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Swedish post-war economic development — The role of age structure in a welfare state*

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Abstract

There are strong life cycle patterns in practically all human behavior as well as in resources and capabilities. Variations in the age structure therefore affect all aspects of the aggregate economy. Swedish post-war development exhibit patterns of age structure effects on saving, growth, investment, current account, budget balance and inflation consistent with the dynamics of these variables in historic cycles. The deviations of actual time series from the model predictions arise with identifiable shifts in economic policy. The poor performance of the Swedish welfare state 1975-1995 can partly be explained by policies working against the underlying age structure changes.

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1 Demography and welfare state macroeconomics

During the last years it has been increasingly acknowledged that shifts in life-expectancy can have important effects on key determinants of economic development such as fertility, savings, and human capital investment. In general, these models have focused on the very long run where stable equilibria are established. Similarly, most macroeconomic models assume a stable macro-demographic situation characterized by constant life expectancy and constant or zero population growth. Demographic transition theory, however, imply that the transition from one stable combination of life expectancy and fertility to another is a process that takes several decades or even centuries. Moreover, in most countries both life expectancies and fertility rates are continuously changing. Thus the macroeconomic data we observe are from economies in demographic disequilibrium. Demography defines a largely predetermined variation in economic fundamentals that must be taken into account in order to explain actual economic development.[1].

We use Swedish post-war time series data to evaluate how demographic change affects the macroeconomy and inductively design a macroeconomic model for such effects. Welfare states of the Nordic type manage a major part of life cycle redistribution through the public sector, thus substituting for individual household decisions. Variations in the age distribution are therefore likely to show up in the budget deficits. Rather than life cycle household saving we posit that the budget deficit is one of the three major transmission mechanisms for age effects.

The second important transmission channel is age effects on output. The fact that output tends to grow faster when the active part of the population increases interacts with the budget variation to create a feedback reinforcing both effects. From our empirical results it also turns out to be necessary to take account of a third age effect, viz. on housing demand. These basic age effects suffice to generate a satisfactory macroeconomic model for our empirical results.

The great variety of different age effects must necessarily interact in the equilibration of the economy. We estimate reduced-form parameters of age structure effects on saving[2], growth[3], investment and the current account[4], the budget

[1]This line of thought has a long and distinguished history in economics. Kelley (1969) and Easterlin (1968) are proposing age variation as a fundamental factor behind long swings in the economy. Perlman (1975) gives a historical review of demography in economics.

[2]Leff (1969) is a pioneer that has been followed by a host of studies. Some important studies are Fry and Mason (1982) and Mason (1987) who show that controlling for growth rates stabilizes the relation. Recent studies by for example Kelley and Schmidt (1996) and Horioka (1991) use modern time series techniques to confirm robust relations between dependency rates and savings.

[3]GDP growth effects have been found by McMillan and Baesel (1990) on U.S. time series, Malmberg (1994) on Swedish time series, Bloom and Williamson (1998), Bloom and Sachs (1998) on world samples, Lenehan (1996) on Australian time series, Andersson (2001) on Nordic time series, Lindh and Malmberg (1999a), Lindh (1999a) on OECD samples.

[4]Separate age effects on investment are much less investigated. Higgins and Williamson

deficit[5] and inflation[6] and find cohort-size variations responsible for most of the medium-run trends in these macroeconomic variables. This systematic, more or less cyclical pattern resemble the reference cycle patterns that have been found to be a stable dynamic feature in Sweden over the last 200 years.[7]

In the next section the estimations are presented. In Section 3 a model consistent with the results is developed and the Swedish economic development in the post-war period are discussed. Section 4 summarizes and discusses the implications.

2 Age effects on the Swedish economy

The variation in the age distribution reflects in the macroeconomic development of the economy since economic behavior and resources of individuals vary in a fairly regular way over the life cycle. Macroeconomic effects can arise in two ways. First there is a direct, pure summation effect. For instance an increase in the number of middle aged net savers translates directly into a higher savings rate ceteris paribus. Market adjustments and interaction with other behavioral changes imply, however, that the observed outcome of a shift in the age distribution may either reinforce, dampen or even reverse the direct effect. It is for example conceivable that a contemporaneous increase of children in the population depresses the growth rate and increases budget deficits causing the national saving rate to fall in spite of the increase of net savers. The exact balance will depend in complex ways on economic policy, institutions and other factors.

The analysis of simple direct age effects is different from the analysis of compounded indirect age effects. The former can be calculated from invariant age-specific behavior at the micro level given, of course, that such invariants can be found. The latter are harder to analyze since they involve macroeconomic feedbacks and equilibrium shifts. However, regression analysis of macroeconomic variables' dependence on age structure estimate the total effects of age structure changes and—to the extent that these correlations remain stable—we can use them to predict macroeconomic responses to foreseeable changes in the age distribution. Although such reduced-form regressions do not yield direct information about economic mechanisms, they do give clues to inform an inductive approach to build a model, as we demonstrate in the next section.

(1997), Higgins (1998) and Lindh and Malmberg (1999c) study these and the implied effects on the current account. The latter effect is also the theme in Herbertsson and Zoega (1999).

[5]But Herbertsson and Zoega (1999) show that this correlation holds also in much more general samples.

[6]Age effects on inflation are shown in Lindh and Malmberg (1998, 2000) on an OECD sample. McMillan and Baesel (1990) and Lenehan (1996) show it on time series from the United States and Australia respectively

[7]We are grateful to Lennart Schön for bringing this to our attention.Schön (2000) is a comprehensive discussion in Swedish but a brief account in English is in Schön (1991).

2.1 Estimation methods

We estimate single-equation parameters by regressing the dependent variables on population age shares. One of the difficulties with regression analysis in this context is that age shares in the population change relatively slowly so to achieve sufficient variation we need fairly long time series to get reliable results. As can be seen in Figure 1 the Swedish age structure does exhibit a fair degree of variation albeit slow. Many other countries, in particular developing countries have much less time series variation. This higher degree of variation makes it easier to identify stable and robust cohort-size effects in Swedish data.

A basic problem with regression models with age variables is that not all one-year or even five-year age groups can be included in the regression since multicollinearity would prevent identification of individual coefficients. Often, age effects are, therefore, represented by a single aggregate measure—for example population mean age, old age dependency rate, youth dependency rate or total dependency rate (old age plus youth dependency rate). A weakness with this approach is that some important variations in economic behavior and economic resources that occur during the course of an agent's normal life are ignored.

Another approach, pioneered by Fair and Dominguez (1991), is to use a polynomial restriction. The age profile of the demographic effects is then restricted to a low-order polynomial. The rather abrupt change in behavior and resources that takes place at retirement is hard to fit in with this restriction.

A third way is to include population shares for a set of aggregated age groups that approximate the most important phases of an individual's economic life cycle. This age share approach allows a fuller representation of the age structure. It also offers a more direct and flexible way of estimating age effects than the polynomial approach. Although we prefer this approach it should be noted that it is a compromise that may be sensitive to collinearity and the exact delimitations.

We have found a subdivision into six age groups to work well in most cases: children 0-14 years old, young adults 15-29 years old, mature adults 30-49 years old, middle aged 50-64, young retirees 65-74 and old retirees above 75 years of age. This general division can be motivated on theoretical grounds. Children, first, do not take economic decisions themselves and are dependent on other adults. Young adults often live single or are still living with parents. They are also to a high extent still in education and have quite distinct consumption habits. Mature adults are raising families, buying homes and starting in earnest to accumulate wealth. The middle-aged people are generally past their family years, have high incomes and are more immediately concerned with their retirement prospects. Young retirees are no longer working although still rather active and healthy and have started to dissave, at least in terms of their pension claims. The oldest have considerably more health problems, much higher mortality and are more concerned with bequests.

To use the population shares as regressors in an equation with intercept we

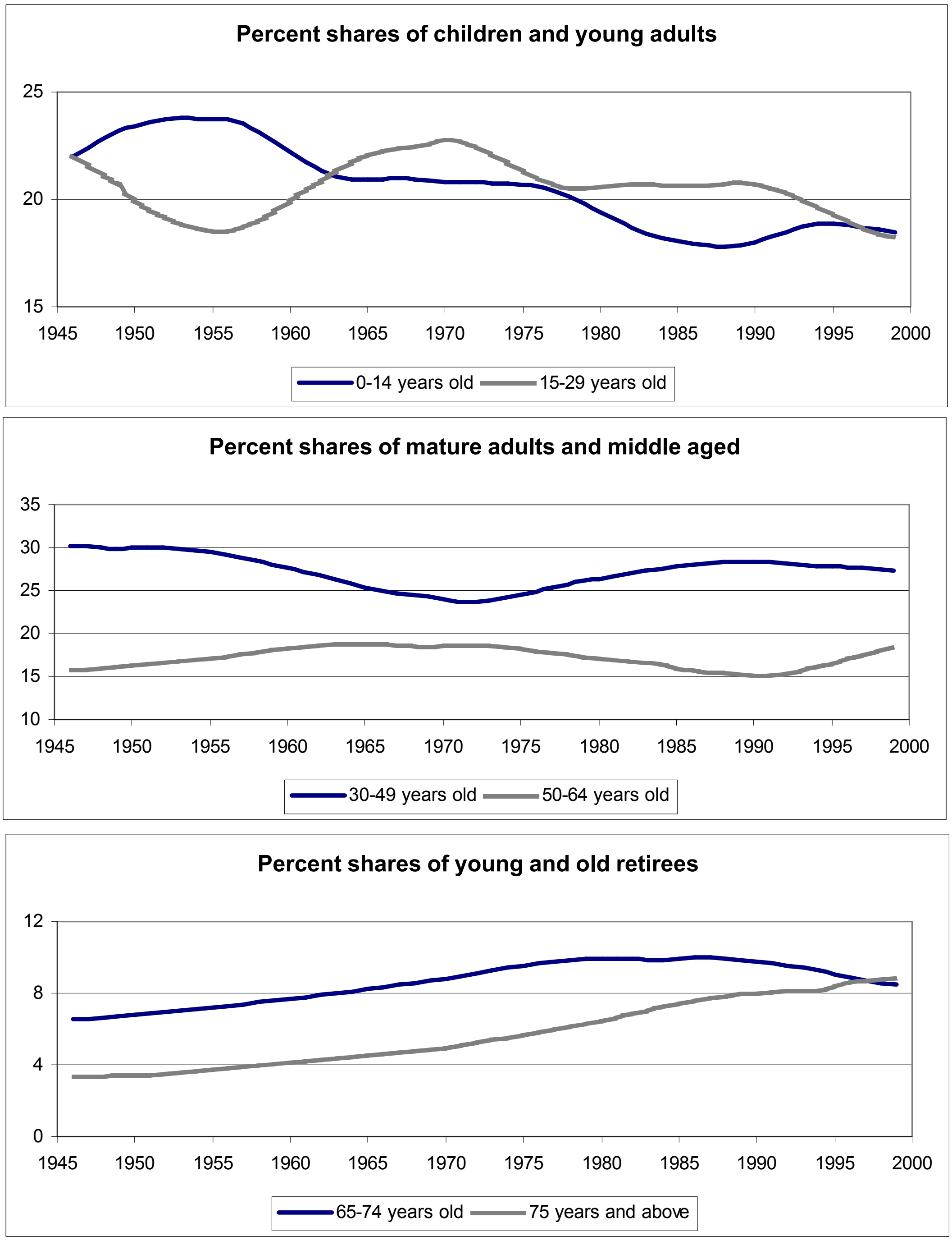

Figure 1: Development of age group shares in Sweden 1946-1999

would have to drop something due to perfect collinearity. Here we have chosen to use all age groups and instead drop the intercept. It is easier to directly see the whole life cycle pattern in the coefficients that way. The interpretation of the coefficient signs is somewhat ambiguous since the linear combination of age group shares cannot be separately identified from any constant that should have been present. One therefore has to keep in mind that the sign of a coefficient must be interpreted relative to the other coefficients.

In this paper our focus is, however, not on the econometric specification of the age models.[8] We, therefore, only present simple OLS estimates where age group shares are used as regressors. The patterns we present below are, however, fairly robust and stable.

The data we use are mostly National Accounts data from Statistics Sweden, which we have extended a few years back by using historical statistics from a diversity of sources. The current account series is obtained from the Central Bank of Sweden. National saving rates are computed by subtracting the current account from the gross investment series. Details on data and sources can be found in the appendix.

2.2 Estimated age patterns

The results are collected into Table 1 below. The absolute t-statistics indicate that not all coefficients are significantly different from zero but the regressions are significant without exception at the one percent level. Note that since the current account, savings and investment is linearly related only two of these three equations are independent. For completeness we present all three anyway.

Autocorrelation of the residuals is high and in several cases the Durbin-Watson statistic is lower than the R^2. This is an indication that spurious regression may be a problem. Since both we and others have tested most of these equations extensively in previous work and performed out-of-sample forecasting with good results, we refer to that work for proof of the stability. The serial correlation and obvious heteroskedasticity also biases the standard errors for the reported t-statistics. Compensating for that by a Newey-West correction for example will not change the general picture so we only report the straight OLS regressions.

In Figure 1 smoothed curves connecting the estimated age coefficients give a visual impression of the age patterns. The difference between the somewhat broader hump-shape of the investment pattern and the more pointed hump of savings has its counterpart in the current account pattern. Young and mature adults cause current account deficits by having more positive effects on investment than on saving while the opposite holds for the middle-aged. The dominant effects are the negative from young retirees and the positive from old retirees.

[8] We refer readers to our other papers in the references where extensive testing and specification searches are reported.

Dep variable	Savings	Invest ment	Current account	Govern. fin. sav.	GDP growth	Inflation
Share 0-14	-1.10	-1.55	0.45	-1.56	-1.17	0.67
	(2.17)	(3.67)	(1.26)	(1.78)	(2.58)	(1.04)
Share 15-29	-0.08	-0.05	-0.03	0.71	0.37	-0.14
	(0.31)	(0.22)	(0.18)	(1.29)	(1.69)	(0.44)
Share 30-49	0.53	0.82	-0.29	0.38	0.64	-0.37
	(1.96)	(3.62)	(1.51)	(0.80)	(2.60)	(1.06)
Share 50-64	2.30	1.99	0.32	1.61	0.97	-1.30
	(5.09)	(5.26)	(0.99)	(2.05)	(2.38)	(2.23)
Share 65-74	-0.11	1.58	-1.68	-1.33	-1.14	4.42
	(0.18)	(3.19)	(4.03)	(1.23)	(2.14)	(5.79)
Share 75+	-1.39	-2.80	1.41	-1.57	-0.87	-2.01
	(2.45)	(5.91)	(3.53)	(1.64)	(1.71)	(2.76)
Adj R^2	0.60	0.69	0.28	0.38	0.42	0.46
Regr $F(5,47)$	16.8	24.3	4.98	6.77	8.52	9.70
[p-value]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
D-W	0.59	0.36	1.37	0.45	1.64	0.35

Table 1: Regression coefficients, Swedish macroeconomic variables 1946-1998. Absolute values of t-statistics are reported in parentheses below the coefficients. For government financial saving our data cover 1950-98, thus the second degree of freedom for the F-test is 43 in that case.

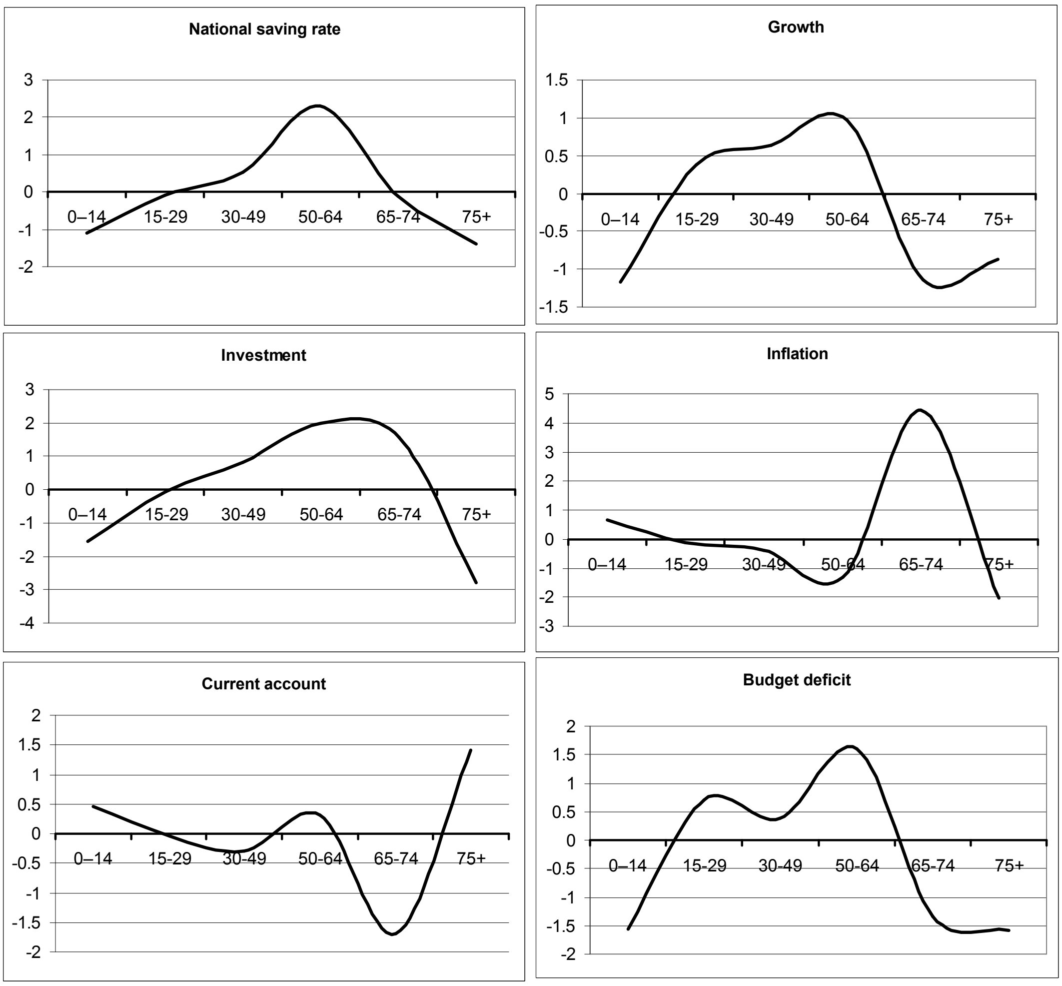

Figure 2: Estimated age effects for six age group shares, connected by a smoothed curve.

The somewhat surprising positive effect from young retirees on investment and the strongly negative effect from old retirees cause this.

Note that national saving is a residual that should not be equated to household savings. Retained profits as well as public budget balances are large and important components in national savings, on the other hand capital gains and pension claims are included in the national savings measure. Both revenue and expenses for the public sector are strongly affected by the age distribution as seen in the age coefficients for financial savings of the consolidated government sector with young and old dependents negatively correlated to the budget deficit, while working tax-paying groups have a positive effect.

The pattern of age effects on the financial saving of the consolidated public sector, shows the expected pattern, possibly excepting the rather weak positive effect from mature adults. Dependents have negative effects while the active population have positive effects.

Growth increases with a high share of the population in working ages while higher dependency rates lead to lower growth, and the more experienced the working population the higher is growth.

The young retirees appear as the group mainly connected to increased inflationary pressures. Age effects on inflation are more or less a mirror image of the age effects on the current account.

The patterns for the six variables here show intuitively consistent patterns. We would have been surprised if inflation was boosted by the middle aged since high inflation then would have coincided with high growth and budget surpluses. The extra high growth effect from the middle aged tallies well with the maximum in the savings rate and so forth. By itself this is an argument against nonsense correlations and spurious regressions, since it would then be a remarkable stroke of luck to get this consistency.

3 Macroeconomic model

The estimated age effects are likely to be the result from equilibrium interactions between several different mechanisms. However uncomfortable, we are led to the conclusion that simple partial models of the type represented by the life cycle hypothesis for saving are insufficient explanations for the age group correlation with macroeconomic development observed here.

A number of indirect mechanisms are interacting to generate this development and must be taken into consideration. For example, age structure will affect saving not only through direct household saving mechanisms but also through effects on inflation and growth rates. In some cases this will reinforce the life cycle pattern but in other cases it may dampen or even reverse the simple direct effects. Also other variables depend on age structure like asset prices[9], mobility on labor markets, relative wages and housing markets[10] and so forth and interact through more or less inert adjustment mechanisms with the dependent variables above.

The patterns found above are, of course, a consequence of how the macroeconomic system reacts to these age structure changes. Since we know that quite substantial changes has taken place in the Swedish system this is very hard to model in any microeconomic detail, so we resort to a traditional macroeconomic approach to reconcile data and theory.

[9] Bakshi and Chen (1994) is an early example. Poterba (1998) a more skeptical study.

[10] Following Mankiw and Weil (1989) there is a large literature on demographic housing demand and the connection to house prices, but there is also a direct connection to residential investment (Lindh and Malmberg 1999c).

Let Y be aggregated value added produced by capital K and efficient labor $N = n(\Phi)$ which is a function of the age distribution Φ:

$$Y = F(K, n(\Phi)) \quad F_K > 0,\ F_N > 0. \tag{1}$$

In all other respects it is a standard constant-returns-to-scale production function. The modification is fundamental, however, since employment or worked hours do not measure this efficient labor input, which should be thought of as normalized with respect to human capital and other factors not modelled in the value-added function. We allow for the possibility that also non-working age groups affect the efficient labor input. Two arguments can be put forward for this. The first is the obvious fact that dependents have a time cost for relatives and friends, diminishing the time left for market work. The second argument is that the demand pattern of dependents to a greater extent is directed towards services, in which productivity growth is lower. One expedient to model this composition effect is by allowing dependents to influence the supply of efficient labor units.

Let M be money supply, P the price level and $m(r, Y, A)$ the money demand as a function of the exogenous—since Sweden is a small open economy—real interest rate r, Y and A the current account. The addition of the current account as a separate determinant of money demand is a convenient way to avoid making part of money supply endogenous. A positive current account imply we are lending to foreign countries. To complete those transactions Swedish currency is deposited in foreign banks, or to the same effect, diminishing the reserves of foreign currency in Sweden, effectively diminishing the money supply available for domestic transactions, but we could just as well view it as an extra demand component for Swedish money.

$$\frac{M}{P} = m(r, Y, A) \quad m_r < 0,\ m_Y > 0,\ m_A > 0. \tag{2}$$

Let private consumption C depend on the real interest rate and disposable income Y^D.

$$C = C\left(r, Y^D\right) \quad C_r < 0,\ 1 > C_{Y^D} > 0 \tag{3}$$

This is a completely standard formulation. However, since both government consumption G as well as net taxes T are strongly dependent on age structure we make the non-standard assumption that the budget deficit is endogenous and depends on interest and age structure. It is perfectly straight-forward to add in a discretionary exogenous decision variable, but for simplicity we only add interest

$$B \equiv G - T = b(r, \Phi) \quad b_r > 0 \tag{4}$$

Disposable income is assumed to depend on the budget balance since government consumption in part is a hidden wealth component in a welfare state. Taxes are, of course, the actual deduction from income, but the household also have non-accounted claims on services and transfers from the public sector, that should be taken into account.[11] On the other hand we simplify the treatment of other forms of wealth by letting a dependence on real interest proxy for capital gains and losses.

$$Y^D = y(r, B) \quad y_r \lesseqgtr 0 \quad 1 > y_B > 0 \tag{5}$$

We reformulate the standard national accounting identity $Y = C + G + I + A$ in terms of disposable income

$$Y^D \equiv Y - T \equiv C + B + A + I \tag{6}$$

We subdivide the investment function into four components: residential investment I^R, private business investment I^B, government investment I^G and inventory stocks change I^S. The private business component is given the standard dependence on interest and output, while government investment is taken as exogenous. Residential investment is assumed to depend on housing demand $H = h(\Phi)$. There seems to be little consensus in the literature on how to model inventory stocks at the aggregate level, but practitioners seem to agree that it is an important leading indicator and output variance is often higher than sales variance, indicating a positive correlation between output and inventories which can be attributed to a buffer stock motive. In our data as well as in other OECD countries high inflation coincides with high inventory investment. One possible interpretation is that high and rising prices precipitate a build-up of buffer stocks. Another possibility is a speculative motive to accumulate goods to be sold at higher prices later. If real interest rates are low enough this may be profitable. Anyway we assume a positive relation also to the price level.

$$\begin{aligned} I &= I^R(r, h(\Phi)) + I^B(r, Y) + I^G + I^S(P, Y) \\ I_r^R &< 0,\ I_H^R > 0,\ I_r^B < 0,\ I_Y^B > 0,\ I_P^S > 0,\ I_Y^S > 0 \end{aligned} \tag{7}$$

Assume $Y,\ C,\ I,\ A,\ B,\ Y^D, P$ are the endogenous variables in this system of seven equations. Differentiating this model to linearize it, the model turns out to dichotomize into one recursive system with solutions for $Y,\ C,\ B,\ Y^D$ and one non-recursive system with solutions for $I,\ A,\ P$. Fixing all other exogenous

[11] About the age dependency of the Swedish budget deficits see further in Lindh (2002).

variables we get the solutions

$$
\begin{aligned}
dY &= F_N dn(\Phi) \\
dB &= db(\Phi) \\
dY^D &= y_B db(\Phi) \\
dC &= C_{Y^D} y_B db(\Phi) \\
dA &= \frac{(1 - y_B(1 - C_{Y^D})) M db(\Phi) + \left(m_Y P^2 I_P^S + M I_Y^B + M I_Y^S\right) F_N dn(\Phi) + M I_H^R dh(\Phi)}{m_A P^2 I_P^S - M} \\
dI &= -dA - db(\Phi)(1 - y_B(1 - C_{Y^D})) \\
dP &= -\frac{P^2 m_Y}{M} F_N dn(\Phi) - \frac{P^2 m_A}{M} dA
\end{aligned}
\tag{8}
$$

Note that $h(\Phi)$, $n(\Phi)$ and $b(\Phi)$ are functionals, i.e. functions of functions, not functions of real numbers. The differential of a functional does not in general have a well-defined meaning. However, since we reduce the distribution to six age groups and assume linear effects we convert the functionals into ordinary linear functions of the age shares

$$dx(\Phi) = \sum x_i da_i \quad x = h, n, b \tag{9}$$

Our estimates imply that the effects on output and the budget surplus are similar. Since B is defined as the deficit we have the near opposite coefficients in n and b. Thus the model implies that disposable income and consumption will vary as the deficit with age structure and consequently saving will have a countervariation, but saving will also be affected by the other variables.

The last three variables are more complex to analyze. The first term in the numerator of dA will be positive both for young and old retirees while the second term will contribute a negative effect in the opposite direction (the expression in parenthesis is positive), but the last term will make the negative effect for the old retirees stronger. From previous work (Lindh and Malmberg 1999b) we know that housing demand h has a profile which is positive for young adults and strongly negative for old retirees. Thus the direction for the current account effect is ambiguous for all age groups except for the old retirees who will have a depressing effect on the current account.

The overall direction will be determined by the sign of the denominator. Our assumption that inventory stocks rise with the price level and money demand rises with the current account makes the sign of $m_A P^2 I_P^S - M$ non-obvious. The marginal effects in the positive term should however be of a smaller magnitude than the money supply measure, so we assume the denominator is negative which is also consistent with the estimates.

The diminishing housing demand from the old retirees counteracts the general excess demand tendency from retirees, so we get the opposite pattern for inflation only somewhat modified by the negative of the output effect, which explains why the young retiree effect becomes so dominant.

A deficit in the current account arises when domestic saving is insufficient to finance domestic investment. Total domestic demand (private and public consumption and investment) is therefore necessarily greater than total domestic supply. Domestic prices therefore tend to rise. In a fixed exchange rate regime domestic inflation then spills directly into a current account deficit as foreign goods become relatively cheaper and substitute for domestic goods. At floating exchange rates this substitution is partly offset by a depreciation of the currency but this has the same effect on the current account since export income becomes less worth and imports more expensive.

Investment combines the negative of the current account effect and a negative fraction of the budget deficit effect. This yields the broad hump shape, the most important element being that the current account effect from young retirees means a positive effect on investment, while the positive active age effects compensate a slightly negative effect from the middle aged.

Since savings $S = I + A$, it is actually determined by the budget deficit effect putting most of the action in the middle aged group. Comparing the patterns they are somewhat different for savings and the deficit but allowing for the uncertainty in estimates it could be a reasonably close likeness. The explanation given through this model does not rely on life cycle household saving, although this mechanism could be added and perhaps should be added to get a pattern more like the actual saving effect. It would, however, not be a crucial factor. We could also add a dependence of the budget deficit on the output level without much change in the qualitative results. What drives the model is the tension between age structure determined efficient labour and the strong age dependence in welfare state expenditure, which to a very large extent is a life cycle redistribution at the economy-wide level that otherwise would be associated with the individual household decisions. In a welfare state like Sweden the dominant part of this redistribution actually do take part through the public sector making individual household adaptation much less important.

Residential investment plays a crucial role for differentiating between age effects from the two oldest groups. The strong negative housing demand effect from the 75+ group drives the positive effect on the current account as well as the negative inflation effect. In turn, the aggregate demand effect through inflation drives the positive inventory stocks effect from young retirees in investment.

We have played down the role of real balances in this model, partly because the institutional setup has been widely varying over the period, but an obvious extension is to try to model this in more detail in order to see how monetary policies may impinge on this model.

Although this attempt to inductively derive an age distribution sensitive macro model can reproduce the basic age pattern effects more research is needed to determine how large the class of congruent models is. There are alternative perspectives that could be adopted. Public sector production is for example non-tradable and we could explain current account effects through a shifting balance between non-tradables and tradables as well. It would also be interesting to discuss the effects within a more monetary model.

The attraction of the approach above is that it requires only a few adjustments to a standard macroeconomic framework all of which are intuitively rather straight-forward and still have far-reaching implications. Note for example that the system dichotomizes into a domestic real part determining budget balance, output, consumption and disposable income; and, on the other hand a monetary part with international capital markets determining the external balance, the latter could easily be complemented by exchange rates mechanisms of various kinds to analyze external balance issues and explain why real exchange rates are predictable through the age structure[12]. With an explicit formulation of the balanced real portfolio of asset owners domestic interest rates could be endogenized as well. Such a model would, however, not dichotomize and is therefore considerably more complex to analyze.

3.1 The importance of age structure for Swedish economic development

From Figure 3 it is obvious that actual outcomes follow the age predicted development much more closely before 1980 than afterwards. This is as it should be. An age model should not be able to predict events like the devaluation policies pursued in the end of the 1970s up to 1982 nor would we expect age structure to be behind the overheated economy in the late 1980s and the collapse in 1992. That the age models are unable to predict those episodes is another strong argument against any spurious regression suspicion. The probability that six spurious regressions would be internally consistent and still indicate these periods as deviations from the normal must be very remote. Most of the productivity slowdown taking place in the 1970s is explained by the large cohorts from the 1910s retiring at the same time that the sparse cohorts from the 1930s dominated the mature adult part of the working age distribution. In most respects it was a rather disadvantageous age structure that pushed inflation upwards and the current account and growth downwards. The deterioration of government financial saving led into a budgetary crisis as public expenditure expanded heavily and the economy was hit by further oil price hikes.

The Swedish age structure then remained disadvantageous up to the middle of the 1990s when a turning point is reached. At the turn of the century demographic conditions for growth are again as good as they were during the 1960s. The age influence on inflation is also strong. Around 1980 age structure has its peak inflationary pressure which turns into a deflationary pressure during the 1990s.

[12] As indeed they are, see Andersson and Österholm (2001).

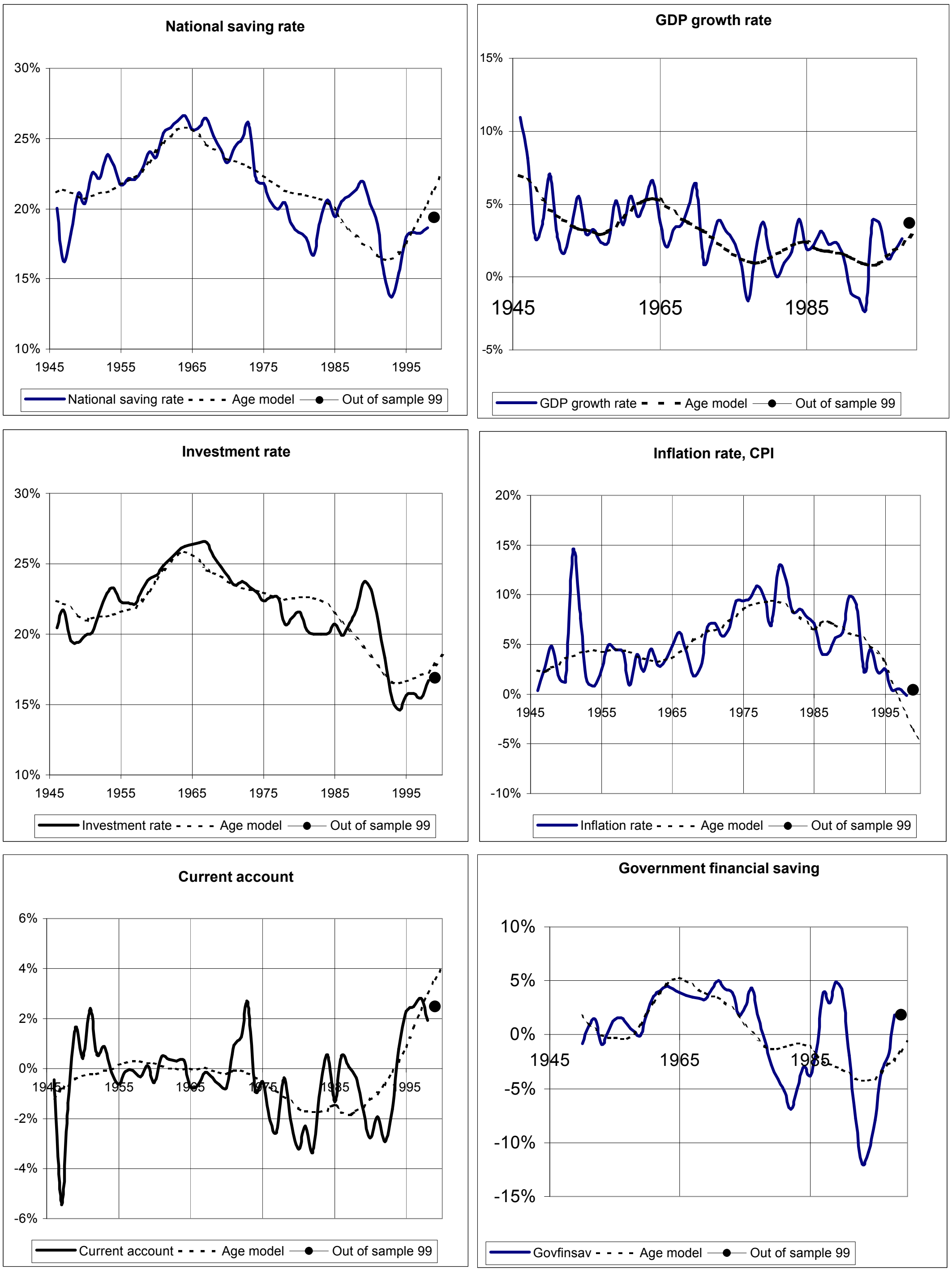

Figure 3: The age model explained part of Swedish post-war development.

Just like individuals, families and households go through periods of surplus and deficits over the life cycle, the evolution of a varying age distribution causes similar variation for the economy of a country.

National savings has been affected by a long-run negative trend created by the age structure from the 1960s and onwards. In the middle of the 1990s this trend turns around. Investment shows a similar trend with the important difference that changes in the demographically induced investment trend lags the changes in demographically induced saving. This lag implies that demography from the beginning of the 1970s up to the beginning of the 1990s has a negative effect on the current account. When the age effect on saving turns to a positive trend a few years into the 1990s the effect on investment is still negative and generates a positive current account effect.

During the 1990s the demographic pressure on the government budget has lightened up considerably. The fertility decrease has turned the trend for the children share. The share 65-74 has decreased by more than one percentage point and the share of middle aged increased by more than three percentage points. Together these changes in the age distribution imply an upward pressure on the saving rate.

A demographic interpretation of Swedish post-war economic history is not all that different from conventional accounts in regard to the mechanisms and is not really a competing explanation but rather a complementary view that deepens our understanding by exposing underlying fundamental trends. The conventional explanation of the overheating of the economy in the end of the 1980s is attributed to lax fiscal and monetary policies due to the influence from too strong unions and a too big public sector. The age based explanation indicates that the problems became worse by policies working against demographic pressures. An appreciation of the demographic situation would have made it possible to design policies working with instead of against the fundamentals in the Swedish economy, to surf the waves rather than plunging headfirst into them.

4 Discussion

In this paper we have illustrated in how changes in the age distribution affect macroeconomic variables a welfare state like GDP growth, inflation rates, saving, investment, the current account and the budget deficit. The results are congruent with standard macroeconomic theory. Introducing a few channels for age effects into a fairly standard textbook model is sufficient to theoretically explain these effects in an internally consistent way. Our theoretical understanding of how different age effects interact in detail is, however, still in its infancy, and more research on this is clearly warranted.

How far would our results generalize? Most European nations have similar welfare systems, similar age structures and similar economic institutions and at least for the Nordic countries we would expect closely similar results. Country panel regressions tend to show similar age patterns overall in the OECD countries so we would expect the reasoning to go through in most of them. Developing countries are both demographically and economically in another phase, where longevity has not yet triggered the introduction of welfare mechanisms that are so important in this context.

If further research confirms age structure driven internal and external imbalances as a real phenomenon, then economic policy will have to be conducted with one eye on the age distribution in order to avoid problems of the kind that seems apparent in the latter half of the Swedish post-war experience. In particular deficits following temporary variations in age structure are quite natural life cycle phenomena and should probably be accepted without policy interference. However, we are on the verge of entering an old age society where welfare mechanisms will become more rather than less important. Changes in age structure will then not be temporary but more or less permanent. Understanding how to adjust economic policy with respect to demography will be a crucial question for policy makers within the coming years.

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A Appendix: Data

This appendix describes sources and definitions of the data. GDP at factor costs in current prices 1860-1980 and a deflator are from Krantz (1997) were used to link to the GDP at market price from Statistics Sweden. Thus the years 1946-1949 are slightly different from the series 1950-1999. For the period 1941-1950 the sum of sector GDPs were used since the aggregate for that period is not accurate according to the author. These series were spliced to the latest update from Statistics Sweden by ratio linking in 1950. Real GDP is the deflated series.

Due to changes in the National Account system the last years 1994-1999 refer to GDP at market prices according to the new ENS definition which is at a level about three percent higher than previous estimates, and have been ratio-linked to previous data. There was also a more minor change in definition in 1980, which also has been ratio-linked.

The consumer price index is spliced in 1980 by ratio linking using the latest update of annual CPI from Statistics Sweden and historical cost-of-living indices from Statistics Sweden that go back well beyond 1860. The basic age structure data are five-year cohort population numbers on annual basis. The series 1911 up to 1967 has been compiled from official statistics by Bo Malmberg. 1968 to 1998 are from the latest updates of Statistics Sweden. Projections 1999-2030 are an updated version of the 1997 forecasts of Statistics Sweden. Note that all these population data refer to 31 December in the current year, but in the estimations they have been lagged one year.

For the period 1950-1998 the latest update from the Central Bank of Sweden was obtained. The missing years 1946-1949 were filled in by data from Ohlsson (1969) table B:1 column 6 without linking. The overlap to the Central Bank data have somewhat larger differences but they are diminishing as we go back in time, so it seemed reasonable not to use any ratio link in 1950 either. Ohlsson (1969) compiles earlier data sources on the balance of payments up to 1966. in order to arrive at a measure more suited to compute savings from. The lacuna 1946-49 was closed by domestic investment in Krantz and Nilsson (1975). The latest updates from Statistics Sweden (April 1999) were then ratio-linked in 1950 to this series. Note that due to definitional changes these data are spliced by ratio-linking in 1980, too. The national saving rate was then obtained by adding the current account to gross investment. Strictly speaking we should have added in net factor income, too, but that is very small numbers. All ratios were computed by using current value estimates. This means that the investment rate is not the real investment rate in terms of goods, but a value estimate consistent with the saving rate and current account, since there is no obviously correct way to deflate these values. Growth rates and inflation have been computed by the logarithmic difference of the level variables.

The series of financial saving of the consolidated public sector was graciously put at our disposal by Lennart Berg who has linked data from Statistics Sweden 1950-1998. It includes the balances of local as well as central government at all levels and the social insurance sector.

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