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ECONOMIES OF SCALE IN THE ISRAELI HEALTH FUNDS MARKET: ESTIMATION AND IMPLICATIONS

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Abstract

This study examines the relationship between the size of Israel's four health funds and average real cost per member over the period 1991–2003. Case-mix adjustment is achieved by using the 1995 national risk adjustment formula. We used two estimation methods, a panel data analysis, and a cross section of time series analysis. The results are quite robust, and indicate that the size of fund that gives the minimum average cost is 2.2–2.4 million members. The three small funds enjoy economies of scale in their operation, while the biggest health fund, Clalit Health Services (henceforth Clalit) is beyond the minimum point. The results do not change when the fact that Clalit owns hospitals is taken into account. Mergers among the small funds would increase efficiency in production, but would increase market concentration. Splitting the biggest health fund would increase both efficiency and competitiveness. The existence of (dis)economies of scale violates the assumption of constant average costs which is at the basis of the updating of the health budget for population growth and its risk-adjusted allocation among the health funds. Simulation of (i) the surpluses/deficits of the individual health funds and of the market as a whole and (ii) the marginal profit/loss per member in the four health funds under constant and variable average costs over the period 1995–2006 illustrate the importance of acknowledging the variability in average cost in the health funds market.

1. INTRODUCTION

A classical U-shaped average cost curve includes first a range of decreasing average cost with increasing output (economies of scale), and beyond a minimum average cost point, a

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range of increasing average cost (diseconomies of scale). The main reasons for the existence of economies of scale are large fixed costs, specialization, and volume-discounts on input prices. Diseconomies of scale originate from practical inability to increase *all* factors of production.

While in an indemnity health insurance market we expect constant average costs per member because of the approximately fixed marginal administrative burden in handling claims, in Managed Care Organizations (MCOs), which integrate the insurance and the provision of care functions, increasing or decreasing average costs might arise from the functioning of the health care providers or their reimbursement (hospitals, physicians, administration etc.).

Few studies have examined the cost structure of the Health Maintenance Organizations (HMOs), the American version of MCOs, focusing on exploring the reasons for the increasing trend of mergers and acquisitions among HMOs. These studies concluded that the average cost declines as the number of members increases, and stabilizes at a size of 50,000–100,000 members, depending on the type of the HMO (Wholey et al., 1996; Given, 1996).

Health funds are the Israeli version of MCOs. There are four health funds in Israel, each operating a different care management scheme, providing a similar package of benefits. (mandatorily uniform following the introduction of a national health insurance scheme in 1995) The national budget of the package of benefits is determined annually by the government, but is partially indexed to changes in input prices, demography and technological advances. It is financed by an earmarked health tax, transfers from the general revenues and copayments. The annual budget is allocated among the health funds according a prospective risk adjustment based on age only. While no overt evidence of risk selection exists, the risk adjustment system is clearly incomplete and leaves much room for implicit risk selection, dumping of high cost individuals, distortion of quantity and quality of expensive services, and financial difficulties to high-risk health funds.

The largest and oldest fund is Clalit (2005 market share of 54%, 3.5 million members), which operates as a staff-model HMO. It owns general and nursing hospitals, and community physicians are salaried, working in Clalit clinics. Maccabi Health Services (market share 24%, 1.6 million members) and Meuhedet Health Fund (market share 12%, 0.8 million members) have no inpatient beds and contract independent physicians for ambulatory care, and the government, Clalit or other public hospitals for inpatient care. The Leumit Health Fund 10% market share, 0.7 million members) owns no beds, and operates a mixture of salaried and capitated doctors. Inpatient care is purchased from Clalit, public and government hospitals. The shape of the average cost per member depends, consequently, on the pattern of administrative costs, the cost structure of the care provided, and on the structure of reimbursement for the purchased care.

The issue of economies of scale in the Israeli health funds market has never been studied, although the issue is important from at least two perspectives. First, the issue is important from a classical market structure perspective of production efficiency. The existence of economies or diseconomies of scale might have different implications on the importance of entry, mergers and splits, which, in turn, determine the number of health funds and affect the concentration and competitiveness of the market. Recently, for

example, the government announced its plan to encourage the introduction of a fifth health fund to promote competition in the market. Second, the demographic update of the health budget and its risk-adjusted allocation among the health funds are based on the assumption of constant marginal costs of care. An increase of 1% in the population is expected to be compensated by a 1% increase in the total budget, and risk-adjustment rates are constant within age-groups. If there are economies of scale, for example, the 1% increase in the budget over-pays the health funds, and the risk adjustment scheme loses its significance (Encinosa, 2001). This second issue applies to all systems with a centrally determined health budget, which is allocated to decentralized, competitive or geographically distributed care organizations.

In the following sections we estimate, heavily constrained by data availability, a simple model of the Israeli average cost function, and examine the implications of the results with respect to the market structure and the demographic indexation of the national health budget and its allocation among the health funds.

2. THE ECONOMETRIC MODEL AND THE DATA

The specification of the cost function to be estimated was determined by the small number of health funds (four) and by the lack of data on input prices. The estimated model specified that *ln* (average real cost) is a quadratic function of the age-adjusted number of members. A year effect and health-fund-specific effects were introduced as well.

The model was estimated by two methods. First, a panel data analysis (4 health funds X 13 years) was used with fixed effects. Second, cross-sectional time-series analysis was used to allow for different variances by health fund and for correlations between the error terms for different health funds (no serial correlation of first order was found). Since the health funds operate in a closed market, interdependencies among them are expected.

Cost data for the years 1991–1994 were retrieved from the financial reports of the health funds, and for 1995–2003 from the Ministry of Health annual reports on the activity of the health funds. Real costs were calculated by deflating the nominal costs by the implicit price index of the health funds' expenditure. The implicit price index was calculated by dividing the national health expenditure in the health funds market in nominal terms by the same expenditure in real terms. Both types of cost are reported routinely by the Central Bureau of Statistics.

The number of members of the health funds over the years was obtained from the National Insurance Institute.

Members differ from one another by the severity of their illnesses. Consequently, the number of members cannot be taken as the level of (homogeneous) output. In order to arrive at a homogeneous measure of output, a case-mix adjustment is needed (Barer, 1982). We based our case-mix adjustment on the national risk adjustment scheme used in the allocation of the health budget among the health funds introduced in 1995.

The national risk adjustment scheme is composed of nine age groups, with weights w_j (j = 1,2,...9). The weights were set to the ratio of the mean cost in age group j and the grand mean, and have remained constant over the study period. The age-adjusted number of

members in health fund i in year t is calculated as: $p_{it} = \Sigma_j w_j n_{ijt}$, where n_{ijt} is the number of members in age group j of health fund i in year t. The age-adjusted number of members in health fund i in year t is related to the number of members by $p_{it} = s_{it} n_{it}$.

For the years 1991–1994, the National Insurance Institute classified the members' age (for the purposes of the allocation of the Parallel Tax) into three groups only: up to 24 years, 25-64, and 65+. The number of age groups grew to nine in 1995, but we were constrained to use three age groups throughout the period. The grouping of the post-1995 nine groups into three was done using the 1995 data.

The model, which was estimated by both methods, is given by:
$ln\ (ac_{it}) = a + b_1 p_{it} + b_2 p_{it}^2 + v_{it}$, where ac_{it} is the average real cost in health fund i in year t, and p_{it} is the age-adjusted number of members in health fund i in year t. Health fund and year effects were introduced as well. The minimal average cost occurs at
$n_{it}^* = (-b_1)/2b_2 s_{it}$. The corresponding marginal cost (mc) is given by
$mc_{it} = ac_{it} n_{it} (b_1 s_{it} + 2 b_2 s_{it}^2 n_{it} + 1/n_{it})$.

As was mentioned above, not only is Clalit the largest health fund, but it also owns general hospitals. In order to account, at least partially, for the difference in production technology between Clalit and the other health funds in order to identify the size-effect, the estimation was performed twice: for the first estimation we used the cost data of all health funds, as described above. For the second, we adjusted the Clalit cost of ownership of hospitals by subtracting the cost of operating the hospitals (according to Clalit's financial reports) and adding the cost of hospitalization of the Clalit members according to the government tariff (i.e., as if they were hospitalized in government hospitals). We conducted several sensitivity analyses as for the exact definition of the "operating costs" of the hospitals, but the results remained quite robust.

3. THE ESTIMATION RESULTS

Table 1 presents a summary of the key variables averaged over the period studied. Average real (1990 prices) cost per member is NIS 987 (about US$500). When Clalit is considered as a non-owner of hospitals, the average drops to NIS 961, indicating that the internal cost of hospitalization in Clalit is somewhat higher than the market opportunities. The mean size of the health funds is 1.46 million members. We note that the grand mean of s is not 1 (but 1.04). This is the result of an increase in the grand mean cost of care due to an aging population and technological changes, while the national capitation rates remained constant over the estimation period.

Table 1
Variables statistics

Variable	Mean	Std. dev.	Min	Max
AC (NIS, 1990)*	987	137	797	1282
AC (NIS, 1990) (Clalit excl. hospitals)	961	109	797	1167
n ('000)	1460	1244	288	3738
p ('000)	1524	1418	264	4173
s	1.04	0.07	0.89	1.12

* US$1 = NIS 2

Tables 2 and 3 present the estimation results of the average cost function by the two methods, the PDA and the CSTSA respectively. Since the analysis covers all four health funds, fixed-effects panel models were estimated (Table 2). Neither the year variable nor a dummy variable distinguishing between the period before and that after the enactment of the National Health Insurance Law in 1995 was found to be significant, and both were excluded from the regression. In the CSTSA model (Table 3), the year variable was insignificant and was consequently excluded from the regression. The Meuhedet and Leumit funds experienced significantly lower average costs than that of Clalit.

Table 2
PDA estimation results

	Clalit costs including hospitals	Clalit costs excluding hospitals
p	-0.000619 (9.76)*	-.0006184 (9.73)*
p^2	1.40E-07 (7.32)*	1.40E-07 (6.21)*
Constant	7.23 (133.63)*	7.203 (119.69)*
Observations	52	52
R-squared	0.68	0.68

The numbers in parentheses are absolute value of *t* statistics.
* Significant at 1% level.

The focal results are that the size of the health funds that gave the minimum average cost is quite robust to the estimation method and to considering Clalit as the owner of hospitals or purchaser of inpatient care, and is between 2.2 and 2.4 million members. When Clalit is excluded altogether, the minimum-average cost size drops to 1.9 million.

Table 3
CSTSA estimation results

	Clalit costs including hospitals	Clalit costs excluding hospitals
p	-0.00058 (10.9)**	-0.00058 (10.85)**
p^2	1.21E-07 (7.19)**	1.21E-07 (7.14)**
Maccabi	-0.107 (-0.86)	-0.015 (0.12)
Meuhedet	-0.390 (3.05)**	-0.297 (2.33)*
Leumit	-0.310 (2.43)*	-0.214 (1.70)
Constant	7.440 (61.08)**	7.350 (60.24)**
Observations	52	52

The numbers in parentheses are absolute value of *t* statistics.

Absolute value of t statistics in parentheses
* Significant at 5% level; ** significant at 1% level.

Figure 1 presents the predicted average-cost curve from the two methods of estimation, when Clalit is taken as non-owner of hospitals. The CSTSA estimation provides two distinct curves, one for Meuhedet and the other for the remaining three health funds. The figure also presents the number of members in 1991 and in 2006 in the four health funds, and the predicted change in their AC according to the CSTSA estimation. The average cost in Clalit has increased with the increase in its size, since it is located in the range of diseconomies of scale. All other health funds enjoyed a drop in their average costs. Although Maccabi achieved the biggest drop in its AC because of its expansion, the AC of Meuhedet is actually lower, in spite of its smaller size, because of its specific effect (due, e.g., to higher efficiency).

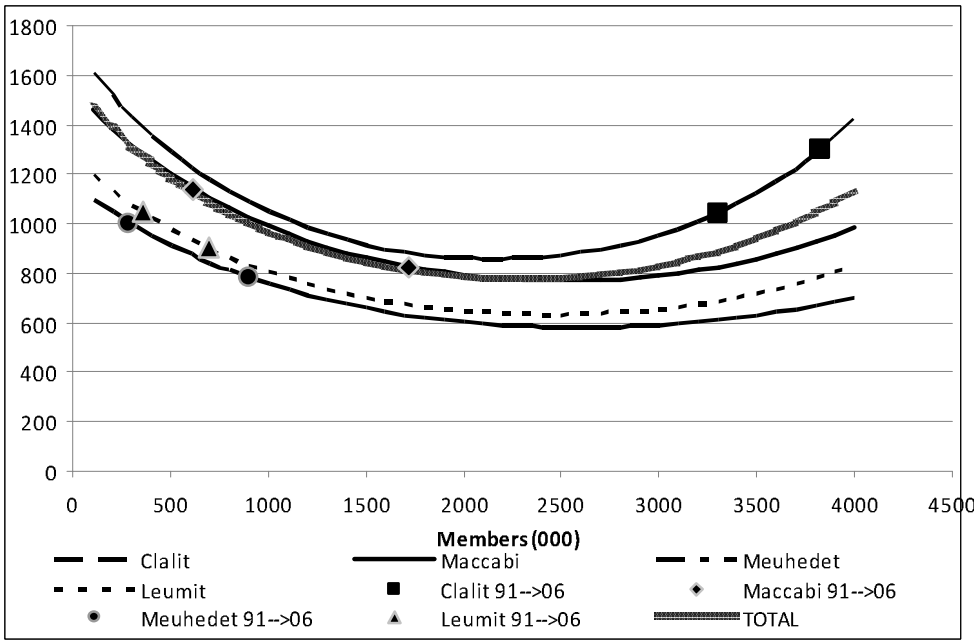
4. IMPLICATIONS

The data are quite limited; however, several clear implications emerge with respect to the market structure, the updating of the health budget, its allocation among the health funds, and the incentives for cream-skimming (also known as preferred risk selection or cherry-picking).

The results indicate that the average cost curve is U-shaped, with a minimum average cost size being 2.2–2.4 million members. Clalit is thus placed beyond that point, suffering from diseconomies of scale in its expansion. On the other hand, Leumit is too small to enjoy the benefits of economies of scale. Meuhedet is similar in size to Leumit, but enjoys lower average costs as a result of other factors. Maccabi showed the greatest expansion,

lowering its average cost considerably. Clalit ownership of hospitals does not seem to have much effect on the average cost patterns, and its higher average costs seem to emerge from its being too big rather than from spending too much on its own hospitals.

Figure 1
The predicted AC (NIS, at 1990 prices)* and the changes in sizes of the health funds from 1991 to 2006



*$1 = NIS 2

The implications for the Israeli health funds market structure are clear: merging Leumit and Meuhedet, an option which has been mentioned in the past, will, indeed improve the efficiency in production, but will increase the concentration of the market. Splitting Clalit into two independent health funds will decrease the concentration and will result in higher production efficiency. The recently advocated plan to encourage the entry of a fifth health fund will decrease concentration, but its effect on production efficiency will depend on which health fund its members are drawn from. If the result is a fall in the market shares of Leumit and Meuhedet, production efficiency will be severely hampered, and both of them as well as the new fund might face financial problems originating from their small size. If most of the new health fund's members switch from Clalit, production efficiency might rise, depending on the size of the new health fund.

The more concrete and testable implications of the non-constant average cost of the health funds are related to the way the their main income is determined—the demographic update of the national health budget originally set in 1995, with the enactment of the (competitive) National Health Insurance Law, and the allocation of the budget among the

health funds. In order to illustrate these implications, we run a simulation of the updating of the budget and its allocation during the period 1995–2006. We completely disregarded the issue of risk adjustment; we focused on the size of the funds, and assumed that each health fund receives revenue in proportion to its market share. We also disregarded changes in the budget due to changes in input prices and technological updates.

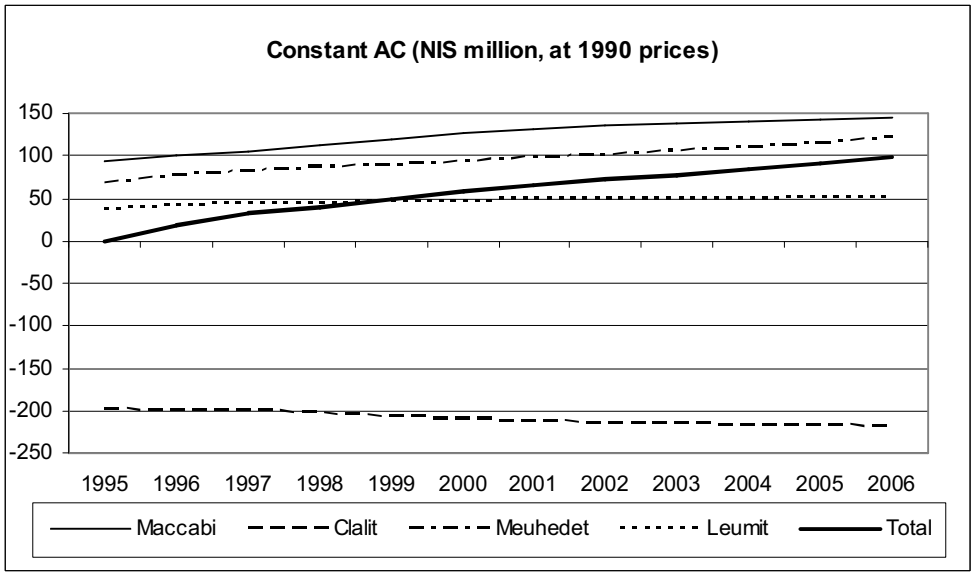
We first predicted the average cost of each health fund for the year 1995 according to its size, using the CSTS model. Under the assumption of constant AC, these costs remained constant throughout the period. Under the non-constant AC, the AC in year *t* was predicted using the CSTS model and the health funds' actual size in year *t*. In order to calibrate the simulation, the 1995 budget was set to the total cost incurred by the health funds, so that in 1995, the system broke even. The individual health fund's deficit or surplus was determined in 1995 according to whether its specific predicted AC was higher or lower than the weighted average of the health funds' ACs. Under full demographic indexation, the budget increases according to the rate of growth of total population. The actual indexation granted by the government was lower, probably reflecting the government's belief in economies of scale in the entire health funds market. The mean annual population growth over the simulation period was 2.27% while the mean actual growth of the budget (due to demographic changes) was 1.94%. One of the questions, of course, is whether the actual indexation was sufficient to keep the budget per capita constant under economies of scale.

Figure 2 portrays the path of the surpluses or deficits of the health funds when the budget is fully indexed, namely, the revenue per capita of the health funds remains constant. When the ACs are constant at their 1995 level (the upper figure), the 1995 surpluses and deficits change according to the size of the health fund (the surplus/deficit per capita is constant), and the total deficit—moderately increasing and reaching about NIS 30 million in 2006—is determined accordingly. When the ACs vary by size (the lower figure), revenue per capita is constant, but the surplus/deficit per capita changes according to the variable AC, and total surplus/deficit depends on the health find's size. Starting as in the upper figure, the individual health finds' paths are completely different when the AC varies by size. In particular, the diseconomies of scale suffered by Clalit caused increasing deficits. Maccabi and Meuhedet, on the other hand, enjoying economies of scale, accumulated big surpluses. Leumit is found in the decreasing AC range, but it is too small and in 1995 its average was too high to achieve a surplus. The aggregate surplus reached about NIS 70 million in 1997, decreased moderately to zero in 2004–2005, and by 2006 became a deifict of NIS 20 million. Note that in 2006 the aggregate market deficit is quite similar under constant and variable ACs, but the situation of the individual health funds is totally different.

The aggregate surplus during most of the period indicates that full demographic indexation of the budget might have overpaid the health funds. Figure 3 presents the surplus/deficit during 1995–2006 under the same two possible average cost structures—constant and variable—with the actual, less than full, demographic indexation. The actual indexation implied that the revenue per capita decreased over time. Consequently, even under constant AC (upper figure), the health finds' margins dropped over the years. Aggregate deficit increased from zero in 1995 to NIS 370 million in 2006, indicating that the actual indexation of the budget was too low. The aggregate deficit of the system is quite

similar under constant and variable AC. However, while under constant AC all four health funds experienced a moderate increase in their deficits, under variable AC Clalit experienced a sharp increase in its deficit, while Maccabi and Meuhedet had increasing surpluses.

Figure 2
Surplus/Deficit in the health funds market with full demographic indexation



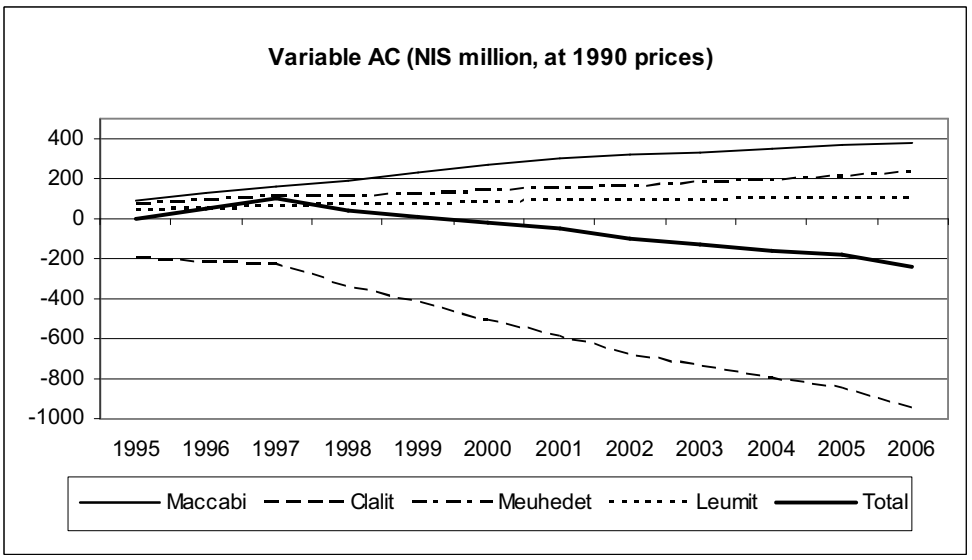
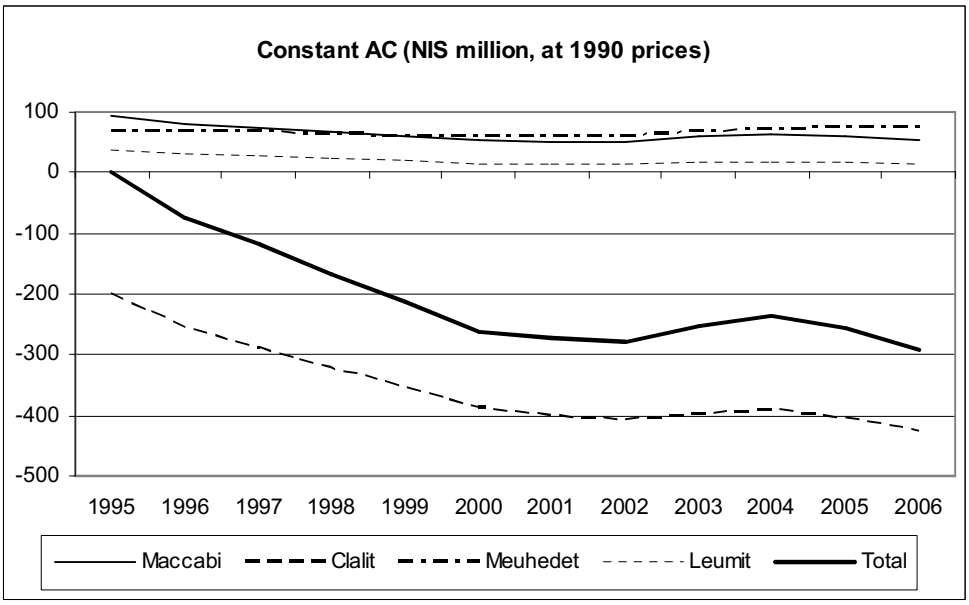
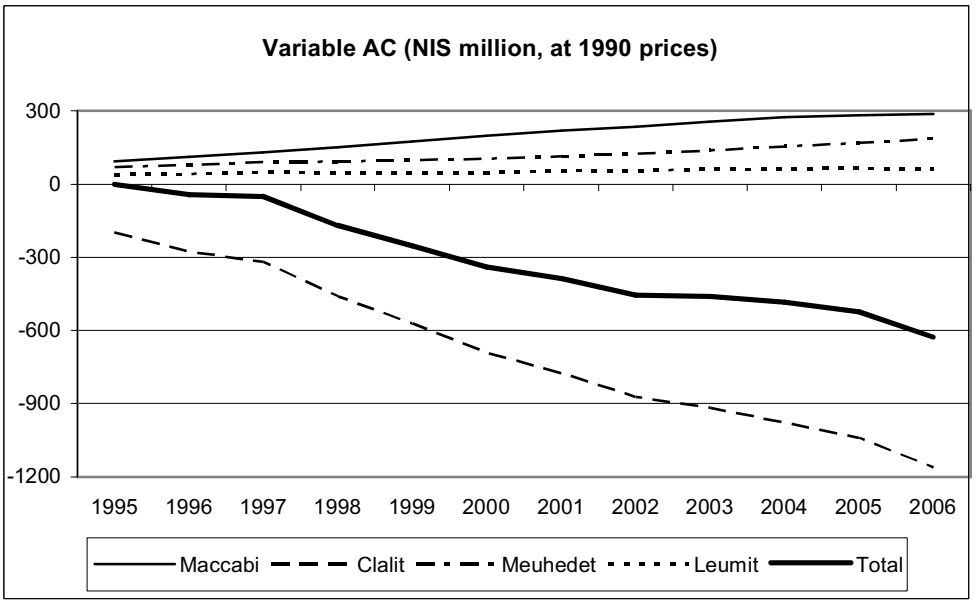


Figure 3
Surplus/deficit in the health funds market with actual demographic indexation





The aggregate surplus is always somewhat bigger (and deficit is somewhat smaller) under variable AC than under constant AC. With increasing population in all health funds, the economies of scale experienced by the three smaller health funds outweigh the diseconomies of scale experienced by the largest, Clalit.

The second simulation produces the marginal profit or loss in each health fund under constant (at the 1995 level) and variable AC. The revenue per member is computed as the weighted average of the ACs of the individual health funds in each year (which is equivalent to the case where the budget covers all costs, and is allocated to the funds according to their market shares). The marginal profit equals the difference between the (constant) income and the marginal cost per member. The upper panel of Figure 4 (constant average cost) in fact shows the differences between the 1995 average (and marginal) cost of the health fund and the weighted average of the AC across health funds. The lower panel repeats the calculations when the AC varies by size. It turned out that for the three smaller health funds, when the AC is decreasing, not only is the MC lower than the AC, but the MC is also decreasing (a similar result was found by Wholey et al., 1996, and Given, 1996). And indeed, the marginal profit per member increased over time, and reached NIS 400 (1990 prices) in Meuhedet, NIS 450 in Maccabi, and NIS 350 in Leumit. The marginal loss in Clalit increased over time, and reached NIS 2,800.

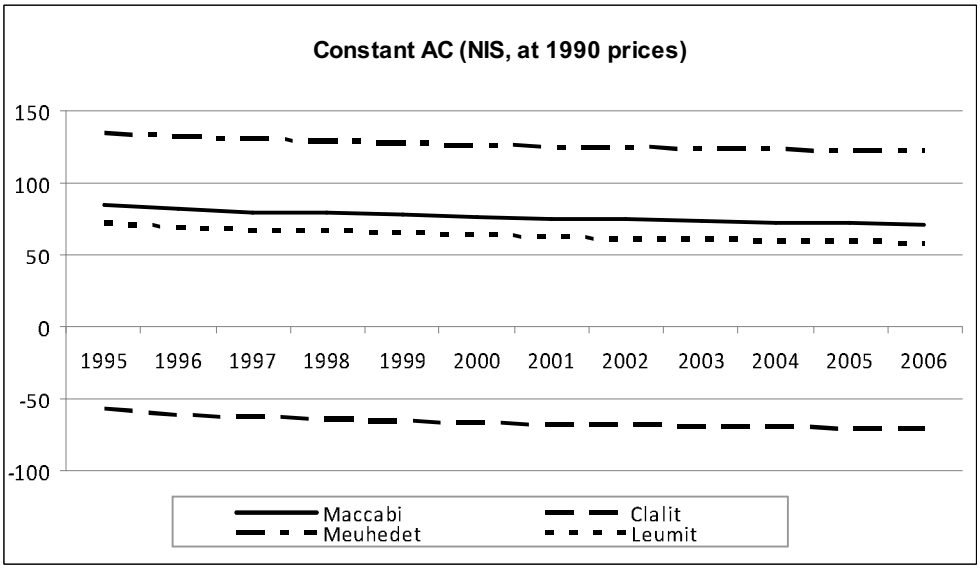
The smaller health funds face no incentive to reject average applicants since they enjoy positive marginal profits, and these profits are likely to increase with their increasing size (because of the age-based risk adjustment, in each age group, sicker than average applicants represent marginal loss). Clalit faces a relatively large loss on new enrollees. Since the national health insurance is universal, and applicants cannot be rejected, Clalit is likely to invest in implicit risk selection measures, including selective advertisement, limiting the quantity and quality of expensive services, and using barriers to the use of services by high risk members.

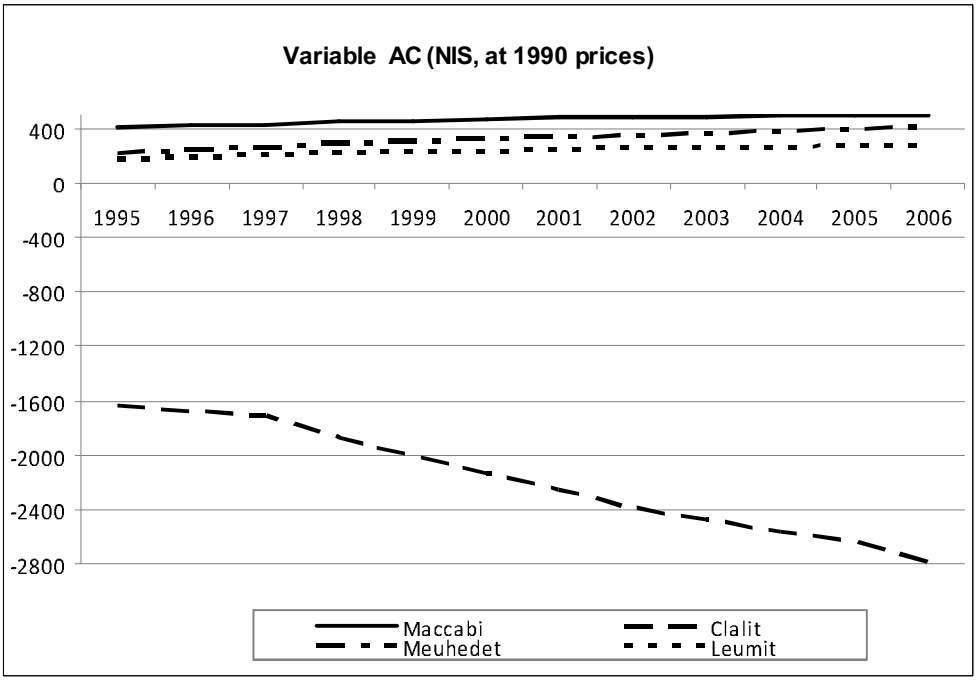
5. CONCLUSIONS

Over the last fifteen years, the Israeli health funds market experienced variable average costs. The minimum AC of the health funds is achieved with a membership of about 2.2–2.4 million. This finding implies that the three small health funds enjoy economies of scale with their increasing populations, while Clalit is too big, and suffers increasing AC. The results are quite robust, and are not likely to be due to another characteristic of Clalit – ownership of hospitals.

With regard to market structure, with the present market shares, there is a clear tradeoff between efficiency and concentration in the range of decreasing AC. Merging health funds, e.g. Meuhedet and Leumit, might result in lower production costs but also in higher concentration. The introduction of a fifth health fund, inevitably small during the first years of operation, will suffer high average costs unless it uses a totally different production function, and its effect depends on the funds from which it draws its members. Splitting Clalit might prove an efficient and pro-competition measure, and should be kept as a viable option.

Figure 4
Marginal profit/loss in the health funds market





The regulator seemed to suspect the existence of economies of scale in the health funds market, and set a demographic update of the budget, which was on average 0.33 percentage points lower than the rate of population growth over the period 1995–2006. This practice proved only partially appropriate—the AC function is U-shaped, with the smaller health funds enjoying economies of scale while Clalit suffers diseconomies of scale. Abstracting from all other factors related to the update of the budget and focusing only on the size of the population, with its increase in all funds, Maccabi and Meuhedet improved their financial situation, while that of Clalit deteriorated. While for any given indexation (full or actual), the aggregate outcome is somewhat better under variable AC, the actual indexation was too low for break-even.

In reality, the health budget has been updated to account for changes in input prices, new technologies and aging as well, and the health funds' revenues included deficit-reducing subsidies. It is thus difficult to examine if the simulation results, focusing on AC and population counts only, can be verified in the health funds' financial reports. The issues discussed above and illustrated by the simulation results call for more research and a closer examination of the way the cost structure of the individual health funds should feature in the update and allocation of the health budget.

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