Demographic Change, Social Security and Economic Growth: Inferences from the Belgian Example

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1. Introduction

This paper will essentially deal with two major areas where demographic effects are of direct concern to planners and policy makers of most Western industrial nations. The first topic concerns those sectors of the social security system that are based on the principle of intergenerational solidarity and which involve, therefore, the demographic balance between active and non-active population segments. The second subject is that of the long term macro-economic consequences of alternative demographic trends. Obviously, numerous uncertainties mortgage the outcomes of such long term calculations, but one may still benefit from using a worked out example to get hold of the orders of magnitude associated with various assumptions. This second section is, therefore, a much more didactical exercise and is by no means a forecasting attempt.

All the data presented here pertain to the Belgian demographic and economic situation. At first, it may seem that the inferences we draw from them are idiosyncratic, but as the parallelism of demographic trends since World War I in Western European countries is rather striking, we expect that the story may have a familiar ring to many analysts in other European welfare states as well.

2. Social security, intergenerational solidarity and demographic change.

As is the case in most Western European countries, the Belgian social security system is no longer based on personal capitalisation but on direct risk-sharing and the principle of solidarity. As a consequence, the system is fairly inflation proof but it may be more sensitive to demographic perturbances as large income transfers take place between the active and the non-active population segments. These income transfers amount in the European welfare states to more than a quarter of the GNP and, in addition, many of our comprehensive pension- and health insurance systems are currently facing serious financial problems. Hence, it seems a worthwhile enterprise to evaluate the importance of the demographic factor in these sectors.

1 A substantial portion of the work reported here was produced in collaboration with Drs. S. Wijewickrema and M. Despontin and with Mssrs. A. De Kerpel and L. Hubert as part of a research grant from the Ministry of Public Health and the Family, Brussels.

2 For a very detailed account of the Canadian example, see F. Denton and B. Spencer, 1973, 1975 and 1976.
The analysis will be carried out in three steps. Firstly, a few pieces of wisdom can be obtained from a strictly analytical approach involving a network of stable populations. From these onward, we shall make a decomposition of recent trends in the Belgian pension and health insurance sectors with the aim of establishing to what extent the demographic factor can be held responsible for the present precarious situation. Finally, we shall use the outcomes of demographic projections in order to find out (i) whether the direction of the impact of the demographic factor is likely to change and (ii) to understand more about the added impact of demographic oscillations and perturbances.

2.1 Age-specific characteristics in stable populations

As has been shown by Coale (1972) and Preston (1972) simple relationships can be worked out to characterize any phenomenon with an age specific distribution in a network of stable populations. If \( c(a) \) denotes the age distribution and \( g(a) \) an age-specific distribution of a characteristic \( g \), then the total volume of \( G \) will be given by

\[
G = \int_{0}^{\omega} g(a)c(a)\,da \quad (1)
\]

Moreover, one can specify the mean age in a stable population as:

\[
\bar{a} = \int_{0}^{\omega} ac(a)\,da / \int_{0}^{\omega} c(a)\,da \quad (2)
\]

and also a mean age, \( \bar{a}_g \), of the stable population after weighing its age structure with the age specific characteristic \( g(a) \):

\[
\bar{a}_g = \int_{0}^{\omega} ag(a)c(a)\,da / \int_{0}^{\omega} g(a)c(a)\,da = \int_{0}^{\omega} ag(a)c(a)\,da / G \quad (3)
\]

It can be shown that (see Coale, 1972, p. 49):

(i) the volume \( G \) will reach a maximum if \( \bar{a} = \bar{a}_g \) and if \( \sigma > \sigma_g \);
(ii) the volume \( G \) will reach a minimum if \( \bar{a} = \bar{a}_g \) and if \( \sigma < \sigma_g \).

This basic rule can easily be applied to the health insurance system. Suppose that \( g(a) \) denotes the age specific profile of payments into the system and \( k(a) \) the age specific profile of the costs. For simplicity, we shall leave the scale of these income and cost distributions on the side and simply assume that

\[
\int_{0}^{\omega} g(a)\,da = \int_{0}^{\omega} k(a)\,da = 1
\]
Table 1:  
Age specific Profiles of Payments and Costs  
of the Health Insurance Systems

<table>
<thead>
<tr>
<th>Age Group</th>
<th>g(a) with Spengler Coefficients</th>
<th>g(a) with Canadian Productivity</th>
<th>g(a) with Hungarian Productivity</th>
<th>k(a) Canadian</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.082</td>
</tr>
<tr>
<td>5-9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.016</td>
</tr>
<tr>
<td>10-14</td>
<td>0.002</td>
<td>-</td>
<td>-</td>
<td>0.014</td>
</tr>
<tr>
<td>15-19</td>
<td>0.036</td>
<td>0.033</td>
<td>0.045</td>
<td>0.025</td>
</tr>
<tr>
<td>20-24</td>
<td>0.081</td>
<td>0.073</td>
<td>0.108</td>
<td>0.032</td>
</tr>
<tr>
<td>25-29</td>
<td>0.119</td>
<td>0.112</td>
<td>0.127</td>
<td>0.034</td>
</tr>
<tr>
<td>30-34</td>
<td>0.125</td>
<td>0.129</td>
<td>0.125</td>
<td>0.038</td>
</tr>
<tr>
<td>35-39</td>
<td>0.133</td>
<td>0.129</td>
<td>0.121</td>
<td>0.039</td>
</tr>
<tr>
<td>40-44</td>
<td>0.130</td>
<td>0.126</td>
<td>0.118</td>
<td>0.041</td>
</tr>
<tr>
<td>45-49</td>
<td>0.119</td>
<td>0.122</td>
<td>0.110</td>
<td>0.049</td>
</tr>
<tr>
<td>50-54</td>
<td>0.113</td>
<td>0.113</td>
<td>0.102</td>
<td>0.055</td>
</tr>
<tr>
<td>55-59</td>
<td>0.089</td>
<td>0.095</td>
<td>0.088</td>
<td>0.060</td>
</tr>
<tr>
<td>60-64</td>
<td>0.051</td>
<td>0.061</td>
<td>0.050</td>
<td>0.078</td>
</tr>
<tr>
<td>65-69</td>
<td>0.002</td>
<td>0.006</td>
<td>0.005</td>
<td>0.090</td>
</tr>
<tr>
<td>70-74</td>
<td>-</td>
<td>0.001</td>
<td>0.001</td>
<td>0.110</td>
</tr>
<tr>
<td>75-79</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.114</td>
</tr>
<tr>
<td>80+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.123</td>
</tr>
</tbody>
</table>


thereby dealing with the proportionate age-specific distributions of g(a) and k(a).
Similarly, one can also establish an age-specific profile of the balance s(a) as:

\[ s(a) = g(a) - k(a) \quad (4) \]

so that all necessary quantities can be defined:

\[ \bar{a}_g = \int_0^\omega a g(a) c(a) da / G \quad \text{and} \quad G = \int_0^\omega a g(a) c(a) da \]

\[ \bar{a}_k = \int_0^\omega a k(a) c(a) da / K \quad \text{and} \quad K = \int_0^\omega a k(a) c(a) da \quad (5) \]

\[ \bar{a}_s = \int_0^\omega a s(a) c(a) da / S \quad \text{and} \quad S = \int_0^\omega a s(a) c(a) da \]

Finally, it can also be shown (Lesthaeghe et al., 1979) that there is a point where \( \bar{a}_g = \bar{a}_k = \bar{a}_s \).

The Belgian health insurance system is fed by:

(i) contributions from the active population (payments are deducted directly at source from salaries and/or payed through one of the many intermediate insurance agencies into the national system),
Tabel 2:
Average per capita Cost p.a. in the Health Insurance System, Belgium 1977

<table>
<thead>
<tr>
<th></th>
<th>Wage Earners</th>
<th></th>
<th>Pensioners</th>
<th></th>
<th>Widows</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100%</td>
<td>75%</td>
<td></td>
<td>100%</td>
<td>75%</td>
</tr>
<tr>
<td>Amount</td>
<td>BF 7,547</td>
<td>25,471</td>
<td>13,937</td>
<td></td>
<td>26,905</td>
<td>14,549</td>
</tr>
<tr>
<td>Index</td>
<td>100</td>
<td>338</td>
<td>185</td>
<td></td>
<td>357</td>
<td>193</td>
</tr>
</tbody>
</table>


(ii) contributions from the employers,
(iii) contributions from the state,
(iv) contributions from pensioners.

From this, it is obvious that the bulk of the payments into the system stems either directly or indirectly from the labor productivity of the active population. As a result, we have taken the age-specific schedule $g(a)$ as that of the distribution of the active population weighed by a productivity profile (Spengler-coefficients). The schedule $g(a)$ is given in column 1 of Table 1 and is presented together with the schedules that would have been obtained if the active population had the productivity schedules of Hungary or Canada. As can be seen from Table 1, the shape of the three $g(a)$-schedules is similar and their use in subsequent calculations would only lead to very minor differences. The schedule $k(a)$ of payments out of the system was not so easily obtained as we possess only rudimentary information on the age-specific distribution of the costs. Nevertheless, analysis of data stemming from family budgets indicate that the cost of a person above age 65 is on average nearly 3 times as large as that of a person in his thirties and that also costs of children below age 5 are higher than that of adults. Similar figures stem from the comparison of the average per capita payment made to a wage earner with that made to a pensioner or widow. The data of Table 2 show that a pensioner or widow entitled to the 100 % coverage (i.e. those falling below a certain income level) costs about 3.4 times as much as a wage-earner and that those entitled to the 75 % coverage nearly twice as much. Orders of magnitude of the ratio of costs of persons 65+ to those of adults that range between 2.5 and 3 have also been reported by J. Bourgeois-Pichat for several member states of the Council of Europe for the early 1970's. Finally, given the lack of a detailed age specific profile for $k(a)$ for Belgium, we have adopted the schedule reported by Gauthier (1973) for Canada where the ratio of 3 is very closely approximated. This schedule for $k(a)$ is also given in Table 1.

The network of stable populations used here consists of those with a life expectancy at birth for males of 68.8 and for females of 72.5 years (Model West in Princeton life tables) and intrinsic growth rates of +0.70, 0 and −0.80 percent
respectively. These growth rates correspond with net reproduction rates (NRR) of 1.2, 1.0 and 0.80, which bracket the NRR's actually observed in postwar Belgium. The corresponding age distributions are summarized in Table 3 and compared to the actual Belgian one in 1980 for the two sexes separately. In subsequent calculations, however, the sexes are combined as the profiles of g(a) and k(a) refer to the entire population irrespective of sex.

The values of \( \bar{\alpha}, \bar{\alpha}_g, \bar{\alpha}_k, \bar{\alpha}_s \) and of G, K and S are shown in Figure 1 for the network of stable populations just outlined. As can be seen there, the intersection of \( \bar{\alpha} \) and \( \bar{\alpha}_g \) (point A) corresponds with a maximum for G in a stable population with a slight negative growth rate of \(-0.5\%\). As the variance of g(a) is considerably smaller than that of c(a), a maximum should indeed be obtained for \( \bar{\alpha} = \bar{\alpha}_g \). Since the variance of k(a) (k(a) having a U-shaped form) is larger than that of c(a), a minimum for K will be reached when \( \bar{\alpha} = \bar{\alpha}_k \). This point, however, falls entirely outside the range of stable populations used here: minimum costs to the health insurance system would indeed occur in a much younger population, i.e. in a stable population with a high positive growth rate. The intersection of \( \bar{\alpha}_s \) and \( \bar{\alpha} \), however, falls within the specified range and identifies a stable population with the most favorable balance in the health insurance system as one with a growth rate of \(+1.2\%\), i.e. with a fertility level just slightly higher than the postwar maximal NRR. Clearly, the age-specific patterns of payments and costs used here to approximate the actual pattern in many Western European nations with "pay as you go"-systems of health insurance yield optimal arrangements in a population which is younger than most actual populations in these countries.
Figur 1:
Values of parameters in equations (1) and (5) in a network of stable populations, both sexes combined, $e_0 \approx 70$ years
The only problem left aside is that of scales for \( G, K \) and \( S \). The absolute values in Figure 1 for these quantities stem entirely from the fact that \( \int_0^\infty k(a) \, da \) and \( \int_0^\infty g(a) \, da \) have been set to unity. If these areas under the curves were set proportional to real monetary values, the lines for \( G \) and \( K \) would shift upward or downward. If the age-specific profile, however, would remain untouched and only the areas would change, the values of \( \bar{a}_g, \bar{a}_n \) and \( \bar{a}_s \) would also remain unchanged and hence the locus of the maximum values for \( G \) and \( S \) and of the minimum for \( K \) would correspond to stable populations that are perfectly identical to those identified in Figure 1. In other words, for as long as the proportional distributions of \( g(a) \), \( k(a) \) and \( s(a) \) remain unaltered, scale adaptations result solely in the upward or downward shift of \( G, K \) and \( S \) but not in a dislocation of their maxima and minima. Such shifts have obviously been taking place from time to time in actual populations as costs and contributions rose: the actual change is one of lateral movement with respect to \( r \) and of autonomous and adaptive movements upward of the lines for \( K \) and \( G \). Given the striking fact that the balance \( S \) is not all that much affected by a downward shift in \( r \) in the range comprised between +1.5 and −0.5 percent, one can readily suspect that non-demographically induced shifts in \( K \) and \( G \) carry the bulk of the actually observed trends in costs and contributions, with \( G \) increasingly lagging behind \( K \).

2.2. The demographic impact on the health and pension system in Belgium, 1968–78

As just indicated, the values of \( G \) and \( K \) can increase as a result of:

(i) age structure effects (i.e. the equivalent of a change in \( r \) in Figure 1);
(ii) an autonomous rise in per capita costs and contributions which leaves the proportional distributions \( g(a) \) and \( k(a) \) essentially unaltered;
(iii) a change in the shape of \( g(a) \) and \( k(a) \).

It is however, likely that an actual change in the finances of these sectors is produced by a combination of these three analytically distinct causes. More specifically, (ii) and (iii) especially may be linked since a rise in costs may lead to a greater proportional concentration of these in the older age groups and a rise in contributions are likely to weigh heavier in the age groups of the active population with the highest salaries. The interaction between changes in the proportional schedules \( g(a) \) and \( k(a) \) and in the monetary values for \( G \) and \( K \) cannot be studied on the basis of the current statistical information available in Belgium. We shall, therefore, assume that \( g(a) \) and \( k(a) \) have essentially remained constant in the period 1968–78 or that such changes have a negligible impact on the comparisons we are about to make. Hence, the effect of factor (ii) being set to zero, we can now engage in disentangling the effects of factor (i) and (iii).

An additional implication is of course the fact that real age structures are not stable but reflect a more perturbed demographic past. The data in Table 3 already
Table 4:
Effect of Age Composition Changes in Belgium and in Stable Populations on the Health Insurance System, 1961–1985

<table>
<thead>
<tr>
<th></th>
<th>Contributions G</th>
<th>Costs K</th>
<th>Ratio K/G</th>
<th>Index K/G on the basis of K/G in a stationary population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgian age structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(both sexes combined)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>6.445</td>
<td>5.059</td>
<td>0.785</td>
<td>97.6</td>
</tr>
<tr>
<td>1975</td>
<td>6.362</td>
<td>5.012</td>
<td>0.788</td>
<td>98.0</td>
</tr>
<tr>
<td>1980*</td>
<td>6.614</td>
<td>5.018</td>
<td>0.759</td>
<td>94.4</td>
</tr>
<tr>
<td>1985*</td>
<td>6.885</td>
<td>5.069</td>
<td>0.736</td>
<td>91.5</td>
</tr>
<tr>
<td>Stable populations (e₀ = 70)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(both sexes combined)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRR = 0.80 (r = -0.85%)</td>
<td>6.496</td>
<td>5.664</td>
<td>0.872</td>
<td>108.5</td>
</tr>
<tr>
<td>NRR = 1.00 (r = 0.00%)</td>
<td>6.484</td>
<td>5.213</td>
<td>0.804</td>
<td>100.0</td>
</tr>
<tr>
<td>NRR = 1.20 (r = +0.70%)</td>
<td>6.334</td>
<td>4.898</td>
<td>0.773</td>
<td>96.1</td>
</tr>
</tbody>
</table>

* Projection with NRR = 0.80

indicated that the population segment between ages 15 and 64 in Belgium is larger than the corresponding segment in any of the three reference stable populations despite the fact that the two stable populations with an NRR of 1.20 and 0.80 bracket the postwar fertility experience. This concentration in the middle age groups stems from the following facts:

(i) the proportion 65+ has been declining recently because of the dying off of "surplus-cohorts" born at the time of much higher birth rates (i.e. cohorts born before 1910) and their replacement by much smaller cohorts born during World War I and during the early 1920's. The fairly early fertility transition, which led to an "over-aging" in the 1950's and early 1960's is now producing a favorable trend as a wave of surplus cohorts disappears. It should be noted, however, that countries with a slower fertility transition (e.g. the Netherlands) are facing exactly the opposite problems and will still have to live with the transitional "over-aging" phenomenon that the Belgians or the Swiss have had more than a decade ago.

(ii) the decline in fertility since 1963 has left a wide indentation at the radix of the age pyramid thereby reducing the proportions below age 15 or 20.

The consequence of such a perturbed demographic past is that the link between the quantities of Figure 1 and the growth rate or the NRR on the vertical axis is no longer intact and that the basic rules defined in the previous section with respect to $\bar{a}$, $\bar{a}_k$ and $\bar{a}_k$ will only hold by rough approximation. Despite this, it is quite worthwhile to see in what direction age compositional changes have had an impact on the current situation in the health insurance system.
Table 5:
Evolution of Major Economic and demographic Indicators and of Components of the Health Insurance and Pension Systems in Belgium, 1968–1985
(1968 = 100)

<table>
<thead>
<tr>
<th>Year</th>
<th>GNP</th>
<th>Disposable Income Households</th>
<th>Wages</th>
<th>Contribution Health Insurance</th>
<th>Costs Health Insurance</th>
<th>Number of Contributors Health Insur.</th>
<th>Number of insured persons</th>
<th>Average contribution per contributor</th>
<th>Average payment per insured person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
</tr>
<tr>
<td>1970</td>
<td>113.4</td>
<td>110.8</td>
<td>116.3</td>
<td>122.2</td>
<td>126.1</td>
<td>111.4</td>
<td>105.4</td>
<td>112.5</td>
<td>120.5</td>
</tr>
<tr>
<td>1972</td>
<td>125.1</td>
<td>123.8</td>
<td>136.9</td>
<td>154.9</td>
<td>158.2</td>
<td>114.9</td>
<td>108.9</td>
<td>112.1</td>
<td>146.4</td>
</tr>
<tr>
<td>1974</td>
<td>139.8</td>
<td>137.2</td>
<td>160.5</td>
<td>171.7</td>
<td>184.4</td>
<td>119.3</td>
<td>112.1</td>
<td>145.3</td>
<td>167.7</td>
</tr>
<tr>
<td>1976</td>
<td>144.5</td>
<td>146.2</td>
<td>169.6</td>
<td>208.4</td>
<td>213.6</td>
<td>117.3</td>
<td>114.7</td>
<td>145.3</td>
<td>167.7</td>
</tr>
<tr>
<td>1978</td>
<td>150.1</td>
<td>153.7</td>
<td>182.2</td>
<td>232.2</td>
<td>233.6</td>
<td>118.1</td>
<td>117.3</td>
<td>145.3</td>
<td>167.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Population 20–64</th>
<th>Population 65+</th>
<th>Number of unemployed</th>
<th>Contributions Pension Syst.</th>
<th>Costs Pension Syst.</th>
<th>Number of Contribut.</th>
<th>Number of Benefic.</th>
<th>Average Contribution per contributor</th>
<th>Average payment per insured person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
<td>100.-</td>
</tr>
<tr>
<td>1970</td>
<td>100.-</td>
<td>102.-</td>
<td>72.9</td>
<td>127.-</td>
<td>117.-</td>
<td>110.4</td>
<td>109.3</td>
<td>122.9</td>
<td>105.5</td>
</tr>
<tr>
<td>1972</td>
<td>100.8</td>
<td>104.2</td>
<td>86.-</td>
<td>150.5</td>
<td>138.8</td>
<td>112.3</td>
<td>117.7</td>
<td>143.8</td>
<td>105.5</td>
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<tr>
<td>1974</td>
<td>101.9</td>
<td>106.8</td>
<td>101.9</td>
<td>158.9</td>
<td>167.6</td>
<td>116.5</td>
<td>126.4</td>
<td>174.1</td>
<td>105.5</td>
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<tr>
<td>1976</td>
<td>103.1</td>
<td>107.9</td>
<td>208.7</td>
<td>205.4</td>
<td>196.-</td>
<td>112.2</td>
<td>134.2</td>
<td>192.1</td>
<td>105.5</td>
</tr>
<tr>
<td>1978</td>
<td>104.1</td>
<td>108.9</td>
<td>258.-</td>
<td>217.8</td>
<td>219.9</td>
<td>112.1</td>
<td>140.2</td>
<td>202.3</td>
<td>202.3</td>
</tr>
</tbody>
</table>

Notes:
(i) Pension system figures refer to the system of wage earners only, not to that of independants
(ii) All indices for monetary quantities are expressed on the basis of constant 1968-prices

Source:
The basic data needed for such an analysis are presented in Tables 4 and 5. In Table 4 we have calculated the values of $G$ and $K$ with the assumption that 

$$\int_0^\infty g(a) \, da = \int_0^\infty k(a) \, da = 1$$

so that the scale for both quantities is directly comparable to that used in Figure 1. The remarkable features are (i) that the $K/G$-ratio thus obtained for the actual age distribution of 1961 through 1985 (projection) is more favorable than that in the stationary model, and (ii) that ratio's improve after 1975 to reach a level in 1985 that is even more favorable than that of a stable model with much higher fertility (NRR = 1.20) and which should come close to yielding a maximum value of S. In other words, in the next 5 years we shall be reaping the benefit of the fertility transition after 1910 and of higher than usual fertility in the 1950's and early 1960's and will reach an unprecedented favorable set of demographic conditions for the health insurance system by 1985.
The next question is obviously whether or not this favorable short term demographic regime has had any real impact on the current trends in costs and revenue of the health insurance and pension systems. The basic data to answer this are presented in Table 5 and in Figures 2 and 3. They cover the period 1968–1978 and take the form of indices with 1968 as the base year. All monetary variables are expressed here in constant 1968-prices.

The index of the proportion of the population in the active age segment (20–64) and that of the retired age segment (65 +) are both increasing, but the ratio between both age segments (65+/20–64) has stabilized at 0.248 since 1972 and will decrease after 1978. Despite this increase of persons aged 20–64, the number of contributors $N_g$ to both pension and health insurance systems started dropping off from 1974 onward. In addition, the number of beneficiaries $N_k$ to both systems increased in that decade at a much faster pace than the number of elderly persons. Clearly, already at this point is there a disconnection between the demographic trends and those for $N_g$ or $N_k$.

The cause of this disconnection with respect to $N_g$ lies especially in the upsurge of unemployment: unemployed persons no longer pay a personal contribution to either system (the State does on their behalf) and the index of the number of
unemployed rose dramatically from 102 in 1974 to 258 in 1978. With respect to $N_k$, the disconnection is to be sought in the fact that the coverage of both systems has been widened to categories of persons who were not insured before 1968. Moreover, there has also been a clear trend toward further reductions in the number of self-employed persons who now fall increasingly under the general insurance system for wage earners.

The gap between the demographic pattern and the actual evolution in costs and payments widens even further at the next stage. In the health insurance system, both the average cost per intervention and the average number of interventions per insured person have dramatically increased. As a result, the total cost $K$ and the average cost per insured person $\bar{K}$ have, in real terms, doubled or more than doubled by 1978, whereas real GNP-growth has not. As a consequence the cost of the health insurance sector went up from 3.5% of the GNP in 1968 to 6.0% in 1978. To match this non-demographic growth in costs, the volume of payments ($G$) had to increase as well. However, the average payment per contributing person ($\bar{G}$) followed only the slower growth curve of real wages ($W$). With a constant or declining value for $N_g$ and a modestly rising value of $\bar{G}$, the gap between $K$ and $G$ would have become enormous if it were not for the steady increase in the direct contribution from the State. Obviously, the health insurance system is increasingly being financed via fiscal means and loans and hence through a further growth spurt of the Belgian public debt.

Very much the same story holds with respect to the major component of the overall pension system, namely that for wage earners. As can be seen in Table 5 and in Figure 3, there is again no clear connection between the demographic variables (% 65 and % 20–64) and the evolution of the number of beneficiaries ($N_k$) and of contributors ($N_g$). In fact, the index of contributors $N_g$ was still at the same level in 1978 as in 1970, to some extent as a result of the upsurge in unemployment, despite the increase in the active population segment aged 20–64. The index of beneficiaries $N_k$ increased to index 140 whereas the index for the number of persons aged 65+ rose only to index 109. One of the reasons for this increase in $N_k$ is the steady shift of persons who spent a sizeable portion of their lives as independents into wage earner status later on in life together with the extension of the system to certain categories that were not covered during the 1960’s. Characteristic of the pension system for wage earners is also the fact that the pensions $K$ either for pensioners (“retraite”) or their widows (“survie”) have not followed the growth curve of real wages while the evolution in the amount of the payments $G$ have exceeded it. On the whole, the system for wage earners functioned well until 1978 when for the first time the total amount payed into the system $G$ fell short of the amounts $K$ payed out of it. The system for independents, however, had been in trouble for several years as the amounts of the pensions rose very rapidly and as the number of paying independents shrank as a result of the overall trend away from self-employment. The newly emerging deficit in the sector of employees and the long standing one in
the sector of independants is again being carried by the State and adds once more to
the growth of the public debt.

To sum up, the present analysis indicates that the Belgian age composition has
not been evolving toward an unfavorable situation: a growing portion in the age
group 20–64 matches the growing portion in the age segment 65+ (constant 65
+/20–64 ratio's after 1972). The trend should furthermore improve during the
1980's and the most favorable balance between these two age groups will be reached
in 1985. Despite this favorable demographic element, the two major sectors of the
social security system have run into trouble as a result of non-demographic factors
such as a substantial increase in unemployment (to nearly 11 percent of the working
force!), an upsurge in medical consumption with prices for medical services dictated
by the cartels of the various medical professions, a continued decline in the number
of self-employed persons, an increase in persons on the government pay-roll and the
existence of a large public debt and of a precarious government budget which
cannot shoulder any new burden. Despite this diagnosis, government officials were
still blaming the aging component for a sizeable portion of the problem during the
1970's, thereby using an earlier demographic phenomenon as a convenient scape
goat. The use of this argument is definitely misguided as far as the 1970's and 1980's
are concerned but it could become valid again from the 1990's onward. In order to
study the future impact of the demographic component, we need a set of alternative
population projections first.

2.3. Alternative population projections

Two sets of population projections are carried out, both based on a population
closed to migration and assuming constant mortality at the level of the period
1970–71. The first set takes the population to a stationary or a stable state as the
result of constant fertility from 1987 onward. This set contains the following three
projections\(^3\).

H3 (1.0): the Net Reproduction Rate (NRR) rises from 0.78 in 1979 to unity in
1987 and remains constant thereafter, so that a stationary population is
ultimately reached.

H3 (1.2): the NRR increases to 1.2 in 1987 and remains constant thereafter. This
projection results in a stable population with a younger age structure
than the present one and with an intrinsic growth rate of +0.70 percent
p.a. By 2020, the population is 18 percent larger than the present 9.7
million.

H3 (0.8) the NRR stabilizes at 0.8 in 1987. Again, a stable age structure is
reached with a considerably older composition and an intrinsic growth
rate of —0.85 percent p.a. By 2020, the population size is 88 percent of
the present one.

\(^3\) Other projections H1 and H2 were also elaborated leading to stationary populations via the
constraint of either a constant birth stream or a constant total population size. These projections are not
being used in this text (see R. Lesthaeghe et al., 1979, p. 32–37).
Figure 4:
Tracks of the Net Reproduction Rate that define the alternative population projections for Belgium

The second set is based on the assumption of oscillating rather than constant fertility, thereby generating population models with stabilizing population waves: identical birth and death rates, population sizes and age compositions are periodically repeated. In practice, the NRR oscillates sinusoidally between fixed boundaries set at NRR = 0.8 and NRR = 1.2, i.e the levels that bracket the Belgian experience since 1920. The differentiating element is, however, the periodicity of such oscillations:

H4(26): this projection has an increasing NRR to 1.2 in 1994 and a further decreasing NRR to 0.8 in 2007, thereby oscillating with a periodicity of 26 years. This periodicity is equal to the mean age at maternity so that a small cohort of mothers is subject to below replacement fertility and therefore generates another set of small birth cohorts. Conversely, large cohorts of mothers are subject to the high portion of the fertility cycle and generate surplus birth cohorts. It can be shown that the cyclical model with a periodicity equal to the mean age at maternity produces cycles in the birth stream with a maximal amplitude: the phenomenon of very nearly perfect resonance is at work (see A. J. Coale, 1972, p. 186).

H4(52): In this projection, the periodicity is taken as twice the mean age at maternity, i.e. 52 years. Exactly the opposite effect occurs from that in H4(26): small cohorts of mothers are subject to the high portion of the fertility cycle and large cohorts of mothers to the below replacement portion of the NRR-cycle. As a result, maximal dampening in the birth cycles occurs.

H4(13): This is an intermediate projection with a periodicity equal to half the mean age at maternity: the waves in the birth stream are therefore smaller than in H4(26) but larger than in H4(52). The reason for its incorporation lies, however, in the fact that the waves succeed each other at a rapid pace.
It is obvious that each projection in both sets has a very limited chance of being realized. However, a combination of several of them may come closer to reality. In this perspective it is essential to understand the implications of each of these "pure state" projections in order to grasp more fully the implications of any one of the possible mixtures. In this sense, such a set of projections has a non-negligible didactical and analytical value.

The NRR-tracks that define the various projections are shown in Figure 4, while the implied proportions aged 65+ and the dependency ratio's are presented in Figures 5 through 8. The most remarkable feature in all these projections is that the
proportions aged 65+ remain initially unaltered till about 2010 – at about 16 percent for the female and 11 percent for the male population. Also note that this proportion reaches a minimum in 1985 by which time the large cohorts born before World War I will have died and been entirely replaced by the smaller ones born in
the subsequent 2 decades. After 2010 the impact of the current fertility levels and of the fertility paths implied by each projection start coming through. In the projection with continued sub-replacement fertility (H3 (NRR = 0.8)), the proportions aged 65+ reach record levels in 2035 of 23 percent (up from 16) and 16 percent (up from
11) for females and males respectively. This wave toward aging is present in the other projections, albeit at lower levels, with the exception of the projection with continued high fertility (H3 (NRR = 1.2)).

The evolution of the dependency ratio (children + elderly persons per 100 adults aged 15–64) is equally interesting. As can be seen in Figures 7 and 8, the dependency ratio falls to a record low by 1985 (from 57 to 47), but increases again to regain its present level by 2000 in all projections except for the one with continued low fertility (H3 (NRR = 0.8)).

It is finally worthwhile taking a closer look at the models with oscillating fertility. Despite the fact that the oscillations of the NRR are contained between the fairly narrow postwar boundaries of 0.8 and 1.2, the model with amplified resonance (H4 (26)) produced waves in the birth stream that are far larger than the ones witnessed in the last decades. Figures 9 and 10 give a graphical representation of the paths of the female births in projections H4 in comparison with the maximum (1964) and minimum (1975) number of births since World War II: it can be seen that the resonance model produces only 50,000 births at one point and 100,000 births 26/2 = 13 years later while the dampening model produces birth cohorts within a band which is only a third as wide. The proportions 65+ in the three H4-projections follow very similar paths until 2050 as the persons who will join that age group are already born (see Figure 6), but the dependency ratio's are more markedly different from the year 2000 onward, with H4 (26) again producing the course with the most amplified waves. If one considers the fact that the NRR rose from 0.85 in 1940 to 1.25 in 1964 in Belgium, i.e. in 24 years, and fell again to 0.83 by 1975, i.e. in 12 years, then it is obvious that we have already had a major wave in our immediate demographic past: the upward portion of the wave followed a path traced by model H4 (52) and the downward portion followed a segment of the movement typical for H4 (26). The wave thus produced will echo through the age structure and explains a large segment of the future evolution till about 2050.

2.4. The impact of alternative population evolutions on the health insurance system

As said earlier, the demographic conditions for 1985 will be optimal for the financing of the health insurance system as the number of potential beneficiaries will be at an overall low while the number of contributors will stand at a record high. In order to study the impact of future changes in the age composition, we have weighted these age structures generated by the H3 and H4 projections with the g(a) and k(a)-schedules defined in Table 1. The resulting values of G and K were divided by the population size to obtain a per capita quantity and these were again expressed in the form of an index with 1985 as a base year. These indices, I_g and I_k respectively, can be interpreted as follows: for any 100 BF paid or recieved in 1985 per inhabitant, the system will receive I_g and pay out I_k BF at any other year, having to find a way of financing the deficit I_k - I_g. Note that these values are solely the
result of changes in the age composition. It is obvious that a more unfavorable distribution of $k(a)$ or further rises in the value of $\int_0^\omega k(a) da$ will produce an extra deficit which is induced by other than demographic factors.

The values of $I_k$ and $I_g$ are given in Figures 11 and 12 for the various projections. Given that the base year data are precisely the most favorable ones, it is obvious
Figure 12:
Evolution of the index of per capita contributions $I_g$ and costs $I_k$ in the health insurance sector in the projections leading to states of stabilizing cycles, $1985 = 100$
that $I_k$ is bound to be larger than $I_g$ for all the following years. In other words, if the system still has a deficit by 1985, that structural and non-demographically induced deficit will have to be carried along. The striking features in Figures 11 and 12 are:

(i) the values of $I_k$ and $I_g$ remain close until the year 2000 except in the projections which postulate rising and high fertility in the next 3 decades (H3 (NRR = 1.2) and H4 (52)).

(ii) on the other hand, after 2005 the indices diverge rapidly and produce large deficits by 2030 to 2035. The lower fertility, the higher the demographically induced deficit is likely to be.

These observations, however, should not be misunderstood. They do not imply that the demographic factor will automatically lead to the bankruptcy of the social security system after 2015 if fertility remains at the current sub-replacement level. Far too many other factors carry substantial weight. Hence, the calculations performed so far only bring out that the demographic factor will cease to have its present alleviating impact whatever the future course of fertility will be and that the maintenance of sub-replacement level fertility will just increase the risk of an imbalance in these social security sectors.

3. Alternative demographic paths
and their macro-economic impact

Even if one wishes to go only marginally beyond the level of mere verbal speculation about the macro-economic consequences of demographic change, one runs into serious problems. Firstly, demographic effects emerge only in the long run while very fundamental structural economic changes can take place much more rapidly. Secondly, even if one wishes to establish the impact of demographic factors on economic growth for historical periods, one may face major specification problems. In other words, fundamentally different theories and models can be worked out which may all prove to account reasonably well for the observed trend. The irony of the present situation is that agnosticism with respect to the value of econometric modelling and the degree of sophistication reached by econometrics are both at an overall high.

Despite such widespread cynicism, it is our view that much can be learned from a worked out example for as long as the implications of certain assumptions and of the necessary ceteris-paribus-clauses are well understood. In the exercise that follows, we have only one essential question: how sensitive is our present economic system to demographic change? This may seem a naive question for we all know fully well that the economy of the first decades of the 21st Century is not likely to resemble that of the last three decades. Hence, all we can do is try to reap a little wisdom from an attempt to establish plausible orders of magnitude.
3.1. A neo-classical economic model for Belgium and its sensitivity to demographic change

If the real growth of the GDP in post-war Belgium is decomposed by means of a Cobb-Douglas production function, we find that the factor labor (i.e. the main production factor through which the demographic variables operate) is responsible for 6 percent of that growth. The other production factors, capital and technological progress, account for 34 and 60 percent respectively (see also Denison, 1967). Admittedly, such a decomposition is far from flawless; but even if one applies other assumptions embedded in alternative production functions, labor’s share does not surpass the 10 percent level. Moreover, the impact of the factor labor incorporates not only the purely demographic variables but also the net balance between increased education and the reduction in working hours together with the increased labor force participation of women. In other words, the impact of purely demographic factors was probably even smaller than the percentages just quoted suggest.

The impact of demographic change on economic growth has also been studied by means of a larger econometric model (see Lesthaeghe et al., 1979, p. 125–143 for a full description). The basic definitions and equations are given in the appendix. The characteristics of the model can be described as follows:

(i) Fertility and mortality conditions determine the age composition in a population that is essentially closed to migration. The age structure enters into the model as an exogenous variable and there are no feedback mechanisms from the economy to the demographic variables. The active population by age and sex, \( P_{ij} \), is weighed by a constant age- and sex-specific consumption function and converted into the total number of consumer units (CU). Furthermore, \( P_{ij} \) produces the total labor force (LA) and the labor supply expressed in “efficiency units” (LAEU) after being weighed by a sex-specific parameter for education, an age-specific productivity function and a constant average number of hours worked per active person per year. The ratio between LAEU and LA produces the labor efficiency coefficient EUC. The number of consumer units CU, the total labor force LA and the labor efficiency coefficients EUC are three demographically determined inputs to the economic part of the model.

(ii) From this point onward, the total number of consumer units CU produces, together with disposable income \( YD \), the total volume of consumption C. The impact of disposable income in the model is far larger than that of the demographically induced changes in the number of consumer units so that oscillations in CU generate only small echoes through the system. The role of LA and LAEU or EUC is more pronounced: both factors enter the economy through the labour market mechanisms.

(iii) The private sector in the model operates essentially along the lines of the theories embodied in a Phillips wage function and a Cobb-Douglas production
Figure 13:
Growth rates of the gross domestic product (GDP) implied by the population projections leading to stable states (H3-set)

The government sector is especially active in preventing the unemployment rate from rising above the 10 percent level: if any excess labor emerges, it contributes to production via the government sector. This particular feature of the model was quickly activated in all simulations and remained operative even after the large birth cohorts of the early 1960's had passed through the active population age segment.

As can be seen from the diagram presented on Figure 10, the only inputs to the model are the demographic ones. It is therefore no surprise that the swings in the GDP-growth rate follow the course of the LAEU-variable rather closely. If the model is fed with a constant age structure (that of 1979), a stable GDP-growth rate of 2 percent results after 25 years. The rates produced by the H3 and H4 sets of demographic projections are pictured on Figures 13 and 14.

On the whole, an economy of the post-war Belgian type is clearly susceptible to demographic changes. We must also admit that the orders of magnitude of the swings or differences in the GDP-growth rates were larger than we had anticipated. The demographic tides produced by projection H4 (26) generate oscillations of the GDP-growth rate comprised between 1.22 and 2.84 percent (see Figure 14), while the difference between the constant high and low fertility projections of the H3-set corresponds to about 1.6 percentage points (see Figure 13). Such a difference is one seventh of the difference that was observed in the postwar period when the GDP-growth rate in real terms reached a maximum value of +6.9 percent in 1964 and a minimum value of −1.5 percent in 1975.
Figure 14:
Growth rates of the gross domestic product (GDP) implied by the population projections leading to the state of stabilizing cycles (H4-set)

4. Conclusions

The findings reported here concerning the orders of magnitude of demographically induced effects neither support the pesimistic philosophies advanced in certain European intellectual circles that credit the demographic variables with the power of creating major economic depressions, nor support the opposite view that considers the demographic factor as playing only a trivial role. Instead, they indicate that demographic-economic problems arise because of the juxtaposition of waves in population variables, produced during our demographic past, with trends, singular or not, in economic variables that stem largely from non-demographic sources. Swings in our fertility history produce irregular age structures and the passage of a surplus-or deficit-cohort may cause different problems at different moments, depending on its location in the age pyramid and on the prevailing economic and financial circumstances of the sectors concerned. The arrival of surplus-cohorts in the age group above 65 during the 1960's together with a very rapid increase of autonomous costs of the healt insurance services amplified the financial burden of this sector in the same way as the arrival of surplus-cohorts at the radix of the active population age segment in a situation of a shrinking employment opportunities aggravated the burden of unemployment during the second half of the 1970's.
Despite the fact that the nature of these problems is not so difficult to understand, misinterpretations frequently occur. During the late 1950's and early 1960's the aging of the Belgian population was blamed for almost any economic illness, ranging from the deterioration of the Walloon industrial capacity to the increase in social security costs. Low fertility (la dénatalité) was seen as the underlying cause and the execution of a vigorous pronatalist policy proyaimed as the remedy. Yet, at that time, the net reproduction rate was about 1.2 and the sizes of the birth cohorts were the largest ever since 1918.

The following quote from *Le Monde* (December 30, 1980) illustrates once more how enigmatic demographic effects appear to be:

**Population active**

*L'accroissement du chômage est un drame provoqué, nous dit-on, par l'augmentation de la population active de notre pays avec, en particulier, l'arrivée des jeunes sur le marché du travail.*

*Notre drame futur, nous répéte-t-on, c'est que, ne faisant pas assez d'enfants, nous allons provoquer une diminution de la proportion de la population active de notre pays.*

*Même si cela est contradictoire, de beaux esprits nous expliqueront sûrement qu'il existe une logique qui nous échappe.*

_Michel Caste._

In the light of the current labor-market conditions in Belgium, we wonder what the levels of youth unemployment would be during the 1980's had the net reproduction rate remained at 1.2 after 1963.

These examples suffice to indicate that the impact of demographic ups and downs depend largely on future economic conditions and that the presumed “solution” for a sectorial problem at present may well be the “cause” of another problem in another sector a decade later.

In view of this, it may be wise to replace the search for an “optimal” strategy by one aimed at the definition of a “safe” strategy. Such a “safe” strategy would consist, at least for most industrialized nations, in maintaining the demographic regime that came into existence after the fertility transition of the period 1870–1920. Since that date, a stationary population model has been approximated and any substantial deviation from it, *whatever its direction*, leads to a discontinuity in the form of population waves. If such population waves can be self-reinforcing (see projection H4 (26) with resonance for example) and if they can generate particular sectorial problems at later points in time depending on future and unknown
economic conditions, a safe procedure would indeed consist of pursuing a policy aimed at minimizing deviations from a stationary population trend. Considering that our institutions have had nearly three quarters of a century to become adapted to such an “average” stationary population model, an increase in fertility to no more than the reproduction level would be welcome at present. If this would not materialize, we are increasing the risk that a major wave toward very high degrees of aging could produce a greater than average shock to the institution of the welfare state shortly after the turn of the century.

In short, the philosophy of this paper rests on the following arguments:

(i) the economies and institutions of the European welfare states – which in my view are worth defending – are adapted to an overall stationary population and to some oscillations around such a model;
(ii) More systematic or more amplified waves around the stationary state are a risk factor as they can interact with unpredictable, possibly unfavourable, economic conditions;
(iii) Population policies should therefore no longer be viewed as elements embedded in ideologies that date from the 19th Century but as flexible and pragmatic tools aimed at keeping the birth stream as close as possible to that of the stationary model;
(iv) Since, however, demographic processes and fertility in particular, cannot be directed easily in one direction or another on the basis of classic economic policy tools and as more “promising” types of intervention can be classified as unethical, we have virtually no other alternative for the future than to engage in very cautious economic planning with respect to the sectors that are likely to be most affected by such demographic ups and downs.

Appendix:
Outline of the Econometric Model.

1. Equations

  \[ LA_{ijt} = a_{ij} \cdot P_{ijt} \quad (i = 1, 2; \ j = 14, 15, \ldots 100) \]  
  \[ LA_t = \sum_{i=1}^{2} \sum_{j=1}^{100} LA_{ijt} \quad (i = 1, 2; \ j = 14, 15, \ldots 100) \]  
  \[ LAEU_{ijt} = d_t \cdot s_j \cdot p_j \cdot a_{ij} \cdot P_{ijt} = d_t \cdot s_j p_j \cdot LA_{ijt} \]  
  \[ (i = 1, 2; \ j = 14, 15, \ldots 100) \]  
  \[ LAEU_t = \sum_{i=1}^{2} \sum_{j=14}^{100} LAEU_{ijt} = d_t \cdot \sum_{i=1}^{2} \sum_{j=14}^{100} s_j \cdot p_j \cdot LA_{ijt} \]  
  \[ (i = 1, 2; \ j = 14, 15, \ldots 100) \]
\[
EUC_t = \frac{ELEU_t}{(L\lambda_t \cdot d_t)} 
\]

\[
\ln \text{LEU}_t = 1.3934 + 0.3204 \ln X_t + 0.06874 \ln Q_t - 0.06874 \ln W_t \\
+ 0.05551 \ln Q_{t-1} - 0.05551 \ln W_{t-1} + 0.03140 \ln Q_{t-2} \\
- 0.03140 \ln W_{t-2} - 0.00592 t + 0.6716 \ln \text{LEU}_{t-1} 
\]

\[
L_t = \frac{\text{LEU}_t}{EUC_t} 
\]

\[
u_t = \left[ \frac{L\lambda_t - LG_t - (L_t/d_t)}{L\lambda_t} \right] \cdot 100/L\lambda_t 
\]

\[
LG_t = \left[ \frac{1}{10} \cdot \left( \sum_{h=1}^{9} \frac{(L_{t-h}/d_{t-h}) - (L_{t-h-1}/d_{t-h-1})}{(L_{t-h}/d_{t-h-1}) + \log} + 1 \right) \right] \cdot LG_{t-1} 
\]

- Capital Stock and Investment.

\[
\ln K_t = 0.14266 + 0.096 \ln X_t + 0.032 \ln X_{t-1} - 0.03367 \ln Q_t \\
+ 0.03367 \ln W_t - 0.03367 \ln Q_{t-1} + 0.03367 \ln W_{t-1} \\
- 0.00231 t + 0.872 \ln K_{t-1} 
\]

\[
I_t = K_t - (1 - \delta) \cdot K_{t-1} 
\]

- Consumption.

\[
C_{U_{ijt}} = c_{ij} \cdot p_{ijt} \quad (i = 1, 2; \ j = 1, 2, \ldots 100) 
\]

\[
C_t = \sum_{i=1}^{2} \sum_{j=1}^{100} C_{U_{ijt}} \quad (i = 1, 2; \ j = 1, 2, \ldots 100) 
\]

\[
C_t = 0.00857 C_t + 0.6348 Y_{Dt} 
\]

- Factor Price Equations.

\[
\ln W_t = \ln W_{t-1} - 0.01466 + 0.05643/u_t + 0.7982 \ln (X_t/L_t) \\
- \ln (X_{t-1}/L_{t-1}) 
\]

\[
Q_t = pk_t \cdot (\delta + R_t) 
\]

\[
R_t = 1.349 + 0.7689 R_{t-1} - 19.6856 [(B_t - B_{t-1})/B_{t-1}] \\
+ 12.7373 [(Y_t - Y_{t-1})/Y_{t-1}] 
\]

\[
Y_t = X_t + XG_t + T2_t 
\]

\[
Y_t = C_t + I_t + G_t 
\]

\[
Y_{Dt} = Y_t - T1S_t 
\]

- Government Action [Eqs. 21–25]

\[
G_t = \left[ \frac{1}{5} \cdot \left( \sum_{h=1}^{5} (Y_{t-h} - Y_{t-h-1})/(Y_{t-h-1}) + 1 \right) \right] \cdot G_{t-1} 
\]
\[ XG_t = \left[ \frac{1}{5} \cdot \left( \sum_{h=1}^{5} \frac{(Y_{t-h} - Y_{t-h-1})}{(Y_{t-h-1})} + 1 \right) \right] \cdot XG_{t-1} \] (22)

\[ T1S_t = T1S_{t-1} - 5253.77 + 0.2808 (Y_t - Y_{t-1}) \] (23)

\[ B_t = \left[ \frac{1}{3} \cdot \left( \sum_{h=1}^{3} \frac{(Y_{t-h} - Y_{t-h-1})}{Y_{t-h-1}} \right) + 1 \right] \cdot B_{t-1} \] (24)

\[ T2_t = [(Y_{t-1} - Y_{t-2}/Y_{t-1}) + 1]T2_{t-1} \] (25)

\[ \ln X_t = [(X_t - X_{t-1})/X_{t-1}] + \ln X_{t-1} \] (26)

\[ \ln L_t = [(L_t - L_{t-1})/L_{t-1}] + \ln L_{t-1} \] (27)

\[ \ln Q_t = [(Q_t - Q_{t-1})/Q_{t-1}] + \ln Q_{t-1} \] (28)

\[ \ln K_t = [(K_t - K_{t-1})/K_{t-1}] + \ln K_{t-1} \] (29)

Constants:

\[ a_{ij}, d, p_j, lg \]

2. Symbols and Orders of Magnitude, Belgium 1970 (1 US$ \approx 35 BF)

- **a**: Labour force participation rate
- **B**: Total money supply (397,050 million BF = US $11,344 million)
- **c**: Coefficient of potential consumption
- **C**: Total amount of private consumption expenditure (761,543 million BF = US $21,758 million)
- **CU**: Total amount of consumer units (1 unit = propensity to consume of an adult man) (7,671,179 units)
- **δ**: Depreciation rate of capital (=0.084)
- **d**: Average number of hours worked per person per year (2,092 hours)
- **EUC**: General coefficient of labour efficiency
- **G**: Total amount of government expenditure (includes government investment and consumption) (333,464 million BF = US $9,528 million)
- **i**: Sex (i = 1 for female; i = 2 for male)
- **I**: Total amount of gross private investment (179,252 million BF = US $5,121 million)
- **j**: Age
- **K**: Total amount of gross capital in the private sector (= total demand for capital) (1,285,811 million BF)
- **L**: Total number of hours worked in the private sector (= total labour demand as expressed in working hours) (6,123 million hours)
- **LA**: Total labour force (3,918,109 people)
- **LAEU**: Total labour force as expressed in efficiency units (8,196,684 thousand efficiency units)
LEU total labour demand as expressed in efficiency units (6,123,399 thousand efficiency units)

lg autonomous growth trend in the number of government employed people

LG total number of people employed by the government (914,863 people)

P end of year population (9,650,944 people)

p labour productivity weight associated with age and sex

pk index of price of capital (14.31 per cent)

Q implicit rental price of capital (14.31 per cent)

R interest rate (5.91 cent)

s education coefficient associated with sex

t time (year)

T1S total amount of direct taxes = the balance of the social security transfers (170,301 million BF = US $ 4,865 million)

T2 total amount of indirect taxes (146,225 million BF = US $ 4,178 million)

u unemployement rate (7.94 per cent)

W average wage per hour in the private industry (95.53 BF)

X total output of the private industry (855,051 million BF = UD $ 24,430 million)

XG total output of the government sector (272,983 million BF = US $ 7,800 million)

Y gross national product (1,274,259 million BF = US $ 36,407 million)

YD total disponable income (1,103,958 million BF = US $ 31,542 million)
References


