

Book reviews

The Use of Drugs in Food Animals: Benefits and Risks, by the Committee on Drug Use in Food Animals, Panel on Animal Health, Food Safety and Public Health, National Research Council and the Institute of Medicine. International edition published by CABI Publishing in association with National Academy Press, Wallingford, UK, 1999, pp. xxi + 253, ISBN 0-85199-371-0, \$US45.

The increasing use of drugs in food animal production has resulted in benefits throughout the food industry. However, there are escalating concerns by the medical and veterinary professions, animal industries and consumers regarding perceived threats to both human and animal health from this usage. The United States Committee on Drug Use in Food Animals has reviewed past research on the major classes of drugs used in food animals, and on the potential effects on human health. The Committee identified antibiotic resistance as the major and most urgent issue. It is therefore the principal focus of this commissioned book. The audience for the book is said to be people working in animal and veterinary sciences, public health and microbiology, but given the increased role for economists in food safety issues, they too may find the material of potential interest.

The book contains eight major chapters, a detailed executive summary and an extensive list of references (some 24 pages). Recommendations are made at the end of each chapter. Chapter 1 provides an overview of the use of drugs in food-producing animals and some of the controversy that has existed concerning this practice for the past 30 years or so. Some statistics highlight the magnitude of the problem: about 25 per cent of all uses of antibiotics are for food animal production; about 80 per cent of that is used in sub-therapeutic doses; and some 60 to 80 per cent of all livestock and poultry will receive antibiotics in feed or water or by systemic injection at some time during their production lifespan (p. 25).

In Chapter 2, 'Food Animal Production Practices and Drug Use', information is provided for each animal industry (poultry, pig, dairy, beef, veal, sheep, minor species and aquaculture) in the United States on the intensification of production systems and the growing reliance on drug use. There is, however, great variation in the level of detail provided for each industry and drug group included.

Chapter 3 contains a discussion of the benefits and risks to human health

from the use of drugs in food-producing animals. The use of antibiotics in animals to therapeutically treat existing disease and the sub-therapeutic use to prevent disease, stimulate growth and increase productivity is discussed, presenting the arguments for and against. It is the sub-therapeutic use of antibiotics and its possible role in the development of antibiotic resistance that have been more recently in question. Resistance will eventually develop to antibiotics in any animal (including humans) in which antibiotics are administered, and the concern is that overuse and misuse will accelerate the development of resistance. However, there is a great deal of disagreement over who or what is responsible for the spread of antibiotic resistance. Occurrences of the transfer of resistant organisms from animals to humans are rare, but the available data are inadequate. The importance of more information is highlighted in the Report. Another point well made is that 'Antibiotic resistance is a global problem found in human and animal environments . . . [and] . . . only a multilateral effort can contain resistance' (p. 86).

Chapter 4 is devoted to discussion of the drug development, government approval and regulatory process in the United States, but the same principles would apply in most countries. The difficulties in getting new drugs registered for animal use are highlighted, especially the cost and time dimensions. The need for a more coordinated and efficient system is emphasised. Chapter 5 then deals with the issues of drug residues and microbial contamination of food. It provides an overview of how the FDA and USDA monitor drug residues in foods of animal origin and the quality assurance programs that have been developed for different animal industries.

In Chapter 6, there is comprehensive information on the development of antibiotics, their modes of action, their use at therapeutic levels to treat disease and their use at sub-therapeutic levels to prevent and control disease and promote efficient growth. There is discussion on the evolution of antibiotic resistance in animals and humans as a consequence of antibiotic usage and the transfer of resistance in animal microbes to human pathogens and the resultant risk of human disease. The arguments for and against antibiotics at sub-therapeutic levels are presented and the Committee point out that banning all sub-therapeutic use may not necessarily be beneficial when it could in fact lead to greater shedding of dangerous organisms such as leptospire and salmonella. Veterinarians and animal producers are concerned that the recent increase in the emergence of antibiotic-resistant strains of pathogens jeopardises the future use of the already sparse number of available antibiotics.

In the short Chapter 7, some of the economic costs of eliminating sub-therapeutic uses of antibiotics are examined. The various factors relevant to determining the effect of such a ban are considered first. These include the

choice of cost measure (lost antibiotic sales, higher farm costs, higher prices to consumers); whether there are viable and effective substitutes; whether the ban would be partial or total; and how consumers would respond to higher prices. In the end, a very simple approach was adopted in which it was assumed that all costs would be passed onto consumers, and that the measure of cost would be how much consumers would need to spend to maintain consumption of each meat type, i.e. a simple percentage increase in per capita meat expenditure. Using this method, the Committee concluded that the average annual per capita cost to consumers would be between \$US4.80 and \$US9.70 (1997 values), depending on whether substitutes are allowed or not. These are very small values for individual consumers, but in aggregate sum to \$US1.2 billion and \$US2.5 billion respectively. It is these latter values which need to be compared to the potential savings in private and public health costs. One pleasing aspect of this chapter is the full disclosure of all the data and assumptions underlying the calculations.

Finally, Chapter 8 deals with the approaches that can be made to minimise antibiotic use in food animal production, including traditional management strategies and recent scientific approaches such as probiotics, immune stimulation, and genetic strategies.

This book is a valuable text addressing an urgent contemporary issue. It highlights the concern about impending shortages of effective alternatives for use at sub-therapeutic and therapeutic concentrations, the importance of limiting pathogen spread from animals and the possibility that these organisms could be antibiotic-resistant. The Committee suggests research areas that may be able to deliver alternatives to the use of antibiotics at sub-therapeutic levels in the intensive animal industries.

A balanced view of the issues is presented, highlighting the deficiencies in our knowledge including what is known and not known about the transfer of antibiotic resistance from animals to humans. This book will be a valuable resource for the medical and veterinary professions, animal industries and drug manufacturers. It will be of less interest to economists, except in those situations where they are part of multi-disciplinary teams looking at specific aspects of food animal production and marketing systems.

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Trade, Growth and Technical Change, edited by Daniele Archibugi and Jonathan Michie. Published by Cambridge University Press, Cambridge, New York and Melbourne, 1998, pp. xvi + 276, ISBN 0 521 55641 4, \$43.90.

This book has a strong applied focus on the impacts of technical change on growth and trade patterns. A range of empirical studies is presented in separately authored chapters. Basic statistical and regression techniques are the widely used tools of analysis. Background to each chapter includes both empirical and theoretical research perspectives. Some prior knowledge of the new growth and trade theories is assumed and strong emphasis is placed on Schumpeterian theories of technical innovation and diffusion. Nevertheless, commentary on the underlying economic theories remains intuitive.

There are ten chapters in the book. In Chapter 1, editors Archibugi and Michie provide an overview of the key issues linking the chapters. They suggest that mainstream economics overly emphasises the public good properties of some forms of technical knowledge. Some knowledge, while costly to discover, has public good characteristics because it is easy to imitate. By contrast, some knowledge has private good attributes only when it is learned by doing.

Archibugi and Michie also note that developments in technical knowledge tend to be highly path-dependent. Initial income gaps between rich and poor may widen over time as returns from investments in technical knowledge tend to increase with the scale of investment. The emphasis in half of the book on examining the sources of and evidence for technical convergence and per capita income convergence is therefore well placed.

In Chapter 2, Christopher Freeman summarises the quantitative evidence supporting Schumpeterian theories of innovation and diffusion at firm and industry levels and notes critical areas for further research. In the following chapter, Parimal Patel and Keith Pavitt present some statistical evidence of technical divergence and specialisation in OECD countries. Aggregate trends in private R&D expenditure as a share of GDP (an input measure of investment in technical knowledge) and per capita number of patent successes registered in the United States (an output measure of technical knowledge) are examined, and an index of revealed technical advantage (based on patent shares) is calculated by industry for various OECD countries. Patel and Pavitt find that countries differ markedly in their areas of technical expertise, while technical strengths and weaknesses tend to be stable over time.

In Chapter 4, Mario Pianti calculates cross-country correlations of technical innovation and economic growth indicators from 1970 to 1990. In Chapter 5, Maury Gittleman and Edward Wolff use linear regression analysis to assess per capita income convergence. The 1960–88 dataset covers

a wide range of developing and industrialised countries from the Penn World Table (mark 5) with supplementary data from *UNESCO Statistical Yearbooks* and World Bank sources. Notably, Gittleman and Wolff find no evidence of a significant relationship between R&D intensity and real per capita incomes outside the industrial group of countries. Moreover, for industrial countries, rates of return to R&D efforts appear to have declined since 1970. They note that increased computerisation of technologies may have altered rates of return on the range of knowledge investments and made the measurement of technical advance more difficult.

In Chapter 6, Archibugi and Pianti, using country specialisation indexes on new patents, find marked differences between industrial countries in the industries where knowledge investments are realised. For similar proportional investments in R&D relative to GDP, the G5 countries are becoming more technically specialised in areas where trade tends to be specialised. Giovanni Amendola, Paulo Guerrieri and Pier Carlo Pado calculate, in Chapter 7, several measures of revealed comparative advantage for various industrial countries and adapt the Balassa index to measure revealed technical advantage using US-registered patent data. They find relatively stable patterns in specialisation, although these patterns tend to weaken over longer time periods.

Hariolf Grupp and Gunnar Munt in Chapter 8 consider the role of regional technological specialisation in generating areas of absolute advantage. In Chapter 9, the role of high-tech industries in international competition is further analysed by Paulo Guerrieri and Carlo Milana. They find evidence of significant structural change in the export competitiveness of high-tech products from the United States, Japan, EU and Asian NICs. In the concluding chapter, Jan Fagerberg investigates the Linder-Porter hypothesis that international competitive advantage is positively related to the presence of strong user-producer linkages on the domestic market. For a range of OECD countries, revealed comparative advantage export and home market indexes are calculated for mainly intermediate goods. Using regression analysis, Fagerberg finds support for the hypothesis both over time and across countries.

Many chapters in the book are extended versions of articles published in the 1995 special issue on 'Technology and Innovation' of the *Cambridge Journal of Economics*. As such, the book comprises an interesting set of applied articles on technology, growth and trade and is worth a read.

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The Rural Entrepreneurs: A History of the Stock and Station Agent Industry in Australia and New Zealand by Simon Ville. Published by Cambridge University Press, Cambridge, UK, 2000, pp. xiii + 259, ISBN 0-521-64265-5, \$49.95.

The publication of this book will leave many people wondering why it has taken so long for anyone to write the history of such an important element in rural life on both sides of the Tasman. Simon Ville, Reader in Economic History at the ANU, has presented a very detailed examination of a unique Australasian institution, why and when it developed, its important role in marketing the produce of isolated farmers, lending them carry on and development funds and providing practical advice on markets and finance.

No one can deny the laborious research of Ville and his two assistants. The evidence is there — in the text, the footnotes and the bibliography — of long hours poring over company records and histories. But unfortunately this does not guarantee a good read. The book is dull; there are no outstanding characters, no charlatans or shenanigans. It could have been commissioned by the stock and station companies. They are perennial good guys doing the right thing by the farmers and graziers since day one. The primary producers, loosely termed ‘farmers’, were generally hostile to the middlemen and wanted to replace them with statutory marketing boards under the control of farmers. They were very successful in the twentieth century with the establishment of the Wheat Marketing Board, the Barley Board, the Dried Vine Fruits Board, the Sugar Board and, among others, a Wool Board that operated a disastrous fixed floor price late in the century.

Very recently, a large majority of wheat growers demanded the retention of a single desk for export wheat rather than let the trade fall into the hands of private grain merchants. The pastoral houses, the more common name for the large stock and station companies, opposed rural socialism and sided with the big graziers to fight against the regulation of the wool market and the floor price scheme. There were graziers on the boards of pastoral houses that, at times, held membership of grazier organisations. This close relationship was resented by farmers and was a factor delaying the establishment of the National Farmers’ Federation until 1979.

However much harmony was found by Ville between primary producers and their local stock and station agent, the antagonism of many farmers to the pastoral houses as middlemen and in league with the larger graziers was very real. Many graziers were supporters of the Liberal Party while the farmers tended to vote for the National Party. Where did the pastoral houses stand politically? I suspect their managers were generally Liberal. Ville

should have dug deeper into the politics of the stock and station industry and the way they tried to influence governments. Large organisations do not exist in isolation from the political issues of the day and it would be amazing if they did not contribute to the coffers of conservative political parties.

Ville and his two researchers could have enlivened this book by leaving the archives and getting out in the bush among the agents. They could have spent a day or two with selected agents and given the reader an insight into their daily work routine. Ville does acknowledge the agent as a central figure 'embedded in rural settler communities and about whom everyone has a view'. The stock and station agent is as well known as the shire mayor and the local publican. Many are a vital segment of the bush telegraph, passing on the gossip and the jokes that can brighten up a day at the saleyards. Auction day humour is a well-known ploy to stir up the bidders. At sheep sales auctioneers may warn bidders how disappointed the ewes will be if they go home without a new ram. The book cries out for a human touch.

Having outlined my criticisms, there are positive things to say about this book. It acknowledges the vital role of the stock and station agency as the first link between the farmer and the market, and stresses the uniqueness of the industry to Australasia. Ville explains that in Britain, for example, small-scale agriculture was often in the hands of tenant farmers who had recourse to the landlord. In other words, the landlord was the *de facto* agent, marketing the produce, sharing the proceeds with the farmer and giving ready advice. The landlord was looked up to because of his social status and higher education.

The British market was more localised and there was no large-scale land settlement as occurred in Australia with new settlers taking up blocks, many without previous agricultural experience. In such a situation, the role of the local stock and station agency was a welcome resource, especially if they advanced money to plant the next harvest or to carry on until the wool cheque arrived. Ville says the agencies were clearly an adaptation to local conditions which included international, and to some extent national, isolation that made the acquisition of marketing and husbandry information difficult in the days of poor communications. It was important that trust developed between the farmer and the agent and, in general, it did, despite what Ville calls farmer concern about being 'enslaved' to the same agent (presumably through borrowings) and the fear of collusive price fixing between pastoral houses.

The author explains that agency services were being provided by the time of the early growth of pastoralism in the 1830s and 1840s and they included wool consignment, livestock sales and farm finance. The stock and station industry grew apace with the industry it serviced and made a living from. Ville plots the changes in the industry, some of the results of the development

of government extension services and the more recent move into large-scale agriculture with the farm companies doing their own marketing.

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Environmental Economics and Policy, second edition, by Tom Tietenberg. Published by Addison-Wesley, Reading, MA, 1998, pp. xx + 460, ISBN 0 321 01142 2, US\$75.

It should be stated at the outset that *Environmental Economics and Policy* was not written to be a textbook for economics majors. Rather, it was intended to introduce students, with little or no economics background, to the economic principles and tools required to manage environmental resources. Thus, it is probably best suited as a text either for an environmental and resource economics course for students from a discipline other than economics, or as a reader to complement a standard course and text.

The overall structure of the book is somewhat standard. It can be divided up into three main sections: basic economic concepts; resource economics (an analysis of both non-renewable and renewable resources); and environmental economics (pollution). Following an introductory chapter, the book sets about developing the basic tools of welfare economics. These first four chapters lay the foundation for much of the economics that follows later in the book. In some respects it is in these chapters that Tietenberg faces the biggest challenge. To introduce the economic tools and concepts in an accessible manner, with relatively little depth, is a difficult task. At times Tietenberg even asks the reader (with no assumed economics background) to draw on their introductory economics course. However, the concepts of static and dynamic efficiency are introduced in Chapter 2 in a well-presented way that is easy to read and understand. In Chapter 3, the reader is introduced to the concepts of the property rights, economic rent, market failure, government intervention and government failure. Unfortunately, the exposition in this chapter is disappointing at times. For example, in the section on public goods, poor editing, which resulted in a paragraph being repeated at different points in this section, along with terse explanations (especially regarding points such as private provision and 'charging' for public goods), made this section confusing. Furthermore, although Tietenberg states that markets are not likely to produce efficient levels of public goods, he fails to remind the student of the obvious — the need for public provision. Given the importance of this topic, especially in a book focusing on policy

issues, this section could have been developed much more carefully and in more detail.

Having developed the economic tools, the rest of the book relies very little on formal analysis. Instead, Tietenberg relies on examples and case studies to expose the reader to a variety of environmental issues and the different types of policies relating to those issues. In so doing, the student learns to examine the incentive structures that are in place and to evaluate the consequences of those structures. For example, in its discussion of energy and the optimal allocation of non-renewable resources through time, the book relies on the example of price controls in the market for natural gas to explain the inefficiencies caused by government intervention. Those expecting a treatment of Hotelling's rule will be somewhat disappointed, Hotelling's name is not mentioned in the entire book. In discussing OPEC, Tietenberg focuses on the inefficiency of monopoly power — the possibility that the monopolist might be the 'conservationist's friend' is all but completely ignored. As an alternative to fossil fuels, Tietenberg discusses the use of nuclear power, in this case focusing on the potential externalities associated with its use. Again, relying on the example of the US nuclear power industry, Tietenberg illustrates how government policies have failed to create incentives for firms to adequately internalise the externality. Although the examples are from the United States, and hence may not be entirely relevant for readers in Australia, the moral of the story is fairly obvious and, as such, can be generally be applied to other industries and countries. For students wishing to explore the topics in more detail, a number of references are supplied at the end of each chapter.

The chapter that is most conventional, and makes the best use of an economic model, is the chapter on wildlife (fisheries). The chapter develops the traditional static model of the fishery and goes on to explain clearly the different approaches to regulation. The discussion on individual transferable quotas is clear and well presented.

In addition to pure environmental economics and policy, the book also devotes considerable space to a variety of related economic development issues. To this end, apart from a sustainable development chapter, there is a chapter on development, poverty and the environment, another on agriculture, and yet another dealing with population issues. Tietenberg manages to integrate the development issues into the book in a relatively seamless manner, and students will probably find these chapters appealing. One topic that is surprisingly under-explored, in this otherwise fairly comprehensive text, is the relationship between globalisation and the environment. Less than two pages are devoted to the issue. Nevertheless, the main points of the debate are touched on and references are provided for the interested reader to go further.

Overall, *Environmental Economics and Policy* is a good text that will complement, but not substitute for, good lectures. The economic analysis is relatively superficial and lacking the rigour that is required of a standard text for the typical environmental and resource economics course. However, it is not written for that audience, and despite its lack of formal economic analysis, it is a text that is filled with the economic way of thinking (and references for further reading). Through the wide use of examples and case studies, Tietenberg exposes the reader to a variety of environmental issues and the economic policies in place relating to those issues.

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The Common Agricultural Policy by Robert Ackrill. Published by Sheffield Academic Press, Sheffield, UK, 2000, pp. 244, ISBN 1 84127 126 8, £10.95.

The amount of material written on the Common Agricultural Policy (CAP) would appear to be matched only by the commodity surpluses it built up during the mid-1980s. Although Ackrill's bibliography is far from comprehensive, it does suggest the sheer volume of material written and the many different angles that have been explored. What, then, can a book simply entitled 'The Common Agricultural Policy' and of less than 250 pages add to this literature? Readers ideally will be expecting a systematic and easy-to-read synthesis of the key insights coming out of this diverse literature that together tell the story of the CAP.

Readers seeking such a story, however, will be disappointed. As Ackrill acknowledges in his Preface, it would be a very long book indeed that addressed all elements of the CAP. Instead, his focus turns to the usual suspects of the costs of the CAP and international pressures. The treatment of both these areas is selective. Nonetheless, Ackrill clearly demonstrates his ability to trawl through Agra Europe reports, Commission reports and numerous other publications to distil the necessary detail.

Following an introduction to agricultural support policies in Europe, material in the book is loosely organised into five chapters. Chapter 2 expands on the Introduction to provide an historical overview of CAP decision-making and especially decisions on administrative prices. Ackrill teases out some interesting detail such as the impact of the various Agricultural Commissioners. As explanations for the decisions are also advanced in Chapters 3 and 5, discussion in this chapter is truncated. The overlap between chapters creates various problems for Ackrill, including arriving at a consistent set of findings throughout the book.

Chapter 3 revisits the decisions up to the mid-1990s to examine the link between budgetary and international pressures and CAP reform. A key finding repeated throughout the chapter is that international pressure rather than budgetary pressure determined the 1992 reforms, based on reasoning that the reforms increased expenditure. Yet European Union (EU) decision-makers repeatedly have revealed their willingness and ability to find extra funds if the policies are effective in meeting their objectives. The perception by EU decision-makers that they were not obtaining good value for their CAP expenditures, rather than the magnitude of the expenditures *per se*, means that Ackrill's failure to report on the distribution of CAP benefits leaves a large gap in his explanation of the 1992 reforms. Another yawning gap is his silence over the pivotal role of cereal price support in many of the crop and livestock support regimes, and the difficulties in controlling supply and price support expenditures for cereals. Thus Ackrill's selective focus rather than a comprehensive examination of all the pressures does lead to some odd conclusions.

One of the strongest sections of the book occurs in Chapter 4 when attention is turned to the Agenda 2000 reforms and the issue of EU enlargement. Readers unfamiliar with developments in this area will find much of interest in how aspiring member countries have had to transform their agricultural policies to align with the CAP. Ackrill offers an informative account of the debate within the EU about the extent to which CAP measures should be extended to new members and the need for further reform of the CAP in response to EU enlargement. A theme reiterated throughout the chapter and the remainder of the book is that the 1999 reforms are the most radical ever, that the CAP faces its greatest challenge, and that the status quo is not an option if the Berlin Agreement of 1999 is not to be renegotiated. Yet the history of the CAP and EU decision-making is one of constant change and of not being constrained by specific agreements. An understanding of the systematic factors that led to the 1999 reforms, and that will more than likely lead to their modification in the near future, is more important than reporting of the panacea-type rhetoric that accompanies the euphoria of virtually every major policy reform or trade agreement.

A theoretical framework for explaining policy reform and an attempt to apply it to the CAP appears in Chapter 5. Why this theoretical framework appears at the end of the book rather than at the start is a mystery of CAP-like proportions. One startling conclusion to emerge, at least for some readers, is that the farm lobby has exerted minimal influence on CAP reforms. While the importance of the Commission, the Council and their interrelationships is undeniable, there is little in the chapter to explain why these EU institutions act in the way they do and the extent to which farm groups influence their actions.

An 'assessment' of the CAP against stated objectives such as Article 39 of the Treaty of Rome appears in the final chapter. For the most part, however, the chapter is more about how these stated objectives have changed through time. Ackrill concludes that CAP reforms are incremental and reactive.

Despite the voluminous literature on the CAP, many misunderstandings remain. On the eve of new multilateral trade negotiations, a clear and insightful outline of the where, what and why of the CAP is sorely missing. Ackrill's knowledge of the CAP emerges clearly in the book, but the lack of organisation and the selective content lead to an outline of limited value to students, decision-makers and other readers. Nonetheless, the CAP is a fertile field for anecdotes and stories, and Ackrill's book is no exception. Thus readers will no doubt find something of interest in the book.

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Public-Private Collaboration in Agricultural Research: New Institutional Arrangements and Economic Applications, edited by Keith O. Fuglie and David E. Schimmelpfennig. Published by Iowa State University Press, Ames, Iowa, 2000, pp. xv + 354, ISBN 0 8138 2789 2, US\$84.95.

This volume grapples with the important issues involved in the changing structure of agricultural research systems. As the title suggests, the main thrust of the book is to look at the collaboration between public and private institutions in the light of the growing capacity of the private sector in agricultural research. The contributions in the book are drawn mostly from a workshop held in Rosslyn, Virginia, in August 1997, jointly convened by the Economic Research Service of USDA and the US Farm Foundation.

The book has four main sections. Part I deals with innovations in funding agricultural research. Fuglie outlines the evolution of the US public and private funding over the past three decades in Chapter 2. Alston, Pardey and Smith follow with a chapter on the experience of four relatively wealthy nations, Australia, Netherlands, the United Kingdom and the United States, in which there has been growth of the private sector in agricultural research. This is a reprint of their paper in the March 1998 issue of this journal. In Chapter 4, Frisvold and Vogel use a CGE model to consider whether specific commodity taxes or general government revenues are the most welfare-enhancing means of financing research.

Part II presents the findings of surveys of public and private research and their policy implications. Frey discusses a survey of public and private plant breeding. The private sector, which accounted for more than 60 per cent of the national investment in plant breeding in 1994, tended to concentrate on hybrid crops and 'new market' cultivar development. This leads to questions about whether resources devoted to basic breeding research and germplasm enhancement are adequate, given the importance of both for sustained productivity growth and quality improvements. Falck-Zepeda and Traxler examine Frey's data further, outlining a conceptual framework for the roles of the public and private sectors in developing crop varieties. Next, Fuglie, Narrod and Neumeyer examine the roles of the two sectors in animal research. The private sector is concerned mostly with animal breeding, product development for animal health and nutrition and new machinery for animal production. The public sector has shifted resources into basic animal sciences and areas that tend to be neglected by the private sector, including food safety.

Part III is concerned with institutions for public-private research collaboration, as such opportunities grow with the trend of increasing private sector research and the federal legislation in the 1980s that changed patent policies and promoted technology transfer. In Chapter 8, Day-Rubenstein and Fuglie provide an overview of various models of collaboration. Knudsen investigates the role of research consortiums in strengthening such collaboration, in Chapter 9, and how consortiums increase the contribution of the private sector to basic research. In Chapter 10, Knudsen, Lower and Jones report the results of their survey of state agricultural experiment stations on their use of plant breeders' rights and patents for crop varieties and germplasm.

Part IV discusses the significance of international spillovers for the United States and sources of such international transfer. Evenson in Chapter 11 and Schimmelpfennig and Thirtle in Chapter 12 consider the evidence on the size and significance of international agricultural knowledge flows in and out of the nation, finding evidence of considerable spillovers. Pray and Fuglie discuss the role of multinational firms in transferring and adapting agricultural technology for developing countries in Chapter 13, and in Chapter 14 Ballenger and Klotz-Ingram examine the contribution of graduate training at US agricultural universities to the expansion of global capacity for agricultural research.

The volume contains various discussions of the appropriation of returns to the research investment dollar between different agents. There is some discussion of the role of intellectual property rights in increasing the private sector contribution to research, yet at the same time reducing spillovers. This potentially may lead to under-investment in basic research that provides

public goods, as the social rates of return on such research are extremely high. With globalisation, foreign public and private R&D potentially could contribute to domestic productivity.

The concluding chapter of the volume brings together the issues of public-private collaboration, the changing structure of US agriculture and its impact on rural communities, policy changes under the Farm Bill, internalisation of environmental costs and food safety requirements. The reader is left to ponder the effects of research on the gap between agriculture and food processing technologies in the developed and developing worlds. Do weaker IPRs and less stringent environmental and food safety regulations in developing nations enable productivity growth in these nations to accelerate? Or does underdeveloped physical and knowledge infrastructure remain as a barrier to such growth? In response to the exploration by Ballenger and Klotz-Ingram of US gains from training foreigners, we could ponder whether it is inevitable that such training would have some global benefits the United States does not appropriate. Or is it that the Farm Bill erodes many of these gains through protectionism?

One of the strengths of this volume is the breadth covered by the researchers. In part, the volume reveals good editorship, with enough overlap between points made and issues raised in each article to provide coherence and complementarity between articles rather than a sense of repetition.

The general equilibrium analysis of Frisvold and Vogel provides an interesting perspective on the role of intersectoral labour supply in welfare outcomes. Perhaps the modelling could have considered the degree of a commodity's export-orientation in determining welfare outcomes, in the light of discussion elsewhere of the impact of globalisation on the returns to research.

It is interesting to look at the affiliations and brief biographies of the twenty or so contributors to the book and realise that all are either university academics or agricultural economists working in public organisations. Insights from private sectors certainly would add important perspective to the discussion of the topic.

As pointed out in the Alston, Pardey and Vincent article, a crucial task for economists concerns the empirical evaluation of net social benefits of the contemporary changes in agricultural R&D funding and the institutional experiments. Investigation of these issues represents great opportunities for agricultural economists to make contributions to the agricultural research policy debate. For those interested in the issues involved this debate, this book is essential reading.

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