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**Determinants of Saving and Economic Growth
in Poland in Comparison to the OECD Countries**

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Responsibility for the information and views set out in the paper lies entirely with the editor and author.

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Abstract

Authors investigate interactions between the rate of economic growth and the saving rate in Poland in the 1990s. Tendencies observed in the Polish economy are related to the long term trends of growth and saving in a number of OECD countries. A simulation of possible development paths of the Polish economy is conducted using results of the estimation of the saving function for the OECD countries in the period 1971–1994. The model implies that, if the factors determining the rate of saving and the rate of growth were the same as those in the OECD countries during the last 25 years, the rate of saving in Poland would be higher by 5 percentage points and would equal 22 percent. Moreover, assuming the medium term rate of growth of 5–7 percent, a reduction of the budget deficit and the current account deficit, would result in a rise in the saving rate up to the level of 25–27 percent of GDP. Savings of households would rise by 2–3 percentage points to the level of 12 percent of GDP. The long term rate of growth would either be lowered down to 4 percent or raised up to 8 percent depending on the extent of utilisation of externalities and increasing returns from the employment of the human capital and technological change.

I. Introduction

The objective of the paper is to investigate the main factors influencing the saving rate and the rate of growth of income in Poland in the 1990s and to simulate their future behaviour. We are primarily interested in interactions between the saving rate and the rate of growth in the medium and long term. Such interactions, and especially the influence of the rate of growth of income on the saving rate, have become the centre of interest for theoretical and empirical studies of modern theory of consumption (F. Modigliani, M. Friedman, Ch. Carroll and D. Weil) and the so called new growth theory (P. Romer, R. Lucas, G. Mankiw, D. Romer, D. Weil). In modern theories of consumption, such as the life cycle theory (F. Modigliani) and the theory of permanent income (M. Friedman), the rate of growth is determined by demographic factors (age structure of the population) and the desire to smooth the consumption path over the entire life-span, which requires defining the lifetime income or the permanent income. The difference between the latter two depends on whether we consider our lives as finite or indefinite. Thus, savings are the part of income, which is accumulated rationally in a longer time perspective and, in this sense, it does not depend on current income. Nevertheless, it depends positively on the rate of growth of income, for in a stationary economy savings may equal zero (savings of younger generations are offset by dissavings of older ones provided one assumes away any bequests).

The consumption smoothing throughout the lifetime accompanied by income fluctuations, cause the propensity to consume of the individuals to change over their life cycles. In this way, the rate of saving in the whole economy depends on the age structure of the population. Population growth raises the ratio of people who save (the labour force) to those belonging to older generations and, thus, raises the aggregate saving rate. Similarly, productivity growth causes the younger generations to be richer than their parents and to save more than the older generations consume out of their savings. Thus, productivity growth makes the aggregate saving rate increase. According to the life cycle theory, the growth of income, stemming from the differences in levels of lifetime income of subsequent generations, is the cause of differences in saving rates among countries. The saving rate rises with the increase in the rate of growth of the economy [Modigliani, 1970; Liberda, 1997, 658].

This tendency is most visible at the household level but may be also noticed for the whole private sector and the entire economy. In macro scale it is necessary to take into account the influence of the balance of payments and the behaviour of

government (i.e. the budget deficit) on the saving rate of households and firms. The question is to what extent private sector savings offset the budget deficit and to what extent households' propensities to save and consume are influenced by the level of firms' savings.

The level of foreign savings is one of determinants of domestic saving rate as it does influence investment and consumption decisions of the private sector. On the one hand, foreign savings can constitute an additional source of financing the domestic investment and also produce a snowball effect causing the latter to increase. On the other hand, foreign savings can crowd domestic savings out, if they cause the profits of domestic investors to drop. The scale of influence the foreign savings have on the domestic investment has been a subject of a wide discussion since the hypothesis of strong relationship between domestic savings and investment (despite relatively high international mobility of capital) was formulated by Feldstein and Horioka (1980).

In the present study we do not investigate the influence of interest rates, inflation, unemployment (except for Spain) on the saving rate. The reason for exclusion of these important determinants of saving rate is that in the samples used in our model (both the time-series and the cross-sectional data), these variables are correlated with other explanatory variables used in the study (i.e. the level and the rate of growth of income). The influence of other factors (i.e. inequalities in the distribution of income, age structure of household members, education, gender, location, character of possessed factors of production, uncertainty and risk in intertemporal choice of consumption) on the saving rate is discussed in other paper by Liberda (1999). In this study we concentrate primarily on interactions between the rate of GDP growth and the saving rate.

Modigliani (1970, 1983, 1993) and recently Carroll and Weil (1993) conducted the most comprehensible empirical studies showing positive relationship between the rate of income growth (and productivity) and the saving rate in households, private sector and the overall rate of saving. Other empirical studies: Edwards (1996); Masson, Bayoumi, Samiei (1995); Schmidt-Hebbel, Webb, Corsetti (1992); Kessler, Perelman, Pestieau (1993), which were concerned mainly with private saving, also indicated positive correlation between the rate of growth of income and the saving rate (see Table I).

It seemed to us important to conduct a similar study for Poland in the 1990s, for its saving rate has been relatively low (17–18 percent of GDP) while the rate of income growth has reached 5–6 percent per annum. Our study addresses the question of how strong is the influence of the income growth on the saving rate and,

in turn, how strongly the saving rate influences the medium- and long-term growth of the Polish economy. Taking into account that the period, for which the relevant data are available is very short (full data for period 1991–1996 and partial data for period 1991–1997), it is not possible to estimate the saving and the growth functions using annual data for Poland.

Thus, we have decided to simulate the relationship between the rate of income growth and the saving rate in Poland, assuming that the determinants of saving and product growth would be similar to those observed in the OECD countries during last 25 years. Roughly speaking, this has allowed us to estimate the rates of saving and income growth, assuming convergence between Polish and the OECD economies. In other words, we could compute the levels of budget deficit, current account deficit, inflation, and unemployment, that would allow Poland to achieve the rates of growth and saving similar to those observed in the OECD countries. To this end, the saving function was estimated for the whole economy, and then, separately (out of their disposable income), for households. In addition, the growth function was estimated for a sample of OECD countries for the period 1971–94 (cross-section and time-series study) and separately for Spain (time series study).

To analyse the determinants of economic growth we make use of the neo-classical Solow (1956) model of economic growth with Harrod-type exogenous technological change [see also Barro and Sala-i-Martin, 1995 and Romer, 1996], as well as its version incorporating human capital accumulation [Mankiw, D. Romer and Weil, 1992], and endogenous growth models by Romer (1986, 1990) and Lucas (1988) [see also Liberda, 1996 and Tokarski, 1998].

The models mentioned above are characterised by the following features:

- The Solow model assumes that production function is characterised by constant returns to scale and imperfect substitution between classical factors of production (capital and labour). The rate of technical progress is exogenous and saving determines investment. Such assumptions imply that the rates of growth of main macroeconomic indicators (i.e. flow of product and stock of capital per capita) are approaching steady-state rates of growth. Such conclusion is valid for any exogenously given rates of saving, of capital depreciation and of growth of the labour force.
- In conditions of steady state growth (assuming Harrod-neutral technical progress) the rate of growth of product per worker and the rate of growth of capital per capita are equal to the rate of technical progress. A change in the saving (investment) rate in the Solow model influences the rate of growth by

Table I. Relationship between the Rate of Economic Growth and the Rate of Saving: Comparison of Empirical Studies

Year	Author	Sample	Explained variable	Explanatory variable	Regression coefficients
1970	Modigliani	World– 36 countries	s (private sector saving rate)	g (rate of growth of GDP <i>per capita</i>)	1.34 (0.20)
1970	Modigliani	World– 24 countries	s (private sector saving rate)	g (rate of growth of GDP <i>per capita</i>)	1.24 (0.25)
1970	Modigliani	World– 24 countries	s (private sector saving rate)	rate of growth of GDP per employee	1.98 (0.29)
1970	Modigliani	World –24 countries	s (private sector saving rate)	rate of employment growth	-0.60 (0.81)
1993	Modigliani	OECD–21 countries 1960–1987	national saving rate	g (t–1)	1.81 (6.1)
1993	Modigliani	LDCs– 85 countries 1982–1988	national saving rate	g (t–1)	1.32 (5.2)
1993	Carroll, Weil	OECD–22 countries 1960–1987	average saving rate 1960 – 85	g	1.84 (1.11)
1993	Carroll, Weil	World– 64 countries 1960–1987	average saving rate 1960– 85	g	1.19 (0.59)
1993	Carroll, Weil	OECD–22 countries 1960–1987	Granger s (t)	g (t-1)	0.257 (0.109)
1993	Carroll, Weil	World– 64 countries 1960–1987	Granger s (t)	g (t-1)	0.318 (0.080)

Table 1. Relationship between the Rate of Economic Growth and the Rate of Saving: Comparison of Empirical Studies

Year	Author	Sample	Explained variable	Explanatory variable	Regression coefficients
1996	Edwards	36 countries 1970–1992 (cross section)	private savings	g (per capita)	0.456 (3.259)
1996	Edwards	36 countries 1970–1992 (cross section)	Government savings	g (per capita)	1.801 (3.285)
1995	Masson, Bayoumi, Samiei	OECD–21 countries 1971–1993	private saving rate	g	2.77 (3.9)
1995	Masson, Bayoumi, Samiei	LDCs- 40 countries 1982–1993	private saving rate	g	1.73 (3.1)
1995	Masson, Bayoumi, Samiei	World-61 countries 1982–1993	private saving rate	g	1.25 (3.2)
1992	Schmidt-Hebbel, Webb, Corsetti	LDCs- 10 countries 1970–1985	Household savings out of disposable income	rate of growth of disposable income	0.54 (4.2)
1993	Kessler, Perelman, Pestieau	OECD–17 countries 1965–1988	Household savings rate (cross section)	g	24,5 (2,2)
1993	Kessler, Perelman, Pestieau	OECD–17 ountries 1965–1988	Household saving rate (time series)	g	-6.0 (1.5)

t-ratios in brackets

- moving the economy on to a higher or lower path of economic growth without increasing its long term rate and only by raising it temporarily until a new steady state is achieved.
- Moreover, the Solow model implies that with decreasing marginal productivity of each factor of production, the rate of economic growth should be subject to the convergence effect (also referred to as the catching-up effect). The latter means that the stock of capital per capita grows along with the growth of product per capita. This in turn, according to the law of diminishing marginal productivity, implies a decrease in the rate of growth of capital per worker and a decrease in the rate of growth of product per capita.
 - Mankiw, D. Romer and Weil agree about the direction in which both the saving/investment rate and the rate of growth of labour supply (rate of growth of population) influence the rate of growth of product per capita in the Solow model. Nevertheless, they do not think that the Solow model is able to correctly describe the differences in dynamics and actual locations of paths of growth in particular countries as, in their opinion, it does not take into account the differences in the dynamics of accumulation of human capital.
 - The Mankiw-D. Romer-Weil model is in fact an extension of the Solow model, where not only the stock of human capital is an explanatory variable in the production function but also the growth of this stock is a product of deliberate or intended investment in human capital.
 - The economy in the Mankiw-D. Romer-Weil model displays natural tendencies to approaching the path of steady-state growth, on which the rate of growth is equal to the rate of technological change. The location of the path depends to a large extent on the level and structure of investment in physical and human capital, the rate of depreciation of these kinds of capital and, also, on the rate of growth of labour supply. The more investment in physical and human capital, the higher the location of the long term path of economic growth. The higher the rates of physical and human capital depreciation or the rate of growth of labour supply, the lower the location of the long term path of growth.
 - The assumption of exogenous technical progress is rejected in the P. Romer and Lucas models of endogenous growth. In these models technological change is equivalent to the growth of individual workers' skills which stems from the intentional investment aimed at human capital accumulation. In that way the technological change becomes an endogenous variable in the model.
 - P. Romer (1986) argues that the marginal product of knowledge (human capital) employed in production of consumption goods is increasing. The production

function becomes convex rather than concave. Also, investment in human capital results in positive externalities from which other producers benefit. In the P. Romer model equilibrium is achieved due to the assumption of diminishing returns in production of knowledge itself. So, monotonically increasing rate of growth of product over time cannot exceed the maximum rate of growth of knowledge "produced".

- The rejection of exogenous character of the rate of saving distinguishes the Lucas model from the Solow and the Mankiw-D. Romer-Weil models. In Lucas model the rate of saving implicitly stabilises at the level at which the discounted overall utility of a representative economic agent is maximised. Such an assumption implies, characteristically for the neo-classical economics, that the focus of macroeconomic studies is moved from large macroeconomic aggregates to studies based on microeconomic foundations.
- The conclusion of the analysis of the optimal path of growth in the Lucas model is, that the rates of growth of main macroeconomic variables (i.e. the flow of product, the stock of physical capital per capita, and the individual qualifications of workers) are mainly dependent on preferences regarding intertemporal allocation of consumption. Moreover, the more the agents prefer current consumption to the future one, the lower the rate of growth of the economy. The higher the savings the higher the rate of growth of income per capita, as returns to the human capital are increasing. At the same time returns to the physical capital are non-decreasing. This also means that a change in preferences can have a pronounced and sustained effect on long term rates of economic growth. Such an effect is impossible in neither Solow or Mankiw-D. Romer-Weil model.

The determinants of the saving rate are described by the life cycle theory function (Modigliani), which was augmented with the budget deficit and the current account surplus variables [1]:

$$s = s \left(\begin{matrix} + & - & - & + \\ g_{-1}, pop_{65}, bd, ca \end{matrix} \right)$$

where:

g_{-1} – rate of growth of product in previous period (lagged by five years)

pop_{65} – ratio of people over 65 in the whole population

bd – budget deficit (as percentage of GDP)

ca – current account balance (as percentage of GDP).

[1] Notation $y=y(x_1, x_2, \dots)$ means that variable y is strictly monotonic (respectively increasing or decreasing) function of variables x_1 and x_2 .

The higher the medium run rate of product growth in the previous period, the higher the saving rate in the current period. The size of population over 65 negatively influences the rate of saving, since people of this age theoretically consume savings accumulated in the past. The scale of this effect can be diminished by the willingness to leave bequests to the next generation. According to the Ricardian Equivalence Theorem, the budget deficit negatively affects the overall saving rate when the savings of the private sector (mostly households) do not fully offset the deficit. The current account balance is positively correlated with the domestic saving rate. Current account surplus causes domestic saving rate to rise and implies exporting savings abroad. Similarly, current account deficit implies a lower saving rate and an increase in inflows of foreign capital to the economy.

The estimates of the rate of economic growth that are presented below are based on the Solow model of growth. It is assumed that the rate of growth of product per capita is described as follows:

$$g = g \left(\begin{matrix} + & - & - \\ s, \lambda, y \end{matrix} \right)$$

where:

g – rate of growth of product per capita $\left(g \equiv \frac{\Delta y}{y} \right)$

s – saving rate (share of savings in GDP)

λ – rate of population growth

y – product per capita.

The variables described above are presumed to have the following impact on the rate of economic growth. The higher the saving rate, the higher the path of economic growth leading to a higher income per capita and, thus, the higher the medium term rate of economic growth. A higher rate of population growth (*ceteris paribus*) leads to lowering of both the capital per capita and product per capita. The negative relationship between g and y describes the convergence effect, which was defined above. A lower starting level of income per capita allows national product to grow faster in the transition period due to higher marginal productivity of capital in the starting period.

2. Results of Statistical Analysis

Estimates of the saving rate and the rate of economic growth were based on cross-sectional data for Austria, Belgium, Canada, Denmark, France, the United

Kingdom, Greece, Germany, Italy, Japan, the Netherlands, Portugal, Sweden and the United States in period 1971–1994. As the authors looked for the determinants of medium and long-term rates of saving and economic growth, the period 1971–1994 was divided into 5 sub-periods: 1971–75, 1976–80, 1981–85, 1986–90 and 1991–94.

The following saving function was estimated:

$$s_{ij} = \alpha_0 + \alpha_1 g_{ij-1} + \alpha_2 pop_{65ij} + \alpha_3 bd_{ij} + \alpha_4 ca_{ij} + \alpha_5 Jap^* pop_{65ij} + \varepsilon_{ij} \quad (1)$$

where:

s_{ij} – rate of saving in country i ($i=1, \dots, 14$) in period j ($j=1, \dots, 5$); (further, by the rate of saving in a given country authors mean the geometrical average of annual saving rates in the analysed sub-period)

g_{ij-1} – the rate of GDP per capita growth in country i in period j (arithmetic average of annual rates of growth)

pop_{65ij} – percentage of people over 65 in country i in period j (figures from 1963, 1968, 1973, 1978, 1983, 1988, 1993)

bd_{ij} – the share of budget deficit in GDP in country i in period j (arithmetic average of annual shares)

ca_{ij} – share of current account balance in GDP in country i in period j (arithmetic average of annual shares)

Jap – dummy variable taking the value of 1 in the case of Japan and 0 in the case other countries

ε_{ij} – disturbance term

$\alpha_0, \alpha_1, \dots, \alpha_5$ – estimated structural parameters of equation (1).

The expression Jap^*pop_{65} in equation (1) is the interactive variable, which modifies the effect of the percentage of population above 65 on the saving rate in Japan in comparison to other countries in the sample. Equation (1) implies also that if g_{ij} , bd_{ij} and ca_{ij} are constant

$$\Delta s_{ij} = \alpha_2 \Delta pop_{65ij} + \alpha_5 \Delta Jap^* pop_{65ij} + \Delta \varepsilon_{ij} \quad (1a)$$

which further implies that an increase Δpop_{65} in the ratio of people over 65, which in each of the analysed countries resulted in an increase in the rate of savings by $\alpha_2 \Delta pop_{65}$, in Japan resulted in an increase in the rate of savings by $(\alpha_2 + \alpha_5) \Delta pop_{65}$ (see equation 1).

Equations describing the rate of growth of GDP per capita were estimated in the following manner:

$$g_{ij} = \beta_0 + \beta_1 s_{ij} + \beta_2 \lambda_{ij} + \beta_3 y_{ij} + \eta_{ij} \quad (2)$$

where:

λ_{ij} – rate of population growth in country i in period j (arithmetic average of annual rates of growth)

y_{ij} – GDP per capita in US dollars in 1990 constant prices (arithmetic average of annual levels of GDP per capita)

s_{ij} – saving rate in country i ($i=1,2,\dots,15$) in period j ($j=1,2,\dots,5$) as in equation 1

g_{ij} – the rate of growth of GDP per capita in country i in period j (arithmetic average of annual rates of growth)

h_{ij} – disturbance term

$\beta_0, \beta_1, \beta_2, \beta_3$ – estimated structural parameters of equation 2.

Equations 1 and 2 were estimated using Weighted Least Squares Method (later referred to as WLS). Results of WLS estimation are shown in Table 2.

The following strictly statistical conclusions can be drawn from the results presented in Table 2:

- Variables specified in equations (1) and (2) explain about 63 percent of the variability in the saving rate and about 56 percent of the variability in the rate of growth (see adjusted R^2).
- All specified explanatory variables, with the exception of budget deficit variable, are statistically significant at 5 percent significance level (bd in the saving rate equation is statistically significant at 8.5 percent level)
- One percentage point increase in the rate of growth of GDP per capita results in the increase in the rate of saving by 1.13 percentage point.
- One percentage point increase in the ratio of people over 65 resulted in the lowering of the rate of saving by about 0.44 percentage points in Japan and by about 0.39 percentage points in all other countries.
- One percentage point increase in the share of budget deficit in the GDP causes 0.17 percentage points fall in the share of saving in GDP.
- One percentage point increase in the share of the balance of payments in GDP rises the rate of saving by about 0.74 percentage points.
- The analysis of factors determining the rate of economic growth implies that one percentage point increase in the rate of saving causes the rate of GDP growth to increase by about 0.13 percentage points.
- Each additional percentage point in the population growth causes the rate of growth to decrease by 0.90 percentage points.

Table 2. Estimation of Parameters of the Saving Rate and the Rate of Growth [2]

Estimation of the saving rate(s)			
Explanatory variable	Estimated parameter	Standard Error of Estimation	t-ratio
Constant **	0.238	0.0291	8.183
g **	1.126	0.245	4.606
Pop. ₆₅ **	-0.389	0.186	-2.088
Jap*pop. ₆₅ **	0.834	0.175	4.770
Bd [†]	-0.172	0.0994	-1.734
Ca **	0.738	0.178	4.152
R ² =0.653	adj. R ² =0.625	DW= 1.535	Number obs.=68
Estimation of the rate of growth (g)			
Explanatory variable	Estimated parameter	Standard Error of Estimation	t-ratio
Constant	0.0106	0.00687	1.539
s **	0.129	0.0238	5.432
λ **	-0.900	0.129	-6.962
γ **	-7.47*10 ⁻⁷	2.20*10 ⁻⁷	-3.398
R ² =0.579	adj. R ² =0.560	DW= 1.488	Number obs.=70

** (*)denotes statistical significance at 5% (10%) level; adj. R² - adjusted R₂, DW- Durbin-Watson statistic. All exogenous variables are instrumental variables in the model.

[2] The following equation of the rate of GDP growth, based on the Mankiw-D. Romer-Weil model, was estimated:

$$g = g \left(s, s_H, \lambda, \gamma \right),$$

where s_H is the rate of human capital investment (percentage of students in population).

Results of the estimation are as follows (t-ratios in brackets):

$$g_{ij} = 0.00873 + 0.136s_{ij} + 0.123s_{Hij} - 0.934\lambda_{ij} - 8.81 \cdot 10^{-7} \gamma_{ij}$$

(1.180) (5.280) (0.878) (-6.710) (-3.221)

$$R^2=0.583 \quad \text{adjusted } R^2=0.558 \quad DW= 1.452 \quad \text{number of observations}=70$$

Lack of statistically significant relationship between the percentage of students and the rate of GDP per capita growth could be, probably, explained with the fact that in the analysed EU countries, the US, Canada, and Japan both the rate of GDP growth and the percentage of students in population fall.

– Each additional \$1000 in the GDP per capita (at 1990 constant prices) lowers the rate of growth by about 0.07 percentage points.

In addition, factors determining the households saving rate (share of savings in households disposable income – s_{ij}^h) were estimated as follows:

$$s_{ij}^h = \gamma_0 + \gamma_1 (\text{pop}_{65ij} + \text{under}_{19ij}) + \gamma_2 g_{ij}^h + \gamma_3 \tau_{ij} + \gamma_4 bd_{ij} + \varepsilon_{ij} \quad (3)$$

where:

g_{ij}^h – is the rate of growth of households disposable income in country i in period j (arithmetic average of annual rates of growth)

pop_{65ij} and under_{65ij} – are percentages of population over 65 and, respectively, under 19 in country i in period j (data for years 1963, 1968, 1973, 1978, 1983, 1988, 1993)

τ_{ij} – the rate of taxation of personal income in country i in period j

bd_{ij} – share of the budget deficit in GDP (arithmetic average of annual shares)

$\gamma_0, \gamma_1, \gamma_2, \gamma_3, \gamma_4$ – structural parameters in equation 3

ε_{ij} – disturbance term.

Estimation of equation 3 in this form, due to data availability, is based on the sample consisting of data for Austria, Belgium, France, Greece, Germany and the United Kingdom period 1971–1994 [this period of time was divided into five intervals as in equations (1–2)]. Equation 3 was estimated using ordinary Least Squares Method. Results are shown in Table 3.

Expressions $\text{Bel}^*\tau$, $\text{Ger}^*\tau$ and $\text{UK}^*\tau$ (where Bel , Ger and UK are dummy variables equal 1 in the case of Belgium, Germany and the United Kingdom respectively and 0 in other cases) similarly to the expression $\text{Jap}^*\text{pop}_{65}$ in previous estimations, are interaction variables. They modify the influence of the rate of taxation of personal income in Belgium, Germany and the United Kingdom in comparison to other countries in the sample.

The following conclusions can be drawn from results of estimation:

- Explanatory variables specified in Equation 3 account for 58 percent of the variability in the households saving rate.
- The share of budget deficit in GDP turned out to be statistically insignificant. Other explanatory variables are statistically significant at 5 percent significance level.
- One percentage point increase in the rate of growth of disposable income raises the household saving rate by 0.46 percentage points.

Table 3. Estimation of Households Saving Rate

Explanatory variable	Estimated parameter	Standard error of estimation	t-ratio
constant*	0.333	0.0981	3.397
g^{hv}	0.462	0.202	2.294
$(pop_{65+} + under_{19})^*$	-0.474	0.216	-2.193
τ^*	-0.323	0.120	-2.703
Bel* τ^*	0.245	0.107	2.294
Ger* τ^*	-0.824	0.342	-2.407
UK* τ^*	-0.340	0.106	-3.210
Bd	0.233	0.210	1.110
$R^2=0.646$	adj. $R^2=0.575$	DW=1.855	number of obs.=43

*statistically significant at 5 percent level.

- One percentage point rise in the percentage of population over 65 or below 19 causes the rate of household saving to fall by about 0.47 percentage points.
- One percentage point increase in the rate of personal income taxation causes the saving rate to fall by about 0.32 percentage points (except for Belgium, Germany and the United Kingdom).
- Moreover, one percentage point rise in the rate of income taxation causes sh to fall by about 0.08 percentage points in Belgium ($-0.32+0.25=0.07$), 1.14 percentage points in Germany ($-0.32-0.82=-1.14$) and about 0.66 percentage points in the United Kingdom ($-0.32-0.34=-0.66$).

In addition to estimations of the saving rate and the rate of growth for the analysed OECD countries (results of which were presented earlier) similar estimations were conducted for Spain using annual data for period 1963–1992. The following functions were estimated [3]:

$$s_t = \alpha_0 + \alpha_1 bd_t + \alpha_2 ca_t + \alpha_3 u_t + \alpha_4 y_t + \varepsilon_t$$

$$g_t = \beta_0 + \beta_1 s_t + \beta_2 \pi_t + \alpha_3 \lambda_t + \alpha_4 y_t + \zeta_t$$

[3] We also attempted to estimate an equation of the form:

$$s_t = \alpha_0 + \alpha_1 bd_t + \alpha_2 ca_t + \alpha_3 u_t + \alpha_4 g_t + \varepsilon_t$$

where g_t is the rate of growth of GDP per capita in period t, but the results were unsatisfying from the statistical point of view.

where:

s_t – saving rate in period t

bd_t – budget deficit in period t (percentage of GDP)

ca_t – current account balance in period t (percentage of GDP)

u_t – rate of unemployment in period t

y_t – GDP per capita in period t

g_t – rate of growth of y_t

π_t – inflation in period t (rate of growth of the CPI);

λ_t – rate of population growth in period t

α_i, β_i ($i=0,1,\dots,4$) – structural parameters

ξ_{s_t}, ζ_{s_t} – disturbance terms.

Results of 2SLS estimation are presented below (t-ratios in brackets, in Equation (1) the AR(1) process is taken into account in order to eliminate autocorrelation of the disturbance term):

$$s_t = 0.222 - 0.212 bd_t + 0.495 ca_t - 0.190 u_t + 3.33 * 10^{-6} y_t + 0.377 AR(1)$$

(14.804) (-1.721) (4.850) (-2.867) (1.690) (1.934)

$$R^2=0.802 \quad \text{adj. } R^2=0.761 \quad DW=1.633$$

$$g_t = -0.0167 + 0.569 s_t - 0.198 \pi_t - 1.416 \lambda_t - 4.94 * 10^{-6} y_t$$

(-0.291) (2.237) (-2.585) (-0.861) (-2.077)

$$R^2=0.612 \quad \text{adj. } R^2=0.550 \quad DW=1.799$$

The following conclusions can be drawn from estimations of the saving rate and the rate of growth for Spain:

- The adopted explanatory variables explain 76 percent of variability of the rate of saving and 55 percent of the variability of the rate of growth.
- All explanatory variables [except for the rate of population growth in Equation (2)] are statistically significant at 10 percent significance level.
- One percentage point increase in the share of budget deficit in GDP (ceteris paribus) lowers the saving rate by about 0.21 percentage points and the corresponding change in the current account balance increases the saving rate by 0.50 percentage points.
- One percentage point rise in unemployment rate causes the saving rate to fall by 0.19 percentage points and a US\$ 1000 rise in GDP per capita (at constant 1990 prices) increases the saving rate by 0.33 percentage points.
- One percentage point increase in the saving rate raises the rate of GDP per capita growth by 0.57 percentage points. An additional percentage point in the

rate of inflation lowers the rate of growth by about 0.20 percentage points. Moreover, a US\$ 1000 rise in GDP per capita lowers the rate of GDP per capita growth by about 0.49 percentage points (convergence effect).

3. Simulation Analysis

Results of estimation of Equations 1–3 allow us to establish relationships between the explanatory variables, on the one hand, and the rate of saving and the rate of GDP per capita growth in Poland on the other. We should remember, however, that it requires us to assume that in the medium and the long run the rate of saving and the rate of GDP per capita growth will follow the patterns obtained in the analysis in the previous section. Therefore, our analysis should be viewed as approximate only.

Manipulating the set of equations (1–2) it is easy to show that by skipping expressions for disturbance terms and dummy variables and substituting parameters with their estimates, one obtains:

$$s_t = \hat{\alpha}_0 + \hat{\alpha}_1 g_{t-1} + \hat{\alpha}_2 pop_{65t} + \hat{\alpha}_3 bd_t + \hat{\alpha}_4 ca_t \quad (4)$$

$$g_t = \hat{\beta}_0 + \hat{\beta}_1 s_t + \hat{\beta}_2 \lambda_t + \hat{\beta}_3 \gamma_t \quad (5)$$

where subscript t stands for time.

From equation (3) (after eliminating: dummy variables, variables that are not statistically significant and disturbance terms) substituting γ_i with their estimators we obtain:

$$s^h = \hat{\gamma}_0 + \hat{\gamma}_1 (pop_{65} + under_{19}) + \hat{\gamma}_2 g^h + \hat{\gamma}_3 \tau \quad (6)$$

Substituting parameters in equations 4–6 with estimators $\hat{\alpha}_i$, $\hat{\beta}_i$ and $\hat{\gamma}_i$ (for $i=0,1,\dots$), which were obtained earlier, as well as, plugging in the average values of exogenous variables for Poland during period 1991–1997 and their forecasted values, allows us to obtain the set of estimated long run saving rates and the rates of GDP per capita growth.

The simulation of possible scenarios for Poland was conducted under the assumption of quite a high rate of economic growth (5–7 percent per annum) and the decreasing budget deficit and current account deficit in the coming years. It was also assumed that the percentage of population over 65 will not change till year 2010. Such

an assumption is consistent with demographic forecasts officially assumed in the Polish social security reform. Results of the first simulation are presented in Table 4:

Table 4. Simulation of the Rate of Saving and the Rate of Growth for Poland Using Parameters Estimated for the OECD Countries in Period 1971–1994

Saving rate equation:						
	Actual data 1996–97	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
g_t	7.0%	6.0%	4.0%	5.0%	6.0%	7.0%
Pop65	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%
Bd	2.6%	2.2%	1.5%	0.0%	-1.0%	-2.0%
Ca	-6.0%	-5.0%	-4.0%	-2.0%	-2.0%	0.0%
Outcome						
s=	22.4%	22.1%	20.7%	23.6%	24.8%	27.6%
Rate of growth equation:						
		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
S	22.4%	22.1%	20.7%	23.6%	24.8%	27.6%
λ	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Y	3000	3100	3300	3500	4000	4500
Outcome						
g=	3.6%	3.6%	3.4%	3.7%	3.9%	4.2%

The first column shows the actual rate of economic growth, size of budget deficit, current account deficit and demographic parameters for Poland. The model shows that if the factors influencing the saving rate in Poland were exactly the same as in the OECD countries during the last 25 years, the saving rate should equal about 22 percent and not, as it is in fact, 17 percent. A fall in the rate of growth of product down to 4 percent annually, despite simultaneously decreasing current account and budget deficits, would cause a two percentage point decrease in the saving rate. It is only a simultaneous fall in both types of deficits combined with maintaining a high medium run rate of growth (6–7 percent) that would enable an increase of the saving rate up to 25–27 percent of GDP.

The bottom part of Table 4 shows the long term rates of growth corresponding to saving rates obtained in the way described in the previous section. Such rates of

growth are undoubtedly lower than medium term run which were assumed in the saving function. They vary from 3.4 percent to 4.2 percent annually (the most optimistic assumptions shown in the last column). Relatively low rates of growth implied by the Solow model suggest a decrease in the rate of product growth in a longer run and point out to the principally weak relation between the saving rate and rate of growth in the steady state of growth. However, such an outcome is not at odds with the Solow model.

Projections shown in Table 4 correspond to patterns of growth observed in the OECD countries in period 1970–1994, during which two severe worldwide economic downturns were observed. Therefore, it could be assumed that the long run rate of growth for Poland would have been higher than implied by estimations for the OECD countries for 1970–94. Moreover, the long run growth is not necessarily correctly described by the Solow model. In particular, a decrease in the rate of growth could be avoided if Polish economy were be able to take advantage of positive externalities and could benefit from higher level of human capital investment and technological change, which occurred in the 1990s. Unfortunately, the time series data for Poland is still not long enough to enable us to state whether the endogenization of the technological change (characteristic to new theories of growth) is already taking place in Poland.

For projection purposes, Poland was also compared with another fast growing European economy – Spain. The results of simulation, which was this time based on the estimators of saving and growth functions for Spain, are presented in Table 5. The saving rate and the rate of growth are – in addition to the budget and current account deficits, the rate of unemployment and inflation – described by the level of income per capita in US dollars. The level of income positively influences the saving rate. It has, however, a negative impact on the rate of economic growth. Plugging in the Polish data into equations estimated for Spain results in the saving rate and the rate of growth approximately equal to their actual values in period 1997–1998. This result could suggest a similarity between the Spanish and Polish paths of growth. Rates of saving of 17–18 percent could imply a 4–5 percent long run rate of growth. Only the lowering of the current account deficit, the budget deficit, the rate of inflation, and the rate of unemployment could increase both the saving rate (to 20–23 percent) and the rate of long run growth (to 6–8 percent) to the levels achieved by the OECD countries.

Households are the main sector generating savings. In our study we isolated only the factors influencing the households saving rate, which are implied by the life cycle theory including the influence of the rate of growth of disposable income on the

Table 5. Simulation of Saving Rate and Rate of Growth for Poland Using Estimation Results for Spain 1963–1992

Saving rate equation:					
	Actual data 1996-97	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Bd	2.8%	2.2%	2.0%	0.0%	-2.0%
Ca	-6.0%	-5.0%	-4.0%	-3.0%	0.0%
U	11.0%	10.0%	9.0%	8.0%	6.0%
Y	3000	3100	3300	3500	4000
S=	17.6%	18.4%	19.2%	20.4%	22.9%
Rate of growth equation:					
		Scenario 1	Scenario 2	Scenario 3	Scenario 4
S	17.6%	18.4%	19.2%	20.4%	22.9%
π	15.0%	13.0%	10.0%	9.0%	5.0%
Y	3000	3100	3300	3500	4000
G=	3.9%	4.7%	5.7%	6.4%	8.4%

Table 6. Simulation of households saving rate in Poland using estimation results for the OECD countries in 1971–1994

Households saving rate equation:					
	Actual data 1996–97	Scenario 1	Scenario 2	Scenario 3	Scenario 4
g^h	4.0%	5.0%	6.0%	7.0%	8.0%
pop65+under19	41.9%	41.9%	41.9%	41.9%	41.9%
τ	16.0%	17.0%	18.0%	18.0%	15.0%
$s^h =$	10.16%	10.30%	10.43%	10.90%	12.33%

propensity to save. The simulation of household saving rate in Poland using estimators of saving function for the OECD countries is shown in Table 6.

The first column in Table 6 shows the actual rate of growth of disposable income, the tax rate, and the percentage of population, which is not active economically. There is a visible convergence between the household saving function in Poland and the OECD countries, as the saving rate calculated for Poland, using the OECD estimators

almost equals the one actually observed (10 percent). An increase in the household saving rate in Poland could be achieved by lowering of the tax rate (or not raising it) or by raising the disposable income. The latter will rise with the higher rate of economic growth.

The above analysis implies the following prospects of economic growth in Poland in the next 10–15 years: a medium run rate of growth of 6–8 percent would allow the saving rate to increase up to about 23–27 percent. This could happen only if the following conditions were fulfilled: the current account were balanced, the budget were balanced or in surplus (2 percent), inflation were lowered down to 5 percent annually, and the rate of unemployment down to 6 percent (the natural rate of unemployment). If, in addition, the rate of growth of households disposable income were assumed to be a little lower than the rate of GDP growth (6–7 percent) and the taxation rate remained unchanged, the saving rate would rise by about 2–3 percentage points (up to 12 percent). The simulation was conducted under assumption of no change (till 2010) in demographic factors such as percentage of population under 19 and over 65. The whole analysis implies two possible paths of economic growth in Poland: one, consistent with the Solow model, where the rate of growth would be diminishing and then levelling off at 4 percent per annum; another consistent with new growth theories, where this rate is maintained at the high level of 6–8 percent per annum.

Our research revealed a wide margin of possible developments. The results of our simulations should be read carefully, and the initial assumptions should not be overlooked. In particular, it applies to the inference about the long run rates of growth. The results here can seem unpromising, especially if the rate of growth would fall and then stabilise at the long run level, as implied by the Solow model. For this reason projection of the above quantities using estimations for HPAEs (High Performing Asian Economies) of South-East Asia could yield higher indicators of growth. On the other hand, such analysis would have to assume very high saving rates (30 percent of GDP) similar to those observed in the HPAEs. Such assumption seems unrealistic in the 10–12 years time perspective. It seems that comparison with the OECD countries is more justified historically and culturally. As a matter of fact our study proved that the household saving rate in Poland is very similar to those observed in the analysed OECD countries.

Microeconomic analysis of patterns of the life cycle consumption and saving can answer further questions on future developments in the saving rate. The age of an individual, income expectations, borrowing constraints, and attitude towards risk are the factors that affect the intertemporal choice. Also, the social security reform that

started in Poland in January 1999 can and should influence the individuals' saving decisions. Undoubtedly, today's young generations will differ from the majority of the Polish society in their saving patterns. Nevertheless, this is the present majority that determines the growth path for the coming decade. The changing structure of the society and the changing intertemporal saving/consumption preferences of the individuals should be under constant investigation of the economists.

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