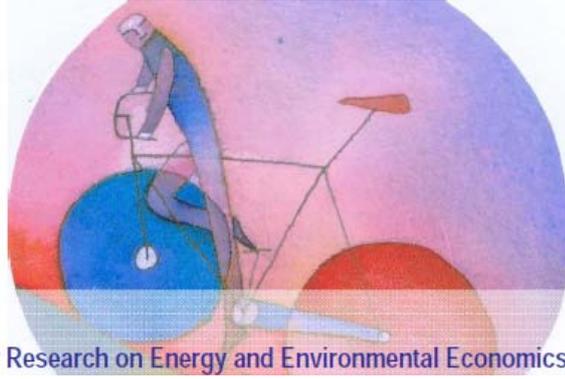


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Roberto Roson

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***IEFE - The Center for Research on Energy and Environmental
Economics and Policy at Bocconi University
via Guglielmo Röntgen, 1 - 20136 Milano
tel. 02.5836.3820 - fax 02.5836.3890
www.iefе.unibocconi.it – iefe@unibocconi.it***

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Assessing the cost of supplying water for agriculture: the food supply cost curve

Roberto Roson*

Abstract

As part of a “Regional Initiative on Water Scarcity in the NENA Region”, the U.N. Food and Agriculture Organization (FAO) has been proposing a practical tool for the assessment of investment projects, called the Food Supply Cost Curve (FSCC). This chapter illustrates the concept of the Food Supply Cost Curve, and which steps need to be taken to practically implement an FSCC evaluation exercise. It concludes by commenting on some preliminary findings obtained at the FAO when the FSCC has been employed in some countries in the Near East and North Africa.

Keywords

Water, Water Scarcity, Social Cost, Social Benefit, Cost-Benefit Analysis, Economic Efficiency, Food Security.

JEL Codes

D61, Q01, Q11, Q11, Q17, Q18, Q25.

1. Introduction

The conception, selection and implementation of medium-large investment projects in agriculture often suffer from a lack of serious economic analysis, assessing the validity, rationality and viability of the projects. Cost-benefit methodologies, so widespread in other economic sectors, are much less applied in agriculture. Instead, and especially in many developing countries, investments in agriculture are justified on the basis of some political objectives, lobbying, unfunded distributional

* Dept. of Economics, Cà Foscari University Venice, and IEFE Bocconi University Milan, Italy. E-mail: roson@unive.it.

concerns, vaguely defined environmental benefits and a misguided interpretation of food security (which is often thought as equivalent to self-sufficiency in food production).

A recent initiative by the U.N. Food and Agriculture Organization (FAO) have addressed the issue from the perspective of water availability in some countries of the Near East and North Africa (NENA). Essentially, the question is whether there are sufficient water resources in those countries to support new investments (extension or intensification) in agriculture, while considering to what other alternative (and possibly more valuable) uses the water resources can be directed (FAO, 2012).

As part of a broader “Regional Initiative on Water Scarcity in the NENA Region”, the FAO has been proposing a practical tool for the assessment of investment projects, called the Food Supply Cost Curve (FSCC). As it will be made clearer in the following, the FSCC is basically an implicit cost-benefit analysis, conducted from the social (rather than private) point of view. Since this instrument was meant to be used as a practical decision support tool by public officers in the government, ministries and regional agencies, it was designed in a quite straightforward fashion and implemented as a simple spreadsheet, to be possibly handled with free, open-source software.

The central idea underlying the FSCC is that there are always two ways of supplying food, of a given kind, in a country: either by importing it from abroad, or by producing it domestically. Domestic production is economically viable if the total unit cost, which includes a share of fixed costs (annualized), turns out to be lower than the unit gross import price (inclusive of trade and transport margins). Here is where the private and public views may diverge. If food production requires water (as it always do, for instance through irrigation) but the water is given for free or at a “symbolic” low tariff, then a farmer may find it profitable to produce something even when that would not be socially desirable. This may explain why we can see sometimes cultivations in the wrong places, like watermelons at the edge of a desert.

A typical FSCC evaluation exercise considers a set of specific investment plans that could be implemented to increase the domestic supply of a certain crop. For any plan, the expected production volume (or the increase over an existing level) is taken into account, along the various cost components, variable and fixed. In addition, the unit amount of water requirement is considered, and valued at an approximated (country-specific) marginal social cost of water. The total unit cost of production (comprehensive of the opportunity cost of water) is then contrasted with the gross import price for the same crop. Under normal conditions, only those investment plans whose unit cost is found below the import price should be implemented. Considering the whole expected production level of the selected projects, and an estimate of future domestic demand, it is also possible to assess what share of demand would be covered domestically. That share could well exceed 100%, as in that case it would imply that the country could profitably become an exporter.

This chapter illustrates in more detail the concept of the Food Supply Cost Curve, and which steps need to be taken to practically implement an FSCC evaluation exercise. It concludes by commenting on some preliminary findings obtained at the FAO when the FSCC has been employed in some NENA countries and for some crops.

2. The Food Supply Cost Curve Concept

In economic theory, the supply curve is a relationship expressing the volume of output supplied by a firm, or any other economic institution or aggregate (e.g., a country, a region), as a function of the prevailing market price. In a partial equilibrium setting, all factors different than the market price and affecting supply (income, other prices) are taken as fixed. The supply curve is normally *upward sloping*, because expanding supply implies mobilizing less productive resources (e.g., land, labour), which makes sense only if the market price is sufficiently high.

The Food Supply Cost Curve (FSCC) is a special type of supply curve, which is estimated to select economically viable investment options in food production, on the basis of an implicit cost-benefit analysis. Its key characteristics are:

- It refers to a specific region (typically a country)
- It refers to a specific future year
- It considers *additional* supply, over a specific baseline (e.g., current consumption levels)
- It refers to a specific crop (e.g., wheat)
- It considers *a finite, discrete set of supply options*, often in the form of investment projects

The selection of the crop, the future year, the number and type of investment depend on the context of the exercise. For example, the crop may be the most consumed one in a region; the reference year may be the one typically considered in economic planning documents; the supply options may be the ones already under debate. Those supply options may include investments in land intensification, irrigation schemes, etc., but also unconventional measures like regional agreements on food trade, or investments in foreign agricultural resources.

As the FSCC only considers a limited number of supply options, it is *stepwise shaped*. By comparing the FSCC with both the international reference price for the crop at hand and the forecasted domestic consumption curve, it is possible to *select the economically viable supply options*, determining also the optimal amount of imports.

As it will be made clear later in this chapter, the basic framework of the FSCC can be extended to account for:

- Non-monetary costs, in particular the opportunity cost of water resources. This means that the supply curve refers to the optimal social supply, not to private incentives.

- Uncertainty in parameters and data. Results of the model would in this case be expressed in probabilistic terms. For example, the model could compute the probability, for each investment option, of being economically viable.
- Volatility in international food prices and food security. If international prices are volatile, it is possible that domestic supply could be efficiently expanded above the levels that would otherwise be set under constancy of world prices.

3. Implementing a Food Supply Cost Curve

3.1 Supply Options Records

The construction of a supply curve is based on the analysis of a set of investment options. Therefore, it is necessary to specify a “supply option record” (SOR) for each analysed alternative.

Information should come from technical data and business plans, and should be sufficiently detailed and not referring to vaguely defined investment options. By way of example, a SOR could have the following structure:

Title of investment/project			
Details			
Investment set-up cost (cent. value, range min-max)			
Duration of investment			
Operating cost			
Yield (net)			
Blue water requirement			

The set-up fixed cost includes all initial investment in machinery, infrastructure, and durable goods. In other words, expenses necessary to start the initiative, which will not be reiterated once the investment will become operational. If the set-up phase covers more than one year, the initial costs should be discounted at a standard interest rate.

For this item and the following ones, three values should be specified. A “central value” expresses the best available estimate for the variable at hand. To account for uncertainty, also a range of values, from a minimum to a maximum level, should be determined. The minimum and the maximum should not be taken literally as “borders”. Rather, the minimum (maximum) is a subjectively assessed bound, which is “very unlikely” to be surpassed under normal circumstances. In order to get informative results from the FSCC, efforts should be made at keeping the interval range reasonably small.

The duration of the investment is the time span considered for the amortization of the initial fixed cost. Therefore, it is different from the lifetime of the physical infrastructure. It is used here to spread the initial cost at constant rates, although more sophisticated amortization schemes could be considered.

The operating cost refers to the variable costs incurred in each year of normal operation: wages, energy, fertilizers, insurance and other services, etc. If the project deals with ameliorations of an existing infrastructure (e.g., intensification projects), only the costs in addition to the current operating costs should be considered. Analogously, only the increase in output levels should be accounted for.

There is one important consideration to make about the computation of all cost elements. All costs should be estimated, whenever possible, *net* of any tax or subsidy, but possibly including external costs (or benefits valued in monetary terms).

A special case is given when the expansion of food supply is obtained through crop substitution. In considering this option, all monetary costs should be accounted for as differences (positive or negative) with respect to the current costs, incurred in the production of the crop being substituted. On top of this, the foregone revenue (expected yield for the actual cultivation multiplied by net international price) should be added, as an opportunity cost.

The yield row specifies the expected (additional) supply generated by the considered project, again as a central value, minimum and maximum. The variability of the yield is due both to uncertainty about the actual degree of success of the investment, and to the natural seasonal variability of crop yields.

The blue water requirements refer to the physical amount of water needed to support production in the proposed scheme. Only surface water, susceptible of alternative uses, needs to be considered, thereby excluding rain or natural soil moisture.

Information included in a SOR is used in the construction of the supply curve to get two key variables, identifying each option: (a) expected yield, (b) average per unit cost. The average cost is obtained by dividing the total cost by the output volume (yield). In turn, total cost is given by the sum of three elements: (1) amortization quota of set-up costs, that is the ratio of fixed costs and duration years, (2) variable operating costs, (3) variable opportunity cost of water, that is the product of water requirement by the unit opportunity cost of water. The methodology for the estimation of the latter is described later in the following.

3.2 Demand and World Price

In the selection of investment options, the FSCC is contrasted with a reference international price for the crop under consideration and with an associated domestic consumption demand. Both refer to the year chosen as horizon for the analysis.

When the time horizon is sufficiently close, current market prices (which can be obtained, for example, from the FAO-OECD Agricultural Outlook [OECD/FAO (2016)]) can be a good basis. Whenever the country is expected to be an importer for the selected crop, the international price should be intended as CIF (cost, insurance, freight), that is, inclusive of all margins (trade, taxes (foreign, not domestic), services) necessary to make the good available in the domestic market. To account for trade and transaction costs, a mark-up on the international price could then be applied. If, on the contrary, the country is expected to be an exporter, the international price should be taken as FOB (free on board), that is, net of export costs. This means that the reference international price should be lowered by a certain degree.

The demand function expresses the *additional* domestic consumption for the selected crops (on top of current consumption levels), forecasted for the specific horizon year. Therefore, *the demand is not a single number*, but a relationship between consumption volume and market price. Since it refers to the future, estimates of the demand must take into account changes in income, economic development and demographics.

Different methodologies, at various degrees of complexity, are available for the estimation of the demand curve. Some demand estimates may be available from previous national studies, and may be adapted for use in this context. Alternatively, the simplest way to estimate a demand curve is assuming that it could be reasonably approximated by a linear function. Calibration of a linear demand requires the identification of two points, that is two pairs price-quantity, which the function is assumed to cross through. Two possible candidate points are: (a) the additional domestic consumption levels at the future year if market prices stay unchanged, (b) same as before, but with prices increased or decreased at an arbitrary rate. Alternatively, instead of a second price-quantity pair, a price elasticity of demand could be provided.

3.3 Selection of Efficient Supply Options

The process of selection of (socially) efficient projects for the expansion of domestic production is graphically depicted in Figure 1. It is assumed that the country under consideration is an importer for the specific crop. The vertical axis indicates the internal market price, whereas the horizontal axis measures the quantity of the crop, above the quantity consumed in the baseline.

Each investment is associated with a rectangle, whose height indicates the unit average cost as computed in the previous section, and the base corresponds to the estimated yield. All options are first sorted, from left to right, in ascendant order of cost, to create a stepwise domestic supply for the crop. A horizontal line at a specific point on the vertical axis represents the reference international

price. A negatively sloped function is the estimated domestic demand for the crop (on top of existing consumption levels), expressing the market price as a function of demanded quantity.

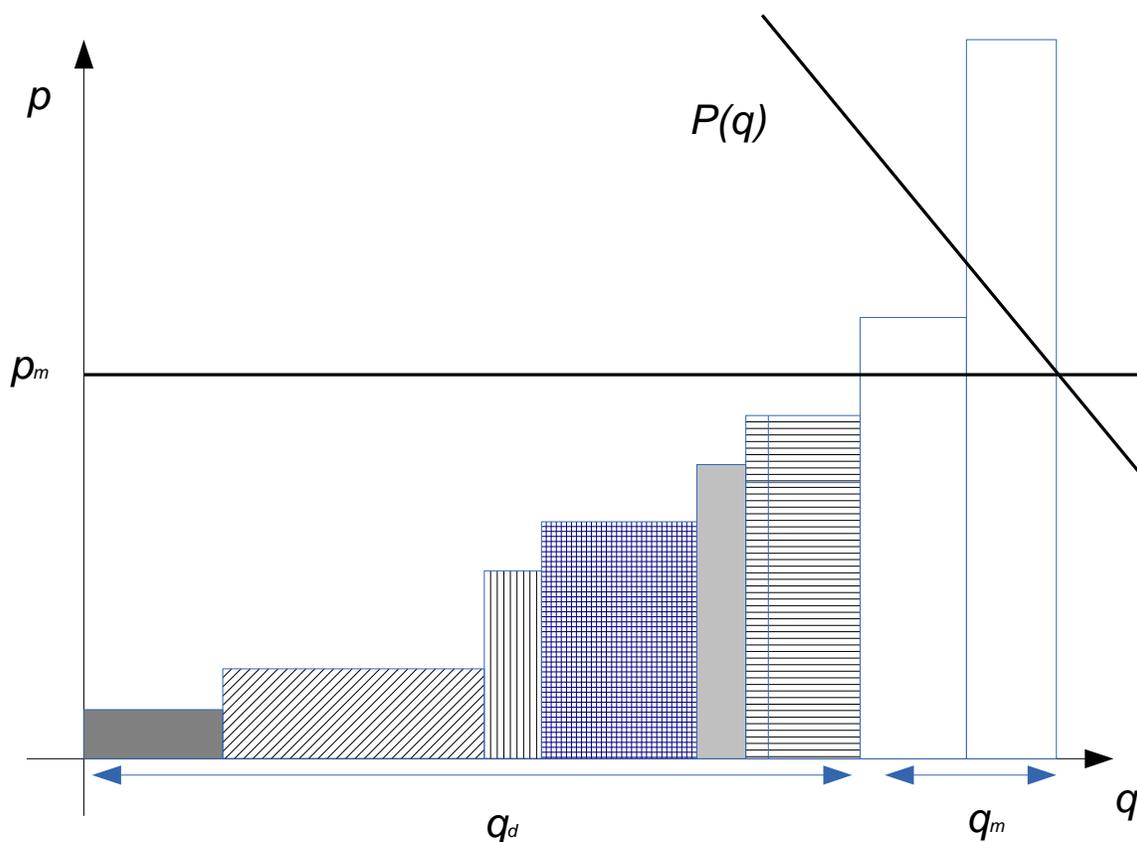


Figure 1 – Stepwise domestic supply and selection of options

The selected domestic supply options are simply those whose unit cost is lower than the international price (inclusive of trade margins). In Figure 1, projects associated with shaded rectangles are selected. The sum of yields obtained by all efficient options identifies the domestically produced quantity q_d .

At the price p_m , at which the good can be purchased on international markets, the domestic demand exceeds domestic production. The difference q_m is simply the optimal level of imports. However, domestic supply could also exceed domestic demand. In that case, the difference between supply and demand would identify optimal export levels.

3.4 Uncertainty

The framework described in the previous section should be regarded as a mere starting point, as it needs to be enriched with a number of additional elements, to make it more realistic and useful. One important aspect that needs to be taken into account is the uncertainty associated with the values of all parameters: costs, yields, international prices and demand. This is graphically illustrated in Figure 2.

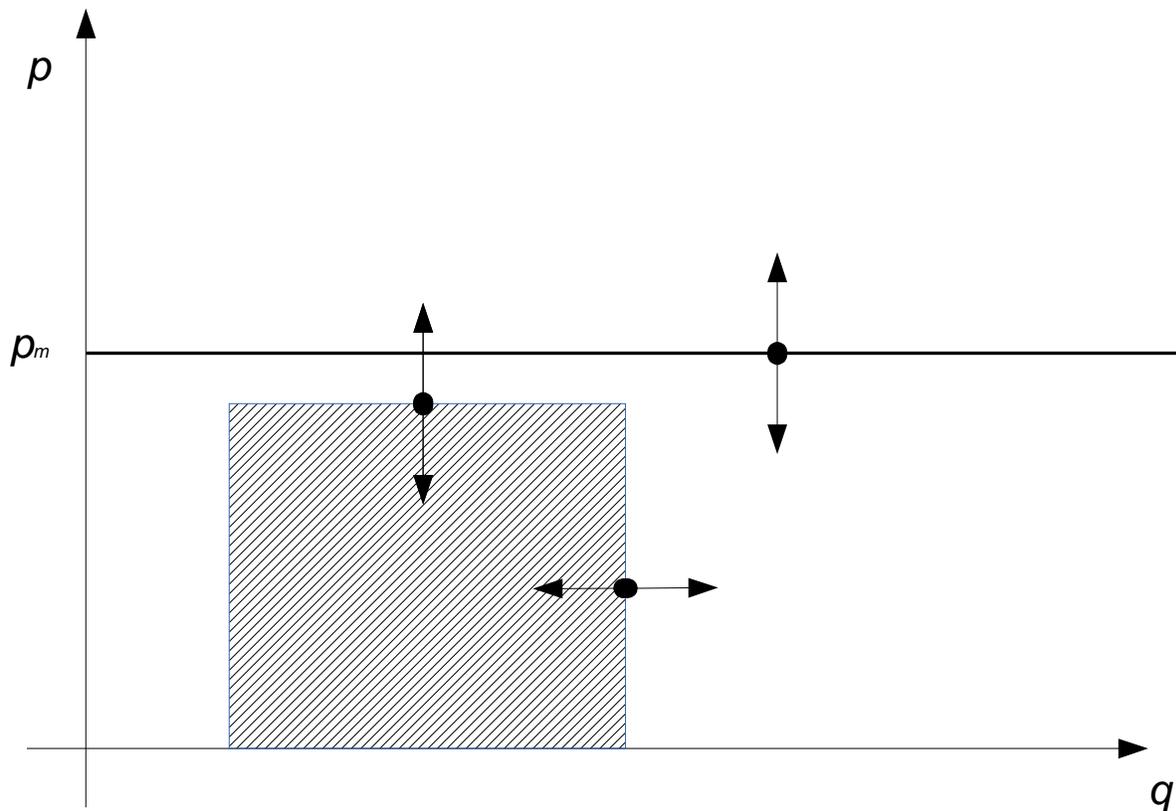


Figure 2 – Effects of uncertainty in model parameters

It is possible to account for uncertainty in parameter values by considering the parameters as *random variables*: variables whose exact value is unknown, and it is replaced by a *probability distribution*. For practical purposes, two probability distributions are especially relevant here: the *rectangular uniform* distribution and the *normal* distribution.

In the uniform distribution, the random variable can take any value from a minimum to a maximum, and all values in this range are all equally likely. In this context, the minimum and the maximum can be taken directly from the values indicated in the SOR. Any linear combination of uniform random variables is a uniform random variable itself (this is a useful property, which can simplify the analysis). The practical interpretation of the uniform distribution is the following one: it is known that the values must be inside a given range, but which values will be actually taken inside the range is completely unknown.

In the normal case, the probability distribution is symmetric and bell-shaped. Parameters can, in principle, take any value (even negative), but the probability associated with values far distant from the average central value are extremely small, virtually zero. The normal distribution possesses several interesting properties, including that any linear combination of normal random variables is a normal random variable. As its name may suggest, the normal distribution is the obvious choice to represent the case in which one central value is the best available estimate, and there is a variable degree of confidence on the reliability of this base estimate. A normal distribution must be symmetric. Therefore, minimum and maximum values in the SOR should be equally distant from the central (average) value, and this distance could be interpreted as *standard deviation* (or a multiple of it). In a normal distribution, there is a probability of (approximately) 68% that the value falls in the range [central value +/- standard deviation]. Clearly, the smaller the standard deviation, the more confident we are on the central value estimate.

The probability that a project is selected is the probability that its unitary cost (c) turns out to be lower than the international reference price (p). Both are random variables. Equivalently, this is the probability that the random variable $p-c$ exceeds zero.

The methodology can be easily illustrated for the uniform rectangular distribution. The random variable $p-c$ is uniform, as both p and c are uniform. Its minimum value is $\min(p)-\max(c)$, whereas the maximum is $\max(p)-\min(c)$.

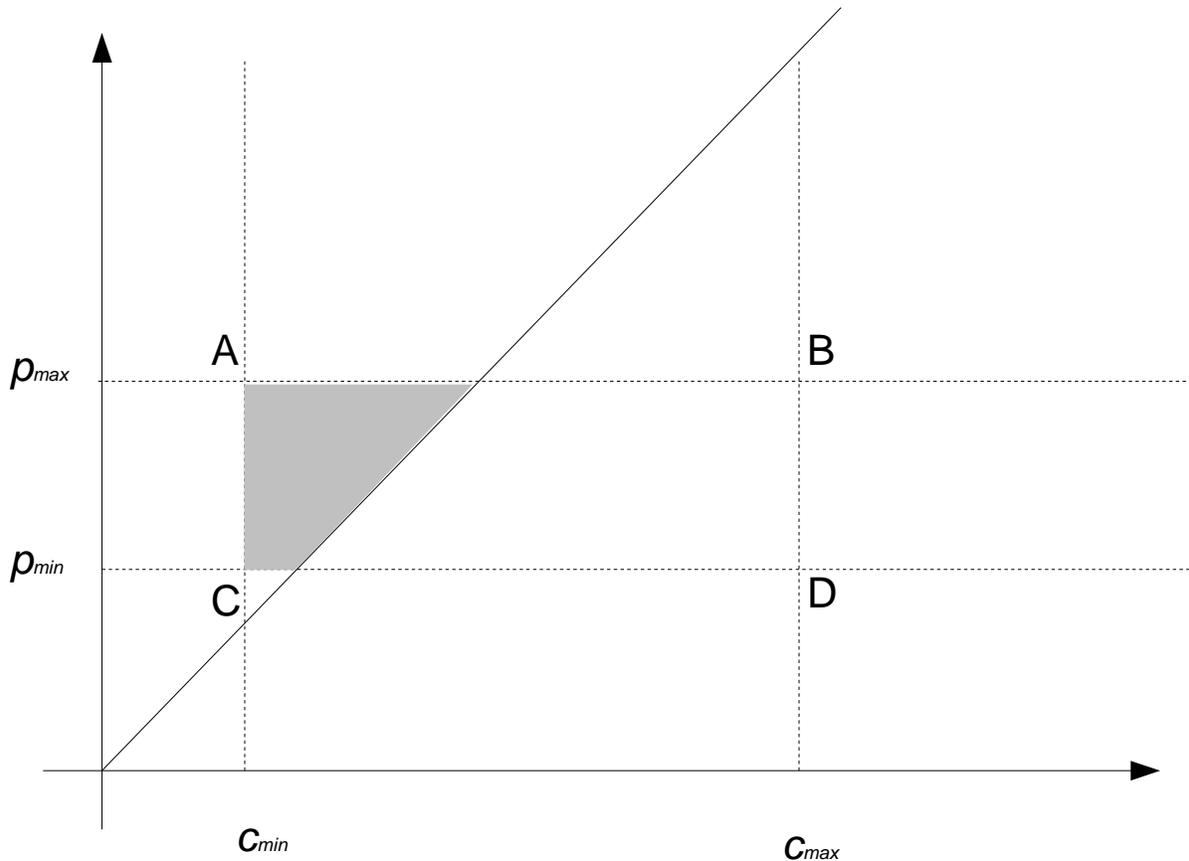


Figure 3 – Realization space of random variables p and c

Consider Figure 3. Each joint realization of p and c is a pair of values, corresponding to a point inside the rectangle ABCD. The project under consideration will be selected if the point falls in the grey shaded area on the left. Since each point in the rectangle is equally likely to occur, the probability ($Prob$) that the option will be selected is given by the ratio between the area of the grey trapezoid and the area of the whole rectangle ABCD. It can be easily demonstrated that this amounts (for the uniform distribution case) to:

$$Prob = MIN \left[\frac{MAX[\max(p) - \min(c), 0]}{\max(p) + \max(c) - \min(p) - \min(c)}, 1 \right]$$

In the formula above, the estimated probability is restricted to fall in the $[0,1]$ range. Of course, a zero probability excludes the possibility that a given option would be selected (and the opposite, of course, is for the probability equal to one). A probability greater than 0.5 means “it is more likely than not that the considered option will turn out to be economically viable”.

The same process can be repeated using normal distributions instead of uniform ones. Again, the random variable $p-c$ would be normal, if both p and c are normal. The selection probability, in this case, would be given by the definite integral of the $p-c$ probability function in the range $[0,+\infty]$. Despite the seeming complexity of the calculation, this is a standard statistical procedure.

After selecting the viable projects, the expected volume of imports can also be described as a random variable, using a methodology almost identical to the one illustrated above. Total domestic demand would be variable because the international market price is random but, if the demand were a linear function, the nature of the demand distribution would reflect the one of the international price (uniform or normal). Total domestic supply is the sum of all yields of the selected projects, which is also a random variable (uniform or normal). Expected imports are just the difference between domestic demand and domestic supply. Of course, the difference between two random variables is again a random variable (uniform or normal).

3.5 Accounting for the Opportunity Cost of Water

The unit cost of each project should include all social costs. Here, an emphasis is given to the role water resources can play in terms of economic efficiency of the different alternatives. To this end, it is important to notice that a full, properly functioning market for water does not actually exist. Water is a production factor, which is not fully paid or is not paid at all, yet it does have an economic value, which can be assessed in a variety of ways.

The opportunity cost of water is a sort of “implicit price”, or value, of water (in a certain region). Blue, surface water can be used in agriculture (e.g., for irrigation), but could also be used for municipal consumption, tourism or other industrial activities. Its price is related to the quality; for example, recycled water can be used for irrigation even if it does not comply with drinking standards.

A complete assessment of the opportunity cost of water for the different countries is a complicated exercise. Therefore, to conduct an FSCC exercise it could suffice to get a reasonable value (range) for this cost, using an eclectic approach and several possible sources of information:

1. Water price in the few places in which a formal market exists (e.g., Australia)
2. Lagrange multipliers associated with water constraints in land use models
3. Simulation of a water market

The latter solution is illustrated in Figure 4.

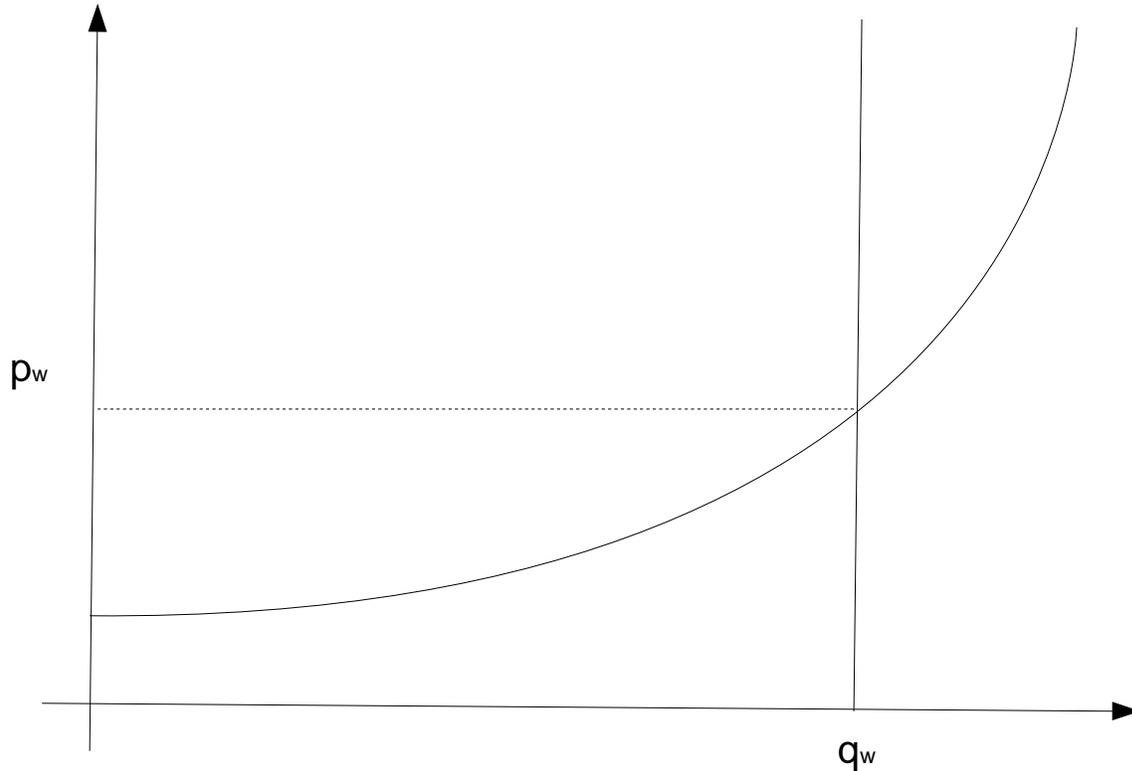


Figure 4 – Computation of the opportunity cost of water

In Figure 4, q_w stands for the consumption of water in the country at the future reference year used for the construction of the FSCC. Its estimation must involve scenarios of economic and demographic development. The other curve is another supply function, this time applied to water, built by considering the different technological and organizational solutions, like in the document realized by The 2030 Water Resources Group (2009). p_w is the estimated opportunity cost.

When assessing the opportunity cost of water, attention should be paid to the fact that the potential transfer to alternative uses *should actually be feasible*. Therefore, geographical location of water resources, actual demand by non-agricultural sectors, water quality, etc. must all be taken into account.

The unit cost of water adds to the other production costs in the valuation of the different options in the FSCC. It is therefore possible that a project, relatively cheap in terms of direct monetary costs, could require considerable amounts of water. If water is physically scarce and, at the same time, necessary in different sectors, then its implicit price could be high, possibly making the project not sustainable.

In some circumstances, different levels of water quality may be taken into account. For example, some projects may entail using treated wastewater, which of course has a very different opportunity cost than potable water. The methodology to compute the opportunity cost remains basically the same, but different cost levels would then be associated with different water supply alternatives.

3.6 Food Security and International Price Volatility

The FSCC approach can be appropriately adjusted to account for price volatility in international markets for agricultural commodities. To the extent that only volatility in international prices is considered, disregarding other possible sources of volatility (e.g., in the volume of domestic supply), then the framework can be easily adapted by adding a *risk premium* to the reference price in the selection of domestic supply options.

The principle is similar to the one we can see in financial markets, where risky investment command a higher expected return, and can be illustrated through an example. Look at Figure 5, where a *utility function* is drawn as a function of consumption levels, which in this context refer to the crop considered in the FSCC. The utility function is *increasing* (welfare is higher with more consumption) and *concave* (the welfare gains associated with increments in consumption get smaller if consumption is already quite high).

Suppose that international prices can take only two values, possibly with the same probability: in bad times (*b*), prices are “high” and consumption levels “low”, in good times (*g*), the reverse occurs (low prices, high consumption). The associated welfare levels of the two states are U_b and U_g in Figure 5.

What consumption level (and associated price) would be considered *equivalent*, in terms of *expected utility*, to the situation described above, under the assumption that *international prices stay constant at a given level*? The answer to this question is obtained by solving the following equation, equating expected utility with and without price volatility:

$$U_e(q_e(p_e)) = \frac{1}{2}U_b(q_b(p_b)) + \frac{1}{2}U_g(q_g(p_g))$$

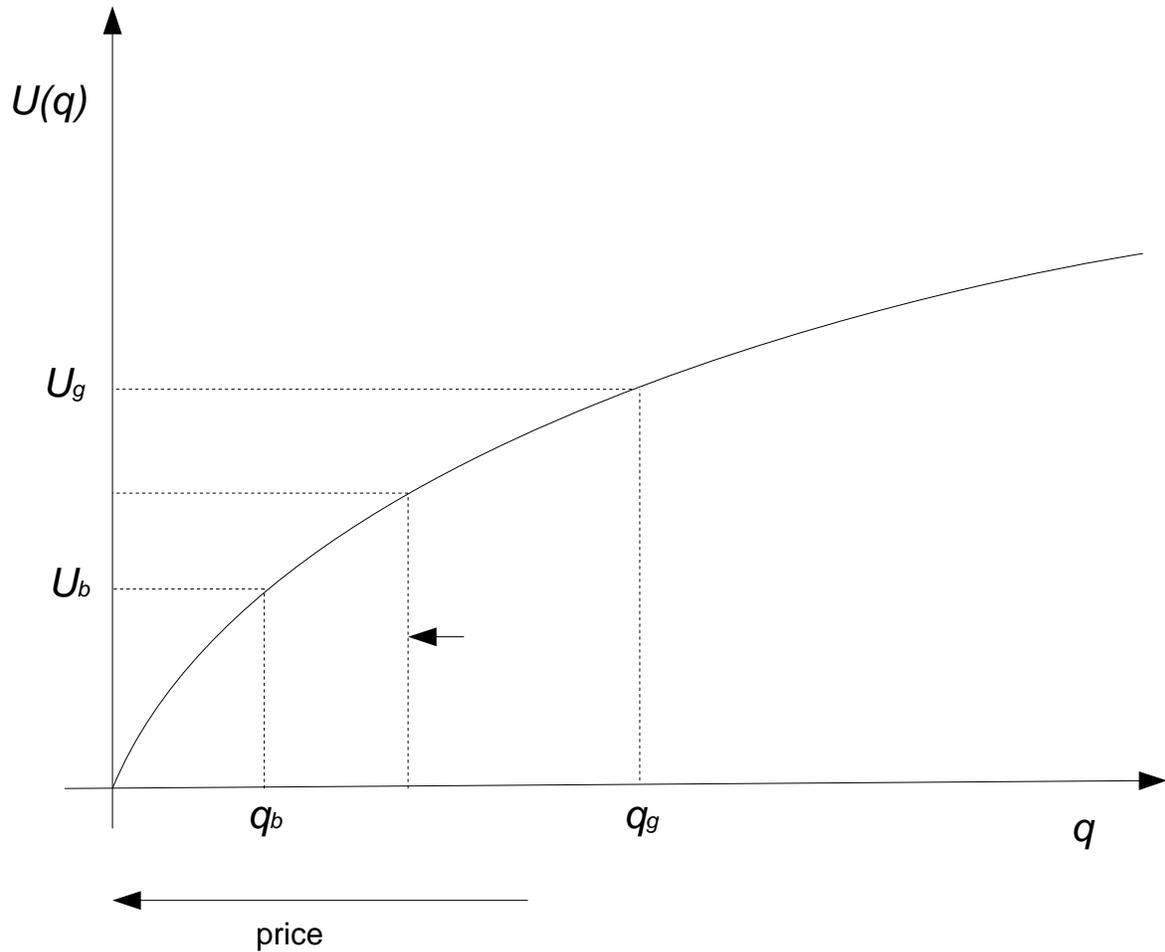


Figure 5 – Utility function and the certainty equivalence

It is easy to see that, because of the concavity of the utility function, the *certainty-equivalent* international price p_e is higher than the average (expected, central value) of the international price (p_c):

$$p_e > \frac{1}{2}p_b + \frac{1}{2}p_g = p_c$$

$$p_e = p_c + r$$

In other words, under the hypothesis of volatility in international markets, the reference price is augmented by a *risk factor* r . It can be easily demonstrated that the risk factor depends on the

curvature of the utility function: a more concave function expresses a higher degree of *risk aversion*, implying a higher risk premium.

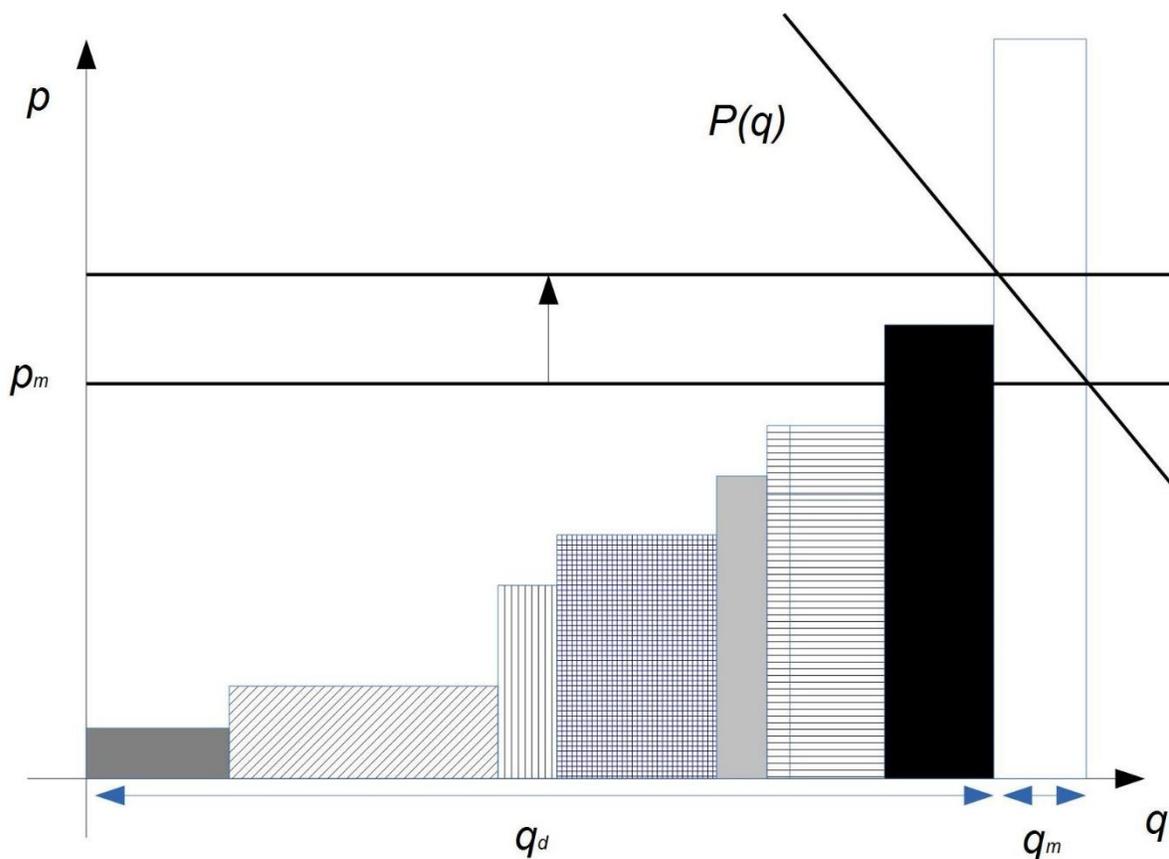


Figure 6 – Options selection at a higher international price

Figure 6 illustrates the implications of raising the reference international price in the process of selection of investments in the FSCC. The full black rectangle represents a supply option that would not have been selected at the expected international price p_m . Now, after adding the risk premium r , that option becomes viable. The economic reason why this option is now being selected is that it works as an *implicit insurance scheme* to get some *consumption smoothing*: lower consumption in good times, more consumption in bad times.

Remember, from the previous section, that the international reference price can be expressed as a random variable. The example above can be generalized to the case where the international price can take any value in a continuum. In this case, the risk premium can be numerically estimated, possibly using the same probability distribution as in the uncertainty assessment.

Computing the risk premium, however, requires some additional information. One sensible solution could be focusing on the welfare of the poorest consumers in a country (e.g., first decile of income distribution), as an *indirect* way to account for *equity concerns*. In this case, one needs to choose a representative utility function, based on a single parameter for risk aversion (e.g., CRRA, CARA functions), setting the parameter value at a level considered realistic in the applied economics literature. Second, a demand function for the (poor) representative consumer should be defined, to describe the link between market price and (per-capita, per-household) consumption levels.

Alternatively, one may want to resort to some empirical estimates available in the literature. A survey of numerical estimations for risk aversion in consumption reveals that a reasonable value for the risk premium would be a +10%/+20% mark-up on the reference international price.

3.7 The Expected Social Surplus

The expected social surplus is a monetary measure of the net welfare associated with the implementation of each project or supply option. It is computed as the difference between the average international reference price, possibly inclusive of the risk premium (if risk aversity is accounted for), and the average estimated unit cost, multiplied by the average estimated production level.

The higher the ESS, the higher the priority that should be assigned to the corresponding project. What is the difference between ESS and the selection probability? The selection probability tells us how likely it is that a certain project will be economically viable, from a social point of view. However, a viable project could generate a limited expansion in the supply, whereas it may be desirable to implement first a project, which gives lower unitary benefits but higher total benefits, because of a larger expansion of supply.

An interesting aspect of the ESS is that *it allows assessing priority across several food commodities*, if several FSCC have been estimated. The various projects for the different crops may be alternative, or not. For example, in the case of new cultivated land (extensification) you can select alternative crops for plantation. The ESS can suggest which crop would be the best solution (although we abstract here from the explicit modelling of crop rotation techniques, etc.).

4. Concluding Remarks: Some Preliminary Insights

The Food Supply Cost Curve has been implemented in a series of pilot studies conducted, under the assistance of FAO, in Oman, Morocco, Tunisia, Jordan and Egypt. In all these countries, two crops have been considered: one common for all (wheat) and another one, different by country, representing a

specialized product. This dual approach is intended to underline the contrast, often emphasized by the FAO, between “staple food” and “value crop”.

Numerical results are all preliminary and still subject to revision, so they will not be reviewed here. Nonetheless, a clear picture seems to emerge from the available set of FSCC exercises. The typical result is that projects of expansion of wheat production in countries of the Near East and North Africa are never economically viable, especially after considering the necessary water resources involved. In other words, it is far more convenient importing wheat from countries like Ukraine, than producing it internally. This result holds, despite volatility in international commodity prices and a very prudential attitude in the domestic agricultural policy.

Results are more nuanced and mixed for premium crops, like tomatoes in Oman, sugar in Morocco or strawberries in Jordan. The overall insight is that, under specific circumstances, these agricultural productions can turn out to be economically and socially advantageous.

The finding that semi-arid countries do not possess a comparative advantage in the cultivation of wheat can hardly be defined as a surprise. Indeed, the FSCC analysis simply supports with data and economic reasoning what could already be grasped by common sense. On the other hand, all this makes even more difficult (at least, from a purely economic viewpoint) understanding why so many governments in the region insist in planning expansion of domestic supply for wheat and other “staple foods”, and are considering as a policy objective raising the level of self-sufficiency.

This kind of policy is getting ground especially after the 2008 global food crisis. From 2003 to their peak in mid-2008, the international prices of maize and wheat roughly doubled, while rice prices tripled in a matter of months rather than years, with very serious societal consequences. Some commentators even argue that this crisis is at the root of the so-called “Arab spring”. In those days, some possible culprits were identified: rising oil prices, growing biofuels demand, evolving Asian diets, declining research and development in agriculture, slowing yield growth, low stocks, macroeconomic imbalances, financial speculation, droughts. However, more recent research (Headey, 2011) neatly recognize as the main explanation a series of adverse trade shocks, triggered by panic-led policy responses in the various food importing and exporting countries.

This result simply confirms the one, which has already emerged in most economic analyses of the great famines of the past: even if a crisis may have been initiated by some natural phenomenon (e.g., adverse climatic conditions), most catastrophic consequences can ultimately be imputable to bad policy and wrong human reaction. From this perspective, it is even more surprising that many developing countries keep pushing in the wrong direction.

Of course, economics alone cannot fully explain the making of agricultural policy. Economic inefficiencies in the agricultural sector, in both developing and developed countries, are nonetheless sizeable as well as hidden: they are not fully perceived by policy makers and citizens. Yet, a legitimate question should be raised, especially in the case of relatively poor and developing countries: how

many universities, infrastructure, services are not being realized, because resources are wasted in badly designed agricultural projects and policies?

This kind of reasoning applies especially well in the case of water resources. Water is employed in agriculture without fully considering the possible alternative uses of water resources in other sectors of the economy, or even between different agricultural sub-sectors. More generally, an economic analysis of water usage and allocation is totally lacking in most water-scarce countries. In this respect, the Food Supply Cost Curve can be seen as a modest effort to inject a little more economic rationality into the practice of agricultural policies.

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