

Potential efficiency gains in the Fiji sugar industry: the performance payment system

Padma Lal

This article assesses the magnitude of expected financial gains and the nature of incentives that a performance payment based contractual system may offer in a segmented sugar industry such as Fiji's. A performance payment system (PPS), such as the Atherton system, could give all industry stakeholders incentives to improve performance. However, in the light of operational issues, a grower-miller based PPS may be more practical. Some loss of static efficiency may occur in this second-best option but, given the gravity of industry inefficiency in Fiji, a contractual agreement to improve the performance of all parties is urgently needed.

Padma Lal is a Sustainable Development Adviser with the Pacific Islands Forum Secretariat.

Diversity in agricultural production offers opportunities for many different types of organisational structure to emerge, ranging from a vertically integrated but privately or cooperatively owned mill and farm production sector to a segmented industry where mills and farms are separately owned. Economic theory suggests that a vertically integrated organisation is most likely to develop in situations such as a sugar industry where different phases of production are complementary and require close coordination in terms of quantitative

and qualitative output/input (Richardson 1996). However, despite the presence of such a technological condition, vertically integrated firms may not develop (Alchian and Demsetz 1972; Coase 1937; Milgrom and Roberts 1992; Putterman and Kroszner 1996) because of the significant transaction costs of monitoring a large number of specialised employees. Consequently, a segregated industry structure may evolve using long-term contract arrangements, provided the contracts are legally enforceable and enforced (Klein et al. 1978).



In the sugar industry both types of structure can be found in the same country, for example, Australia (Hildebrand 2002) and India (Ferrantino et al. 1995)—the two countries with which the Fiji sugar industry has close historical links. In Fiji, the sugar industry largely began as a vertically integrated industry under the Colonial Sugar Refining (CSR) company, using indentured labourers from India.¹ With the termination of the indenture system, CSR introduced a small-farmer system; but it could no longer demand the same performance from labour as it did under the strictly controlled indenture system (Lal 1992; Moynagh 1981; Narsey 1979). However, because of the divergence between CSR's goal of maximising returns to its shareholders and the 'free' labourers' aim of maximising returns to their effort, as well as the increasing monitoring costs of the plantation system, the vertically integrated industry gave way to a segmented sugar industry (Moynagh 1981). Separation of the ownership of mills and farms gradually took place in 1920s and 1930s, necessitating the institution of a contractual arrangement between growers and the miller for the supply of cane and the sharing of sugar revenues, net of industry costs. The contractual arrangement between the CSR and the growers was highly biased in favour of the miller (Table 1), with the miller overpricing its own inputs and offering low prices for the farmers' produce.

Biased contractual arrangements are not just peculiar to Fiji. Observations throughout the world show that many agricultural contracts are found to be biased in favour of the processor (Glover and Kusterer 1990; Gosh 1994; Singh 2002). The issue of fair product price is at the core of many controversies in countries where the processor wields considerable power either because of its monopoly control or where the industry is an important GDP earner

and a major source of rural employment, as is the case in Fiji.

The sugar industry has been the backbone of Fiji's economy, although tourism is slowly replacing it as the major source of GDP. Sugar is the largest commodity export earner, the second-largest contributor to GDP after tourism, and the major employer of the rural labour force. In 2002, it generated 9 per cent of GDP and employed 25 per cent of the formal labour force. Sugar exports, mainly to Europe under the Lomé Convention (more recently the Cotonau Agreement) generated revenue of F\$235 million.

The industry is based on about 3 million tonnes of sugarcane produced by some 22,000 growers and processed into raw sugar by the Fiji Sugar Corporation (FSC), a publicly listed company, which owns all four mills. Despite receiving two to three times the world sugar price under the Lomé Convention, the industry has shown a marked decline in recent years. The performance of both the miller and growers has declined to the point where, unless the current trend is reversed, the industry is unlikely to survive in the short to medium term even if the preferential access were to continue (Lal and Rita 2005).

To address this declining performance, a cane-quality payment system has been proposed since at least early 1990s to replace the fixed ratio used to share the net industry returns. The purpose of this article is to examine the nature of the incentives and efficiency gains that a performance payment system (PPS) might offer an industry of numerous small farmers and a monopsony miller.² It is argued that although theoretically a PPS is appropriate for a contractual agreement between two parties closely dependent on each other's productivity—and there are potentially large increases in industry revenue to be realised—modifications of the ideal system may be necessary for it to be effective.



Table 1 Comparison of industry revenue sharing during different periods in the history of the Fiji sugar industry

Attribute	1889–1945 ^a	1945–1960 ^b	1960–73 ^c	1973–89 ^d	1989–present ^e
Value of products included	Sugar only	Sugar and molasses	Sugar and molasses	Sugar and molasses	Sugar and molasses
Industry costs deducted before sharing	Yes	Yes	Yes	Yes	Yes
Milling costs deducted before sharing	Yes	Yes	Yes	No	No
Sharing basis	Cane quality; POCs	Cane quality; POCs	Revenue net of industry and milling costs	Revenue net of industry costs	Revenue net of industry costs
Sharing ratio	Fixed base price for cane with POCs 13 or over, penalty for less	Fixed base price for cane with POCs 13 or over, penalty for less	82.5:17.5 of net revenue (or equivalent of industry costs)	65:35 of revenue net of industry costs	70:30; plus a sliding scale in favour of growers
Miller performance accountability	Nil; miller knew all	Nil; miller knew all	Nil; miller knew all	Nil; miller knew all	Nil; miller knew all
Returns to miller's asset	At least 15 per cent	At least 15 per cent	At least 15 per cent	Allowable 10 per cent	Allowable 10 per cent
Risk sharing	Nil; growers shouldered all risks	Nil; growers shouldered all risks	Nil; growers shouldered all risks	Growers lost 65 per cent of loss in net revenue	Growers lost 70 per cent of loss in net revenue
Accountability	CSR had absolute control	CSR had absolute control	CSR determined costs and no accountability costs	Prescribed allowable costs	Prescribed allowable costs
Dispute resolution	Nil; industrial action	Nil; industrial action	Nil; industrial action	Independent arbitration	Sugar Industry Tribunal

^a CSR; ^b CSR post Shephard's Award; ^c Eve Commission; ^d Denning Award; ^e Master Award

Source: Kermode, R.G., 1989, 'Report of sugar industry tribunal', in *Sugar Industry Tribunal Master Award and Report*, Sugar Industry Tribunal, Lautoka; Moynagh, M., 1981, *Brown or White? A History of the Fiji Sugar Industry, 1873–1973*, The Australian National University, Canberra; Narsey, W., 1979, 'Monopoly capital, white racism and superprofits in Fiji: a case study of CSR', *Journal of Pacific Studies*, 5:66–146; Shephard, C.Y., 1945, *The Sugar Industry of Fiji*, Colonial Office, His Majesty's Stationery Office, London.



Table 2 Net industry revenue sharing ratio between growers and miller (per cent)

Sugar output	Growers' share	Miller's share
Less than 325,000 tonnes	70.0	30.0
325,001–350,000 tonnes	72.5	27.5
Greater than 350,000 tonnes	75.0	25.0

Source: Sugar Industry Tribunal, 1989. *Sugar Industry Tribunal—Master Award and Report*, Sugar Industry Tribunal, Suva.

The cane payment system and its impact on performance

Fiji uses a fixed cane-payment system to share its industry revenue (net of specified industry costs) between growers and the miller. Revenue-sharing arrangements and the individual contractual obligations of growers and the miller are stipulated in the collectively negotiated Master Award (Figure 1). Growers are paid 70 per cent of the net industry revenue for up to 325,000 tonnes of sugar produced. For sugar in excess of this volume, growers receive between 72.5 per cent and 75 per cent and the miller receives the balance (Table 2).

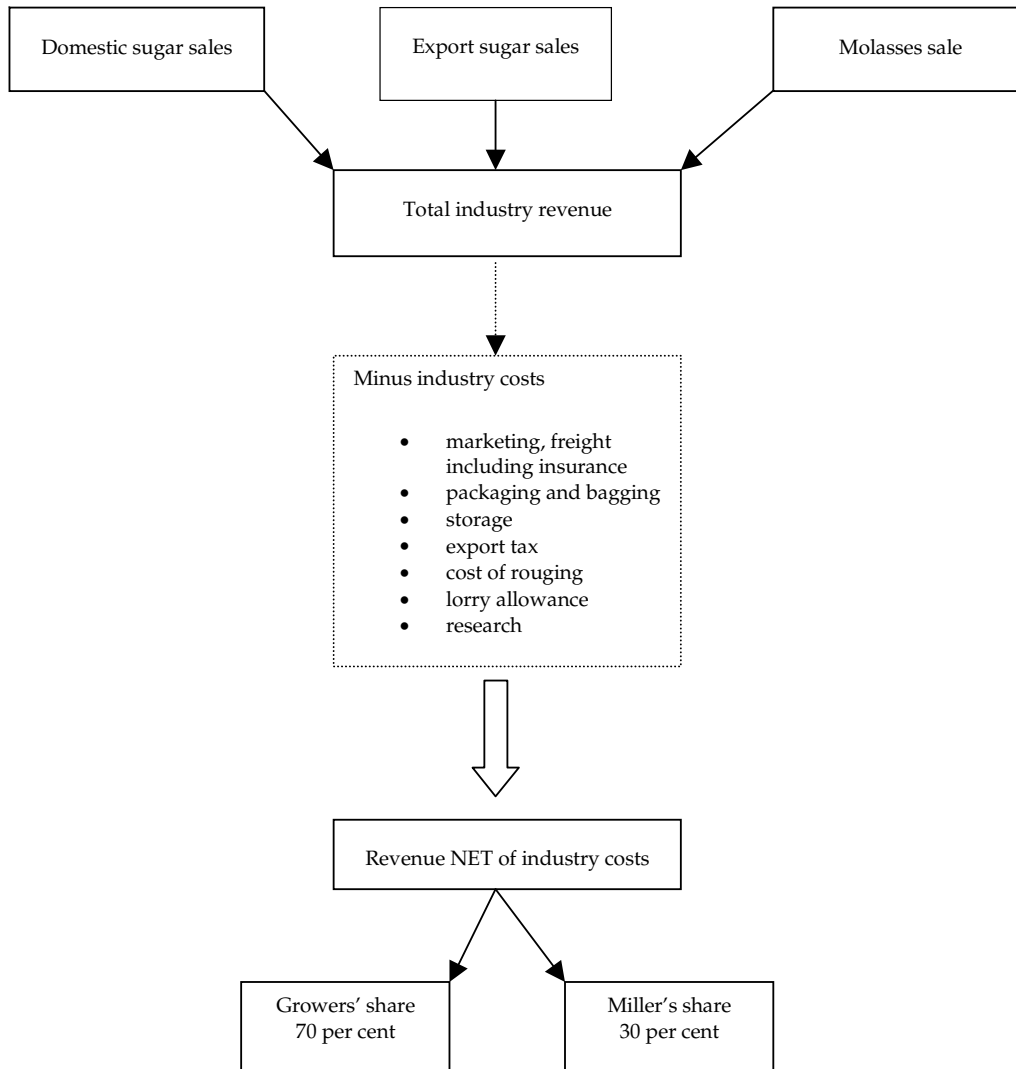
The 70:30 sharing ratio was arrived at after considerable deliberation about what comprised a fair sharing of industry proceeds. Among the key factors considered were many of the arguments put forward in the Denning Award, including the ratio of the costs of cane production and milling and processing costs, the fair return on capital assets, and the risk sharing between the growers and the miller. Other factors were a consideration of what comprised fair and equitable returns to farmers and what was considered 'sufficient for farmers to maintain a reasonable standard of living' (Kermode 1989:132).

Discontent over the sharing formula has, however, remained for decades, with the miller arguing for a change in the sharing

formulae back to 65:35 or 60:40. In 1973, CSR withdrew from Fiji when the Denning Award stipulated a 65:35 sharing formula. Since then, many consulting firms have argued that under the 70:30 rule 'the proportion of revenue given to growers must now be approaching the limit beyond which the miller's capacity to finance adequate renewal of factory and transport installations would probably be jeopardised' (Landel Mill Commodities Studies Ltd 1991:23). It has regularly been argued that, under the current formula, the miller does not have any incentive to invest in efficiency improving investments and the growers do not have any reason to increase the quality of cane (Davies 1997; Landel Mill Commodities Studies Ltd 1991). More recently, the Asian Development Bank (ADB) reported that it is this unfair sharing formula, and other conditions in the Master Award, that have been the underlying cause of the poor financial performance of the Corporation (ADB 2003). Without examining the root causes of the poor financial performance of the FSC or the cane pricing issue in detail, the ADB team recommended that the Government should abolish the 70:30 sharing formula and argued that 'FSC should receive 40 per cent of sugar proceeds, rather than the 30 per cent level, applied [by the Independent Arbitrator] for social reasons, in the final determination' (ADB 2003:3).



Figure 1 Current net industry revenue shared between growers and miller



Source: Sugar Industry Tribunal, 1989. *Sugar Industry Tribunal—Master Award and Report*, Sugar Industry Tribunal, Suva.



It is worth noting that there is no universally agreed basis for deciding what comprises a fair sharing arrangement. It is largely an equity issue and there are no theoretical arguments to underpin decisions about such distributional issues. When CSR was the miller, growers were paid from 8 to 40 per cent of net sugar revenue at a time when the same company paid its Australian growers 65–70 per cent (Narsey 1979). Internationally, the sharing ratio varies widely, from 72.5:27.5 (in Barbados) to 65:35 (Australia). The lowest ratio is in Vietnam where there is a single miller paying 51 per cent of the raw sugar sales to growers (ADB 2003:22). Although Lord Denning considered a 70:30 split to be ‘too high’, the Independent Arbitrator, Justice Kermode, when finalising the Master Award, decided that the 70:30 split was legally and morally fair.

A word of caution is warranted when comparing reported sharing ratios because some countries such as Fiji and Barbados use a fixed ratio to divide the industry revenue, and pro-rate the growers’ share to individual growers according to the weight of cane. Others, like Australia, use it as the base sharing ratio, but divide the net proceeds between growers and miller according to their respective performance. In Fiji, millers pay for transport out of their share of net returns; in other cases, such as in Thailand, growers pay for the transport from their share. In Fiji, growers have converted in increasing numbers to lorry transport and pay for transport costs.

Regardless of the exact sharing ratio, a fixed sharing formula does not provide either party with incentives to improve their performance (Burrows 1998; Landel Mill Commodities Studies Ltd 1991). On the contrary, it provides perverse incentives. This is evident from recent trends in the performance of the growers and the miller in Fiji, where the cane quality has declined as has the efficiency of the mills in extracting and processing the sugar contained in the cane.

Growers’ incentives and cane quality

Cane quality is measured in terms of the sucrose content, or pure obtainable cane sugar (POCS). Physiologically, POCS is determined by cane variety, the maturity of the cane, and climatic factors. For a given variety of cane, the sugar content depends on the level of rainfall and daily mean temperature at key stages of the cane’s vegetative growth phase (Muchow et al. 1997; Peterson and Gaunt 1967), the stage at which the cane is harvested and processed, and the length of the crushing season (Chapman and Milford 1997). The sugar content increases as the cane matures but then decreases beyond a certain stage of maturity; thus, the sugar content generally decreases later in the crushing season. Although a combination of these factors helps explain the large variability in POCS observed in Fiji from year to year, it cannot explain the steady decline in the POCS observed since 1974 (Sugar Commission of Fiji 1997).

In the 1960s the industry average POCS was about 14 per cent. More recently, the industry POCS has averaged about 11.8 per cent. Such a decline could be due to the fact that growers are paid according to weight and have no incentive to produce quality cane. If anything, because they are paid on volume, they have a perverse incentive to plant cane varieties that are easy to grow, and use other practices that increase volume rather than quality. Growers are also likely to harvest immature cane for convenience. Such practices are in sharp contrast to the CSR days, when growers were paid according to sugar content. At the time, cane husbandry practices were closely monitored and enforced by CSR field officers. Monitoring is lacking today, although the Master Award clearly stipulates similar key conditions about varieties of cane to be grown, good husbandry practices, and the



quality of cane that FSC would accept. Recently, the FSC, which manages research and extension, has reduced the number of field officers, and over the past three years the field extension service has been stopped completely.

Burnt cane

The sucrose content of cane is also dependent on the proportion of stale, burnt cane delivered to mills. The current cane-payment system, combined with a shortage of cane cutters and the conditions in the mills, has also encouraged the supply of lower quality burnt cane. Since the 1980s the proportion of burnt cane has increased rapidly (see Lal 2006: Figure 6). Burnt cane affects the industry in two ways: it increases the levels of impurities in cane juice and causes problems in processing, particularly at the clarification and pan boiling stages. Burnt cane, but more importantly delayed burnt cane, also deteriorates rapidly, causing a rapid decline in POCS and ultimately in recoverable sugar.

There is a penalty imposed for burnt cane but it has been regarded as too low to act as a disincentive (Davies 1998; Ram 1995). If anything, the current payment system provides farmers with incentives to burn their cane since under the fixed cane-payment system, growers do not bear the full costs of their action. Furthermore, growers have an incentive to burn their cane because it removes weeds and hornets and thus makes it easier to harvest manually. Moreover, as argued by Davies (1997) and Lal (2003), farmers (often out of fear of having their cane left standing) burn their cane to jump the queue—a behaviour encouraged by frequent mill breakdowns and approaching rainy weather.

Miller's performance and the fixed payment system

A fixed payment system also does not encourage the miller to improve performance, particularly as the cost of doing so is

borne by the miller while the benefits are shared with the growers. In recent years, the performance of the miller has deteriorated both in terms of financial performance (White 2003; Lal 2003) and milling efficiency (see Lal 2006: Figure 3)—milling efficiency is primarily measured in terms of per cent sugar recovery (Queensland Sugar Corporation 1993). The poor performance of the miller can also be seen in the transport sector. In an effort to reduce its direct costs, FSC has neglected maintenance of the railway lines and encouraged growers to convert to road transport—the cost of which is largely borne by the growers. With poor rail maintenance, frequent delays in cane transport are observed, which accelerates deterioration of POCS content. Delays greater than 48 hours are not uncommon (Lal 2003).

The ADB Technical Assistance team recently argued that the decline in milling efficiency is a direct result of the 'unfair' sharing formula (Asian Development Bank 2003:29–33). It is true that the 30 per cent received by FSC is lower than millers in some countries (such as Australia) receive. However, the argument that there is a lack of sufficient capital for improvement in Fiji does not make sense when one compares the quantum of revenue received by the FSC compared with Australian mills, for example. Thirty per cent of a net industry sugar price of F\$600 received by the FSC is still greater than 35 per cent of about F\$300 world price received by Australia.

Given any cane payment system, each party will make decisions in their own interests, taking into account their own costs and benefits, and without regard for the other participants or for the industry as a whole. Therefore, it is necessary to design a payment system that provides growers and millers with incentives that are compatible with the welfare of the industry as a whole. To encourage alignment of the respective stakeholders' interests with that of the industry, an incentive-based payment



system is more appropriate than a fixed sharing formula. The following discussion looks at the proposed Atherton formula-based PPS currently being considered by the Fiji Government.

Performance payment system

The economic literature tells us that organisational design should encourage alignment of individual's goals with those of a corporation and that the contractual arrangement between the parties should reflect their respective performances (Alchian and Demsetz 1972; Jensen and Meckling 1976; Milgrom and Roberts 1990; Milgrom and Roberts 1992; Tosi et al. 2003). Otsuka et al. note that 'attenuation of work incentives can be mitigated if [worker] income is made to depend in some fashion on the consequences of his effort' (Otsuka et al. 1992:1,967). That is, contractual design should reward growers and miller for their respective performances and penalise for poor performance, encouraging the alignment of their goals with those of the industry.

Contractual arrangements can be regarded as an efficient alternative to a vertically integrated industry structure if contracts are easy to draw up, cheap to monitor and legally enforceable, and risks have been considered (Klein et al. 1978). Efficient contracts balance the costs of risks against the incentive gains that may result (Milgrom and Roberts 1992; Weitzman and Kruse 1996). In the sugar industry, this would mean the introduction of a contract based on a PPS that rewards the miller for improvement in sugar recovery and has penalties for poor performance. Similarly, growers would be rewarded for cane with higher sugar content and penalised for poor quality cane. Such a contractual arrangement would encourage growers and millers to align their goals with that of the industry,

and ensure some risk sharing between the miller and the growers. The need for such a system in Fiji has been advocated for at least a decade (Landel Mill Commodities Studies Ltd 1991), and has been seriously considered since 1998.

The following assessment of the PPS proposed for Fiji examines the nature of incentives provided to growers and the miller to improve their performance, the magnitude of penalties for poor performance, and the effect of improvements in individual performance on the size of the industry cake. The resilience of the PPS to changes in the base parameters and sharing ratio is also discussed.

The Atherton formula

Many different types of cane quality-based payment systems, or performance-based payment systems, are in use around the world (Table 3). Essentially, there are two broad categories of PPS: miller-grower equity and miller-grower-grower equity. In a miller-grower equity system, the miller is paid according to its performance but the growers are paid according to the average performance of growers. In the miller-grower-grower equity system, the miller and individual growers are paid according to their respective performances. However, in practice there are many in-between variations, depending on the local context-specific issues found to be dominant at the time the formula was designed.

Both systems have key common features. Firstly, revenue received from the domestic and export sales of raw, white and refined sugar are treated as industry revenue. Linking cane payments to the value of the products means that market risks are borne by both the miller and the growers. In some countries, such as Fiji and Jamaica, the value of molasses is also included in the industry revenue. The value of other byproducts, such

**Table 3 Revenue sharing arrangements and product revenue shared with growers**

Country	Cane payment system	Products
Australia	Quality of individual grower's cane and relative payment system	Raw sugar (millers retain molasses)
Brazil	Quality based but no relative payment	Crystal sugar and ethanol
Columbia	Quality of individual grower's cane	Raw/mill white sugar and other byproducts
Jamaica	Quality of individual grower's cane and relative payment system	Sugar, molasses and other byproducts
Mexico	Growers' average quality	Estandar sugar (miller retains molasses)
India		
Maharastra	Cooperative	Sugar and molasses
Uttar Pradesh	Fixed price (flat rate)	..
Thailand	Quality of individual grower's cane (recently)	Raw/white/refined sugar and molasses (only part of refined sugar export premium shared by growers)
South Africa	Quality of individual grower's cane and relative payment system	Raw/refined sugar and molasses (only part of refined sugar export premium shared by growers)

Source: Todd, M., Forber, G. and Digges, P., 2004. 'Cane payment systems', in G. James (ed.), *Sugarcane*, Blackwell Science, Carlton:181-94.

as ethanol, may also be included, as is the case in Brazil. However, in countries such as Australia, Columbia and Mexico, revenue from byproducts are retained by the miller. The products included for industry sharing is a question of equity but is also related to the incentives offered to millers for investment in high value products. When growers and miller share in the value of all products, the miller has less incentive to produce high value products. In Australia, when the industry changed its policy on revenue sharing and allowed millers to retain the value of white sugar, investment in sugar refinery increased and as did the production

of white sugar. Guatemala, Columbia and Mexico had a similar experience (Todd et al. 2004).

From industry revenue is deducted the industry costs, that is, costs associated with marketing, brokerage, freight, for example, but not milling and processing costs. By linking the sharing ratio to industry revenue net of these industry costs, growers and miller share in the risks associated with market conditions. This is contrary to what happened in Fiji during the CSR days (see Table 1), where milling and processing costs were also deducted and thus the miller share primarily reflected returns to their capital.



Consequently, the growers bore all the risks and the miller received the benefits of changes in market prices (Narsey 1979).

Under the PPS, the net industry revenue is divided between growers and miller using a fixed sharing formula. This sharing ratio is often based on the relative costs of farm production and milling and processing costs for a tonne of cane. The ratio may be adjusted for the climatic risks borne by growers and what is considered to be humane and fair, as was the case in the Master Award, mentioned earlier. Some PPS also contain a base performance indicator for growers (such as a base POCS or base recoverable POL (RP) in Australia) and the base mill-performance measure (sugar recovery or coefficient of work), against which their respective performance is judged. Each stakeholder is then rewarded if their performance is better than the agreed base parameter and penalised if their performance is lower. Therefore, the PPS recognises miller-grower equity.

In some cases, such as South Africa, the net industry revenue is divided between miller and growers according to a fixed ratio, but only the variation in the growers' performance is the focus of attention. Thus, the formula only involves a parameter that reflects only the cane quality and individual growers are paid according to the recoverable value of sugar contained in their cane, which recognises the amount of fibre and non-sucrose content (South African Sugar Association 2004). Thus the main focus is on quality of cane and grower-grower equity.

Alternatively, as is the case in Mexico, the cane payment system may be based on the average quality of cane delivered by all growers, and stipulates a minimum sugar recovery by the miller. If the miller achieves a sugar recovery rate greater than this base parameter, it gains (Todd et al. 2004). But if it performs below this standard then it bears the full cost. There is some semblance of

grower-miller equity here, although individual growers do not have an incentive to improve their cane quality.

The proposed Fiji formula reflects considerations of incentive effects as well as risk sharing between growers and the miller.

Proposed PPS for Fiji

The Fiji PPS, which was first proposed in 1998–99 by Atherton (an Australian consultant) is an adaptation of the cane payment system used in Queensland since the turn of the 20th century (Queensland Sugar Corporation 1993). It is worth noting that the Australian cane quality payment system, on which the Atherton formula is based, is not without criticism. The system has been criticised for over-compensation to millers for improvement in their performance and over-compensation to growers for increases in the sugar content of cane; the price of cane moves proportionally with the price of sugar which means that the rate of return to the miller is heavily dependent on the price received (Dixon and Johnson 1988). Others, such as Todd et al. (2004) note that millers may not have any incentive to increase their throughput in the middle of the season (by investing in larger plant) when the sugar content is at its peak.

Although these are valid observations in the context of the Fiji sugar industry, they are second-order improvements that can be addressed once the correct basic principles have been followed. At this stage it is important for Fiji is to establish what Goldberg has called a relational agreement that 'reflects the purposive behaviour of parties' (Goldberg 1980:74), although in the short term it may involve some loss in efficiency.

The formula

The Atherton formula is guided by two basic principles: the need to provide growers and the miller incentives to improve their performance; and a dynamic system that is



responsive to changes in the price of sugar and an incentive structure that is independent of the base parameters.³ It includes a component which ensures a base-sharing of the industry's net proceeds between growers and miller. The base-sharing ratio reflects the relative cost of cane production, processing and milling and the risk factors considered by Justice Kermode (Kermode 1989). The Australian formula had the original ratio of 66:34 (Queensland Sugar Corporation 1993:30).

The Atherton formula also contains base performance indicators for growers and the miller against which their respective performance is assessed. Growers' performance is measured in terms of Recoverable POL (RP). Miller performance is measured in terms of percentage of sugar recovery, which according to Atherton is a better indicator of mill efficiency than the Coefficient of Work (COW) used in Australia. The term 'recoverable POL' is preferred in Fiji over POCS in order to avoid a repeat of the perception of cheating that growers experienced during the CSR days. POCS and RP (recoverable POL) are essentially the same measure. The formula is

$$\begin{aligned} &\text{Growers' cane price (\$/tonne of cane)} \\ &= \text{sugar price (\$/tonne POL)} * z * (\text{RP} - y) \end{aligned}$$

Where sugar price is the average market price of a tonne of POL (the measure used internationally to reflect the quality of sugar), net of allowable industry costs per tonne of sugar and molasses; RP is recoverable POL in sugarcane; z is a constant representing base milling efficiency (sugar recovery); and y is a constant which sets the miller's 'contribution'/'share' of the base recoverable POL (equals $\text{RP} * \text{miller's share}$).

Under this formula, the growers' cane price is directly proportional to the net industry unit price. The higher the sugar price, the higher the returns to the growers and the miller. Similarly, at a given base milling efficiency, the grower's contribution

to the industry's net revenue is equal to $(\text{RP} - y)/100$.

The next section examines the incentive effects embedded in the Atherton formula and the effect that changing the base parameters will have on the level of incentives available to growers and miller.

Potential efficiency gains—the empirical evidence

The calculations provided below are an extension of preliminary calculations carried out by Atherton, Lal and Prasad during September of 2003 and which underpinned Atherton's report to the Government of Fiji.

$$\begin{aligned} &\text{Base performance} - \text{RP} = 11 \text{ per cent;} \\ &z = 82.5 \text{ per cent;} \\ &y = 3.3 \text{ per cent} \end{aligned}$$

This base scenario is based on the following assumptions: a base sharing ratio of 70:30 between the growers and the miller, as per the Master Award; the base sugar recovery rate, z , of 82.5 per cent (the national average per cent sugar recovery across all mills in Fiji between 1988 and 2002), and base cane quality of 11 RP, and with a value of $y = 3.3$ per cent (that is, 30 per cent * 11 RP). It is also assumed that the actual $\text{RP} = 11$ and the actual sugar recovery is 82.5 per cent and the net industry price is F\$600 per tonne of POL in sugar. Under this scenario, the growers and the miller will retain their 70:30 split (Table 4).

$$\begin{aligned} &\text{Total cane price} \\ &= 600 * 0.825 * (11/100) = \text{F\$54.45/tonne} \\ &\quad \text{of cane} \end{aligned}$$

$$\begin{aligned} &\text{Grower A's cane price} \\ &= 600 * 0.825 * (11.0 - 3.3)/100 = \text{F\$38.12} \end{aligned}$$

$$\begin{aligned} &\text{Miller's price} \\ &= \text{F\$54.45} - 38.12 = \text{F\$16.34} \end{aligned}$$

Grower to miller sharing ratio is 70:30.



**Table 4 Base sharing ratio = 70:30; base recovery 82.5 per cent;
base RP 11; actual recovery 82.5 per cent**

RP	Total cane price	Price to grower	Per cent to grower	Price to miller	Per cent to miller
9.00	44.55	28.22	63.3	16.34	36.7
10.00	49.50	33.17	67.0	16.34	33.0
11.00	54.45	38.12	70.0	16.34	30.0
12.00	59.40	43.07	72.5	16.34	27.5
13.00	64.35	48.02	74.6	16.34	25.4
F\$/RP		4.95			

Source: Author's calculations.

Scenario 1: Changes in cane quality, RP

Suppose the miller's performance remains constant at the sugar recovery of 82.5 per cent and a grower improves the quality of cane with the RP at 12 per cent (Table 4). With an improvement in the quality of cane, the total industry revenue has increased to F\$59.40 per tonne of cane. Of this, the grower's share has increased to F\$43.07 per tonne, or 72.5 per cent, while the miller's price is still the same, F\$16.34. However, the miller's share has dropped to 27.5 per cent (which could act as an incentive for the miller to improve performance to retain the 30 per cent share). In other words, the industry as a whole would have gained about F\$4.95 per tonne, or about F\$15.84 million, assuming the ten-year average production of 3.2 million tonnes of cane!

Conversely, if the cane quality were to decline by one point RP, while the miller's performance remains the same, the industry would lose a net revenue of F\$15.84 million. The growers' share would decline to 67 per cent from the current 70 per cent, providing an incentive for the grower to improve performance.

Thus, under the proposed Atherton formula, growers would be rewarded for

improved performance and penalised when cane quality drops when compared with the base performance measures. At the same time there would be pressure on the miller and growers as the other's performance improves because their own share would have dropped below the base 70:30 ratio.

Scenario 2: Changes in miller's performance—sugar recovery

Suppose a grower maintains cane quality at POCS equal to 11 per cent, and the miller achieves an 85 per cent sugar recovery rate. Under such a scenario, not only do the net returns per tonne of cane increase but so does the share to the miller. The industry as a whole will benefit by about F\$5.2 million from an increase in sugar recovery by 2.5 percentage points, all of which accrues to the miller. The miller can expect to receive F\$1.65 per tonne more. That is, in effect the miller would receive 32.1 per cent of the net industry returns. Although the grower receives the same dollar amount as before, the share of net returns is reduced to 67.9 per cent (Table 5). Such a system could thus put pressure on the grower to improve cane quality, even though the cane price received has not changed.



Scenario 3: Grower and miller both improve their performance (change in RP and sugar recovery)

If the grower and the miller improve their performance, the industry as a whole benefits from the increase in net returns. Moreover, both the growers and the miller receive increased payments. Depending on the levels of improvement, their share of the net revenue will also change (as summarised in Table 6).

A similar set of analyses can be done for maintaining grower performance but allowing the miller's efficiency to vary. The same pattern emerges where the miller is rewarded for any improvements and penalised for a decline in performance relative to the base parameters.

Effect of changing base parameters

The FSC has been arguing for the base sharing formula to be changed from 70:30 to 65:35, as well as using lower base parameters for recoverable sugar and the RP. The effect of doing this is explored below.

Changing the base sharing ratio from 70:30 to 65:35

Changing the sharing ratio will affect the 'y' parameter in the Atherton formula. This will no doubt affect the distribution of industry net returns between growers and the miller but not the underlying incentive structures. Suppose the base sharing ratio is 65:35 as requested by the FSC, at the base RP of 11 and sugar recovery rate of 82.5 per cent,

Table 5 **Impact on grower share with changes in miller performance and grower performance different from base RP=11 and base recovery of 82.5 per cent**

Actual RP	Actual recovery			
	80.0	82.5	85.0	87.5
9.00	65.3	63.3	61.5	59.7
11.00	72.2	70.0	67.9	66.0
13.00	76.9	74.6	72.4	70.4
15.00	80.4	78.0	75.7	73.5

Source: Author's calculations.

Table 6 **Base sharing ratio 70:30; base recovery 82.5 per cent; base RP 11; actual recovery 85 per cent; and variations in RP**

RP	Total cane price	Price to grower	Per cent to grower	Price to miller	Per cent to miller
9.00	45.90	28.22	61.5	17.69	38.5
10.00	51.00	33.17	65.0	17.84	35.0
11.00	56.10	38.12	67.9	17.99	32.1
12.00	61.20	43.07	70.4	18.14	29.6
13.00	66.30	48.02	72.4	18.29	27.6
15.00	76.50	57.92	75.7	18.59	24.3

Source: Author's calculations.



growers and the miller will be assured of 65 per cent and 35 per cent respectively (Table 7). However, if growers were to supply better quality cane, say with a RP of 12, and the miller maintained its 82.5 per cent sugar recovery, the sharing ratio changes although the industry gain remains the same as before. With an increase in RP of one unit, the industry gains F\$15.84 million, and the growers receive an extra F\$4.95 per tonne, just as before. However, the improvement in the net returns gives the growers a 67.9 per cent share, instead of the base 72.5 per cent that they would have received under the 70:30 ratio.

The miller receives a slightly higher price, F\$19.60 per tonne of cane (Table 7) with an increase in RP, as compared with F\$16.34 before (see Table 4). The miller's price of cane remains the same although the growers receive an additional F\$4.95 per tonne. When the miller improves its performance to, say 85 per cent, its gain is the same although the sharing ratio is different. The 65:35 base sharing ratio provides similar incentives as when the ratio was assumed to be 70:30. Therefore, the choice of a 70:30 ratio or a 65:35 ratio is an issue of equity because the incentives to improve remain the same; both the growers and the miller will be encouraged to improve their efficiency.

So, what is an appropriate sharing ratio? This is what we turn to next.

As mentioned earlier, many countries have used the relative cost of farm production to the cost of milling and processing a tonne of cane to decide the sharing ratio (Queensland Sugar Corporation 1993; Sugar Industry Tribunal 1989). A similar approach could be used here. However, if the relative cost argument were to be used, the ratio can be tipped in favour of the miller, because its costs in recent years have more than doubled with decreasing efficiency (Lal 2006). At the same time, the grower cost profile has changed: more hired labour is used, effectively increasing their cost of production. Therefore, given the inefficient state of the growers and the miller, and the absence of detailed farm level cost data, the relative cost argument cannot be used convincingly. Denning and Kermode (Kermode 1989) also discussed the level of weather risk that farmers have to bear when arriving at their respective sharing ratio. Therefore, at this stage, an argument can be made for the PPS to be introduced using the current 70:30 ratio primarily because the transaction cost of changing the sharing formula is likely to be very high, given the current political climate and the tension between the Government and the Opposition, whose power base is largely the sugarcane

Table 7 Sharing ratio = 65:35; base recovery 82.5 per cent; base RP 11; actual recovery 82.5 per cent

RP	Total cane price	Price to grower	Per cent to grower	Price to miller	Per cent to miller
9.00	44.55	25.49	57.2	19.06	42.8
10.00	49.50	30.44	61.5	19.06	38.5
11.00	54.45	35.39	65.0	19.06	35.0
12.00	59.40	40.34	67.9	19.06	32.1
13.00	64.35	45.29	70.4	19.06	29.6
F\$/RP		4.95			

Source: Author's calculations.



Table 8 Base sharing ratio 70:30; base recovery 80 per cent and base RP 11; actual recovery 80 per cent

RP	Total cane price	Price to grower	Per cent to grower	Price to miller	Per cent to miller
9.00	43.20	27.36	63.3	15.84	36.7
10.00	48.00	32.16	67.0	15.84	33.0
11.00	52.80	36.96	70.0	15.84	30.0
13.00	62.40	46.56	74.6	15.84	25.4
15.00	72.00	56.16	78.0	15.84	22.0
F\$/RP		4.80			

Source: Author's calculations.

growers. Perhaps at a later stage, say in five years time, the sharing ratio could be reviewed, when key improvements have been achieved and appropriate data on milling and processing costs and production costs have been objectively collected.

Changing base cane quality (RP) and sugar recovery ('z')

FSC has suggested using a much lower set of base values than considered above (Industry Restructure Committee 2003). Changing the base RP will affect the 'y' measure and which will in turn affect the growers' share. At one stage, FSC suggested a RP base of 7 (the reason for this is unclear, particularly when a RP level above 9 is usually used to start a crushing season. If the base RP were reduced to say 10, which is commonly obtained early in the season, while keeping the base sugar recovery to 82.5 per cent as before and the sharing ratio kept at 70:30, there is little impact on the workings of the Atherton formula. There is no difference in the dollar value received by growers. Nor does the gain per unit RP change. However, the incentive structure changes slightly. Instead of expecting to receive 70 per cent when the POCS is 11, growers will receive 70 per cent when their POCS is 10. Keeping the base RP low means that the growers will receive a

disproportionately higher share than they currently do at the same RP (Table 8). This could give the wrong signal to the growers. Commonsense tells us that if the goal is to increase performance, setting unrealistically low targets will not provide the incentives for improvements beyond that target.

Similarly, if the base sugar recovery rate were reduced to 80 per cent, while maintaining the base RP at 11, the industry as a whole and the individual stakeholders lose because the industry sets a low target. If the miller settled on meeting its base parameter, the industry would receive an equivalent of F\$52.80 per tonne of cane instead of the F\$54.45 it would have received before (Table 8). While the miller would receive 30 per cent at a RP of 11 and base recovery of 80 per cent, the dollar amount is F\$15.84 as compared with F\$16.34. Similarly, although growers still retain their 70 per cent share at a RP of 11; the dollar amount is F\$36.96 as compared with F\$38.12. Therefore, by reducing the base RP and base recovery ratio, there is a reduced level of incentive for both the growers and the miller because the same sharing ratio is maintained but at a lower industry performance. Furthermore, the lower the base sugar recovery rate the lower would the base RP need to be if the 70:30 ratio is to be retained (Table 9).



Table 9 Set of base RP and recovery required to ensure 70:30 ratio is maintained if growers and miller achieve the base target

Base RP	Base recovery
9.00	80.0
11.00	82.5
13.00	85.0

Source: Sugar Industry Tribunal, 1989.

Risks and variability in income

Under the PPS, growers will see a greater variation in their annual income than before. Though climatic variation influences cane output, it is often the extreme events of drought or hurricane that have major effects. On the other hand, income levels under the PPS will be more sensitive to climate variability because the sugar content is directly influenced by rainfall and temperature, particularly at the maturing phase (Muchow et al. 1997). The additional risks from climatic variability was already considered in the original Denning Award, and retained in the Master Award. Therefore, this may not be an issue here. A greater concern is, however, the larger variations in POCS observed during a harvesting season than between seasons.

Practicalities of PPS

In an ideal world, the first-best solution is to use the Atherton formula to pay each grower for the quality of cane and the miller for its milling and processing performance. This would mean that the formula should be applied to each mill area separately. At a minimum, the FSC could establish each mill as a cost centre while retaining its current corporate structure. The advantage of doing this would be that incentives would not be diluted by the benefits of improvements

generated in a mill area being shared with non-performing mills and or growers. It would also help growers and each mill area management to develop what Weitzman and Kruse (1996:100) note as 'something akin to developing a corporate culture that emphasises company [industry] spirit, promot[ing] group cooperation' which is much needed in the industry.

For the Atherton formula to provide appropriate incentives to individual growers, each grower should be paid on the basis of cane quality. This means that cane from each individual grower needs to be tested and compared with mill efficiency. Operationally, there are two key issues that need to be considered. The first is how to deal with natural variation in the POCS during a season. This is a physiological issue. However, its effect on equity has to be taken into account in how the formula is applied. The second issue deals with the problem of separately testing cane from each grower, many of whom produce less than 100 tonnes of cane annually.

Variations within a season

As noted earlier, POCS (or RP in the formula) varies during a crushing season. Usually POCS is lowest at the beginning and the end of the crushing season and is the highest around the middle of a 22–24 week season. The longer the season the more the POCS



deteriorates, as summarised for Lautoka mill in 2003 (Figure 2). To accommodate such variation, Atherton proposed a relative payment scheme. In this scheme, the price paid for the average period POCS was the same as for the seasonal average POCS.

Thus, say the season average POCS for a mill is 12. At this average, the price per tonne of cane = $600 \times 0.825 \times (12 - 3.3) / 100 = \text{F\$}43.07$. If a grower were to produce cane with a POCS of 13, the price of cane would then be $\text{F\$}48.05$ ($600 \times 0.825 \times (13 - 3.3) / 100$). That is, the payment for a unit increase in POCS is $\text{F\$}4.95$, regardless of what the average POCS for that period happened to be.

As an illustration, suppose the distribution weekly average POCS during a crushing season was as illustrated in Figure 2, with the lowest POCS (9 per cent) at the beginning of the season in May and in January, and the highest being in mid September (14 per cent). Suppose at the beginning of the season, the average POCS for Week 5 is 10. Therefore, if a grower

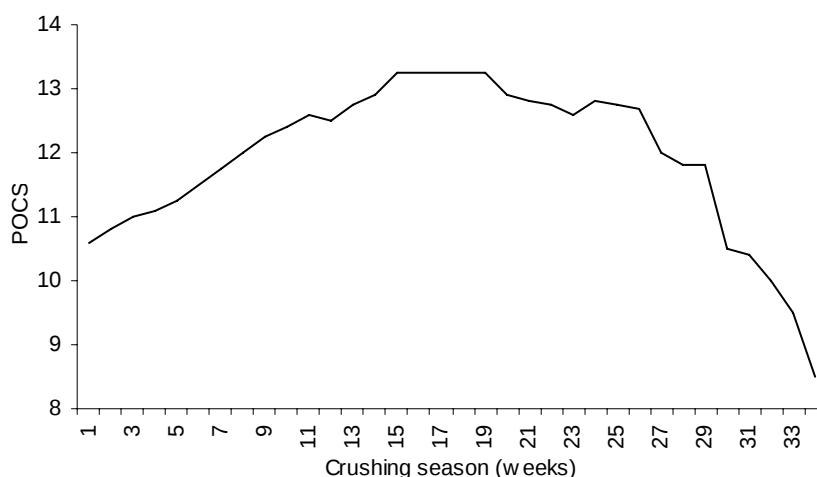
supplied cane of POCS of 10, he will receive $\text{F\$}43.07$ per tonne. A grower with one unit POCS higher than the average will receive an additional $\text{F\$}4.95$ per tonne. Similarly, if the peak period POCS around the middle of the season is 14, each grower would still receive $\text{F\$}4.95$ per unit of POC greater than this amount. Such a system would maintain the equity between growers and miller, as well as maintain equity between growers whose cane was harvested at different times of the season.

In summary, with some adjustments to the way the formula is applied, equity can be maintained between growers despite variations in the POCS level within a harvesting season.

Individual grower-based PPS

PPS can produce the desired outcome if every grower were paid according to their respective cane quality. But to effectively implement the proposed PPS, objective monitoring of each individual grower's consignment of cane is

Figure 2 Five-year average of weekly POCS, Lautoka mill, 1994–1998



Source: Mill Work Advice, 1968–2003 (hard copies obtained from the Fiji Sugar Cane Growers Council, September 2003).



necessary. Given the presence of so many small producers, it is not practicable to confidently sample each grower's cane and estimate the POCS reliably.

This was a major issue during the CSR days when growers were paid according to their POCS level. The CSR paid a fixed price per ton of cane of 13 POCS with a penalty for every one per cent below this base and a reward for POCS greater than 13. This system of payment, though performance based, was asymmetrical. The miller had the advantage of possessing all the information, and there was no monitoring system in place. In any case, there was also the physical difficulty of monitoring numerous small consignments of cane from mostly small farmers (farms of around 4.5 hectares). Furthermore, the price received by the growers was fixed and did not vary with the price of sugar received by CSR, and the CSR solely retained the right to change the price paid unilaterally (Shephard 1945). This led to political agitation until the cane quality payment system was changed from an individual quality based payment to an average POCS.

Although under the Atherton formula, payment to growers and the miller is directly linked to the market price of sugar, the problem of small farms remains. Three of the four mills are not equipped to handle small consignments of cane. Even at the fourth mill, cane consignments of at least 10 tonnes are required. Such a consignment size is feasible only for lorry delivered cane, but impossible for cane delivered by rail, where consignments are usually 3–4 tonnes per truck. Thus, without major changes to the delivery system, as well as structural changes to the mill at the tipping stations, an individual grower-based PPS can not be easily introduced in the short run. Furthermore, the capital cost of equipment for cane assessment by NIR (near infra-red technique) or core sampling INFRACANA technology, required to

measure the quality of each consignment of cane is expected to be about F\$1 million (M. Habib, then NIR Project Manager, SCOF, personal communication). In addition, at three of the four mills additional structural changes would be required before individual grower consignments can be adequately assessed.

The industry at this stage can ill afford such capital investments, not only because the miller has been running at a loss but more importantly because the industry is facing large uncertainties in its preferential trade terms with the European Union after 2006.

As a second-best solution, a grower-miller, equity-based cane quality system can easily be implemented at each mill since miller and growers' average performances are already measured and monitored regularly. The existing laboratory system of assessing first expressed juice from cane and mill efficiency at key stages along the processing and milling chain can be used for the purpose of introducing the PPS. At a minimum, it would address the most contentious issue of recent times—who should improve by how much for the industry to survive. The grower-miller equity PPS would provide appropriate incentives to each stakeholder to improve their performance. Experience in Mexico shows that even when growers are paid on their average quality, a PPS encourages them to improve their performance (Todd et al. 2004).

Monitoring and auditing

Contracts are only as good as their enforcement. Past experience in the use of the CQPS system by CSR suggests that unless a transparent auditing system is in place, a PPS system will be viewed with suspicion and the PPS-based contract is not likely to be sustainable. The often illiterate growers were told by CSR that their 'sugar had become molasses', and because growers



were not paid for revenue earned from molasses, they received little value for their cane (Narsey 1979). In the absence of a transparent system for monitoring cane quality at a time where accountability of the miller was almost non-existent, growers felt cheated out of a fair return for their effort. Consequently, prolonged political agitation led the CSR to change the CQPS, as mentioned above.

Even today, the sugar industry is highly politicised and the costs of political agitation can be large. These can be reduced by introducing a system of regular monitoring and accountability. An independent technical audit team could be set up whose task would be to randomly check on cane assessment equipment, analytical methods, and milling efficiency performance measures produced by the miller. Such a system is already used under the Master Award to check on the accuracy of the weighbridges used to weigh each cane consignment.

To increase accountability and minimise principal-agent problems, such performance measures should be made regularly available to the FSC Board and the Growers Council. However, both bodies would need to ensure that they have appropriate technical people who could monitor and demand performance, or at least explanation in the short term if performance is found to be lacking. Currently, neither the FSC Board nor the Council have appropriately trained staff who can understand the mill performance reports and ask FSC management for accountability.

To make this commercial organisation more accountable, FSC essentially needs two types of Board members. The first group of Board members should include those, such as accountants and experienced business people, who have direct commercial expertise and business knowledge. The second group must have appropriate technical knowledge about milling and processing of sugar cane.

In Fiji, people with business and accountancy backgrounds have dominated the FSC Board. Representation from the second group has been lacking. Normally, a company's performance is judged by its financial performance—profits, dividends paid to shareholders, and share values. However, particularly when a company is not performing well, financial indicators are often not sufficient for monitoring what is happening. For a complex activity such as sugar production, the Board should also have sufficient technical knowledge about the industry to ask intelligent questions and scrutinise the performance.

The Sugar Cane Growers Council, as the peak grower body, should also employ a sugar technologist who can at least monitor miller performance, as well as the accuracy of the cane quality assessments carried out by the miller. In the end, it is not the contract *per se* which is good or harmful, but how it is implemented. One of the crucial elements will no doubt be the level of trust and sense of partnership that can be developed between the growers and the miller. In Fiji, this will not be easy given the history of distrust and confrontation that has existed since the 1880s. Although a PPS can improve productivity, it needs a corporate culture that emphasises industry spirit and promotes group cooperation (Weitzman and Kruse 1996).

Conclusion

In a segmented sugar industry based on the supply of intermediate products, no market prices exist. As a result, a relational contract is needed between the miller and growers for the supply of cane, which includes amongst other things a basis for the sharing of net revenue as well as sharing in market risks. A negotiated or contract price sharing arrangement would ideally reflect the value



of marginal product of cane, which is directly and integrally dependent on individual and collective performance of the growers and the miller. Dynamic efficiency can be encouraged by a governance structure that provides ongoing incentives for stakeholders to self adjust and self enforce with changing circumstances. Furthermore, the vulnerability of the industry can be reduced by deliberately structuring the contractual relationship such that the stream of benefits and costs to each party is more coincident (Goldberg 1980).

The proposed Atherton formula-based performance payment system can provide such a governance structure with appropriate incentives for growers and miller to improve their performance. Under this PPS, growers who supply cane of a quality better than the base parameter would be rewarded in absolute values as well as in proportionate terms. As long as the miller's performance is maintained, it will not lose out in value terms, though proportionately the miller will receive less than the base ratio. Similarly, if the miller improves its performance but the cane quality does not change, the miller is rewarded in absolute terms as well proportionately. Payments to growers and miller are also self-adjusting with changes in the sugar trade environment.

An ideal system is where each grower and miller shares in the risks and is provided with individual incentives. Such a miller-grower-grower equity system would be feasible if no major structural changes were required in the mills. However, since the Fiji sugar industry is facing severe financial problems, as well as market uncertainties post 2006, as a second-best option a grower-miller equity system may be more cost effective at this stage. In any case, such a second best option will at least help address the main contentious issue of who is mainly responsible for the poor status of the

industry—growers or the miller. A common debate in the country has revolved around the question of the overall performance of the miller as compared with the aggregate performance of the growers. Although in the long run the first-best solution is essential if long-term efficiency is to be achieved and sustained, the second-best option could at least help address the more immediate problems.

Nonetheless, even with the introduction of the second-best PPS, the question of what base parameters to use will remain. This is an equity issue, which can only be resolved through dialogue or as a minimum by accepting the past averages as a starting point. It is important to note that though the choice of base parameters does affect the absolute targets for stakeholders to achieve, and thus the overall industry performance, in the first instance setting low base targets for grower and miller performance will give inappropriate signals. Once the sharing ratio is accepted, it is a matter of agreeing on one of the stakeholder's base performance measures, because the other's will be automatically determined. Furthermore, whichever set of base parameters is accepted, it does not affect the relative incentive structure, although setting too low a target can send the wrong signal to the growers.

Productivity gains will nonetheless depend on the sense of trust and partnership that develops between the growers and the miller. In conclusion, in a segmented industry such as sugar, getting the institutional design right is critical if social welfare is to be maximised and the contractual parties are to have appropriate incentives to improve their own, and the industry's, performance. Finally, the proposed PPS is based on sugar (and molasses) as the main output. However, if any mill decides to focus on other products, such as co-generation of electricity, the PPS will need rethinking.



Notes

- ¹ Other sources of indentured labourers, such as from the Pacific islands, were also trialled, together with sourcing sugarcane from private European suppliers. However, CSR's operations, largely based on plantation estate model, was found to be most effective (see Moynagh 1981 for a history of the Fiji sugar industry).
- ² The term performance payment system (PPS) is used here rather than cane quality payment system (CQPS), usually preferred in Fiji and elsewhere, because PPS better captures the situation in Fiji where inefficiency issues are associated with both the miller and the farmers. The term CQPS suggests that it is only the cane quality that is of major concern, assuming that a private company would be maximising its profits and operating efficiently, and that a pricing system would provide incentives for farmers to produce higher quality cane. In Fiji for too long the belief has been held that the poor industry performance has been due only to deteriorating cane quality and that the miller was not responsible. See Lal (2006) for further discussion of this point.
- ³ These principles, although not stated anywhere in government or industry documents, were as deduced from discussions reflected in the minutes of the industry's Cane Quality Subcommittee meetings (available from Sugar Commission of Fiji).

References

- Alchian, A. and Demsetz, H., 1972. 'Production, information costs, and economic organisation', in L. Putterman and R.S. Kroszner (eds), *The Economic Nature of the Firm*, Cambridge University Press, Sydney:193–216.
- Asian Development Bank, 2003. *Inter-mediation of Sugar Sector Restructuring: restructuring expert final report*, Asian Development Bank, Lautoka.
- Burrows, G.H., 1998. 'Regulations and efficiency: pricing sugar cane in Queensland', *International Sugar Journal*, 100(1194):293–98.
- Chapman, R.N. and Milford, B.J., 1997. 'Economic constraints and opportunities in the Australian sugar industry', in B.A. Keating and J.R. Wilson (eds), *Intensive Sugarcane Production: Meeting the Challenges Beyond 2000*, CAB International, Wallingford:55–70.
- Coase, R., 1937. 'The nature of the firm', *Economica*, 4:386–405.
- Davies, J., 1997. *An analysis of the efficiency of Fiji's sugarcane rail system*, University of the South Pacific, Fiji and the Acadia University, Suva and Nova Scotia.
- , 1998. *The causes and consequences of cane burning in Fiji's sugar belt*, University of the South Pacific, Suva.
- Dixon, P. and Johnson, D.T., 1988. 'Pricing of Queensland sugar cane: appraisal of the present formula and a suggestions for reform', *Review of Marketing and Agricultural Economics*, 56(1):27–35.
- Ferrantino, M.J., Ferrier, G.D. and Linvill, C.B., 1995. 'Organisational form and efficiency: evidence from Indian sugar manufacturing', *Journal of Comparative Economics*, 21(1):29–53.
- Glover, D. and Kusterer, K., 1990. *Small Farmers, Big Business: contract farming and rural development*, Macmillan, London.
- Goldberg, V., 1980. 'Relational exchange: economics and complex contracts', *American Behavioural Scientist*, 23(3):337–52.
- Gosh, B., 1994. 'Contract farming in Africa: an application of new institutional economics', *Journal of African Economics*, 2(2):231–61.



- Hildebrand, C., 2002. *Independent assessment of the Sugar Industry (The Hildebrand Report)*, report prepared for the Department of Agriculture, Fisheries and Forestry, Canberra.
- Industry Restructure Committee, 2003. Industry Restructure Committee Meeting Records, Sugar Commission of Fiji, Lautoka.
- Jensen, M.C. and Meckling, W.H., 1976. 'Theory of firm: managerial behavior, agency costs and ownership structure', *Journal of Financial Economics*, 9:305–60.
- Kermode, R.G., 1989. 'Report of sugar industry tribunal', in *Sugar Industry Tribunal Master Award and Report*, Sugar Industry Tribunal, Lautoka.
- Klein, B., Crawford, R. and Alchian, A., 1978. 'Vertical integration, appropriable rents and the competitive contracting process', *Journal of Law and Economics*, 21:297–326.
- Lal, B.V., 1992. *Broken Waves: a history of the Fiji islands in the 21st century*, University of Hawaii Press, Honolulu.
- Lal, P., 2003. 'Reform for efficiency gains: industry status and prospects for reform', paper presented at the Sugar Cane Growers' Councilors Workshop, Sugar Cane Growers Council, Lautoka.
- , 2006. 'Agency costs, corporate governance and the Fiji Sugar Corporation', *Pacific Economic Bulletin*, 21(2):70–93.
- Lal, P. and Rita, R., 2005. 'Potential impact of the EU sugar reform on the Fiji sugar industry', *Pacific Economic Bulletin*, 20(3):18–42.
- Landel Mill Commodities Studies Ltd, 1991. *A Review of the Sugar Industry in Fiji*, LMC International Ltd, Oxford.
- Milgrom, P. and Roberts, J., 1992. *Economics, Organisation and Management*, Prentice Hall, Englewood Cliffs, New Jersey.
- Moynagh, M., 1981. *Brown or White? a History of the Fiji Sugar Industry, 1873–1973*, The Australian National University, Canberra.
- Muchow, R.C., Robertson, M.J. and Keating, B.A., 1997. 'Limits to the Australian sugar industry: climatic and biological factors', in B.A. Keating and J.R. Wilson (eds), *Intensive Sugarcane Production: Meeting the Challenges Beyond 2000*, CAB International, Wallingford:37–54.
- Narsey, W., 1979. 'Monopoly capital, white racism and superprofits in Fiji: a case study of CSR', *Journal of Pacific Studies*, 5:66–146.
- Otsuka, K., Chuma, H. and Hayami, Y., 1992. 'Land and labour contracts in agrarian economics: theories and facts', *Journal of Economic Literature*, 30(4):1,965–2,018.
- Peterson, R.O. and Gaunt, J.K., 1967. 'Some factors influencing recovery of sugar', *Queensland Society of Sugar Cane Technologist*, Queensland Society of Sugar Cane Technologies, Bundaberg.
- Putterman, L. and Kroszner, R.S., 1996. 'The economic nature of the firm: a new introduction' in L. Putterman and R.S. Kroszner (eds), *The Economic Nature of the Firm*, Cambridge University Press, Sydney:1–31.
- Queensland Sugar Corporation, 1993. *The Distribution of Proceeds of Vested Sugar, Volume I and II*, Queensland Sugar Corporation, Brisbane.
- Ram, R., 1995. A higher cane quality payment system: an analysis for the Fiji sugar industry, MSc Thesis, University of East Anglia, Norwich.
- Shephard, C.Y., 1945. *The Sugar Industry of Fiji*, Colonial Office, His Majesty's Stationery Office, London.
- Singh, S., 2002. 'Contracting out solutions: political economy of contract farming in



- the Indian Punjab', *World Development*, 30(9):1,621–38.
- South African Sugar Association, 2004. RV Price: 2003–2004 season final price of recoverable (RV) in cane, South African Sugar Association, Natal.
- Sugar Commission of Fiji, 1997. *Sugar Industry Strategic Plan, 1997–2000*, Sugar Commission of Fiji, Lautoka.
- Sugar Industry Tribunal, 1989. *Sugar Industry Tribunal—Master Award and Report*, Sugar Industry Tribunal, Suva.
- Todd, M., Forber, G. and Digges, P., 2004. 'Cane payment systems', in G. James (ed.), *Sugarcane*, Blackwell Science, Carlton:181–94.
- Tosi, H.L., Shen, W. and Gentry, R.J., 2003. 'Why outsiders on Boards can't solve the corporate governance problem', *Organisational Dynamics*, 32(2):180–92.
- Weitzman, M. and Kruse, D., 1996. 'Profit sharing and productivity', in L. Putterman and R.S. Kroszner (eds), *The Economic Nature of the Firm*, Cambridge University Press, Sydney:288–96.
- White, M., 2003. 'The financial viability of Fiji Sugar Corporation: an assessment from the Corporation's annual financial reports', *Fijian Studies: A Contemporary Fiji*, 1(2):287–300.

Acknowledgments

This paper is based on the cane quality payment system proposed by Phil Atherton, a consultant from Australia. I had the pleasure of being nominated by the Sugar Cane Growers Council to work with Mr Atherton on this project in late 2003. I would like to thank Mr Atherton for his generosity in openly sharing the thinking behind the proposed system. The analysis presented here is based on that formulae, which is still under consideration by the Government and the stakeholders. I also wish to express my thanks Mr Jagannath Sami, the CEO of the Fiji Sugar Cane Growers Council, in not only nominating me to represent the growers on this important task, but to also make available hard copies of many difficult-to-find unpublished sugar industry related grey literature. I have also benefited from several discussions with Mr Sami, Mr Habib Mohammed, the Project Manager, NIR trials, behind the cane quality assessment, Sugar Commission of Fiji.