⁰

Mirrlees’s contributions to growth theory were also notable. His research began, as noted earlier, in work with Nicholas Kaldor that explored the role of technical change in growth, pursuing the implications of allowing technical progress to affect production only through introduction of new equipment so that increases in labour productivity become tied to gross investment.³¹

He continued to take an interest in growth questions, particularly those concerned with the optimum level of saving. Here again he was digging deeper into issues raised by Frank Ramsey.³² The question here concerns distributional ethics but to do with distribution across generations: to what extent can forgoing of consumption by earlier generations be justified by gains to later generations from greater capital accumulation?

The answer says something about both the right level of saving for society and the shadow prices to apply to goods at different times in cost–benefit appraisal. Ramsey’s initial treatment suggested a utilitarian case for very high savings rates but raised challenging technical questions about whether a well-determined optimum even existed given the indefinite duration of future human generations. Mirrlees addressed these technicalities³³ and explored

³⁰Little and Mirrlees, 1991.

³¹Kaldor and Mirrlees, 1962.

³²Ramsey, 1928.

³³Mirrlees and Hammond, 1973.

extensions of the model to incorporate, for example, technological progress³⁴ and economies of scale.³⁵

VIII. Concluding comments

The contributions of Jim Mirrlees have enriched and informed multiple fields of economics. His specific investigations into tax and public policy have changed the way that questions in those fields are discussed. His ability to simplify complex problems in ways that reveal their tractable essence means that his work has yielded insights that have reverberated throughout the discipline.

In practical terms, his insights have left us wiser and more able to see how everything fits together. As evidenced by the Mirrlees Review, implications can be radical and of policy relevance.

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³⁴Mirrlees, 1967.

³⁵Dixit, Mirrlees and Stern, 1975.

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