

PRIVATE AND PUBLIC SAVINGS IN A HIGH POPULATION GROWTH ECONOMY*

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I. INTRODUCTION

Until recently economists did not show sufficient interest in the relationship of population to economic growth. It was the nineteenth century economists who were originally concerned with the prospect of world population growing too fast in view of scarce natural resources. But once Malthus' gloomy prediction that population, growing geometrically, would outstrip food supplies, which would increase by addition, proved to be irrelevant in the late nineteenth and early twentieth centuries due to demographic trends and technological advances, «population» gradually became uninteresting to economists.

But the picture has changed drastically since the early 1950's. This was because something unprecedented had occurred: world population growth rates jumped drastically as a result of rapid and continuous declines in death rates, mainly resulting from improved health practices and the introduction of modern medicine in many parts of the world. Presently the population of Asia and Africa is growing at a rate of approximately 2.5 % annually and the rate of increase in Latin America is even higher.

Another development that created an awareness of population was the lagging of food production behind population increase in underdeveloped countries. Some have spoken of widespread famines nearing unless measures to reduce population growth and increase agricultural output were taken.

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This so-called «population explosion» is most rapid in the underdeveloped world. Many countries, while making serious attempts to improve their lot, find an additional obstacle to be overcome in the form of excessive population increase. A substantial proportion of the modest economic gains recorded in most of these countries is wiped out by population growth instead of improving per capita incomes. On the other hand, population growth also cuts sharply into potential savings, making the process of growth still more difficult.

Even though their own rates of population growth are less severe and they don't face immediate problems of increasing output, the more developed countries also have a stake in the issue. If population growth proves to be a formidable barrier to achieving economic betterment in underdeveloped countries, this will have a far reaching impact on the social and political stability of the world as a whole. Those countries enjoying comparatively higher material standards realize that it will be considerably more unpleasant to face the consequences of living in a world community composed of large masses of poverty-stricken people.

These are more than sufficient reasons for the revival of interest in the economics of population growth. But until recently it was mainly the demographer or the public health officer who has been genuinely interested in questions relating to population. It is high time that the economists also become seriously involved in the problem. The state of economics does not yet provide us with the necessary background to adequately determine the relationships between demographic trends and economic trends, let alone to understand the longer term implication for mankind. There is much need for research and improvement in our knowledge.

This paper has the purpose of bringing out some aspects of the interrelationships between population growth and savings in an economy. The methods employed here are of a cursory nature and are intended not to produce precise figures and projections but rather to give reasonable estimates and to show some trends.

Numerical exercises are made based on Turkish data. Thus a few sentences are warranted describing the relevant magnitudes. Turkey's 1970 population is estimated to be approximately 35 million, growing at 2.6 % annually. The age structure is young,

with 41.7 % of the population under age 15 in 1965. Turkey's per capita income in 1969 was approximately \$ 310 (in 1965 constant prices), and the rate of growth of GNP averaged 6.5 % during the last five years.

Where costs are shown here, they will be in Turkish Lira, and may be converted to dollars roughly, by dividing by 10.

II. IMPACT OF POPULATION GROWTH ON SAVINGS IN UNDERDEVELOPED COUNTRIES

Among the various scarcities that hinder the development efforts of underdeveloped countries, inadequate supply of domestic savings occupies the prime position. In order to achieve sustained growth, it is essential to accelerate investments. And if we exclude the possibility of massive capital inflow into these countries, the investments have to be financed by domestic capital. Thus a certain portion of income has to be saved in order to realize investments, (though it should not be forgotten that the availability of investment goods is also of paramount importance.)

It is also well known that the mobilization of domestic savings in underdeveloped countries faces serious obstacles. With low levels of per capita income the propensity to save is also very low and often it is neither an easy task nor advisable to depress already insufficient per capita consumption in order to increase the supply of domestic savings. It is feasible though to save a certain portion of the annual increases in total output. In more technical terms, this means an increase in the marginal rate of domestic savings over and above the average rates.

It is easy to see how this can be achieved in economies with stationary or slowly increasing populations. But especially in certain underdeveloped countries where the population increase is around 3 % per annum, this is not an easy task. In such countries maintaining the existing level of per capita consumption itself becomes a formidable task. A situation of this nature has far reaching implications since the ultimate goal of development efforts is the increased welfare of the population, and the best known yardstick for measuring welfare is per capita consumption. Some increase in per capita consumption levels is desirable and often indispensable, not only for social and political reasons but also as a stimulus to work hard.

We must admit here that the rate of growth of per capita income registered in the majority of underdeveloped countries during the last few decades has been more encouraging than this would suggest; nevertheless examples can be given where per capita consumption or even income levels were actually depressed over a decade or so. In any event a case can be made by illustrating how the existing high rates of population growth act as a depressant in the efforts to increase the marginal rate of savings. As we pointed out, improvements in per capita consumption -both in terms of private and public consumption- provide a necessary stimulus for people to work harder and more importantly are instrumental in avoiding social and political unrest, especially in view of the «rising expectations» in present day underdeveloped countries. If we consider a 2 % annual increase in per capita consumption as a minimum condition of healthy economic development, countries with a 3 % annual growth in population will require 5 % annual income growth on the average. This would be a commendable effort in view of resource scarcities and other rigidities these countries are facing, and even at 5 % rate of GNP growth, countries whose annual population growth is 3 % would find it close to impossible to increase their marginal rate of domestic savings. Only with higher annual GNP growth, perhaps 6 %, could these countries achieve a marginal saving rate of approximately 20 %, though of course this should not be expected to be automatic. To secure such a rate of saving it is likely that other measures would be required which would establish or readjust saving patterns.

The foregoing analysis establishes a basic relationship between population growth and the supply of domestic savings, and thereby economic growth. It can be summarized that the higher the rate of population growth, the higher the amount of resources that must be diverted to public and private consumption purposes, the lower the supply of domestic savings and investments, and the slower the rate of economic growth. In the following paragraphs we will explore this relationship in more detail. However, a closer analysis would require a breakdown of the various forms of domestic savings in underdeveloped countries. Savings in an economy can broadly be put in two basic categories : voluntary savings and forced savings. Voluntary savings can further be classified as household savings and business savings.

Let us begin with savings in the business sector. At this stage we will not be concerned with the question of ownership, since even though majority of business firms are generally privately owned, it is common in underdeveloped countries to have a large number of corporations owned and operated by the government. What stimulates savings in these corporations most is profitable new investment opportunities and an economic outlook conducive to expansion. Business firms do not attempt to increase their savings unless they find it profitable to expand their business. The relevant question is thus whether a fast growing population is more conducive to this kind of climate.

Economists have long debated the stimulating effects of population growth on investments. In advanced countries, where basic needs are abundantly met, a growing population certainly contributes to effective demand and greater employment or exploitation of economic resources. (although many in these countries are now questioning the necessity and wisdom of ever greater mass consumption and resource wastage.) In poorer countries population growth stimulates investments up to a point in certain sectors of the economy, such as housing, but we must remember that it is the actual or effective demand in various commodity markets that really matters. A firm will be encouraged to expand its production and capacity to the extent that there is a demand for its products. Thus, though it is true that need for various products is large in a rapidly growing population, it is not the need of the population but rather the purchasing power that matters. As long as a fast growing population produces a comparatively lower level of total income for the whole society as for individuals- total effective demand would be weakened, depressing purchasing power and discouraging investment and business savings. However, this relationship is not the only one possible and it is a much safer proposition not to maintain that the business or corporate savings are always affected in a certain direction by the rates of population growth.

In this respect it is important to note the increasing proportion of business savings within domestic savings in underdeveloped countries. Available data in a very few countries show that between the years 1953-54 and 1959-60 the contribution of corporate savings to domestic savings far exceeded expectations and

III. SOME NUMERICAL ILLUSTRATIONS

In determining the relationship between population growth and savings in an economy, one can look at the problem from various angles. One approach is to determine the savings requirements in an economy that is trying to provide its members with a certain level of material welfare; this can be measured in terms of an increase in per capita income. It is not difficult to recognize that in an economy where the rate of population growth is relatively higher, people will have to sacrifice more in order to attain a similar material well being than in another society with lower population growth rate.

In order to clarify this point a little further, let's first make a distinction between two types of investments in an economy. One group of investments has to be made in order to meet the needs of the «newcomers», that is, those who are added to the population every year. Unless new investments are made, these people will not have the schooling, health facilities and jobs to make a living. Prof. A. Sauvy calls this type of investments «demographic investments»⁴ because they are made for demographic reasons. A society has to save a certain portion of its income to invest in demographic investments if it does not want the material well being of the people to fall.

In addition to this type of investment, society has to make investments so that there will be a positive change in per capita incomes. Sauvy calls this second type of investment «productive investments». Thus we can write: Total Investments = Demographic Investments + Productive Investments.

Given two countries with identical population, income levels, and resource endowment, country A with a higher rate of population growth will have higher demographic costs and will have to invest more than country B, in order to keep the per capita income levels similar. This in turn means the citizens of country A will have to sacrifice more in order to increase savings.

A numerical example would clarify this point further. Let's assume that in country B the annual population growth rate is

(4) Alfred Sauvy, «La Population des Pays Sous-développés», in *Lectures on Economic Development*, Economics and Political Sciences Faculties Publication, Istanbul 1958, p. 68.

various policies that influence these factors. Another important consideration of course is the distribution of income. A relatively unequal distribution of income is expected to affect household savings favorably, but the case is complicated and deserves a close examination.

Government savings constitute the third category and represent the difference between government receipts and current expenditures. Thus, it depends on two factors, one of which is the capacity and potential for taxation (taxable capacity). It can easily be seen how a lower fertility rate would allow the per capita income to increase, thus resulting in a larger base and capacity for taxation, whereas with a rapidly growing population per capita incomes may not increase significantly despite possible increases in total output. In such cases increased taxation may entail lowering standards, which is rarely a tolerable proposition. As was the case with household savings, taxable capacity also depends on the prevailing income distribution, institutions and instruments.

The second factor affecting government expenditures is the level of public consumption. It can be readily seen how high rates of population growth stimulate government expenditure on education, health etc. We will analyze the impact of this type of expenditure on savings, in greater detail later. It is important at this stage to also note that public consumption expenditures have been on the rise in all underdeveloped countries in the last two decades, cutting sharply into the potential savings in the government sector.

The foregoing analysis suggests that marginal rates of domestic savings in underdeveloped countries are affected by the overall rate of economic growth on one hand, and by the rate of population growth on the other. The effect of population growth on savings is more obvious in the case of household and government savings than business savings.

Additional factors are relevant in determining the saving potential in underdeveloped countries. Certain structural and institutional changes may help improve the saving capacity, and a higher marginal rate of savings may be attainable even under the prevailing income and population growth rates.

was between 27 % and 60 % of the totals.¹ For the majority of the Latin American countries, it is maintained that business savings amounted to far more than half of gross domestic savings.² In addition, savings from corporate incomes are rather high, being of the order of 30 to 70 % for various countries.³

A much more direct case can be made for the relationship between population growth and the savings of the household. Household savings is a residual item in that it is what is left after the family spends for consumption purpose out of their disposable income. Since disposable income is really what is left after various government taxes have been levied, the very definition of household saving implies the role of government. In a country where the government share is rather high, government may assume the role of the main saver and household savings become insignificant.

Nevertheless, it is appropriate to assume that there is a negative correlation between high rates of fertility and the amount of household savings. Higher rates of fertility imply relatively high dependency ratios which in turn mean a higher ratio between those who consume but do not contribute to the income, and those who both consume and produce. Out of a given level of disposable income families with more children would find it more difficult to save. Income to be spent on children includes not only food, clothing, and shelter but also education and health expenses.

Once this basic relationship between the rate of fertility and household savings is established, we again need to make certain qualifications. It has been pointed out above that the level of household savings attainable within a society is affected considerably by the disposable income, that is, by government taxation policy. Moreover the state of savings institutions and instruments has a great deal to do with household savings, and the rate of household savings can be affected measurably by the implementation of

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- (1) Development Plans: Appraisal of Targets and Progress in Developing Countries, *World Economic Survey*, 1964, Part 1, United Nations, p. 5.
 - (2) Gavin W. Jones, *The Economic Effect of Declining Fertility in Less Developed Countries*, An Occasional Paper of the Population Council, February, 1969, p. 11.
 - (3) *World Economic Survey*, op. cit., p. 5.

1.5 % and is 2.5 % in country A. Let's also assume that the additions to capital stock give similar yields in both countries (that is, the capital/output ratio is similar, say at a level of 3.2) If both countries aim at a 4 % per capita rate of income growth, country B will need a savings ratio of 17.6 % of gross national product ($1.5 \times 3.2 = 4.8$ % for demographic investments and $4 \times 3.2 = 12.8$ % for productive investments.). Country A can only attain a similar rate of per capita income growth by putting more strain on its people, since its required savings ratio would be 20.8 % [$(2.5 \times 3.2) + (4 \times 3.2) = 20.8$].

One would further argue that the difference in their efforts needs to be greater than these percentages reflect, because the capital-output ratio is higher in demographic investments, which include the costs of rearing children until they reach a certain age. However, since with this rather crude arithmetic we are only trying to demonstrate the main point, this level of precision is not necessary.

Next let's try a similar approach, but this time instead of comparing two countries let's take one country and show how different population growth rates affect savings requirements. (We call this a «simple programming approach» since it is basically this type of analysis that underlies crude macro-economic approaches to planning.)

Let's take the Turkish economy as an example. Turkish Five-Year Development Plans aim at increasing per capita income by approximately 4 % annually. If we try to formulate the required rate of growth of GNP in an equation we can write :

$$Y_t = Y_0 (1+g)^t = Y_0 (1+r)^t (1+p)^t$$

where, Y : gross national product (GNP)

g : rate of growth of GNP

r : rate of per capita GNP growth

p : population growth rate.

Since we assume $r = 0.04$, taking into account a period of $t = 10$ years, $(1+r)^{10} = 1.48$.

Now we can introduce three different population growth rates as three alternatives, namely 2 %, 2.6 %, and 3 % per annum. These rates are also representative, in the sense that 2.6 % is the

prevailing rate of annual population growth, 2 % is the government's present objective, and 3 % is the rate Turkey's population came very close to in the past and may once again reach.

With the first alternative, $(1+p) = 1.02$, then $(1+p)^{10} = 1.203$, with the second, $(1+p) = 1.026$ and $(1+p)^{10} = 1.293$ and with the third alternative, $(1+p) = 1.03$ and $(1+p)^{10} = 1,344$. With the values for $(1+r)$'s and $(1+p)$'s established, we can now estimate the value of $(1+g)$'s over a ten-year period.

$$1 \text{ st alternative: } (1+g)_{1977-1967} = (1,48) (1,203) = 1,789$$

$$2 \text{ nd alternative: } (1+g)_{1977-1967} = (1,48) (1,293) = 1,914$$

$$3 \text{ rd alternative: } (1+g)_{1977-1967} = (1,48) (1,344) = 1,909$$

The Turkish GNP had a value of 85.1 billion TL. in 1967. In order to provide 4 % annual per capita income growth, GNP has to reach the following levels after 10 years.

$$1 \text{ st alternative: } 85.1 \times 1.789 = 152.2 \text{ billion TL.}$$

$$2 \text{ nd alternative: } 85.1 \times 1.914 = 162.9 \text{ billion TL.}$$

$$3 \text{ rd alternative: } 85.1 \times 1.989 = 169.3 \text{ billion TL.}$$

The required increase in the GNP after ten years is :

$$1 \text{ st alternative: } 152.2 - 85.1 = 67.1 \text{ billion TL.}$$

$$2 \text{ nd alternative: } 162.9 - 85.1 = 77.8 \text{ billion TL.}$$

$$3 \text{ rd alternative: } 169.3 - 85.1 = 84.2 \text{ billion TL.}$$

Finally, the saving requirements in order to achieve these objectives can be estimated by applying the capital/output ratio, which happens to be 3.2 for Turkey.

$$1 \text{ st alternative: } 3.2 \times 67.1 = 214.7 \text{ billion TL.}$$

$$2 \text{ nd alternative: } 3.2 \times 77.8 = 249.0 \text{ billion TL.}$$

$$3 \text{ rd alternative: } 3.2 \times 84.2 = 269.4 \text{ billion TL.}$$

The above figures show savings requirements in order to sustain an annual 4 % per capita GNP growth under three different population growth rates and clearly indicate the additional burden put on the population at higher population growth rates.

A third exercise can be used to further explore the impact of different rates of population growth on overall savings. Here we want to first determine what percentage of the increase in total product goes into savings, under the existing policies of the government and the existing savings patterns of the population, thus, determining the marginal savings ratios. Second, we will estimate the possible levels of savings according to different rates of population growth.

Table 1. Gross National Product and Domestic Savings

	(in billion TL.)				
	1967 (1)	1972 (2)	1972 - 1967 (2-1)	Percentage increase	
				Five Years	Annual
Total GNP (Y)	85.1	119.4	34.3	40.3	7.0
Total Investments (I)	16.9	29.0	12.1	71.6	11.4
External Savings (F)	1.7	2.0	0.3	17.6	3.3
Domestic Savings (S)	15.2	27.0	11.8	77.6	12.2
Total Consumption (C)	69.9	92.4	22.5	32.2	5.8
of which C_p	57.9	74.1	16.2	28.0	5.1
of which C_g	12.0	18.3	6.3	52.5	8.8
Disposable Income (Yd)	65.5	85.9	20.4	31.1	5.6
				(in TL.)	
Per Capita GNP	2580	3200	620	24.0	4.4
Per Capita Yd	1986	2290	304	15.3	2.8
Per Capita C	2119	2463	344	16.2	3.2
Per Capita S	461	720	259	56.2	9.6

Source: Second Five-Year Development Plan of Turkey. Per capita figures estimated accordingly.

The above figures in Table 1 are taken from Turkey's Second Five-Year Development Plan, and per capita figures and percentage increases are estimated accordingly. The Table reveals that the Gross National Product is expected to increase by 7% annually, from 85.1 billion TL in 1967 to 119.4 billion TL in 1972. In order to achieve this growth, on the average some 22.7% of total GNP will be invested annually throughout the 1967-72 period. After making the necessary adjustments for external savings, the domestic savings are expected to be on the order of 20.8% of the

GNP. The table further reveals that pursuance of such policies will allow the disposable income to grow by 5.6 %, total consumption by 2.8 % and private consumption by 5.1 % annually.

As a result of these developments and given an annual population rate of growth of 2.6 %, per capita GNP will go up by 620 TL, from a level of 2580 TL in 1967 to 3200 TL in 1972. Accordingly per capita disposable income will increase by 304, per capita consumption by 344 and per capita savings by 259. Given the per capita income increase of 620 TL in five years, a 259 TL increase in per capita savings implies a marginal savings to income ratio of 41.2 %.

Now we have the necessary information to estimate the saving potential of the Turkish economy under the various rates of population growth. The marginal savings ratio was rounded to 40 % in preparation of Table 2.

Table 2. Future Domestic Savings Based On Different Population Growth Rates

	1972	1982	1992
Total GNP (in billion TL)	119.4	234.8	461.9
Per Capita GNP (in TL)			
2 % population growth	3310	5342	8622
2.6 % population growth	3177	4835	7359
3 % population growth	3092	4525	6624
Per Capita Savings (in TL)			
2 % population growth	772.4	1585.2	2897.2
2.6 % population growth	719.2	1382.4	2392.0
3 % population growth	685.2	1258.4	2098.0
Total Savings (in billion TL.)			
2 % population growth	27.9	69.7	155.2
2.6 % population growth	27.0	67.1	150.1
3 % population growth	26.5	65.3	146.3
Total Savings/GNP (%)			
2 % population growth	23.3	29.7	33.6
2.6 % population growth	22.6	28.6	32.5
3 % population growth	22.2	27.8	31.7
Per Capita Consumption (in TL)			
2 % population growth	2537.6	3756.8	5724.8
2.6 % population growth	2475.8	3452.6	4967.0
3 % population growth	2406.8	3266.6	4526.0

We can follow from Table 2 that total savings will be 33.6 %, 32.5 %, and 31.7 % with 2 %, 2.6 % and 3 % rate of population growth, respectively, in 1992. Similarly the level of savings attainable is highest with 2 % population growth, next with 2.6 % growth and is the lowest with 3 % rate of population for any given year. It is also significant here that while the savings ratio is higher with lower population growth rates, per capita consumption is also higher at these lower rates, which indicates that society is not only saving more but also enjoying higher consumption levels on a per capita basis.

IV. SAVINGS THROUGH PUBLIC EXPENDITURES

It was noted earlier that the level of government savings depends on the level of public revenue on one hand and public spending on the other. Although there have been remarkable increases in government revenues in many underdeveloped countries, government expenditures have also increased rather sharply. One major cause of this development was a public awakening in many newly independent countries and demands for improved services in various fields, including health and education. Responding to this pressure, governments in many underdeveloped countries found themselves spending more and more on current expenditures every year. Thus the level of government savings, on the average, has not reached significant proportions within the total domestic savings.

Another factor that strongly affects the public expenditures is, of course, the high rate of population growth in many countries. In countries where annual population growth is especially high, the demand for various public services is pressing. Even the maintenance of existing standards of health, education, transportation, and metropolitan services may prove to be a difficult task.

Among the various factors that affect public expenditures, the role of the population growth rate is relatively easy to identify. Again, with some figures from the Turkish economy, let's try to show the impact of different rates of population growth on government expenditures and ultimately on government savings.

The definition for government expenditures we will use here is the money spent by the government for non-economic or non-productive services. Thus it does not include the expenditures of the State Economic Enterprises or similar agencies. It does include some investment expenditures such as building of schools, hospitals, courthouses and the like which are not productive investments as the definition goes.

Government expenditures rose very sharply in Turkey in the 1960's. The average annual increase for the decade is around 10 % in constant prices and it is the intention of the government to continue an increase of around 8.5 % annually. As a result per capita government expenditures rose from 291 TL in 1953 to 490.6 TL in 1965. (1965 constant prices) This corresponds to a rate of increase considerably higher than the per capita income growth.

The following table was prepared in order to show how different rates of population growth will affect the various kinds of government expenditures and savings.

Table 3. Government Expenditures and Potential Savings

	1972	1982	1992	2000
Per Capita				
Expenditures (in TL)	787.9	1,444.2	2,406.7	3,373.5
Gross National Product (in bil. TL)	119.4	234.8	461.9	793.6
Total Expenditures (in bil. TL.)				
2 % population growth	28.4	63.5	128.9	211.6
2.6 % population growth	29.6	70.1	151.1	260.0
3 % population growth	30.4	74.9	167.8	297.9
Potential Savings (in bil. TL) ¹				
2 % population growth	2.0	11.4	38.9	86.3
2.6 % population growth	0.8	4.8	16.7	37.9

(1) Compared to 3 % population growth.

In preparing Table 3, per capita government expenditures are assumed to increase at a gradually declining rate, starting at 7 % per annum through 1972 and falling to approximately 4 % by 2000. Thus total government expenditures are expected to grow from 20 % of GNP at present to some 32 % of GNP in 2000 at the 2.6 % population growth rate.

The table reveals that at a 2 % annual rate of population growth, potential government savings are significantly higher than at a 3 % population growth rate. For instance, the potential government savings from a 2 % growth rate may be as high as 5 % of GNP in 1982, 8 % of 1992's GNP and approximately 10 % of year 2000's GNP. (It should not be forgotten that these projections have been made under the strict assumption that per capita government expenditures would not change regardless of the rate of population growth. That is, the quality and the quantity of the services will remain the same.)

The same type of analysis may be extended to various kinds of government expenditures and the potential savings in each case can be estimated. Instead of repeating the previous approach let's take up educational expenditures separately and try to demonstrate potential savings through lower population growth rates. Separate estimates have been made for primary and secondary schools, but the university enrollments are excluded.

For primary education, per student expenditures are estimated to rise from 291.8 TL in 1967 to 773 TL in 2000, allowing for improvements such as smaller classes, better paid teachers and the like; also assumed is that 100 % of the 7-12 age group children will be attending primary schools. The following table is based on this data and assumptions.

Table 4. Elementary School Expenditures and Potential Savings

	1972	1982	1992	2000
Per student expenditure (TL)	338.2	454.3	610.2	773.0
Total enrollment (7-12 age group) (in million)				
2 % population growth	5.7	6.6	7.8	9.1
2.6 % population growth	5.8	7.0	8.8	10.5
3 % population growth	5.9	7.3	9.5	11.7
Total expenditures (bil. TL)				
2 % population growth	1.9	3.0	4.8	7.0
2.6 % population growth	2.0	3.2	5.4	8.2
3 % population growth	2.0	3.3	5.8	9.0

From Table 4 we may conclude that in 1982 the government can save close to 7 % on elementary school expenditures if the rate of population growth is 2 % instead of 2.6 %, and over 3 % if the growth rate is 2.6 % instead of 3 %. In 2000 the respective savings reach the order of 17 % and 9 %.

For secondary education, the following assumptions and calculations were made before any comparison was possible: gradually increasing schooling ratios are applied for different age groups in order to estimate the number of students expected in secondary school in various years. These ratios were: for 13-15 age group, 29.8 % in 1967 and 90 % in 2000, for 16-18 age group, 13.9 % in 1967 and 60 % in 2000. Costs per student in secondary school were estimated for general and vocational education and then a weighted average was taken.

Table 5. Secondary School Expenditures and Potential Savings

	1972	1982	1992	2000
Per student expenditures (in TL)	1,246.0	1,755.6	2,473.7	3,253.4
Total enrollment (13-18 age group) in million				
2 % population growth	1.8	2.7	3.9	5.2
2.6 % population growth	1.9	2.9	4.4	6.0
3 % population growth	2.0	3.1	4.8	6.6
Total expenditures (bil. TL)				
2 % population growth	2.3	4.7	9.8	17.0
2.6 % population growth	2.4	5.1	11.0	19.6
3 % population growth	2.4	5.4	11.8	21.5

From the data given in Table 5, the savings in secondary education in the year 2000 would be on the order of 11 % if the rate of annual population growth continues to be 2.6 % as against 3 %, and 15 % if the rate of population growth comes down from 2.6 % to 2 %. The difference between 2 % and 3 % growth rates would make a difference in the savings of 26 %.

V. PRIVATE SAVINGS THROUGH HOUSING INVESTMENTS

We will now use housing requirements and expenditures in order to show the potential private savings in one area. One of the immediate impacts of different population growth rates is naturally on housing requirements. The need for new housing units is also affected by the rate of urbanization, but this is again directly influenced by the rate of population growth. In this example we will take the housing requirements only in the urban centers - places with 10,000 population or more. This is partly because the problems are more pressing in the cities and partly because we are interested in the monetized sector of the economy.

In Turkey, only 16,4 % of the total population lived in urban centers in 1927, and this ratio went up very slowly until 1950, when it was 18.5 %. Since then the rate of urbanization has gained momentum, reaching 6.5. % per annum in 1955 - 60 and 5.2 % in 1960 - 65. The Second Five Year Plan projects a 6.5 % rate of urbanization in the coming years.

In our projections we have assumed the same 6.5 % rate until 1972 and then a gradual decrease to 3.5 % annually until 1990 at which time 60 % of the population will live in the cities. These ratios were applied first for the 2.6 % population growth estimates, later to the total population figures based on 2 % and 3 %, population growth rates.

As the next step we need to determine the number of housing units to accommodate these people in the cities. Once we have determined the size of the average family, then we can estimate the housing units by dividing the population figures by family size. The average family size is five at present and it would be realistic to expect this figure to go down by one tenth of 1 % annually until it reaches 4.5 per family in 2000.

Table 6. Housing Requirements, Spending and Potential Savings

	1972	1982	1992	2000
Urban population (in millions)				
2 % population growth	13.7	21.5	30.8	38.1
2.6 % population growth	14.3	23.8	36.1	46.8
3 % population growth	14.7	25.4	40.1	53.7
	1967-72	1972-82	1982-92	1992-2000
Additional housing units (in millions)				
2 % population growth	0.7	1.6	2.2	1.9
2.6 % population growth	0.8	2.0	2.9	2.6
3 % population growth	0.9	2.2	3.4	3.4
Housing investment spending (in bil. TL)				
2 % population growth	28.0	64.0	88.0	76.0
2.6 % population growth	32.0	80.0	116.0	104.0
3 % population growth	36.0	88.0	136.0	136.0

After determining the total housing requirements each year, the additional housing units to be added to the stock for each period can be found, given the figure for the original stock. In 1967, 2.1 million housing units were estimated to exist. In Table 6 we show the additional housing figures for each period. The last step

to be taken is to find the cost of building a housing unit at present, excluding the price for the lot. We estimated this to be approximately 40,000 TL for a 90 square meter construction. The amount of investment required for the specified periods are also given in Table 6. The savings involved in attaining lower rates of population growth can be deduced from the figures given in Table 6. For instance during the 10 year period from 1982 to 1992, 28 billion TL or 33% less investment is required with a 2% population growth as against 2.6%. The savings between 2% and 3% rate of population growth is 48 billion TL or approximately 35% during the same 10 years.

VI. SOME CONCLUDING OBSERVATIONS

The foregoing illustrations, isolate the domestic savings from other factors that contribute to GNP growth and neglect to an extent, the interdependencies among various factors. It is helpful to employ somewhat straightforward techniques in order to simplify the understanding of the problem, but the use of some mathematical models that take into account the dependencies in the system improve the analysis, especially if the data are sufficiently reliable.

Such an attempt has been made recently in a study sponsored by the Agency for International Development.¹ The economic-demographic model that was employed, included a standard Cobb-Douglas production function, an employment function based on the assumption that unemployment resulted primarily from relatively slow growth of capital, and a linear consumption function of the form.

$$C = c_y Y + c_p P$$

The level of net investments and savings is determined residually,

$$I = Y - C$$

We can rewrite the function for investments,

$$I = Y - c_y Y - c_p P$$

In the model the population coefficient (c_p) is expressed as a function of the income coefficient (c_y), the consumption ratio and the per capita income. That is,

(1) By TEMPO, General Electric's Center for Advanced Studies, Santa Barbara, California, August 1969.

$$c_p = (C/Y - c_y) Y/P$$

Then

$$I = Y (1 - c_y) - [(C/Y - c_y) Y/P] P$$

After the relevant coefficients were estimated for Turkey the function determining the net investments or savings took the following form for a given year,

$$S_t = I_t = 0.15 Y_{t-1} - 15 P_{t-1}$$

The model was solved in the computer both on a constant fertility and a declining fertility assumption. By the year 2000, declining fertility resulted in slower population growth, a substantial decline in the children/adult ratio, a significant increase in the total savings and per capita GNP, but hardly any change in the level of GNP. This last finding of the study is rather contrary to the general belief, and of course, is the product of the nature of the production function and various coefficients employed.

Before closing, it should be stated again that there is much room for improvement in our state of knowledge of the relationship between the economic and demographic trends. Nevertheless, without going into greater analytical depth, it can be shown that higher rates of population growth are associated with lower levels of per capita income and lower levels of domestic savings. It necessitates a larger volume of consumption expenditures -both public and private- out of a given income while the per capita consumption remain relatively low. The other problems such as the ones connected with employment, urbanization, public services and food, that result from higher rates of population growth are outside the context of this analyses. We can nevertheless state that lowering the fertility rates in many countries can lessen the hardships inherent in achieving national objectives.