

Economics of Pesticide Policy Reform in Developing Countries – selected results of a multi-country project

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Abstract

Patterns of increasing pesticide use are endangering the sustainability of agricultural production. This leads to pressure for pesticide policy reform. Research results from a multi-country study project show that economic instruments in pesticide policy are undervalued regarding their potential for decreasing the wedge between private and social costs. Results from a case study in Costa Rica demonstrate that the impact of pesticide taxation on income of coffee growers is likely to be small while significant reduction of pesticide use could be achieved.

Keywords: Pesticides, externalities, policy reform, economic instruments, coffee

1. Introduction

Policy makers trying to design efficient policies for the use of pesticides in agriculture in developing countries are often confronted with a dilemma. On the one hand, food security and competitiveness on international agricultural output markets are on top of the policy agenda, and are difficult to achieve without intensification of agriculture. On the other hand, negative externalities of pesticides can damage the sustainability of agriculture. Developed countries have largely relied on command-and-control approaches in pesticide regulation (Reus et al., 1994, OECD 1996), even though this may not always be an efficient environmental policy instrument because of high enforcement costs. Strengthening the role of economic instruments in the environmental policy framework has been in the centre of the debate of environmental economic theory and policymaking. However, crop protection

administrations have not yet taken into account the potential contribution of economic concepts in pesticide policy reform design.

This paper looks at the role that economics can play in pesticide policy reform in developing countries. In an applied research project of the University of Hannover and GTZ on pesticide policy a conceptual framework on pesticide policy reform has been applied in several developing countries, e.g. Thailand (Jungbluth 1996) and Cote d'Ivoire (Fleischer et al. 1998). Taking the case of Costa Rica as an example a socio-economic assessment of the status of crop protection in the country was performed as a first step (Agne 1996). Thereafter, an in-depth case study of the coffee sector investigated the economic implications of a considered policy change (Agne 2000).

2. The role of economics in pesticide policy reform

In the context of input policies, pesticides require special treatment because of their specific characteristics as potentially harmful toxic agents. In particular, pesticide policy has to account for the external costs of pesticide use. According to basic economic theory, signalling information about the true costs of pesticides to users leads to decisions which are optimal from the society's point of view (Pearce and Tinch, 1998).

The available policy remedies include direct regulation, moral suasion and economic instruments. They differ in the way they influence the behaviour of the economic agents. Direct regulation, including bans on individual chemicals or classes of chemicals, is an effective means of barring the introduction of hazardous compounds into the environment. Instruments of moral suasion rely on increased knowledge and awareness of pesticide users for voluntary adoption of improved technologies and practices. They include public awareness campaigns and farmer training. Economic instruments, for example taxes, registration fees and import duties, redistribute the costs of pesticide use from the public to pesticide producers and users and move the private costs towards the social costs of pesticide use.

The starting point of pesticide policy analysis and reform should be a thorough economic analysis of the baseline situation (Agne et al. 1995). Here, the factors which distort the use of pesticides from its socially optimal level taking into account potential externalities are identified. While the implicit value of direct and indirect subsidies of the pesticide price can be assessed in monetary terms, this is more difficult for non-price factors of government-induced distortions (Waibel 1994). Especially investment programs in government's research and extension institutions and the intensity of regulatory intervention shape the availability and the likelihood of adoption of technological choices among farmers. The extent to which those factors contribute to distorted pesticide and other input use is best assessed by expert opinion.

The next step includes raising awareness about the status of the crop protection sub-sector and the basic principles of policy reform among stakeholders and key decision-makers at national level. In many countries, rational pesticide policy formulation suffers from institutional fragmentation and lack of effective co-ordination among agencies. Policy workshops and other broad consultation processes provide a forum for defining targets and priorities, and appropriate institutional roles and responsibilities for different elements of policy reform (Schillhorn van Veen et al., 1997). The availability of information on the external costs of pesticide use is one of the main elements of the awareness raising process. These costs need then to be incorporated into a comprehensive policy framework. based on the basic principles of welfare economics.

Entering the actual design of pesticide policy reform is part of the third step. On the basis of the results of policy workshops, crop protection policy reform plans are elaborated. Economics plays a central role in this phase as the impacts of different policy instruments on pesticide use, income of affected agricultural producers, and the level of external costs help to inform decision-makers about the consequences of policy reform.

Since the actual implementation of an optimal policy mix of regulatory and economic instruments depends on the relative strength of interest

groups and executing government agencies in the policy process, sound economic analysis of options and scenarios plays a crucial role.

Providing access to information for structurally disfavoured groups (e. g. consumers, agricultural producers) about reform impacts increases and the likelihood of achieving welfare gains.

3. Results from a case study – Costa Rica

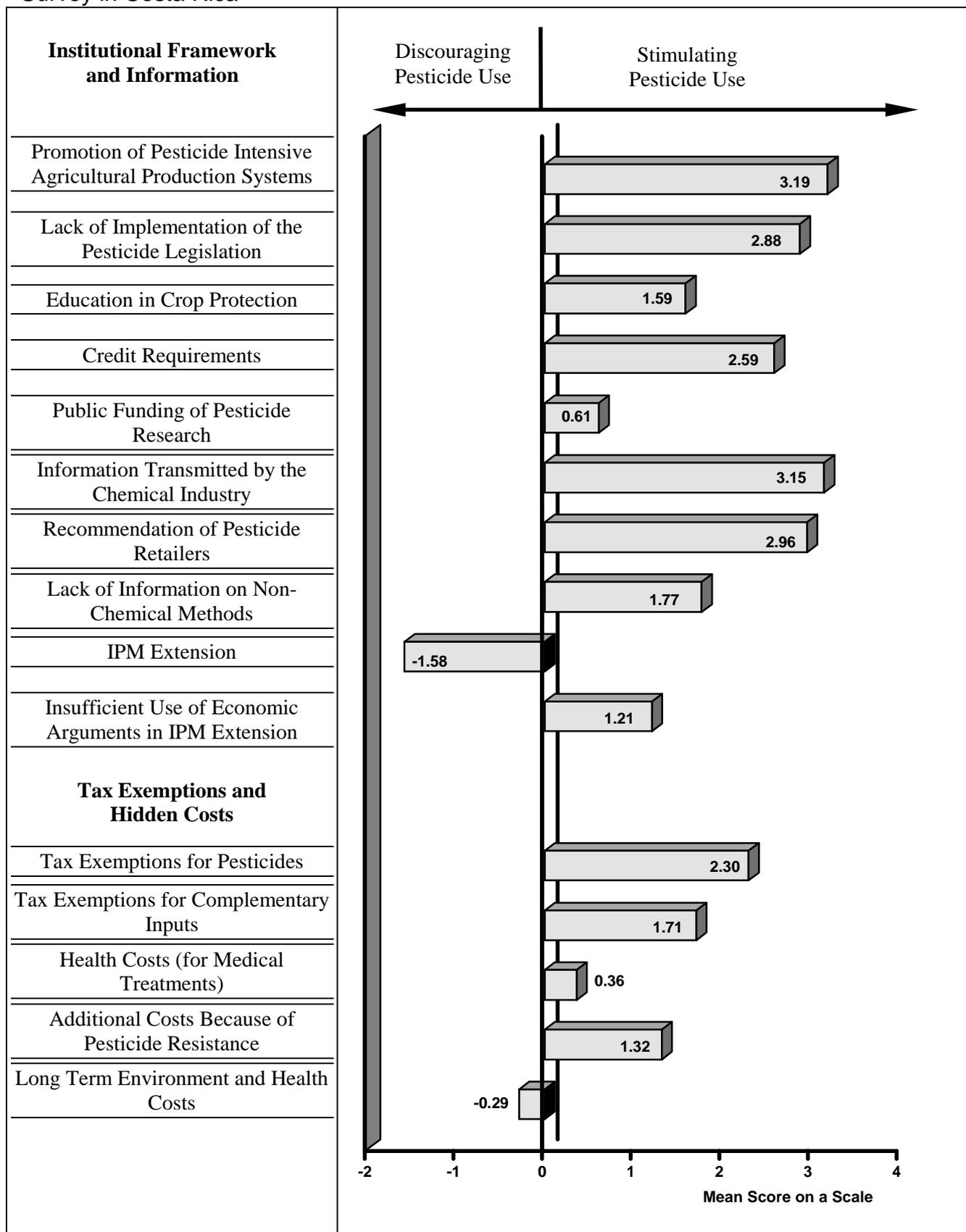
Costa Rica provides a good case for the application of economics in pesticide policy formulation. Pesticide use per agricultural worker is among the highest in the world due to pesticide intensive crops such as banana and many non-traditional export crops. Previous studies indicated that the country has continuously been confronted with undesired effects of pesticide use which represent long-term costs for the producers and the society at large. Costa Rica adopted sustainable agricultural production as the overall agricultural policy goal in 1995 which has major implications for highly intensified production systems.

3.1 Situation analysis – policies distorting pesticide use levels

Costa Rica's pesticide imports rose from about USD 56 million in 1990 to USD 102 million in 1996. For the latter year, it is estimated that more than USD 215 per hectare agricultural land was spent on pesticides. The government encouraged the area expansion for pesticide-intensive crops through trade liberalisation and promotion of growing non-traditional horticultural crops.

Pesticides, like other agricultural inputs, are regarded as indispensable for agriculture and are therefore exempted from all taxes and duties. Assuming a low demand elasticity for pesticides and based on 1996 import figures and import duties, government revenues would have increased by approximately USD 6 million, if the originally decreed import duty had been imposed. Those funds are actually a subsidy for chemical pesticide use.

Figure 1: Determinants of Pesticide Use and their Impact According to an Expert Survey in Costa Rica



(Source: Agne 1996)

The study included a stakeholder analysis aiming at revealing the perception of experts concerning the determinants of the current level of pesticide use. Some twenty experts from national ministries, research institutes, the private sector and international organisations participated in a specially designed seminar-workshop in Costa Rica (Agne 1996). To facilitate the discussion, experts were asked to identify the factors determining levels of pesticide use and rate these factors on a scale of -5 to +5, indicating discouraging and encouraging pesticide use respectively.

Results showed that the majority of factors encourage pesticide use (Figure 1). Among these, institutional arrangements and information constraints were the most important. Tax exemptions for pesticides were also considered key by the experts attending the meeting.

Implementation of some of the laws which have been put in place for limiting the negative impacts were found to be a major problem in Costa Rica because of prohibitively high enforcement costs. On the other hand, representatives from governments and other stakeholder organisations were reluctant to consider specially designed taxes and other market-based solutions which would help to internalise the externalities into the market system. This probably reflects the lack of accurate information about the level of external costs and about the outcome of proposed policy instruments.

3.2 Impacts of introducing a pesticide tax

In order to allow a better-informed policy discussion and to improve the access to detailed farm level information, an econometric analysis of pesticide demand in the coffee sector of Costa Rica was carried out. The objective was to assess the impact of a pesticide tax on pesticide use and the income of coffee producers. The analysis of pesticide demand is a precondition for the appropriate design of policies that affect pesticide prices. Some authors suggest that pesticide demand is inelastic (e.g. Oskam et al. 1992), implying that taxes on pesticides would have little

impact on use levels unless they were set extraordinarily high. And extremely high taxes may have a significant impact on farm income.

An extensive survey in two major coffee growing areas was used as the empirical base for the analysis. Results show that the use of agrochemical and of labour in coffee production have increased significantly from 1993 to 1995, largely as a result of the increase in world market coffee prices during this period. Yields and the use of external inputs and manual labour differ significantly between the two regions, and between the different farm sizes.

Pesticide demand was estimated using a profit function approach. Three flexible functional forms were used to estimate the aggregated pesticide demand in a fixed-effects panel model (Table 1)

Table 1 : Price elasticities for aggregated pesticide demand (mean based)*

	Pesticide Price	Fertilizer Price	Wage	Coffee Price
Quadratic	-0.99 (0.34)	-0.02 (0.12)	0.71 (0.41)	0.12 (0.09)
Normalized Quadratic	-0.11 (0.13)	0.30 (0.07)	-0.23 (0.15)	0.04 ⁺
Generalized Leontief [†]	-0.69 ⁺	0.08 (0.13)	0.57 (0.49)	0.05 (0.04)

* Numbers in parentheses are standard errors.

⁺ These elasticities were not estimated but computed as residuals.

Source: Agne 2000

The functional forms were derived from the Quadratic, the Normalised Quadratic and the Generalised Leontief profit functions. The demand function derived from the Quadratic model provided both significant and plausible results. The own-price elasticity at means of aggregated pesticide demand shows that pesticide demand is elastic., The cross-price elasticity between pesticide demand and the wage suggests that labour is an important substitute for some pesticides used in coffee.

Table 2: The impact of pesticide taxation scenarios on the gross margin in coffee in Costa Rica

	<u>Scenario 1:</u> 10% tax on all pesticides	<u>Scenario 2:</u> 50% tax on all WHO I+II pesticides	<u>Scenario 3:</u> 20% tax on WHO I+II, 5% tax on other pesticides
sample average	-0.63%	-0.86%	-0.57%
coffee area ≤ 5 ha	-0.53%	-0.76%	-0.50%
coffee area > 5 ha	-0.77%	-1.00%	-0.68%

Source: Agne, 2000

Using a partial budget model, the impact of three pesticide tax scenarios on income from coffee production was investigated. In this partial budget simulation it was not possible to take the possible substitution of pesticides into account because parameter estimates could not be made for all input factors. Nevertheless, it is obvious that the impact on income from coffee production was found to be marginal (Table 2).

The study shows that - coffee farmers are likely react to price changes of pest control inputs and could switch to alternatives. Farmers' income would be affected by less than 1 % in all tax scenarios. However, results also indicate that a pesticide taxation policy would have to be carefully designed if net welfare changes are to be positive.

4. Conclusions

The results of the two studies show that there is scope for the use of economic instruments in crop protection policy reform. Arguments about the high costs of pesticide reduction for the agricultural sector which carry considerable weight in the policy debate can be challenged through carefully designed micro-economic research work. The creation of global and regional networks of pesticide policy specialists that would include economists and crop protection specialists may facilitate the formulation of pesticide policies in line with agricultural productivity and

environmental objectives. Such networks may also help to overcome the lack of appropriate data needed for a complete economic analysis of pesticide use.

5. References

Agne, S. (2000) The Impact of Pesticide Taxation on Pesticide Use and Income in Costa Rica's Coffee Production, Pesticide Policy Project, Publication Series Special Issue No.2, Hannover.

Agne S., G. Fleischer, F. Jungbluth, H. Waibel (1995) Guidelines for Pesticide Policy Studies - A Framework for Evaluating Economic and Political Factors of Pesticide Use in Developing Countries. Pesticide Policy Project Publication Series No.1, University of Hannover /GTZ.

Agne, S. (1996) Economic Analysis of Crop Protection Policy in Costa Rica. Pesticide Policy Project, Publication Series No. 4. Hannover.

Fleischer, G., V. Andoli, M. Coulibaly, T. Randolph (1998) Analyse socio-économique de la filière des pesticides en Côte d'Ivoire. Pesticide Policy Project Publication Series No.6, University of Hannover /GTZ.

Jungbluth, F. (1996) Crop Protection Policy in Thailand. Economic and Political Factors Influencing Pesticide Use. Pesticide Policy Project, Publication Series No. 5. Hannover.

OECD (1996) Activities to Reduce Pesticide Risks in OECD and Selected FAO Countries. Part I: Summary Report. OECD, Paris.

Oskam, A.J., H. van Zeijts, G.J. Thijssen, G.A.A. Wossink, R. Vijftigschild (1992) Pesticide Use and Pesticide Policy in the Netherlands. An Economic Analysis of Regulatory Levies in Agriculture. Wageningse Economische Studies 26, Wageningen, Netherlands.

Pearce, D., R. Tinch (1998) The True Price of Pesticides. In: Vorley, W., D. Keeney (eds.): Bugs in the System. Redesigning the Pesticide Industry for Sustainable Agriculture. Earthscan, London.

Reus, J.A.W.A., H.J. Wecksel, G.A. Pak (1994) Towards a Future EC Pesticide Policy: an Inventory of Risks of Pesticide Use, Possible Solutions and Policy Instruments. Publication CLM 149, Centre for Agriculture and Environment, Utrecht.

Schillhorn van Veen, T., D. Forno, S. Joffe, D. Umali-Deininger, S. Cooke (1997) Integrated Pest Management, Strategies and Policies for Effective Implementation. Environmentally Sustainable Development Studies and Monographs Series No. 13, The World Bank, Washington D.C.

Waibel, H. (1994) Towards an Economic Framework of Pesticide Policy Studies. In: Agne, S., G. Fleischer, H. Waibel (eds.): Proceedings of the Göttingen Workshop on Pesticide Policies. Göttinger Schriften zur Agrarökonomie, Heft 66. Institut für Agrarökonomie der Universität Göttingen.