Israel and Water

Martin Sherman, Oct. '91.

The water problem in Israel has reached such a degree of severity that it exceeded the limits of an economic problem and has assumed the dimensions of a strategic one which impinges upon her very physical survival.

For the purposes of this distinction, the difference between an economic and a strategic approach to a problem is that in the former instance, resources are considered given and finite, and principle focus of attention is on ways to allocate them optimally; whereas in the latter case, the point of departure is not available resources but desired objectives, and the principle focus of attention is on marshalling and activating the resources required for the attainment of these objectives.

In the context of the Israeli water problem, it can be said with no little degree of accuracy, that the proponents of economic approach tend to stress the demand for water and the need to reduce it, whereas the proponents of the strategic approach tend to stress the supply of water the need to increase it.

The full significance of this distinction will become clear later, however at this stage it will suffice to point out that it would be a grave error to believe that Israel has sufficient water and that a suitable pricing system would bring about a rational allocation satisfying all appropriate needs. For underlying this claim is the implied assumption that if the water supply to agriculture were to be reduced, there would be enough water available to satisfy the non-agricultural demand (domestic, municipal, and industrial).

This assumption is, however, totally invalid.

At present the national water system in Israel comprises three major sources:

The Sea of Galilee (Kinneret)
The Coastal Aquifer
The Mountain (Yarkon-Taninim) Aquifer

In the current year, if the danger levels in these three reservoirs are not to be breached, it will be possible to supply a total quantity of 550-650 million m3 (150-200 million m3 from the Sea of Galilee, 150 million m3 from the Mountain Aquifer, and 300 million m3 from the Coastal Aquifer). This is roughly equivalent to the quantities required for non-agricultural purposes. Consequently the entire output of the present national system is required for non-agricultural uses, even without taking into consideration of the increase in future consumption due to population growth and higher standards of living. Thus any supply for agricultural uses necessarily implies over-exploitation of the these sources.

As the non-agricultural demand is relatively inelastic, especially in the short run, it is difficult to see any feasible way to reconcile balanced management of these resources over time[1], with an increased supply to the non-agricultural sector at the expense of the agricultural sector since, as was shown above, any supply to agriculture necessarily implies continuous over-exploitation of the resources.

In the longer run the picture is if anything bleaker.

Israel is a country devoid of natural riches. The only resources she has at her disposal are human resources. Consequently, her future development, indeed her very survival is dependent on the quality and ability of her people. Consequently one of her most vital strategic aims is to generate a quality of life which can compete with that in other countries which may constitute an alternative abode for talented Israelis with high earning capacity. Water is an important component is generating the necessary quality of life required by this segment of the population.

Now if one compares the figures for water consumption in Israel with that in California where roughly the same weather conditions prevail, some disturbing conclusions emerge. Whilst the average municipal consumption in Israel is roughly 75 m3 per capita per annum, in California the average household consumption alone is between 130 - 200 m3 per capita per annum. Thus if total municipal consumption in Israel were to reach the level of domestic consumption representative of the Western living standards, and the local population were to reach 7 mill, the entire natural supply (including also sources not presently incorporated in the national system such as the minor aquifers in the Arava and the Jordan Valley) will be required to satisfy municipal needs.

It is therefore clear that it is dangerously incorrect to conclude that water presently used for agricultural irrigation can be considered as an alternative that can transferred for use in the non-agricultural sector - since both in the short run (because the composition and structure of the national system) and in the long run (because higher population and living standards) all the available supply will be requires for non-

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1 I.e. pumping rate equal to natural recharge due to precipitation.

agricultural purposes, if the sources are not to be over-exploited, and therefore depleted, over time.

This situation creates a serious challenge to the prevailing conventional wisdom which hold the somewhat simplistic position that appropriately higher prices will reduce the consumption of a scarce resource to appropriate levels commensurate with supply. This assumes that the demand curve (which depicts the quantities that the market will demand at different price levels) is relatively elastic. See Fig I.

For it is clear that under conditions of inherent long- and short term inelasticity such as described (with a very steep demand curve - Fig II) the role of price as a demand-regulating device is seriously diminished since price increases will have little effect in reducing demand. See figure II.

This however does not mean that there in no compelling need to raise the price of water in Israel to levels which reflect the real cost of production. Indeed just the opposite is true but for a reason totally antithetical to that of reduction of demand.

To understand this it should be noted that due to the fact that the supply of available water is limited to roughly the level of the inelastic quantities demanded by the non-industrial sector, the supply curve (which depicts the quantities that producers are willing to supply as different prices) will also be inelastic. Thus the Israeli water system is operating under conditions of highly inelastic supply and demand, both in the short and long run. See Fig. III.

This inelasticity of supply portrays the intrinsic structure of Israel's water problem and the twin predicament facing her in this regard. On the one hand she is a country located on the fringe of a desert and is dependent entirely on the weather for her water supplies; on the other hand, if western living standards are to be maintained, the inherent long term demand will, as a matter of certainty, outstrip long term natural supplies.

Thus the only solution to this twin predicament is to generate additional, artificial sources of water that are not dependent on the weather. As large scale importation of water is presently unfeasible both because of engineering problems and, perhaps more significantly, because to the political instability of the relevant source countries (Turkey and Yugoslavia), there are only two feasible methods of extending the supply of water beyond the amount available in nature. These are the construction large scale sewage re-cycling and desalination projects. (See Appendix) However, such a large scale undertaking requires commensurate large scale investment. Given the financial realities and budget austerity in Israel, the necessary capital will only become available if a reasonable return on investment can be offered. The only source of return for such capital is the price of the product i.e. the price of water.

Consequently in order to extend the supply curve beyond the range of inelasticity into the range where supply and demand curve intersect in the normal fashion and where price acts again as demand regulating instrument (See Fig IV), prices must be raised. For only at these higher level of prices will it be possible to raise the capital required to create the additional artificial sources of water.

Therefore in contrast to the tenets conventional wisdom, the reason that the price of water needs to be raised is not the necessity of regulating (i.e. reducing) demand, but the necessity of regulating (i.e. increasing) supply.

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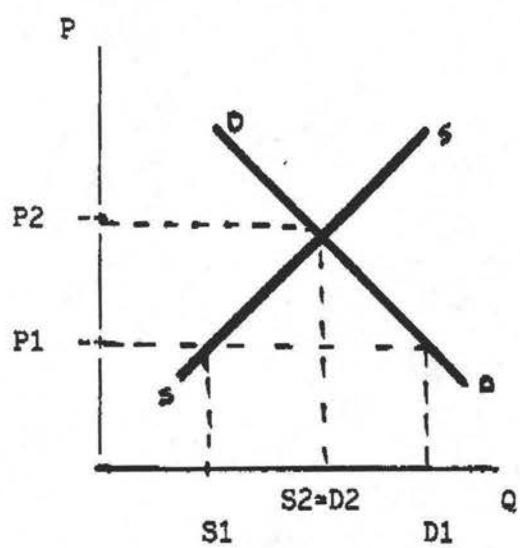

FIG I

At the price P1, demand D1 outstrips supply S1. However if price rises to P2 then demand and supply will reach equilibrium, S2=D2

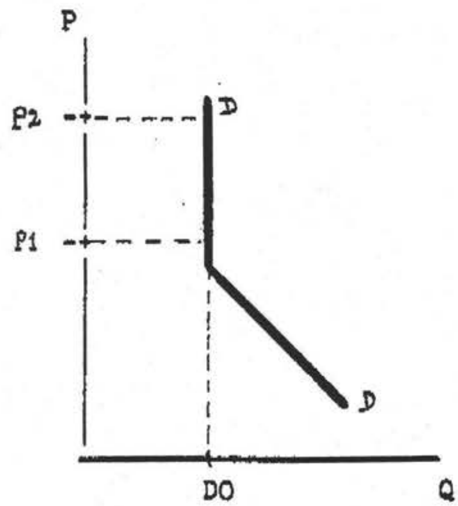

FIG II.

DO represents the inelastic non-agricultural demand. Raising prices from P1 to P2 will have no effect on the quantity demanded

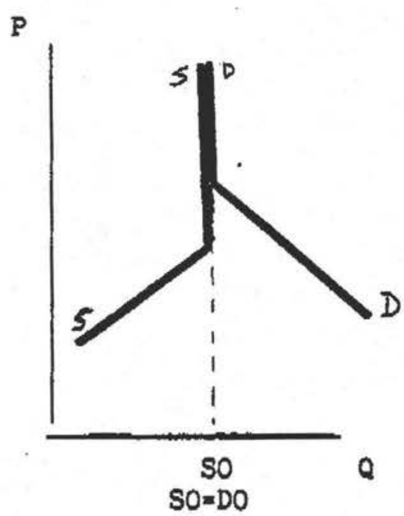

FIG III.

SO represents the total water supply (in the national system in the short run, and in the entire country in the long run). This is roughly equal to DO the inelastic non-agricultural demand in the short run and long run respectively. Since the supply cannot be extended beyond SO under existing conditions, the supply curve will be vertical (i.e. inelastic) at this point where SO=DO (approx.) This then is the range in which the Israeli water system is operating and one in which price rises would be ineffective in restricting demand as seen in Fig II above.

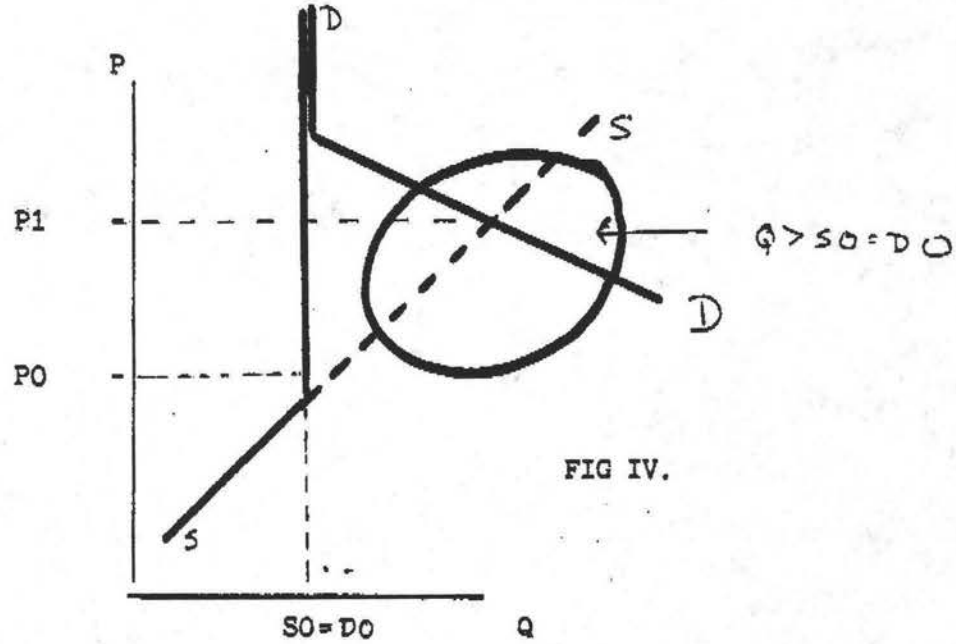

FIG IV.

By increasing prices offered the supply curve can be extended beyond SO by attracting investment in artificial water sources since these will facilitate a reasonable return on capital. This will allow the Israeli water system to operate in a range Q>SO=DO where normal supply and demand conditions exist as depicted in Fig I above.

APPENDIX

Possible Methods to Increase the Water in Israel

There are several possible methods of increasing the available water supply

1. The Purification and Re-cycling of Sewage and Waste Water.

   This method can extend the utilization of the exiting supplies, but is subject to severe limitations in a number of fields.

   (a) The water produced will always be a percentage of the existing supply. Today extensive use is already being made of this method. So in spite of the fact that there is still ample potential for development in this field, without increasing the primary supplies of water, recycling existing supplies will always involve limited quantities derived from the mainly from non-agricultural consumption.

   (b) Not only will the total amount of recycled water be limited to a fraction (currently about 60%) of the primary water, but it will also probably be restricted as to what it can be used for, and where it can be used. Currently recycled water can be used only in agriculture for the irrigation of a restricted range of crops, such as fibers, and only in areas where there is no danger that it will pollute underlying sources of ground water.

   (c) Giving the existing structure of the Israeli water system, the potential for recycling water is limited to about 300-400 mill m3 of which approx. 200 mill m3 is already fully utilised.

2. Importation of Water from Abroad

   This possibility has been raised on several occasions, however not only are there serious engineering problems and heavy investments involved in executing such activity but the potential sources of such water, Turkey and Yugoslavia, are plagued by political instability, making this method too unreliable a one upon which to base the planning of large-scale future consumption.

3. Desalination

This is the only available method utilising known and proven technology by which to genuinely increase the existing supply of water independently of the weather. The technique is applicable to both sea water and inland brackish water and can be implemented to generate large quantities of water reliably enough to plan future consumption upon them.