Analyzing the Impact of Food Price Increases: Assumptions about Marketing Margins can be Crucial

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Abstract

This paper shows the importance of explicitly considering marketing margins in analyses of the impact of price changes on the welfare of different segments of the population. Failure to acknowledge the implicit marketing assumptions embedded in an analysis that assumes equal percentage changes for both farm and consumer prices leads to a bias towards finding negative impacts of higher food prices. In addition, the bias is not necessarily uniform across income quintiles; thus, failure to explicitly consider marketing margins could lead one to conclude that the poor are hurt relatively more than the rich by a price increase when in fact the opposite is true, or vice-versa. We provide rules of thumb and simple techniques that may help to ascertain, in many circumstances, the percentage change in consumer prices that is appropriate for a given percentage change in farm prices.

Key Words: Food prices, food policy, poverty, household surveys, marketing margins, distributional impact.

JEL: Q12, Q13, Q17, Q18.

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Analyzing the impact of food price increases: assumptions about marketing margins can be crucial

Introduction

Data from household income and expenditure surveys (HIES) are useful to assess the impact of price changes on the poor (see the studies listed in the references, among others). For example, they are often used to ascertain the net production and consumption status of various segments of the population, disaggregated by income quintile, location, gender, ethnic group or other characteristics. In order to use these data on net consumption/production status to assess the magnitude of welfare impacts due to a given exogenous shock (e.g. a price increase on world markets), it is necessary to decide on the relative price changes faced by farmers and consumers, as can be seen in the basic formula for determining welfare changes (Minot and Goletti 2000):

$$\frac{\Delta w}{x_0} = \frac{P_F^1 - P_F^0}{P_F^0} PR - \frac{P_C^1 - P_C^0}{P_C^0} CR \qquad (1)$$

where x_0 is initial income, Δw is the net welfare effect of the price change, P_F and P_C represent farm and consumer prices respectively (with superscripts 0 and 1 indicating initial and final prices) and PR and CR represent production and consumption ratios for the specific commodity in question, defined as the value of production or consumption divided by total income.[1]

A natural choice is to use an equal percentage change for both farmers and consumers. If the price change is viewed as a long-term price change in nominal terms, this is a natural assumption. For example, long-term changes in farm prices, marketing margins and consumer prices may all be due primarily to growth of the money supply and inflation, which should affect each of those three items by the same percentage increase. However, if the simulated price change is viewed as a short term change in real prices (i.e. food prices rising more than other prices), then using the same percentage change for both farmers and consumers is equivalent to making some implicit assumptions that may bias the results of the impact analysis. This is an important point, because the recent surge in food prices was in fact a short-term change in real prices, not a long-term change in nominal prices.

The importance of marketing margins

For sake of illustration, assume that initial domestic farm and consumer prices are $P_F^0 = 10$ and $P_C^0 = 20$ (in units of local currency per unit weight). Assume now that the CIF border price increases by an amount that raises domestic consumer prices by 20%, so that $P_C^1 = 24$ (note that this is not the same as stating that the CIF border price increased by 20%). If we assume that P_F^0 also increases by 20%, then $P_F^1 = 12$. This implies that the real marketing margin has also increased by 20%, from 10 to 12. But if marketing systems are

[1] This formula only considers the immediate impact of the price change. It does not take into account behavorial responses to the price change, such as consumers shifting from rice to corn, or from higher quality rice to lower quality rice, when rice prices increase. Such responses will reduce the welfare impact of any price change, and the new welfare impact can be estimated by using demand and supply elasticities. See Minot and Goletti (2000) for more details.

competitive, it is not clear why marketing costs[2] should increase by 20% due to a change in world market food prices.[3] Thus, assuming identical real price changes for farmers and consumers implicitly assumes that marketing margins between farm and retail also increase in real terms by the same percentage amount. If instead we assume that real marketing costs and margins remain unchanged in the face of the world food price shock (we will call this Case 1), then $P_C^1 = 24$ would imply that $P_F^1 = 14$. In this case, a 20% increase in consumer prices is consistent with a 40% increase in farm prices. This does not mean that farmers benefit more than consumers are hurt: in absolute terms, the price increases by 4 units for both. The greater percentage increase at the farm level is simply a reflection of the fact that the base on which the percentage change is calculated for farmers is lower. This lower base is due to the fact that real resources are required to transform food at the farm level to food at the retail level, i.e. marketing costs are positive.

However, it is possible that absolute marketing margins in real terms are not constant in the face of an external food price shock. For example, traders may employ rules of thumb in setting prices that lead to equal percentage changes in both farm and consumer prices. In this case (we will call this Case 2), $P_F^{12} = 12$ instead of $P_F^{11} = 14$ (where the superscript 12 indicates time period 1, Case 2, while the superscript 11 indicates time period 1 and Case 1). In this case, the rules of thumb employed by traders lead to an increase in real marketing margins without any increase in real marketing costs. This scenario is indeed plausible, but if this scenario is to be used to analyze the impact on households, then the additional income earned by traders must be added to the incomes of some households in the economy (this assumes that trading is done by domestic residents, which is likely to be the case in most developing countries). This is because an equi-proportionate increase in farm and retail prices benefits traders as traders, but the standard impact analysis looks at welfare only from the point of view of individual agents (including traders) as producers and consumers. In other words, it ignores the fact that some of these producers and consumers also receive trading income that has increased as a result of the assumptions made about equal percentage increases in farm and retail prices.

Deciding how to allocate this income across quintiles is not an easy task, and the allocation is likely to be somewhat arbitrary because of lack of data. While traders in general are usually wealthier than farmers, it is less clear how wealthy they are relative to other segments in society. Surely, some large traders are very wealthy, but there are also many small traders who are not particularly wealthy. In order to avoid this issue of how to properly allocate trading profits across quintiles, we use Case 1 in our case study of Peru below and contrast it to Case 2 where no additional income is allocated to traders. A scenario of Case 2 without allocation of additional income to traders is consistent with how changing food prices are typically analyzed in the literature (Barrett and Dorosh, 1996; Budd, 1993; Deaton, 1989; Ivanic and Martin, 2006; Minot and Goletti, 2000).

To some extent, any number of different relative price changes between farmers and consumers could be assumed in an impact analysis. Ideally, the assumptions would be guided by high quality empirical data on how prices at different levels of the marketing chain vary in

[2] Under perfect competition, marketing margins are equal to marketing costs when returns to management are included in costs.

[3] It is true that higher farm prices increase working capital costs for traders, but working capital costs are only one portion of marketing costs. Thus, increased real farm prices do raise real marketing margins, but not by an identical percentage. For simplicity, we will ignore this increase in real marketing costs in the discussion.

different geographical areas, but such data are rare. Even when these data are available, there is still the problem of controlling for the influence of other developments (e.g. changes in oil prices, interest rates) that occurred at the same time that food prices increased. Given these problems, this paper will argue that only the assumption of constant absolute marketing margins is consistent with a true *ceterus paribus* analysis. In other words, if one wants to examine the impact of a shock to world food prices only (e.g. excluding the impact of rising fuel prices that might raise real marketing margins), then marketing margins should be assumed constant. If one argues that all shocks to world food prices will be accompanied by changes in real domestic marketing margins without any change in domestic real marketing costs (i.e. constant absolute marketing margins is a bad assumption), then the additional real returns to traders must be incorporated into the impact analysis.

Our assumption of a constant marketing margin is identical to that employed by Minot and Goletti (1998), who examined the impacts of rice price changes in Viet Nam. Their study is one of the few to analyze the welfare impacts of changing prices with explicit attention to the marketing sector (they use a spatial equilibrium model), thus allowing them to model different percentage price changes for farmers and consumers. In line with the reasoning above, the price changes used in their analysis were larger for farmers than for consumers. We do not use a spatial equilibrium model here, but instead generate a simple rule for deciding upon different percentage changes in prices for farmers and consumers that can be used in analyses less sophisticated than Minot and Goletti (1998). Using actual data from Peru, we then also compare the results of (i) assuming constant absolute marketing margins (Case 1) with (ii) assuming equi-proportionate price increases without allocating additional income to traders (Case 2).

Deriving a simple relationship between producer and consumer price changes

If equal percentage changes in farm and consumer prices introduce a hidden assumption about real marketing margins, what is the appropriate relationship to use between percentage changes in farm and consumer prices? The general derivation for Case 1 is relatively simple:

First, consumer prices P_C are equal to farm prices P_F plus a marketing margin M:

$$P_C = P_F + M \tag{2}$$

Note that prices should be expressed in comparable units, e.g. if farm prices are in currency per kg paddy and consumer prices are in currency per kg rice, then the milling ratio (kg rice per kg paddy) must be used to ensure equivalent units.

When taking differences this yields:

$$dP_C = dP_F + dM$$

The assumption of constant M gives:

$$dP_F = dP_C$$

We then divide both sides by P_F and multiply the right hand side by P_C/P_C:

$$\frac{dP_F}{P_F} = \frac{dP_C}{P_F} \bullet \frac{P_C}{P_C}$$

Which can be re-written as:

$$\frac{dP_F}{P_F} = \frac{dP_C}{P_C} \bullet \frac{P_C}{P_F} \quad (3)$$

This shows that the percentage change in farm price equals the percentage change in consumer price multiplied by the ratio of the consumer to the farm price.

Data sources to obtain the price ratio

There are several sources of data that could be used to obtain the farm to consumer price ratio in (3) for the food in question. One possibility is the HIES itself, provided it has data on either prices or quantities (data on expenditures and quantities can be used to calculate an implicit price). Another possibility is secondary data on prices, although one must be careful that such data are nationally representative and pertain to the same quality at farm and retail levels. If secondary data on farm prices are not available, and the HIES does not have data for either prices or quantities, it is also possible to use macro food balance sheet data (production, imports, exports, stock changes) coupled with expenditure and revenue data from the HIES to obtain an estimate of relative farm and consumer prices, as we will now show.

In a self-sufficient economy, consumer expenditures CE on the staple food will equal production value PV plus marketing costs MC (all of these numbers are in units of local currency).

$CE = PV + MC$

Which is equivalent to:

$P_C \bullet Q_C = P_F \bullet Q_F + MC$

where Q_F and Q_C represent the quantity of production and the quantity of consumption, respectively (which are equal under self-sufficiency).

Divide through by $(P_F \bullet Q_F)$ to obtain:

$P_C \bullet Q_C / P_F \bullet Q_F = 1 + MC/(P_F \bullet Q_F)$

Using $Q_c = Q_p$ (the units must be identical, e.g. kg of paddy converted to kg rice or vice-versa):

$P_C/P_F = 1 + MC/(P_F \bullet Q_F)$

Using $P_F \bullet Q_F = PV$ and $MC = CE - PV$ on the right hand side gives:

$P_C/P_F = CE/PV \quad (4)$

Thus the ratio of prices is equal to the ratio of CE to PV in a self-sufficient economy. In an economy that is a net importer of the staple food, consumer expenditures must first be scaled down by the ratio of domestic production to domestic consumption (which will be less than one); this gives consumer expenditures on domestically produced staple food (we assume that imports and domestically produced food are of identical quality), which can then be divided by production value PV to obtain the price ratio. In an economy that is a net exporter of the staple food, consumer expenditures should be scaled by the same ratio, which now however will be greater than one. Thus, in either case:

$CE' = CE \bullet (PROD/CONS)$

And $P_C/P_F = CE'/PV$ (5)

This reduces to equation (4) in the case of self-sufficiency, but it also holds for the more general case of net importers and net exporters.

An application to Peruvian data

We now present the results of using Case 1 and Case 2 (without distributing marketing income to any of the quintiles) for rice and potatoes in Peru to show the difference in results between the two cases. The analysis presented in this section is based on national household level data from the Enquesta Nacional de Hogares (ENAHO) in 2006. These are Living Standards Measurement (LSMS) type data and are collected annually by the national statistics institute (Instituto Nacional de Estadistica (INEI)) in Peru. The 2006 ENAHO survey covered a total of 20,577 households, 65 percent of which come from urban areas, while the remaining 35 percent live in rural areas.

Figures 1ab show, for rice, the welfare changes across quintiles for two separate simulations, Case 1 and Case 2. Case 1 assumes a 10% increase in farm prices and a 6.3% increase in retail prices. Case 2 shows a 10% increase in both farm and retail prices. Figure 1a is for the entire country, while Figure 1b is for rural areas only. The 6.3% increase in retail prices was calculated based on data from the Peruvian household income and expenditure survey on expenditures coupled with macro food balance sheet data as explained above.[4]

In the case of rice, Peru is a small net importer. Figure 1a shows that all quintiles lose from an increase in rice prices in both Case 1 and Case 2. It is not true that all quintiles in a net importing country must always lose, but if all quintiles do lose from an increase in prices, the country must be a net importer. Thus, this result is consistent with Peru's status as an importer.

Peru is predominantly urban, with rural areas accounting for only about 35% of the total population. Given that (i) Peru is close to self-sufficiency in rice (imports are about 3% of domestic consumption); (ii) nearly all domestically produced rice comes from rural areas; and (iii) that rural areas only account for a small share of the population, one would expect that some quintiles in rural areas are likely to benefit from an increase in rice prices. Indeed, this is shown in Figure 1b for Case 1, where all quintiles except the poorest benefit from an increase

[4] Note that the ratio of 6.3% to 10% is 0.63, similar to the milling ratio for rice. This is pure coincidence, however. In many Asian countries, a 10% increase in farm prices coupled with constant absolute marketing margins would be consistent with an approximate 7% increase in retail prices. Given Peru's mountainous topography, larger marketing margins than in Asia may be expected.

in rice prices. For Case 2, however, all rural quintiles are hurt, which is somewhat surprising given the stylized facts of the Peruvian rice economy. This result is most likely driven by the fact that Case 2 assumes an increase in marketing margins that is simply withdrawn from the income of the country, as explained earlier.

Figures 2ab show, for potatoes, the welfare changes across quintiles for two separate simulations, Case 1 and Case 2. Case 1 assumes a 10% increase in farm prices and a 4.9% increase in retail prices. Case 2 again shows a 10% increase in both farm and retail prices. Figure 2a is for the entire country, while Figure 2b is for rural areas only. As with the case of rice, the 4.9% increase in retail prices was calculated based on expenditure data from the Peruvian household income and expenditure survey coupled with macro food balance sheet data.

In the case of potatoes, Peru is again a small net importer. For the whole population, Figure 2a shows that, for Case 1, some quintiles win from an increase in prices while others lose, an unsurprising result. Case 2 shows that all quintiles lose. This latter result is not impossible given Peru's net import status, but it is mildly surprising.

In rural areas, Figure 2b shows that, for Case 1, all quintiles are winners from a price increase. In contrast, for Case 2, four of the five quintiles lose, and the third quintile experiences a very small net gain. This is very surprising given Peru's near self-sufficiency status and the small proportion of the population that lives in rural areas. As with rice, this is most likely driven by the fact that Case 2 assumes an increase in marketing margins that is simply withdrawn from the income of the country.

Another key difference between Cases 1 and 2 in the case of potatoes can be seen in the results for the first quintile. Under the Case 2 scenario, the poorest quintile is harmed substantially by a price increase for potatoes (with only quintile 4 being harmed more, but only slightly more). Under the Case 1 scenario, however, the poorest quintile benefits the most from a price increase. Thus, use of equi-proportionate price increases at farm and retail levels can even bias the relative impacts across quintiles.

These comparisons between Cases 1 and 2 show that it is important to make clear assumptions about marketing margins, and that failure to do so can have important effects on the results, both in terms of whether a given quintile wins or loses from a price increase, but also in terms of relative effects across quintiles.

Processing of wheat and maize

The above discussion focused on rice and potatoes, two commodities which undergo minimal processing between farm and consumer, although for both commodities there are still important marketing costs due to transportation and storage. However, similar reasoning will apply to commodities such as wheat and maize, where more substantial processing occurs between farm and consumer (in addition to transportation and storage). In the case of wheat, this commodity is produced by farmers but almost never purchased by consumers, who instead purchase wheat flour, bread or biscuits. In the case of maize, consumers do purchase maize, but sometimes maize grits or maize flour. More important, a substantial portion of maize is consumed as pork or poultry, even in many developing countries. In order to properly assess the impact of higher wheat or maize prices, it is necessary to estimate the percentage increase in the prices of end product that are consistent with any given percentage

increase in wheat or maize prices. It would be a major error to assume that a 10% increase in maize prices, for example, leads to a 10% increase in pork and poultry prices, and the same is true for wheat and wheat flour.

In order to develop rules of thumb for wheat and maize, we must know the value share of wheat or maize in their respective end products. Knowledge of this value share allows one to translate a given percentage change in the price of wheat into a percentage change in the price of wheat flour. Note that the required parameter is a value share, not a physical ratio such as a milling ratio.

Based on discussions with experts, we propose the following rules of thumb for use in developing countries (Table 1). These rules of thumb are proposed only to serve as guidance; if detailed data are available for specific products in specific countries, such data should be used instead. In order to obtain the appropriate percentage increase in the price of the end product, the value share in the final column should be multiplied by the percentage increase in the price of the farm commodity. For example, a 10% increase in the price of wheat would be consistent with a 6% increase in the price of wheat flour, derived by multiplying 10% by 0.6.

At an abstract level, wheat and maize are no different than rice and potatoes. There are costs that must be incurred to transform the farm commodity into a product that consumers can eat (storage, transport and processing). Further, it is most likely not appropriate to assume that these marketing costs always increase by the same percentage amount as does the price of the farm commodity. In such cases, the percentage increase in farm and consumer prices will be different, and Table 1 provides guidance on the appropriate percentage changes to use when one is analyzing the impact of a *ceterus paribus* increase in food prices.

Table 1. Value shares of wheat and maize for various end products, developing countries

Farm commodity	End product	Value share of farm commodity in end product
Wheat	Wheat flour	0.60
Wheat	Bread	0.50
Wheat	Biscuits and pastry	0.30
Maize	Poultry meat	0.20 to 0.40
Maize	Eggs	0.20 to 0.40
Maize	Pork meat	0.10 to 0.30

Summary

This paper has shown the importance of explicitly considering marketing margins in analyses of the impact of price changes on the welfare of different segments of the population. Failure to acknowledge the implicit marketing assumptions embedded in an analysis that assumes equal percentage changes for both farm and consumer prices leads to a bias towards finding negative impacts of higher food prices. In addition, the bias is not necessarily uniform across income quintiles; thus, failure to explicitly consider marketing margins could lead one to conclude that the poor are hurt relatively more than the rich by a price increase when in fact the opposite is true, or vice-versa. We have provided rules of thumb and simple techniques that may help to ascertain, in many circumstances, the percentage change in consumer prices that is appropriate for a given percentage change in farm prices.

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Figure 1a. Sensitivity of welfare results (quintiles 1 to 5) to assumptions about price changes
Case 1 and Case 2 for rice, Peru 2006
Entire country

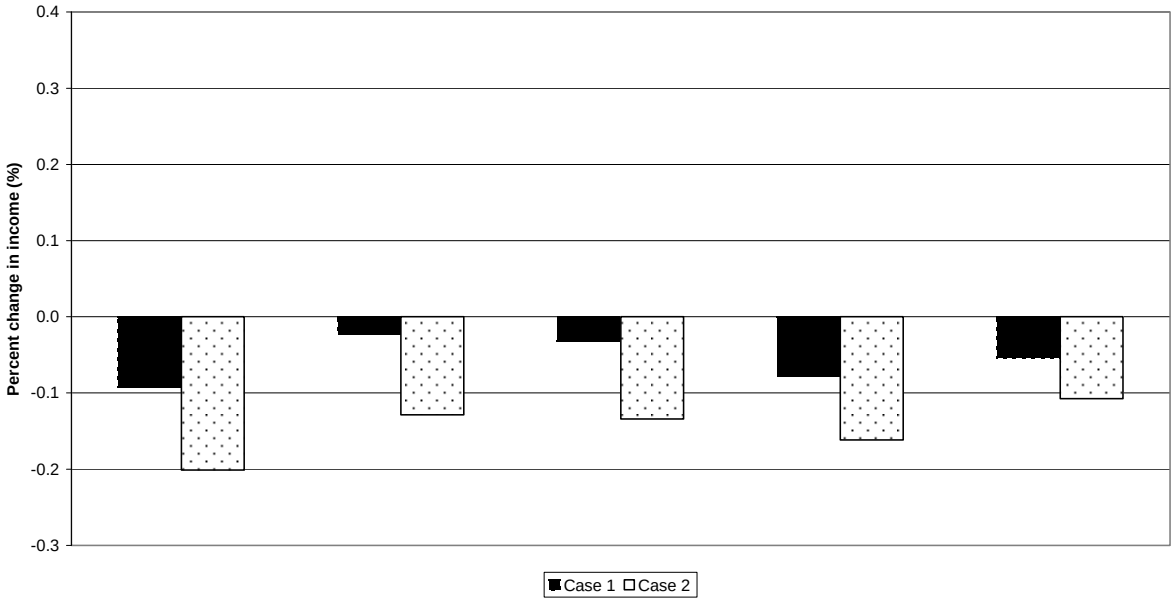


Figure 1b. Sensitivity of welfare results (quintiles 1 to 5) to assumptions about price changes
Case 1 and Case 2 for rice, Peru 2006
Rural areas only

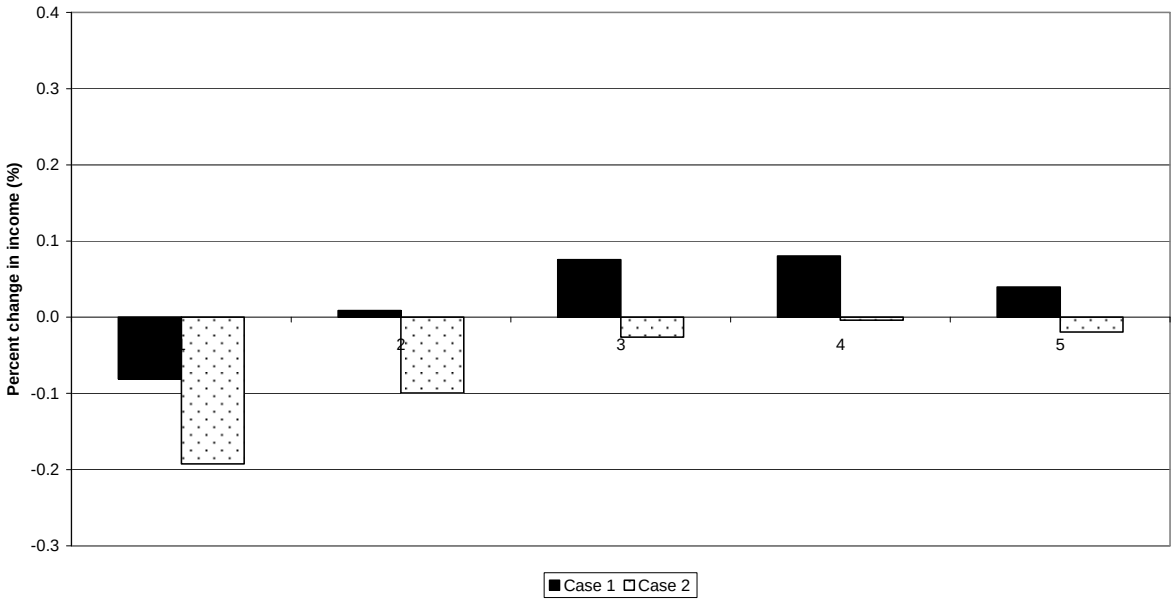


Figure 2a. Sensitivity of welfare results (quintiles 1 to 5) to assumptions about price changes
Case 1 and Case 2 for potatoes, Peru 2006
Entire country

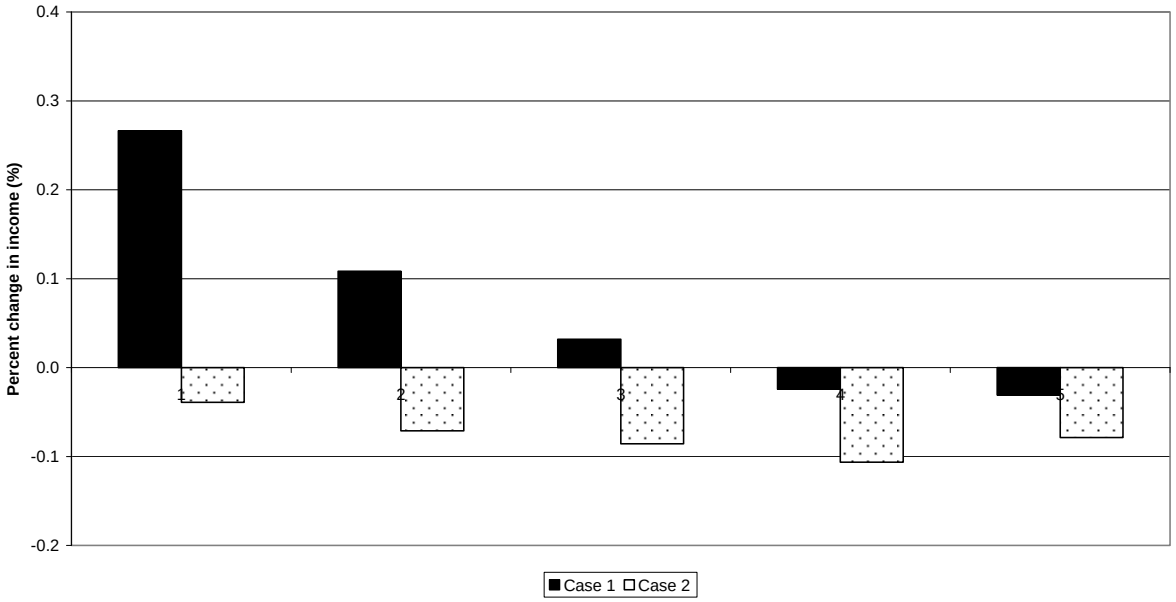
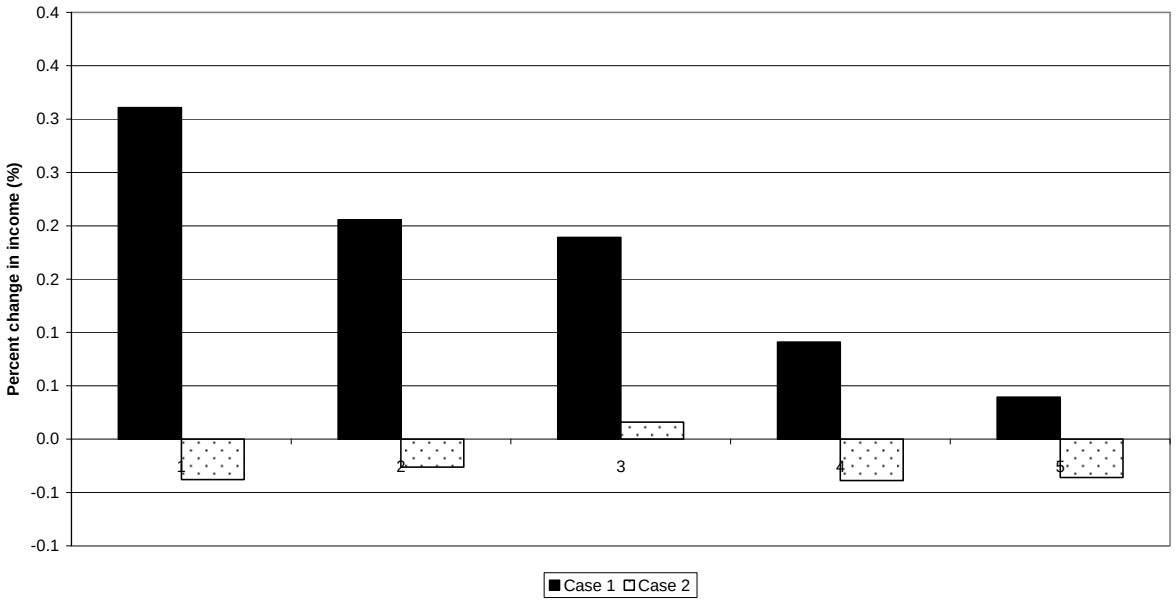


Figure 2b. Sensitivity of welfare results (quintiles 1 to 5) to assumptions about price changes
Case 1 and Case 2 for potatoes, Peru 2006
Rural areas only



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