28746

Farmers and Price Fluctuations in Poor Countries

Marcel Fafchamps
Department of Economics, University of Oxford
June 6, 2000

1. Introduction

Farmers the world over face dramatic fluctuations in the price of the crops they produce. They have all devised ways of coping with the resulting market risk. Some of these methods rely on market institutions, others rely on government intervention, others yet rely on self-insurance and income diversification. The purpose of this presentation is to examine how farmers in poor countries are affected by price risk and how they cope with it. The emphasis is on the role of agricultural markets. We also investigate how organized commodity markets could be used to provide insurance against price risk.

We begin by contrasting price risk with other sources of risk and we discuss how they are related. Next, we examine the welfare cost of price risk for farmers and we investigate the factors that determine how vulnerable farmers are to commodity price risk. The following section is devoted to risk coping strategies, with a particular emphasis on the role played by agricultural markets in the mitigation of price risk. Finally, we discuss the possible role of organized commodity markets in providing protection against agricultural price fluctuations for farmers in poor countries.

2. The Many Faces of Risk

Farmers face a lot of risk, not just commodity price risk. Yields fluctuate as a function of rainfall and pest infestation. This is particularly true in tropical and sub-tropical agriculture where evapotranspiration rates are high and plants are subjected to severe heat and drought stress. The lack of irrigation infrastructure and the paucity of effective pest

control mechanisms compound the problem in many places. Input prices also vary and the timing of input delivery can be erratic, especially in poor countries. Imports of agricultural inputs are too often subject to the vagaries of foreign exchange availability. Furthermore, input delivery to rural areas is hindered by poor roads, thin markets, and ineffective bureaucracies.

Farmers are also subject to personal risk, such as health shocks and death in the family. Due to the absence of winter, the tropics are a fertile breeding ground for many parasitic diseases such as malaria and trypanosomiasis. Insufficient vaccination and lack of medical facilities translate into higher mortality and morbidity from common diseases such as gastro-intestinal infections, bronchitis, or measles. AIDS is prevalent in many poor countries, where it affects the population at large. Bankruptcy risk is a serious concern as well and distress sales of land, animals, and farm equipment often result from farmers' inability to shoulder risk.

Poor countries are also subject to large aggregate shocks. The undifferentiated nature of their economies and their specialization in the export of a handful of primary products make them particularly vulnerable to swings in the inter-national price of their main export commodities. Terms of trade shocks can be extremely large, often resulting in massive fluctuations in foreign exchange earnings and government revenue. These fluctuations typically have repercussions on the entire economy. As a result, the economies of poor countries are characterized by large year-to-year macroeconomic fluctuations – much more so than developed economies where diversification reduces the macroeconomic effect of any change in the export price of a single commodity. Moreover, most developed economies de facto insulate their farmers from world price

fluctuations. This is certainly true of the European Union and is largely true in the United States as well. Poor countries are much less able to do so. Other aggregate shocks affect farmers in poor countries as well, such as political unrest, warfare, hurricanes, landslides, locusts, and droughts. Although not restricted to poor countries, these massive shocks usually stretch local resources to their limit and disrupt farming.

From this brief overview of the categories of risk that affect farmers in poor countries, it appears that commodity price fluctuations touch them in two important ways: directly, by affecting their crop revenues; and indirectly, by affecting the strength of the local economy. This distinction is important because direct and indirect influences do not require the same insurance mechanism. Indirect effects can be eliminated or mitigated by insulating foreign exchange earnings and government revenues from commodity price fluctuations. How this can be achieved is beyond the scope of this presentation, but it is important to recognize that doing so requires insuring the country itself, not individual farmers. In contrast, direct effects can only be corrected by dealing with price risk at the farmer level, hence requiring different institutional arrangements altogether.

In practice, the two often are related because poor countries find it difficult to insulate their farmers against a large drop in world commodity prices. The example of Cote d'Ivoire in the 1990's, which attempted to protect its farmers from a dramatic fall in the international price of cocoa, is instructive: initially successful at preserving producer prices, the attempt eventually failed because the drop in price lasted longer than anticipated and the government ran out of money. In the end, Cote d'Ivoire was worse off than it would have been had the price decrease been passed on to farmers right away.

So, even though the government's action reduced direct price risk, it served to magnify indirect price risk through its repercussion on the entire economy.

3. The Welfare Cost of Price Risk

Having described the risk environment in which farmers operate, we are now ready to investigate the welfare costs of price risk assuming that no insurance is available. This caveat is important because, in practice, farmers typically have ways of insuring themselves to some extent.

The first observation to make is that commercial farmers do not, as a rule, worry about price risk but rather about revenue risk. The distinction is important because yield shocks experienced by farmers may be correlated with price shocks. In an economy with a fixed, downward sloping demand for agricultural products, for instance, a negative yield shock would result in a lower supply and therefore raise agricultural prices. The resulting drop in farm revenue is thus likely to be smaller than the price drop. In fact, as Newbery and Stiglitz (1981) have shown, the drop in revenue will be zero in case of a non-stochastic, unit elastic demand. To see why, let P stand for price and Q stand for quantity. Suppose that Q goes up by 10%. With a unit elastic demand, P goes down by 10% as well. The net effect on revenue PQ is thus zero. As the example suggests, revenue goes up in response to low output whenever demand is inelastic. In other words, revenues increase in bad harvest years when demand elasticity is less than one. By the same reasoning, low price years would be high revenue years if demand is elastic. This suggests that low prices should not be equated with low revenue and loss of welfare. Applied to exported agricultural commodities, this reasoning implies that a low price for, say, cocoa might

actually signal high cocoa revenues if the fall in price is driven by high yields as opposed to, say, a slump in demand.

Different farmers and different countries need not experience identical yield shocks, though. To the extent that farmers or countries face idiosyncratic shocks, price fluctuations need not follow their own yield shock. For instance, suppose that, as a result of a good coffee harvest in Brazil, the international coffee price falls. As we have discussed earlier, the fall in price need not hurt Brazilian exporters because it is compensated by higher volumes. The price drop, however, hurts producers who have not experienced a high harvest. In fact, it can be argued that the presence of alternative suppliers makes the demand faced by Brazilian exporters more elastic, and thus favors Brazil. To see why, suppose that Brazil's output – and exports – of coffee go up by 10%. Assuming that in an average year Brazil represents 50% of world production, this raises world supply by 5%. Supposing that the world demand for coffee has an elasticity of one, this lowers the world price by 5%. It is as if Brazilian exporters face a demand elasticity of 2. Revenues for Brazilian coffee exporters increase by 5% while revenues for other world producers fall by 5%. The presence of producers in other countries indirectly enables Brazilian coffee producers to benefit from high yields, in spite of low prices. Other producing countries are penalized by what they perceive as an 'exogenous' price shock, that is, a price change that is not correlated with their own output. The situation can thus be summarized as follows. When one's yield is perfectly correlated with aggregate output, the effect of low yield on revenue is positive if demand is inelastic, zero if demand elasticity is one, and negative if demand is elastic. When one's yield is uncorrelated with aggregate output (even more so when one's yield is negatively

correlated with aggregate output), low yield has an unambiguously negative effect on expected revenue.

Fluctuations in a single commodity price affect mostly farmers who specialize in that commodity. Highly diversified farmers, in contrast, need not experience much revenue loss. In practice, many poor farmers – though not all – have a diversified crop portfolio. Their farm revenue should be relatively insulated against single price changes. But the welfare consequences of even a small drop in income might be dire: a large commercial farmer may be able to absorb a one-year 50% drop in revenue, while a small subsistence farmer may starve as a result of a 5% drop in revenue. It is therefore not surprising that commercial farmers are typically more specialized than smallholders. Agricultural price fluctuations may affect not only farm revenues but also the price farmers pay for the products they consume (Fafchamps 1992). A rise in the world price of rice, for instance, tends to raise food prices in rice importing countries – not only for rice, but also for other food products which serve as rice substitutes. It has been found that, in many poor countries, most farmers are actually deficit food producers (Barrett 1997). In other words, most rural households which are observed farming do not, in general, produce enough to feed themselves and rely on income from remittances, off-farm wages, and non-farm self-employment to purchase food. These individuals are thus penalized by a rise in food prices even though they may be producing food themselves. Contrary to commonly held beliefs, poor farmers need not benefit from an increase in agricultural prices if they are deficit producers and they end up paying more for food. As a result, poor farmers often tend to emphasize food products in their farm production plans, even

when revenues from commercial crops are higher. This is because producing one's own food is the best insurance against food price fluctuations.

The effect of supply and demand shocks on farm revenues also depends on the extent to which a commodity can be stored. Just like trade serves to smooth price fluctuations by arbitraging price differentials across space, storage serves to smooth price fluctuations across time. In the presence of storage, temporary fluctuations in supply and demand should have little effect on prices – provided that these fluctuations are seen as temporary and short-lived.[1] If, on the other hand, supply and demand shocks are believed to follow a random walk, price fluctuations may be large even with storage. The difficulty is that, in order to smooth prices across time, substantial stocks must be held over fairly long periods. It is, for instance, difficult if not impossible to eliminate agricultural price fluctuations across years without accumulating very large stocks following successive good years. By the same token, price smoothing fails when stocks run out. Since, by the law of martingales, all finite stocks must eventually run out, complete price smoothing can never be achieved.

The welfare cost commodity of price fluctuations for farmers in poor countries can be summarized as follows. In the case of export commodities, risk is most severe for small exporting countries – that is, for countries whose export of a single commodity represent a small share of total world supply. This is because these exporters risk reduced foreign exchange earnings if a larger exporter experiences a positive yield shock. When world demand is inelastic, price risk is even higher for small exporters. What is expected to affect them most are fluctuations from one year to the next. Export commodity risk has

[1] It is well known that, once we allow for storage, prices will follow a random walk at least up to the point of stocking out.

effects both directly on farmers and indirectly on the economy as a whole. In the case of food crops, importing countries are also subject to price risk. Although it may benefit a small group of surplus producers, a rise in world food prices tends to penalize small farmers, who typically do not produce enough food to feed themselves. Protecting poor farmers and landless rural workers against food price fluctuations may require an extensive food delivery system to ensure that price smoothing extends beyond major cities to the countryside where it is most needed.

4. Risk Coping and Agricultural Markets

As we mentioned earlier, farmers have developed a variety of ways to mitigate the effect of risk on their well being. Farmers in poor countries typically combine a variety of methods, some of which seek to smooth income itself (e.g., diversification; reliance on drought resistant cultivars), some of which provide self-insurance (e.g., precautionary saving), and some of which rely on informal risk sharing. It would take too long to detail all these methods and how they operate in practice (Fafchamps 1999). The important message to remember is that these methods are seldom sufficient to eliminate risk.

There is one particular category of risk coping strategies that is of interest to those interested in commodity price fluctuations. This category relates to the role of agricultural markets in hedging net revenue risk. Most small farmers in poor countries farm their own land with their own labor. They nevertheless need money to purchase farm inputs – such as fertilizer and improved seeds – and to pay for extra labor, especially at harvest time. Their overriding concern is that their revenue, net of monetary costs, be positive and hopefully sufficient to feed the family. This is related to what earlier we have called ‘bankruptcy risk’: farmers who cannot cover their monetary

production costs may be forced to sell productive assets and thus be thrown into poverty. Price risk is but one factor that influences net revenue risk. A number of institutions and contracts have emerged whose function is best understood as protecting small farmers against bankruptcy risk while ensuring an adequate supply of monetary inputs. One such institution, sharecropping, operates through the land market. Compared with a fixed land rental contract, sharecropping presents the advantage that the price paid for land is proportional to output and thus to gross revenue. The tenant cannot, therefore, be asked to pay more for the land than he earned from it. Although sharecropping, by itself, does not insure tenants against the cost of fertilizer and other monetary inputs, landlords in practice pick up a share of these costs – sometimes all.

Sharecropping is an effective way to protect tenants against one type of bankruptcy risk, that associated with the rental of land. Other sources of bankruptcy risk require other institutions. In this respect, three institutions or contracts are worth mentioning. One institution is the organization of a public or private corporation with a monopsony on the purchase of a specific commodity from producers, say, cotton. The corporation advances farm inputs to farmers at highly subsidized prices and recoups input costs from the purchase price. Like sharecropping, the purpose of this institution is twofold: to provide farm inputs on credit, and to ensure that what farmers pay for inputs is proportional to their crop revenue. In practice, insurance against bankruptcy risk is achieved by manipulating the purchase price itself. The extent of insurance coverage depends on the details of the scheme. Certain schemes practice pan-territorial pricing, which de facto means that input costs are shared by all producers. Other schemes only pool risk at the village level. In these schemes, the village (cooperative, farmer group) is collectively

responsible for repayment of the input costs incurred by the village alone. This ensures that villages who use little inputs do not pay for inputs used by other villages, but it does not provide as much insurance coverage. In fact, certain village schemes collapse when a majority of farmers in the same village face crop failure.

Monopsony schemes have two weaknesses: first, they are vulnerable to smuggling, so that they must repress private trade in order to function; second, monopsony power can be used to tax farmers. Vulnerability to smuggling comes from the fact that, having received inputs on credit, farmers may be tempted to abscond input repayment by selling to a third party at market prices. Smuggling is most difficult to avoid in border areas (e.g., groundnuts along the border between Senegal and Gambia). Abuse of monopsony power by private and public commodity boards has been extensively criticized elsewhere and is not the topic of this presentation.[2]

Contract farming can be seen as an alternative setup that seeks to mimic the private monopsony situation without resorting to monopsony. Contract farming works in much the same fashion, with the crop buyer providing most of the monetary inputs together with advice and guidance. In exchange, the farmer promises to deliver some or all of its output to the buyer. Although the de-tails of the contract vary (Jaffee and Morton 1995), the end-result is the same: the farmer is protected against bankruptcy risk arising from incurring monetary expenses. The farmer is also de facto provided credit for the duration of the production cycle.

[2] In this respect, private monopsonies have often been nationalized in response to claims that they were abusing their market power. It is ironic to note that public monopsonies e.g., marketing boards are now accused of the same ills.

As with monopsony schemes, farmers have an incentive to breach the contract ex post so as to obtain a higher output price and thus abscond from repaying the credit received. The main difference between contract farming and monopsony schemes is in contract enforcement technology: contract farming relies on the strength of commercial contract law while monopsony schemes ultimately rely on road blocks and police repression. The relative effectiveness of these two systems is thus likely to depend on the enforceability of private con-tracts. In countries or areas where contracts can easily be breached, contract farming is unlikely to succeed. Contract farming might also work where the buyer has a de facto monopsony over the purchase of a particular commodity, such as a tomato processing plant located far from a city.

Forward sale to traders can be seen as performing a similar function. In a forward sale, the trader pays the farmer some money in exchange for a promise to deliver part or all of a crop at a future date. Although contract terms vary, many forward sales limit the farmer's responsibility to the standing crop: if the crop fails, no money is due. Whether or not the future price is set depends on the contract. Again, such contracts are open to abuse as farmers may seek to abscond their credit obligation by selling to another trader. This in turn may raise the implicit interest rate traders must charge in order to recoup their money. Hence the ill repute in which forward crop sales are held in much of the developing world.

From the above discussion, it appears that institutions exist that protect farmers against commodity price risk. In all cases, however, insurance is provided against net revenue risk, not price risk in isolation. This is consistent with our discussion in the previous section: price risk per se is irrelevant to farmers. Second, insurance is not provided

against non-monetary inputs such as own land and labor. This suggests that what worries farmers most is not risk per se but bankruptcy risk, that is, the fear of losing productive assets. Third, nearly all contracts contain an element of credit. This but emphasizes farmers constant need of cash to finance the purchase of monetary inputs. Fourth, the main constraint on insurance delivery is contract enforcement. Since it is intrinsically difficulty to recover from poor farmers via legal means, insurance is most easily provided when the buyer has monopsony power. Without it, insurance is difficult to provide. Adverse selection and moral hazard combine to make markets fail.

Contract enforcement difficulties may favor large farmers. First of all, it is more cost-effective for an abused buyer to pursue a large farmer with lots of equipment and assets on which to foreclose. Recourse to legal institutions is thus more credible in case of breach of contract by a large farmer. Second, it may be relatively less costly to screen large farmers and to socialize with them. Socialization and its corollary, ostracism, have indeed been suggested as an alternative mode of contract enforcement.

5. The Role of Organized Commodity Markets

Equipped with a better understanding of how farmers in poor countries deal with risk and how agricultural markets serve to insure against price risk, we now turn to the role that organized commodity markets can play in this process. First of all, it is clear that individual countries could use futures markets to insure themselves against high output in other exporting countries. Existing commodity exchanges could probably supply this function – and probably do so already. So, for instance, Kenya might sell its coffee forward for fear that a bumper harvest in Brazil would drive prices down. Doing so would smooth foreign exchange earnings and insure the country against short-run price

shocks. It would not, however, totally eliminate price risk. First of all, it would provide Kenya with an higher than expected revenue if Kenya itself benefited from a bumper crop. As should be clear to the reader, this form of futures trade would favor speculation and is likely to result in large discount on future sales. Other derivative contracts would be more effective, e.g., options that are activated if Brazil reports a harvest of more than a certain amount. Secondly, because of storage a bumper harvest now would depress future prices as well. Full insurance against commodity price shocks would therefore require trade in two to three year futures. For reasons that will be clear shortly (e.g., demand by processors), such futures are typically not offered.

Activity on futures markets might insure countries against some of the consequences of commodity price fluctuations, thereby sheltering their economy from the aggregate foreign exchange and government revenue crises so often observed. So doing, it would protect farmers from some of the indirect effects of commodity price shocks on the delivery of public services, unemployment in cities, etc. But it would not, by itself, provide insurance against revenue risk to farmers. One way of doing so might be to set up commodity markets in the countries themselves.

Organized commodity markets are essentially organized around two functions: more efficient spot trading; and forward trading ('futures'). Of the two, only the latter has implications for insurance. Historically, forward trading developed in response to demand from food processors: millers and brewers sought to reduce their inventory costs by planning future deliveries. Chainstores also began using futures markets to plan their deliveries ahead of time. Futures markets thus developed as a response to the need of buyers. They superseded forward delivery contracts with individual farmers, which were

costly to arrange and monitor. This simple observation should remind us that the development of futures trade in commodity markets is unlikely to arise without some demand from processors. Whether these processors are located in the producing country or elsewhere largely determines the shape that an organized commodity market might take. It would be foolish, for instance, to set up a stand-alone market for cocoa futures in Ghana, since cocoa is not processed in the country to any significant extent.[3] But it might be possible to set one up for corn.

The other side of the market is made of producers and traders. Here the main organizational issue is credibility: can buyers rely on delivery promises made by sellers? We have seen in previous sections that contract enforcement appears difficult to organize, especially with small farmers. Credibility is thus likely to be the most serious obstacle to the establishment of futures markets in poor countries.

Supply of futures may also be an issue. For many poor farmers, locking the price of a crop early in the season is not a main concern. Besides, governments often perform this task fairly effectively by announcing the purchasing price of major export crops at the beginning of the season. Small farmers would be more interested in a scheme that would enable them to lock in prices for future years. Such a scheme, however, would still fall short of what farmers really want, which is insurance against bankruptcy risk. Where a scheme might be useful is if intermediaries use futures markets to raise funds that they can use to provide inputs and credit to farmers in exchange for future delivery. As our previous discussion suggests, such a modified scheme might require some form of monopsony in order to be effective (e.g., auctioned trading licenses together with chattel

[3] It might, however, be possible to establish an organized market for cocoa futures in Ghana, provided the market is linked to the world cocoa market. This assumes that issues of screening of poor traders,

mortgages/recovery of debts on crops purchased by other licenced traders, to discourage side deals). Setting up an institutional montage in which futures markets play a domestic role is not an easy task and would require that many institutional obstacles be overcome. If insurance against price fluctuation is the primary objective, it might be simpler to resort to lotteries. Consider the following scheme. Lottery tickets are sold using normal channels for the sale of lottery tickets – e.g., street boys, booths, etc. Unlike standard lotteries, these tickets are based on world commodity prices – e.g., if the price of cocoa falls below $100, the buyer of a $1 ticket is entitled to collect $20. The lottery can be further refined, e.g., by stipulating that if the price falls below $80, the payoff is raised to $40, etc. Similar lotteries can be based on local weather conditions, e.g., if rainfall this year falls below 500mm, then a $1 ticket pays $10. One can even imagine revenue insurance/lotteries that are triggered by combinations of weather and world price events. Provided that prices and payoff's are set appropriately, this simple system can deliver price and weather insurance for small farmers.[4] The only institutional issue to resolve is that whoever issues the lottery tickets has sufficient cash to pay – a common concern in catastrophe insurance schemes. Thus, if the purpose is solely to deliver crop insurance to the poor, the lottery scheme has the merit of simplicity. The lottery scheme, however, fails to deliver credit: if anything, farmers have to purchase the lottery ticket beforehand. The lottery scheme also feeds on a common human weakness: the desire to gamble. Once compulsive gambling and other speculative behavior are taken into account, it is unclear that a lottery scheme would be welfare improving.

---

credibility of the organization, and foreign exchange control can be solved adequately.

[4] Easier said than done: while it might be reasonable to assume mean reversion for the weather, prices typically follow a random walk. Betting against a random walk in considerably more risky than betting

6. Conclusion

In this paper we discussed issues surrounding commodity price risk for farmers in poor countries. We saw that price risk is but one dimension of the risk faced by farmers. Price risk per se is irrelevant to producers who worry about net revenue instead. The relationship between price risk and revenue risk is complex as it involves issues of demand elasticity, correlation between yields, and diversification. Of particular interest to commodity prices is the idea that positive yield shocks in some exporting countries hurt other exporters.

We also discussed the effect that commodity prices have on the economy of poor countries that derive a major share of their export earnings from primary exports. When discussing strategies and institutions farmers have developed to cope with risk, we argued that many contractual arrangements surrounding agricultural markets can be understood as providing insured credit for farmers to finance the purchase or rental of crop inputs such as land or fertilizer. One striking feature these institutions have in common is that, although farmers bear a sizeable portion of revenue risk, they are protected from bankruptcy risk: re-payment of the credit obtained to purchase inputs is guaranteed never to exceed crop revenue. This feature was identified as indicative of farmers' most pressing concern: protection against distress sales of their productive assets. We also identified the main obstacle to the widespread use of such arrangements: contract enforcement. Some form of crop monopsony – either national in the case of marketing boards or local in the case of contract farming – might be required to ensure a sufficiently high repayment rate for the scheme to be profitable without becoming usurious.

---

against a stationary process. In the case of price lotteries, stringent prudential regulations would be required to ensure that thee insurer has adequate reinsurance coverage.

We then discussed how these ideas apply to organized commodity markets. We begun by noting that governments could be active on existing international commodity exchanges to purchase futures and protect themselves against short-run price fluctuations. So doing would partially shelter their economy from commodity price shocks but it would not provide insurance against revenue risk to individual farmers. Regarding the establishment of organized commodity exchanges in poor countries themselves, we observed that futures markets, by their very nature, require that future delivery promises be credible. Contract enforcement difficulties are thus likely to plague futures markets just like they currently hinder forward crop contracts. Additional institutions, such as licenced traders, might be necessary for a futures market to be sustainable. We also noted that, in the absence of local processors, futures market could only be sustainable if they are integrated with international commodity exchanges. These obstacles, though not insurmountable, are sufficiently formidable that one may wish to proceed with caution. A much easier vehicle to provide price, yield, and revenue insurance to farmers would be to set up a lottery system indexed on observable price and weather events. Though significantly simpler to implement, this system would fail to provide an additional service that is essential to farmers: credit.

References

Barrett, Christopher B., "Food Marketing Liberalization and Trader Entry: Evidence from Madagascar," World Development, 1997, 25(5), 763–777.

Fafchamps, Marcel, "Cash Crop Production, Food Price Volatility and Rural Market Integration in the Third World," Amer. J. Agric. Econ., 1992, 74(1), 90–99.

Rural Poverty, Risk, and Development, Rome: FAO, 1999. Economic and Social Development Paper No. 144.

Jaffee, Steven and John Morton, Marketing Africa's High-Value Foods: Comparative Experiences of an Emergent Private Sector, Dubuque, Iowa: Kendall-Hunt Publishing Company, 1995.

Newbery, David and Joseph Stiglitz, The Theory of Commodity Price Stabilization: A Study in the Economics of Risk, Oxford UP, 1981.