ECONOMIC GROWTH AND THE WELFARE STATE: A MODEL OF BREAKS AND STARTS*.

Tatiana Fic

National Bank of Poland, Warsaw,

Chetan Ghate

Indian Statistical Institute, Delhi, and DIW Berlin

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Abstract

Can a rapidly rising welfare state induce a structural break in the growth rate of an economy? This paper constructs a simple political economy model of economic growth and the welfare state in which both variables are jointly endogenous and affect each other non-linearly. The model predicts that while high welfare state regimes are associated with low economic growth regimes, low welfare state regimes are associated with high growth regimes. The model also predicts that an upward structural shift to a high welfare state regime *precedes* the structural break in growth to a low economic growth regime. Using a sample that contains representatives of all the welfare state models over the period 1950-2001, we test each of these predictions using a Markov switching framework. Our main finding is that the structural decline in growth rates that several welfare state economies experienced during 1970-1975 can be attributed to movements to a high welfare state regime. Consistent with the theory, we also find that an upward structural shift to a high welfare state regime precedes the structural break in growth to a low economic growth regime.

Keywords: Welfare State, Structural Change, Regime Switching Models, Positive Political Economy, Endogenous Growth.

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1 Introduction

In the late 1960's - mid 1970's, several of the world's industrialized economies experienced a reduction in their growth rates. For instance, in a 1992 symposium devoted to the issue of long run growth, Kahn (1992) noted that "the potential rate of economic growth in the industrialized countries is now half of what it was in the 1960's". The structural-break in growth is also confirmed by Shigehara (1992) who found that nearly all the OECD economies experienced a slowdown that occurred between 1968 and 1975.

The most widely accepted cause of the growth slowdown is a reduction in total factor productivity (Griliches, 1980; Nordhaus, 1982; Romer, 1987; Baulmol et al.,1989), a phenomenon now referred to as the productivity puzzle. In the last decade however, a growing literature has begun to focus on the growth implications of unproductive government spending, and whether such expenditures offer an alternative channel for structural breaks in growth (see Levine & Renelt, 1992; Easterly & Rebelo, 1993; Barro & Sala-i-Martin, 1995; Turnovsky & Fisher, 1995; Tanzi & Zee, 1997; Ghate and Zak, 2002; Romer, 2003). This literature posits two channels whereby fiscal choices induce structural breaks in growth. First, unproductive government expenditures (government consumption and transfers) hinder growth because such expenditures are a less-than-perfect substitute for private consumption in the aggregate (or possibly even a complement). This makes private savings decline, affecting investment and growth in the long run. A complementary explanation takes the political economy approach and is more applicable to welfare state economies. Here, because politicians determine government expenditures, fiscal flows reflect their objectives. Hence, political decisions have an important impact on the allocation of resources (Ghate & Zak, 2002; Romer, 2003). If fiscal choices, catering to constituent interests, lead to a bloating of the welfare state, then growth can be affected adversely. This is because higher welfare state spending is financed by higher taxation which creates a drag on long run economic performance (Lindbeck et al, 1994; Atkinson & Werner-Sinn, 1999; Ghate & Zak, 2002).

Barr (1992) documents the expansion of the public sector created by higher expenditures on redistribution in public budgets in ten countries. In each case, public state welfare spending is substantial, from around 12 percent of GDP in 1980 in Australia and Japan, to 25 percent or more in Germany, the Netherlands and Sweden. Further, welfare spending constitutes a higher proportion of GDP in all ten countries since 1960, with spending doubling in Netherlands and Sweden, and nearly tripling in Switzerland. In the United States, public welfare state spending - inclusive of public expenditure on all cash benefits plus public expenditure on health care - has risen from 7.3 percent of GDP in 1960 to 15 percent of GDP in 1980.

This paper takes the model of growth and the welfare state developed in Ghate and Zak (2002) as a point of departure, and estimates the main predictions of this model. Our analysis provides evidence attributing the structural decline in growth in nineteen welfare state economies experienced during 1970-1975 to an upward structural shift in their welfare states. The nineteen welfare state economies constitute the comparative welfare state dataset (CWS) compiled by Huber, Ragin, & Stephen (1997). Cumulatively, these economies constitute representatives from all of the welfare state models (Scandinavian, conservative-corporatist, and laissez-faire).[1] Our main finding is that the structural breaks in the growth rate of sixteen of the nineteen economies analyzed in our sample can be attributed to a structural break in the trend growth of the welfare state variable. Broadly interpreted, this suggests that a rise in the trend growth rate of the welfare state offers an alternative explanation (apart from productivity) for the structural decline in growth performance of these economies.

To test the mapping between structural breaks in the welfare state inducing structural breaks in growth, we employ a Markov switching model along the lines of Hamilton (1989). Our framework assume the existence of two regimes: a high growth and low growth regime, and a high welfare state and low welfare state regime. The primary advantage of using the regime switching approach is that it allows us to compute the mean values (of growth rates) in different regimes as well as the probabilities of moving from a high growth to low growth regime (or low welfare state to high welfare state regime). Consistent with the literature, we follow Ben-David and Papel (1998, pp. 561) by defining a growth slowdown as a "statistically significant negative break in the trend function of the growth process." However, our measure of the welfare state follows Ghate and Zak (2002): i.e, we define the size of the welfare state as the ratio of real transfer spending to real outlays on public investment. Proxying the welfare state in this manner allows us to examine the size of the welfare state per "dollar" of productive government spending. Hence, a growing welfare state can either be driven by two factors: an increase in real transfer spending relative to

[1] We also include Japan and Ireland which do not fit into these traditional categories.

public investment, or reductions in public investment relative to a given level of transfer spending.[2]

Our analysis leads to several other interesting results. First, the data indicate three separate waves of country-groupings with coinciding break timings in their growth rates. This supports evidence of the inter-relatedness of regime switches where structural breaks in the first wave economies affect the incidence of structural breaks in the second and third group of economies. Second, we find that the general behavior of the evolution of the welfare state across over the 1950-2001 period exhibits a non-linear logistical growth pattern. To wit, we find that the welfare state initially grows at a slow rate, then grows rapidly following the first structural break, and finally reverts back to a lower growth rate after the second structural break. This allows us to identify three characteristic periods of welfare state behavior: two regimes corresponding to slow growth and one corresponding to high growth. We then ask how this pattern generates a growth slowdown. Third, and lastly, the non-linear and jointly endogenous relationship between economic growth and the welfare state identifies the intuition behind how the welfare state and growth are inter-related. The intuition runs as follows. Initially, a high pre-break growth rate induces the welfare state to rise at a slightly faster rate than the growth rate of output. Over time however, this leads to a decline in growth. In the long run, lower growth dampens the growth of the welfare state. In other words, we find that regimes which generate low welfare state values also generates high growth values, while regimes that generates high welfare state values

[2]Adding government consumption to transfer spending does not alter the empirical results of the model. Hence, we omit it from the analysis.

also generate low growth values. In fact, we find that the average transition period across the nineteen economies between both structural breaks is approximately fifteen and a half years.

The paper is structured as follows. Section 2 outlines a variant of the dynamic model of growth and the welfare state outlined in Ghate and Zak (2002), and derives three testable implications of this model. Section 3 outlines a brief motivation for why we use a regime switching approach to model to test these hypotheses. Section 4 presents some empirical evidence governing the main hypotheses in the paper. Section 5 concludes.

2 The Model

The model closely follows Ghate & Zak (2002).[3] Optimal policies are the solution to a representative politician's problem who enacts pro-growth policies and pro-redistributive policies. A politician's instantaneous felicity, W, is assumed to be a convex combination of the welfare of both policies. The parameter $\chi \in [0, 1]$ measures a politician's relative preference for pro-redistributive policies over pro-growth policies. When $\chi = 0$, politician's derive utility from growth enhancing policies. When $\chi = 1$, politician's derive utility from re-distributive policies. Hence, the politician's objective function is assumed to embody a trade-off between transfers and growth.

Following Barro (1990), we assume that pro-growth policies are driven by the level of public investment, λ, to maximize capital deepening (output growth). Public investment

[3] In this paper, we construct a minor variation to the model proposed by these authors. Here, politician utility is a convex combination of the utility that individual lobbies derive from the policies implemented for the groups. The specification follows Blomberg (1996).

raises private productivity which in turn raises output and consumption (Aschauer, 1989; Rioja, 1999). We assume that the utility that politicians derive from promoting pro-growth policies, $V_\lambda(\frac{K_{t+1}}{K_t})$, is linear in the growth rate. This implies that the utility that a politician derives from enacting pro-growth policies is given by the expression $(1-\chi)\frac{K_{t+1}}{K_t}$.

The second aspect in the political decision problem is the value constituents place on receiving transfers, σ, from politicians, $V_\sigma(\sigma)$. The function $V_\sigma(\sigma)$ is continuous, strictly increasing, and concave. Politicians' preferences for transfers relative to capital growth are captured by the parameter χ, with politicians' value placed on transfers being $\chi V_\sigma(\sigma)$. Higher values of χ indicate a greater indication of policy makers to engage in re-distribution vis-a-vis productive public investment. When $\chi = 0$, politicians derive no utility from promoting transfers.

We assume costs associated with bureaucratic waste in administering government investment projects and transfer programs, given by $\epsilon_\lambda \in (0,1)$ and $\epsilon_\sigma \in (0,1)$, respectively. When $\epsilon_\lambda = 1 (\epsilon_\sigma = 1)$, public investment (transfer) programs are administered with no waste. When $\epsilon_\lambda < 1$ $(\epsilon_\sigma < 1)$, a fraction of the funds raised for public investment and transfer programs is lost because of the waste or corruption associated with administering these programs. Hence, $\epsilon_\lambda\lambda$ and $\epsilon_\sigma\sigma$ can be interpreted as the *effective* level of public investment and transfers, respectively.

Politicians finance transfers and public investment by levying a proportional tax on output according to a simple balanced budget rule, $\tau_t = \tau Y$, with $\tau \in (0,1)$ denoting the tax rate, and $Y = F(\cdot,\cdot)$ representing output produced using a neo-classical production function satisfying the standard conditions.

Combining the above two objectives of politicians, the fiscal policy triple $\{\tau_t, \sigma_t, \lambda_t\}_{t=0}^{\infty}$ is found by solving

$$Max_{\tau,\lambda,\sigma} W = (1-\chi)\frac{K_{t+1}}{K_t} + \chi V(\sigma_t) \tag{1}$$

s.t.

$$C_t = F(K_t, (\epsilon_\lambda \lambda_t))(1-\tau) + \epsilon_\sigma \sigma_t - I_t \tag{2}$$

$$I_t = K_{t+1} - (1-\delta)K_t \tag{3}$$

$$\tau F(K, \lambda) = \lambda_t + \sigma_t, \tag{4}$$

Equation (2) is the economy's resource constraint equating consumption, C, to after tax output, $F(\cdot,\cdot)(1-\tau)$, investment, I, and effective transfers, $\epsilon_\sigma \sigma_t$. Equation (3) is the stock accounting condition for the private capital stock, K, with $\delta \in [0,1]$ the depreciation rate. Equation (4) is the government budget constraint equating revenues to expenditures on transfers and public investment in each period.

The Lagrangean for the politician's problem is,

$$L = \frac{(1-\chi)}{K_t}\{K_t^\alpha(\epsilon_\lambda \lambda_t)^{1-\alpha} + (1-\delta)K_t - C_t - (1+\theta_t)\lambda_t + \epsilon_\sigma \theta_t \lambda_t\} + \chi \epsilon_\sigma^\nu \theta_t^\nu \lambda_t^\nu. \tag{5}$$

It will be useful to define the level of transfers relative to government investment as

$$\theta_t \equiv \frac{\sigma_t}{\lambda_t}. \tag{6}$$

This allows us to rewrite the government revenue constraint, (4), as

$$\tau_t = (1+\theta_t)\lambda_t. \tag{7}$$

The first order conditions with respect to λ_t and θ_t are

$$\frac{(1-\chi)}{K_t}\{(1-\alpha)K_t^{\alpha}(\epsilon_\lambda\lambda_t)^{-\alpha}\epsilon_\lambda-(1+\theta_t)+\epsilon_\sigma\theta_t\}+\chi\nu\epsilon_\sigma^{\nu}\theta_t^{\nu}\lambda_t^{\nu-1}=0, \tag{8}$$

and

$$\frac{(1-\chi)}{K_t}\{-\lambda_t+\epsilon_\sigma\lambda_t\}+\chi\nu\epsilon_\sigma^{\nu}\theta_t^{\nu-1}\lambda_t^{\nu}=0, \tag{9}$$

respectively.[4] Solving for θ_t in (9) implies

$$\theta_t^{\star}=[\frac{\nu\chi\epsilon_\sigma^{\nu}}{(1-\chi)(1-\epsilon_\sigma)}]^{\frac{1}{1-\nu}}\cdot\frac{1}{\lambda_t}\cdot K_t^{\frac{1}{1-\nu}}. \tag{10}$$

Multiplying both sides of (10) by λ_t and noting the definition of θ_t implies

$$\sigma_t^{\star}=[\frac{\nu\chi\epsilon_\sigma^{\nu}}{(1-\chi)(1-\epsilon_\sigma)}]^{\frac{1}{1-\nu}}K_t^{\frac{1}{1-\nu}}. \tag{11}$$

Interestingly, note that the aggregate dynamics of the welfare state match the data when we assume that $\upsilon>\frac{1}{2}$. This implies that - in a growing economy - transfers grow at a slightly faster growth rate than output. This induces the growth rate of output to fall as higher transfers are financed by higher taxes, leading to lower disposable income.

Likewise, it is easy to see that

$$\lambda_t^{\star}=[(1-\alpha)\epsilon_\lambda^{1-\alpha)}]^{\frac{1}{\alpha}}K_t. \tag{12}$$

Finally,

$$\tau_t^{\star}=\sigma_t^{\star}+\lambda_t^{\star}. \tag{13}$$

[4]In order to concretize the analysis, we use a Cobb-Douglas production function $F(K_t,\epsilon_\lambda\cdot\lambda_t)=K_t^{\alpha}[\epsilon_\lambda\lambda_t]^{1-\alpha}$, for $\alpha\in(0,1)$. We let preferences over transfers be represented by a power function $V(\sigma_t)=(\epsilon_\sigma\sigma)^{\nu}$, with $\nu\in(0,1)$.

Equation (13) implies that optimal taxes increase monotonically with χ. This is because a rise in transfers is funded out of higher taxes. Further, it is easy to see that the expression for θ_t from (10) is monotonically increasing in the ratio $\frac{\chi}{1-\chi}$. More specifically, let H denote high, and L denote low. This implies that a structural break in χ - say from χ_L to χ_H - induces a structural break in θ from (10) at time period t.

Following Solow (1956), we substitute out the above optimality conditions in the capital market equilibrium condition. The dynamical system that describes growth in this economy is given by[5]

$$K_{t+1} = s[GK_t - HK_t^{\frac{1}{1-\nu}}] + (1-\delta)K_t. \tag{14}$$

where after tax output, denoted by $Y_t - \tau_t = [GK_t - HK_t^{\frac{1}{1-\nu}}]$. Define $g_{t+1} = \frac{K_{t+1}}{K_t}$ to be the growth rate. Then,

$$g_{t+1} = (sG + 1 - \delta) - HK_t^{\frac{\nu}{1-\nu}}. \tag{15}$$

Together with equation (10), equation (15) determines the joint evolution of the welfare state and growth in the economy.

To focus the analysis on the impact of θ_t on g_{t+1}, since the constant term H depends positively with $\frac{\chi}{1-\chi}$, from (15) it is easy to see that,

$$\frac{\partial g_{t+1}}{\partial \frac{\chi}{1-\chi}} < 0. \tag{16}$$

Equations (10), (15), and (16) permit us to see how a structural break from a rise in the welfare state create a regime shift in growth: to wit, suppose χ rises from χ_L to χ_H. This

[5]Here, $G \equiv \alpha[\epsilon_\lambda(1-\alpha)]^{\frac{1-\alpha}{\alpha}} > 0$, and $H \equiv [\frac{(\nu\chi\epsilon_\sigma^\nu)}{(1-\chi)(1-\epsilon_\sigma)}]^{\frac{1}{1-\nu}} > 0$. We also assume a regularity condition , $s\alpha[\epsilon_\lambda(1-\alpha)]^{\frac{1-\alpha}{\alpha}} - \delta > 0$, to ensure that the dynamics are not trivial. This restriction is likely to hold if δ is sufficiently small.

implies that θ_t, given by (10), rises from a low welfare state regime to a high welfare state regime in time period t. From (15) however, a rise in χ reduces the g_{t+1}. Consequently, growth moves from a high growth regime, $g_{H,t+1}$, to a low growth regime, $g_{L,t+1}$ in $t+1$. The intuition, as stated before, is that a rise in χ by raising σ_t^*, also requires an increases in taxes, τ_t^*. This reduces disposable income, capital accumulation, and subsequently growth. It is important to note however that a rise in θ in time period t does not affect K_{t+1} in time period t, but in time period $t+1$. This is because equation (15) is inter-temporal. This implies that if the model outlined is correctly specified, a structural increase in the welfare state should *precede* the structural break in growth.[6]

Figure (1) describes the dynamic impact of regime switches in the welfare state to regime switches in the growth rate given by equations (15) and (10). Initially, a high growth regime funds a growing welfare state. This leads to a high growth-growing welfare state. However, since a rise in transfers requires taxes to rise from (13), the drag created by higher taxes on disposable income reduces capital accumulation and growth.[7]

Finally, note from (14), as $\chi \to 1$ (or $H \to \infty$), a higher propensity for redistribution on the part of policy makers creates a poverty trap. This is because a higher propensity to re-distribute increases the taxes required to fund transfers reducing after tax output. In

[6]To concentrate the analysis around movements in θ inducing movements in the growth rate, we ignore the possibility that the other constant parameters in the model can induce a structural break in growth. This is for three reasons. First, it is a well known fact that α, the share of income paid to capital, is constant. Second, the constant savings assumption has solid empirical support (Campbell & Mankiw, 1991; Blinder and Deaton, 1985). Finally, we assume that ϵ_λ and ϵ_σ are sufficiently small to not impact the aggregate dynamics of the economy.

[7]The condition for balanced growth obtains by evaluating $\frac{dK_{t+1}}{dK_t} > 1$. When $\chi \neq 0$, $\chi \to 1$ implies that $\tau_t \to \infty$ from (13), or $lim_{\tau_t \to \infty} \overline{Y} = 0$. In contrast, when $\chi = 0$, transfers are set to zero, which implies after tax output is linear in capital, i.e. $\overline{Y} = Y - \tau_t = \alpha\{(1-\alpha)\epsilon_\lambda\}^{\frac{1-\alpha}{\alpha}} K_t$.

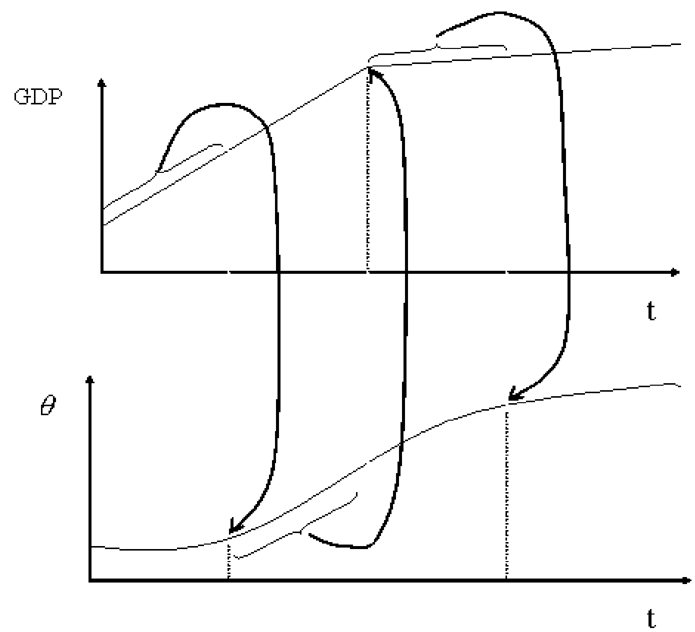

Figure 1: STRUCTURAL BREAKS IN θ AND GROWTH

contrast, when $\chi = 0$ (or $H \to 0$) , endogenous growth obtains and the economy grows on a balanced growth path. The after depreciation growth rate, or the *net* rate of growth is given by $sG - \delta$. Hence, the value of χ determines the aggregate dynamics of the economy.[8]

3 EMPIRICAL RESULTS

3.1 Motivation for Markov Switching Approach

To test the model outlined in Section 2, we employ a Markov regime switching model

[8]Matsuyama (1999) constructs a similar model in which factor accumulation and innovation capture different phases of a single growth experience.

along the lines of Hamilton (1989). Before outlining the testable hypothesis however, we first briefly detail the importance of using a Markov regime approach for the model outlined in Section 2. As stated in the introduction, the primary advantage of using the regime switching approach is that it allows us to compute the mean values (of growth rates) in different regimes as well as the probabilities of moving from a high growth to low growth regime (or low welfare state to high welfare state regime). Also, to the best of our knowledge, using a regime switching approach to assess welfare state-economic growth dynamics is new in the literature. As such, our model proposes a new modeling strategy for assessing the joint non-linear impact of growth and welfare state evolution.

A hypothetical structural break in growth induced by a rise in the welfare state is depicted in Figure (2). Both variables, g (growth), and, θ (measure of welfare state), are generated by two regimes. The causal link between g and θ exists *if the regimes that generate them overlap.*[9] However, any inference on the *direction of causation* is not restricted a-priori by a pre-specified linear or non-linear function. This means that variable movements depend only on their regimes.

More specifically, there are several reasons for employing a regime switching approach to test the predictions of the model outlined in Section 2. As a general strategy however, we first analyze all the variables of interest within the Hamilton (1989) framework. Inferences on the behavior of each series is then used as a benchmark for analyzing the dynamics and causal links between the expenditure structure and growth.

[9] However, if the transition in θ is smooth and long lasting, regimes with high growth and low welfare states and low growth and high welfare states may not overlap.

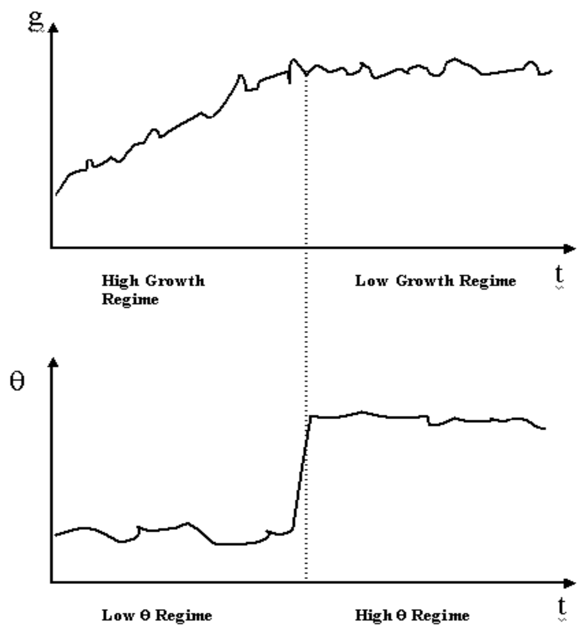

Figure 2: Structural Breaks and Regime Switches

First, using a regime switching framework allows us to bypass the well-known problems associated with an *ex-ante* selection of the timing of structural change. To wit, the date of the structural change is not defined under the null-hypothesis. This implies that the standard testing theory is not applicable (Hansen, 2001).

Second, an assessment of the impact of fiscal policy on economic growth based on linear regressions does not provide economically plausible and statistically significant results. This is because the relation between fiscal policy and growth is typically non-linear with the fiscal and growth variables jointly endogenous. While a solution to the joint endogeneity problem would be to use exogenous instrumental variables to proxy for various regressors, because of the multiplicity of possible regressors, the influence of one variable on growth does not necessarily imply that other variables do not affect growth (Easterly and Rebelo, 1993; Brons, de Groot, & Nijkamp, 1999). Likewise, using simple linear regressions can lead to serious model mis-specification.[10]

Third, a conceptual difficulty with using cross-country growth regressions is the multiplicity of explanations (Durlauf, 2000; Durlauf & Quah, 1998). This leads to a large set of potential explanatory variables.[11] This points to one of the advantages of using a regime switching model: we focus exclusively on the variables that drive the dynamics of the theoretical model.

Finally, several cross-country empirical analyzes assume that the statistical model is

[10]Having said this, using a-priori specified non-linear models does not fully solve the problem since the results are sensitive to the assumptions on model structure.

[11]For instance, Durlauf (2000) and Durlauf & Quah (1998) report over ninety different variables as potential explanations for cross-country growth variation.

invariant across investigated units (countries). This assumption - often referred to as parameter homogeneity - is usually a strong assumption to justify. For example, it is difficult to justify that a 1% change in school enrollment has the same effect on growth in two countries like the US and Botswana (Durlauf, 2000). Sorting countries into groups does not solve parameter heterogeneity as country groupings are typically ad hoc with few alternative groupings.

3.2 Testable Hypotheses

Using the model in Section 2, Equations (10) and (15) and (16) lead to the following testable hypothesis.To ensure that the model matches the key features of the data, we assume that $\nu > \frac{1}{2}$.

- Starting from $K_0 > 0$, from (10), a rise in growth implies that θ grows slightly faster than capital since transfers from (11) grow slightly faster than capital but public investment increases only in proportion to capital. In other words, in the *expansion stages of the welfare state*, $\uparrow$ growth $\rightarrow \uparrow \theta$.

- From (16), an upward structural break in θ (higher χ) induces a downward structural break in the growth rate of the economy. Intuitively, a rise in transfers (because of a higher χ) in t reduces disposable income in t. From the capital market clearing condition, (14), K falls in $t+1$. This leads to a reduction in growth.

- From (10) and (15), the structural break in θ *precedes* the structural break in the growth. This is because a rise in χ affects θ in time period t, but growth only in $t+1$.

- From (11), a reduction in growth leads to a lower capital stock in $t+1$. This also reduces transfers (σ) in $t+1$ as transfers fall slightly faster than capital (even though public investment falls in proportion to capital). This means that θ falls slightly faster than capital in $t+1$. From the capital market clearing condition, this raises disposable income, and therefore growth in $t+2$. In other words, in the *contractionary stages of the welfare state*, $\downarrow \theta \rightarrow \uparrow$ growth.

3.3 Data Description

To begin with, we first analyze all the variables of interest within the Hamilton (1989) framework. Inferences on the behavior of each series is then used as a benchmark for analyzing the dynamics and causal links between fiscal choices and growth. We then test the above hypotheses using the CWS data-set compiled by Huber, Ragin, and Stephens (1994) as well as the IFS and OECD datasets.[12] The sample encompasses data for 19 welfare states economies. These are Australia (AUL), Austria (AU), Belgium (BEL), Canada (CAN), Denmark (DEN), Finland (FIN), France (FRA), Germany (GER), Ireland (IRE), Italy (ITA), Japan (JAP), Luxembourg (LUX), Netherlands (NET), New Zealand (NZL), Norway ((NOR), Sweden (SWE), Switzerland (SWZ), United Kingdom (UK) and United States (US).

However, due to the lack of complete data on transfers and public investment over 1950-

[12]Annual data on RGDP are obtained from the IFS. Annual data on real outlays on public investments and real transfers come from the IFS , CWS, and OECD databases. The variable θ for DEN and LUX are defined as the ratio of total real transfers to gross domestic investment as there is insufficient data available on public investment.

2000, the welfare state variable, θ, starts only from 1960. In contrast, our analysis of regime switches in RGDP starts from 1950. Growth rates of RGDP are computed as differences of logs of total constant prices GDP. As the raw data contain business and political cycle factors irrelevant for long run output movements, a Hodrick-Prescott filter is run on both RGDP and θ.

3.4 Structural Breaks in Growth Rates

As stated in the introduction and shown in Figure 2, we first analyze all the variables of interest within the Markov regime framework. Inferences on the behavior of each series is then used as a benchmark for analyzing the dynamics and causal links between the welfare state and growth. To analyze structural breaks in the growth rates, we use follow Hamilton (1989).[13] The RGDP growth series is decomposed into two stochastic trends corresponding to two regimes over 1950-2001: one that generates high growth and one that generates low growth rates. Table 1 summarizes the results for the investigated countries. This constitutes our first finding.

As Table 1 indicates, a majority of countries in the CWS dataset experience a growth slowdown in the mid 1970's, with average growth rates equal to 5.07% prior to the structural break, and 2.29% after the structural break. The *net* change in growth rates across all nineteen economies is - 2.78%. The highest pre-break growth rates are observed in Japan and Germany with growth rates of 9.33% and 7.09%, respectively. These countries also record the biggest slowdown in the post-break period, 6.64 and 4.32%, respectively. Switzerland

[13] See Appendix A.

and Norway are the slowest developing economies after the break - growing at an average rate of 1.56% and 1.76%, respectively. The direction of change in growth is opposite in Ireland and Luxembourg (for these economies the average post-break rate exceeds the pre-break growth rate). Evidence for Norway and New Zealand shows that these economies experience two breaks - one indicating a growth slowdown (Norway in 1980 and New Zealand in 1974) - and the second an upturn in growth (Norway in 1994 and New Zealand 1954). Finally, the model does not identify a break for United Kingdom.[14]

Table 1 also allows us to distinguish groups of countries with coinciding break timings. This identifies groups of economies whose growth rates are influenced by structural declines in the growth rates of groups of other economies. For instance, the first wave of countries that experience a downward regime switch in growth encompass the United States (1972), Japan (1972), Germany (1971) and Switzerland (1972). The three big economies - US, Germany and Japan - could be regarded as engines of growth for other countries as growth in these economies stimulates the development of the others (for instance, via international trade).[15] The second wave of regime switches occur over 1974-1976: Denmark, Finland, Sweden, Australia and New Zealand over 1974-1975, and Belgium and Netherlands over 1975 -1976. Finally, the analysis identifies a third group of countries with downward regime shifts in growth: these countries comprise Austria, France and Italy, and Canada with

[14]This result also confirms the findings of Ben-David and Papel (1998). This is because the British economy grew at an average of 2.68% - a growth rate substantially lower than the growth average for the high growth regime averages (5.07%), and closer to the average growth rates across the low growth regime (2.29%).

[15]The relatively early break for Switzerland could be explained by the fact that it is a small economy outside of the EU institutional apparatus.

Country	Pre-break growth rate (%)	Post -break growth rate (%)	Change: -slowdown +upturn	Structural break
AU	5.4	2.34	-3.06	1977
AUL	5.32	2.81	-2.51	1975
BEL	4.33	2.04	-2.29	1975
CAN	5.18	2.38	-2.8	1977
DEN	4.3	1.89	-2.41	1975
FIN	5.25	2.74	-2.51	1975
FRA	5.25	2.03	-3.22	1977
GER	7.09	2.77	-4.32	1971
IRE	8.26	3.67	4.59	1992 (opposite direction)
ITA	6.1	2.69	-3.41	1977
JAP	9.33	2.69	-6.64	1972
LUX	6.16	3.95	2.21	1985 (opposite direction)
NET	5.53	2.29	-3.24	1976
NOR	4.29	1.76	-2.53. +2.53	1980. 1994 (opposite direction)
NZL	3.81	1.79	-2.02	1954 (opposite direction). 1974
SWE	3.09	2.06	-1.03	1974
SWZ	5.21	1.56	-3.65	1972
UK	2.68	0.26		only first regime was recorded
US	4.02	2.37	-1.65	1972
AVERAGE	5.07*	2.29* **	-2.78	

* without Luxembourg. Ireland (as the direction of the growth trend was opposite) ** with growth rate for UK=2.68% (as there was no break)

Table 1: Growth characteristics.

growth breaks in 1977.

In summary, Table 1 indicates that the early 1970's is an important turning point for many industrialized economies. Recall that our definition of a growth slowdown is a statistically significant negative break in the trend function of the growth process. Hence, the implication of our results are that the average pre-break growth rates exceed the average post-break growth rates. The incidence of growth slow-downs for developed countries is also consistent with the many findings of post-war divergence in income levels across developed economies themselves. In the interest of economizing on space, we plot the evolution of RGDP rates in three representative economies as shown in Figures 3, 5, and 7. A majority of the RGDP series analyzed for countries conform to one of these three figures here.

We now attempt to assess where the slow-downs and switches identified by the model in the RGDP series can be attributed to structural breaks in the welfare state series.

3.5 Structural Breaks in θ.

Our analysis of the variable θ confirms the prediction from the theory that the welfare state evolves in a logistic pattern for most analyzed countries. Hence, the evolution of the welfare state is non-linear. This constitutes our second finding. We plot the evolution of the welfare state corresponding to the RGDP figures (3, 5, and 7). As these figures show, applying the Hamilton model with two regimes - corresponding to a slow and fast welfare state growth - enables identification of three characteristic periods of welfare state behavior. The first regime is a period in which the welfare state grows slowly when it is at a low level (period 1). The second regime is a period in which the welfare state grows rapidly in the transition period (period 2). The third regime is a period in which the welfare state grows slowly again although at a higher level than the size that the welfare state attained after the transition period (period 3).

Table 2 confirms that most countries analyzed experienced two structural breaks in θ. We also find that the average transition period between both structural breaks across the dataset lasts for 15.5 years. For instance, the process of welfare state growth begins earlier in Canada (1966) and Sweden (1968) than the other economies in the CWS data set. New Zealand exhibits the most stark increase in the size of the welfare state growing by 239%. Finally, there are four economies with three structural breaks in θ: Denmark, Germany, Japan and Italy. We later discuss why Germany and Japan should be regarded as special cases.[16]

A detailed description of individual countries in the CWS dataset cases is presented in Table 3. For twelve countries - Australia, Canada, Denmark, Finland, France, Germany, Japan, Netherlands, Norway, New Zealand, Sweden and Switzerland - the empirical evidence surrounding θ confirms the co-evolution of growth and the welfare state described by equations (15) and (10) and Figure (1). Figures 3-4, 5-6, and 7-8 offer three set of representative diagrams of growth starts and breaks for these countries. In each, the first structural break in θ precedes the structural break in growth. Moreover, for three countries - Austria, Belgium, and Ireland - there is no evidence of a rise in θ preceding the structural break in growth. Further, for the UK, the first structural break in θ in 1971 is not followed

[16]The third structural break in θ in Denmark is probably caused by growing private investment as there is no data on public investments available). The directions of structural breaks in θ in Italy are opposite from the other four economies.

Country	Structural break 1	Structural break 2	Structural break 3	Length of period the trans.	% change in theta (end of period 1. beginning of period 3(HP values))
AU	1993				
AUL	1971	1984		13	152.4
BEL	1977				
CAN	1966	1982		16	161.3
DEN	1972	1983	1989	11.6	100
FIN	1972	1996		24	180.1
FRA	1971	1983		12	71.5
GER	1972	1984	1992	12.8	80.7
IRE	1980				
ITA	1970	1988	1997	opposite direction	
JAP	1972	1987	1996	15	131.3
LUX		1981			
NET	1970	1985		15	218.7
NOR	1970	1986		16	79.9
NZL	1973	1993		20	239
SWE	1968	1986		18	179
SWZ	1969	1984		15	78.7
UK	1971	1985		14	261.3
US		1980			

Table 2: Theta characteristics.

by a structural break in growth, while for the US, we do not find evidence of a statistically significant rise in θ even though the model predicts a structural decline in growth starting in 1972.

Looking at Figures 3-4 - which correspond to the evolution of the welfare state and RGDP growth for Finland - a reduction in the trend growth rate in 1976 reduces the forecasted probability of staying in the high growth regime to zero. This is associated with an increase in the growth rate of θ in 1973-1974, after which the forecasted probability of staying in a low θ regime drops to zero (the welfare state begins to rise in Finland post 1974). Similar patterns are discernible in the structural breaks governing France's and Sweden's RGDP growth rates. However, the difference between Finland on the one hand, and France and Sweden on the other hand, is the shorter transition period taken in France and Sweden taken to revert back to the low growth welfare state regime again (approximately 20 years in Finland versus 10 years in France and 15 years in Sweden).[17] The remaining countries in this group follow a similar pattern of breaks and starts although with varying transition periods. These transition periods are outline in Table 2.

The intuition behind the co-evolution between growth and the welfare state is as follows. First, a high pre-break growth rate gives an incentive for the welfare state to rise. However, a growing welfare state subsequently leads to a slowdown in economic growth. Finally, slower economic growth dampens the pace at which the welfare state grows, resulting in

[17]However, in the Swedish case, the probability of the high growth regime has been increasing since 1996. This has most probably been a result of the welfare reforms enacted in the mid-nineties which led to negative growth rates in the rise of the welfare state (Lindbeck et al, 1994). In the case of Luxembourg, the direction of θ and growth switches are opposite than in the rest of countries but still consistent with the theory - a decrease in welfare state growth leads to higher growth.

the second structural break in θ. In other words, for these twelve economies, the empirical evidence support the testable implications outlined in Section 4: i.e., that regimes that generates low θ values are associated with regimes that generate high growth rates, while regimes that generate low θ values also generate low growth.

3.6 Three Structural Breaks in the Welfare State

For four countries - Denmark, Germany, Japan, and Italy - the welfare state series exhibits three structural breaks. Of these four, we focus on the cases of Germany and Japan, as they deserve some elaboration. Figures 9-10 and 11-12, relating to Japan and Germany, respectively, summarize the dynamics of growth and the welfare state.

Figure 9 shows that the forecasted probability of staying in a high growth regime declines around 1972 in Japan, even though Japanese economic growth remains impressive until 1989. However, the time trend of θ identifies three distinct periods of welfare state growth: 1974-1987, 1988-1997, and 1998 onwards.

In the 1974-1988 period, the forecasted probability of staying in the low growth welfare state regime drops to zero. Further, this probability increases (approximates 1) only around 1988, when there is a structural break in the trend growth rate of the welfare state. The forecasted probability of staying in a low welfare state regime however drops again to zero around 1998, as θ begins to rise.[18] What drives the increase in θ in Japan after 1995 however are reductions in real outlays in public investment. More specifically, after peaking in 1995, total road investment in Japan has fallen from $15,245.5$ billion yen to $12,064.1$ billion yen

[18]Since 1993, Japan RGDP growth has been 0.79 %. This is the number we obtain from running the Hamilton model on growth rates for the sample after the first break.

Country	Theta Str. break 1	Growth Str. break	Theta Str. break 2	Comments
AU	1993	1977		No evidence
AUL	1971	1975	1984	OK.
BEL		1975	1977	No evidence
CAN	1966	1977	1982	OK.
DEN	1972	1975	1983	OK
FIN	1972	1975	1996	OK.
FRA	1971	1977	1983	OK.
GER	1972	1971	1984, 1992	OK. 3 breaks.
IRE	1980	1992		No evidence
ITA	1970	1977	1988, 1997	No evidence (opposite direction of breaks in θ)
JAP	1972	1972. 1993	1987, 1996	OK. 3 breaks Model recognizes the 2nd break in growth in 1993 but this cannot be directly attributed to θ.
LUX	1981	1985		OK. (a decrease in θ growth leads to higher growth)
NET	1970	1976	1985	OK.
NOR	1970	1980. 1994	1986	OK. Uncertain whether 2^{nd} break in growth will lead to an increase in θ.
NZL	1973	1974	1993	OK.
SWE	1968	1974	1986	OK.
SWZ	1969	1972	1984	OK.
UK	1971	-	1985	-
US	-	1972	-	-

Table 3: Evidence for the Model.

in 2000 (Land, Infrastructure, and Transportation Ministry, Report, 2000). This provides one possibility for the structural rise in θ in Japan: a concerted drive to reduce outlays on public investments in the late nineties.

Germany, like Japan, also exhibits three structural breaks in θ. The model however identifies only one structural break in the growth rate (in 1971). As Figure (12) shows, the forecasted probability of staying in a low welfare state regime drops to zero in the 1975-1977 period, rises back to 1 during the 1983-1993 period and then drops down to zero again in the post 1993 period. The structural increase in θ since 1993 however reflects the increase in transfers to East Germany related to unification and the inability of Germany to undertake adequate labor market reforms. It remains to be seen whether the structural rise in θ will dampen the economic growth in Germany in the future.[19]

[19]The model did not identify a growth break so far.

4 Conclusion

This paper undertakes an empirical test of the model of economic growth and the welfare state developed by Ghate and Zak (2002). By using a Hamilton regime switching model on an exhaustive list of welfare state economies, our main finding is that the structural breaks in the growth rate of sixteen of the nineteen economies in the CWS data set can be attributed to a structural break in the trend growth of our welfare state variable. Our results can be interpreted as providing an additional explanation (apart from productivity) for the structural decline in growth performance of these welfare state economies.

We find that general intuition behind the co-evolution between growth and the welfare state is as follows. To wit, initially, a high pre-break growth rate induces the welfare state to rise. Over time, a growing welfare state leads to a decline in growth. In the long run, lower growth dampens the growth of the welfare state. This is because higher taxes are required to fund a growing welfare state leading to long run income losses. In other words, a regime which generate low welfare state values also generates high growth values, while a regime that generates high welfare state values, also generates low growth values. We find that the average transition period across the nineteen economies between both structural breaks is approximately fifteen and a half years.

We also find that in several economies, as predicted by the model, the structural break in the time trend of welfare state growth *precedes* the structural break in growth rates. However, reductions in economic growth are associated with lower values of the welfare state as lower growth forces politicians to cut transfers and taxes. The dynamic feedback process between growth and the welfare state illustrates the joint endogeneity of both variables, and the implications each has for the time trend of development.

5 APPENDIX A

This discussion follows Hamilton (1989). Consider the stochastic process,

$$\tilde{y_t} = n_t + \tilde{z_t}, \tag{17}$$

where $\tilde{y_t}$ is the dependent variable, n_t is a Markov trend following

$$n_t = \mu(s_t) + n_{t-1} = \alpha_0 + \alpha_1 s_t + n_{t-1}, \tag{18}$$

$s_t \in \{0, 1\}$ denotes a regime variable with transition probability matrix

$$P = \begin{pmatrix} q & 1-q \\ 1-p & p \end{pmatrix}, \tag{19}$$

and $\tilde{z_t}$ is a random component. Each observation of the dependent variables is drawn from two distributions: the first m_1 observations are generated by regime 0, the next m_2 from regime 1, and so on. It is important to note that each $m_i, \forall i \in 1, 2...M$ (where M is denotes the total number of switching points) is unknown.

We assume that $\tilde{z_t}$ follows an ARIMA(r,1,0) process where,

$$\tilde{z_t} - \tilde{z_{t-1}} = \varphi_1(\tilde{z_{t-1}} - \tilde{z_{t-2}}) + \varphi_2(\tilde{z_{t-2}} - \tilde{z_{t-3}}) + ... + \varphi_r(\tilde{z_{t-r}} - \tilde{z_{t-r-1}}) + \epsilon_t, \tag{20}$$

with $E(\epsilon_t) = 0$, $Var(\epsilon_t) = \sigma^2$, and $Cov(\epsilon_t, \epsilon_{t+k}) = 0$. Taking first differences of equation (17) and substituting $y_t = \tilde{y_t} - \tilde{y_{t-1}}$ and $z_t = \tilde{z_t} - \tilde{z_{t-1}}$ implies

$$y_t = \alpha_0 + \alpha_1 s_t + z_t. \tag{21}$$

Since y_t is observable, our objective is to estimate the transition probabilities across states, the parameters α_0 and α_1 (denoting the mean level of y_t in both regimes), and the variances of their random components.

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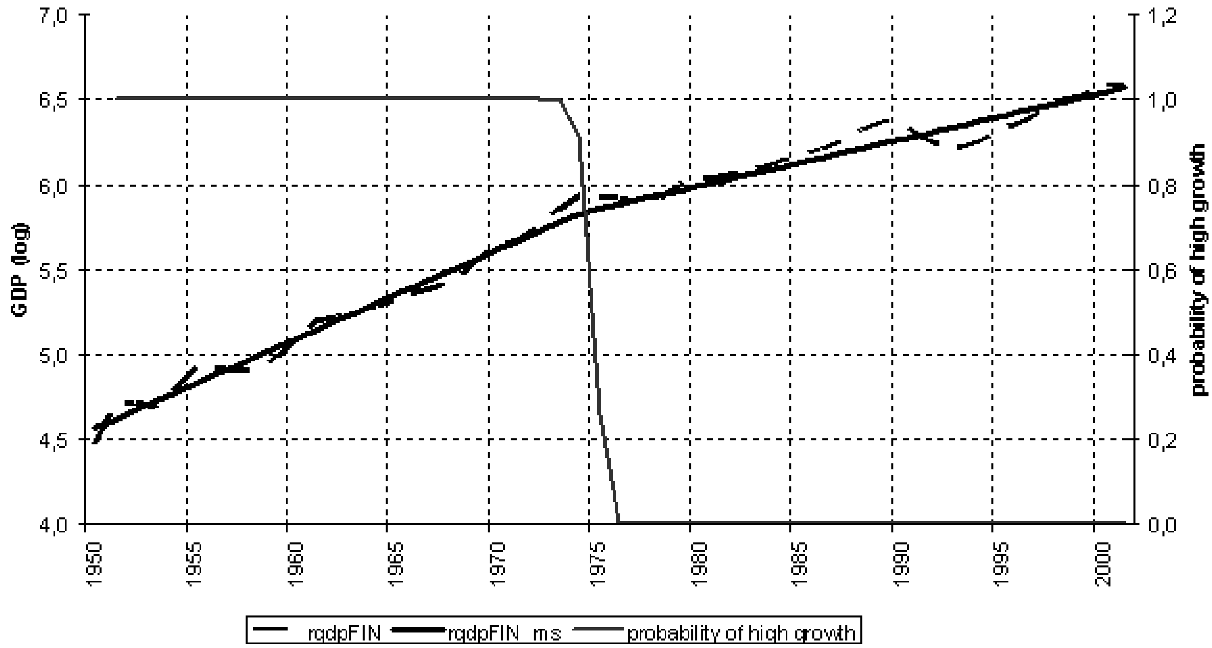

Figure 3: Finland - Real GDP Growth Rate

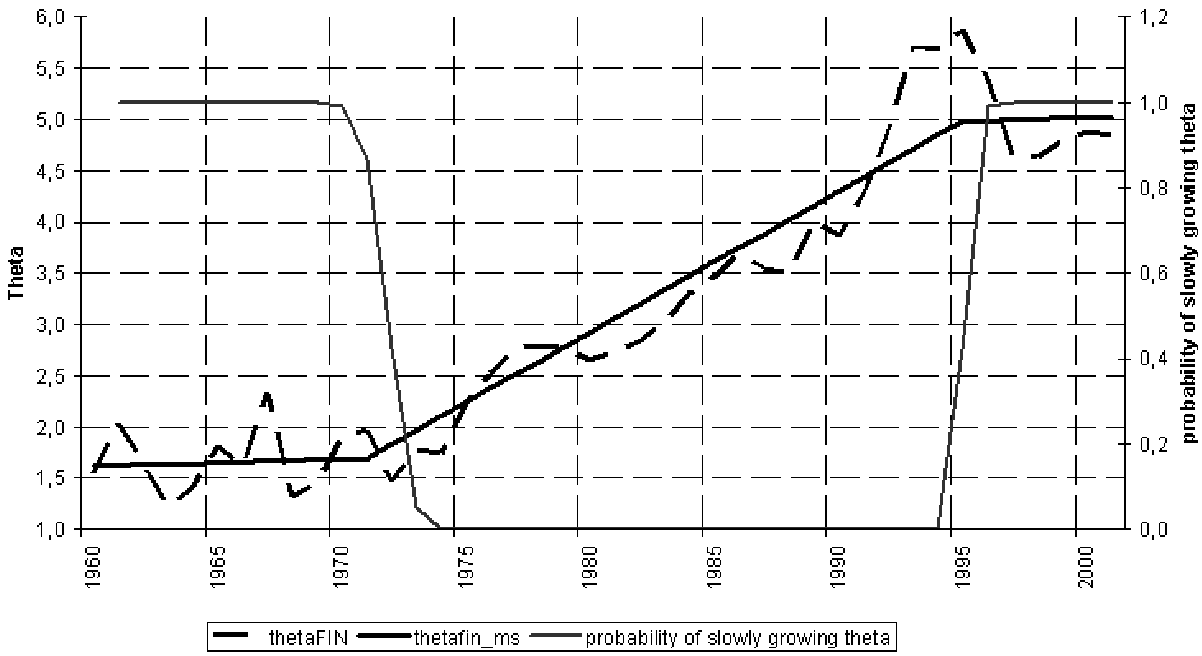

Figure 4: FINLAND - GROWTH RATE OF θ

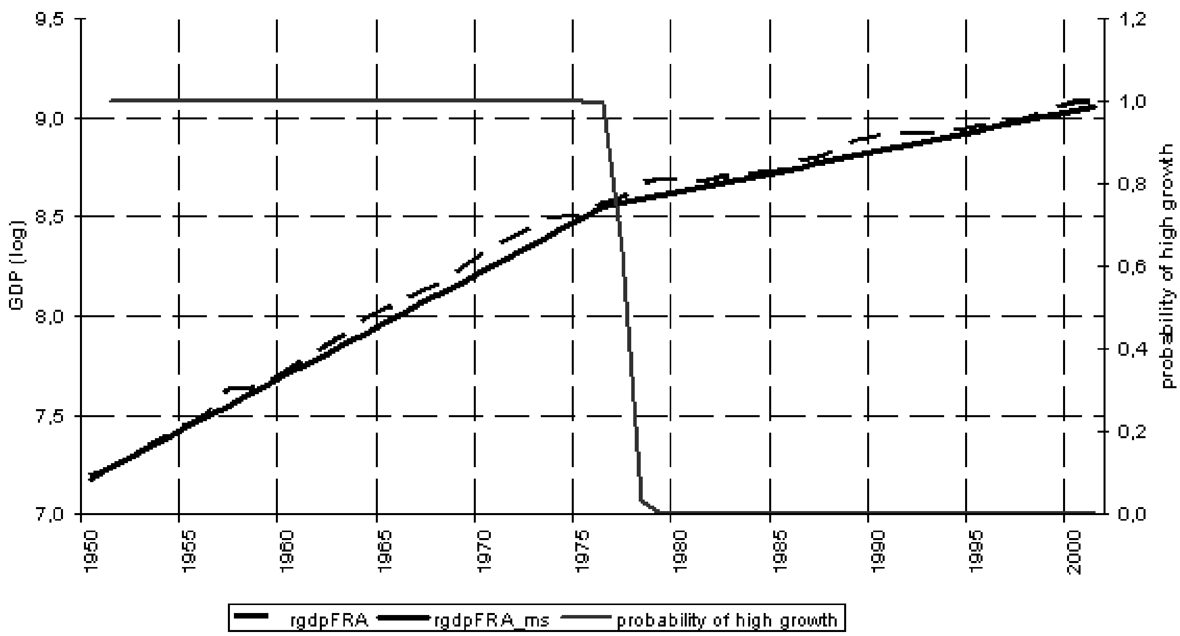

Figure 5: France - Real GDP Growth Rate

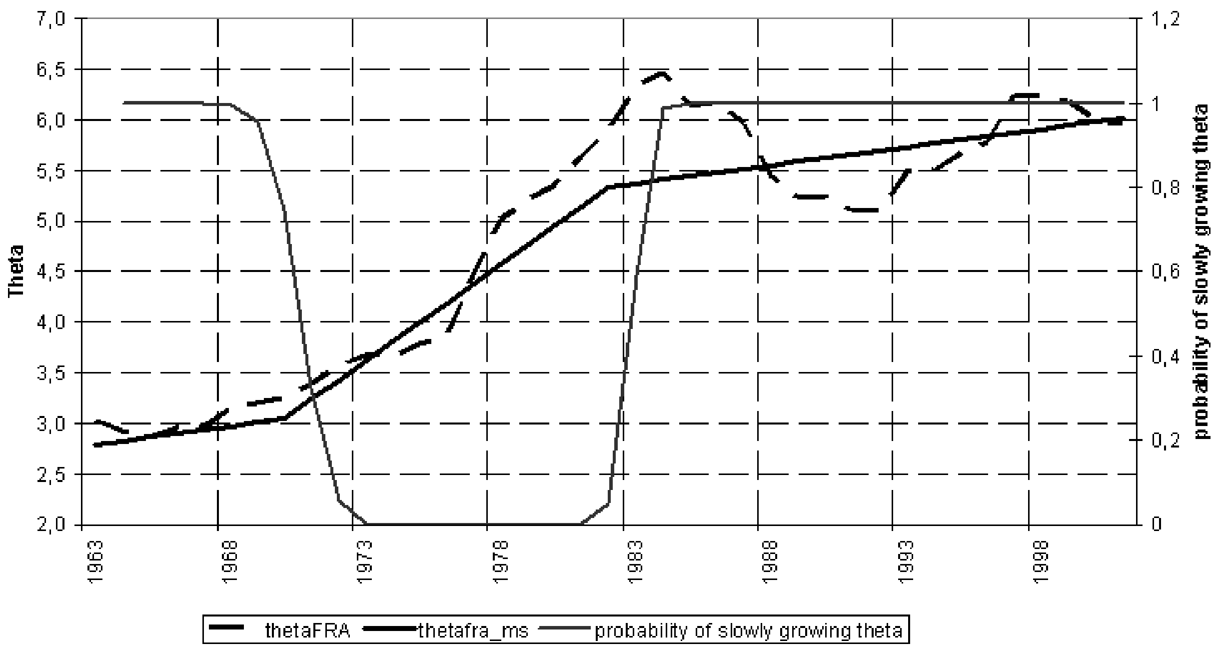

Figure 6: FRANCE - θ GROWTH RATE

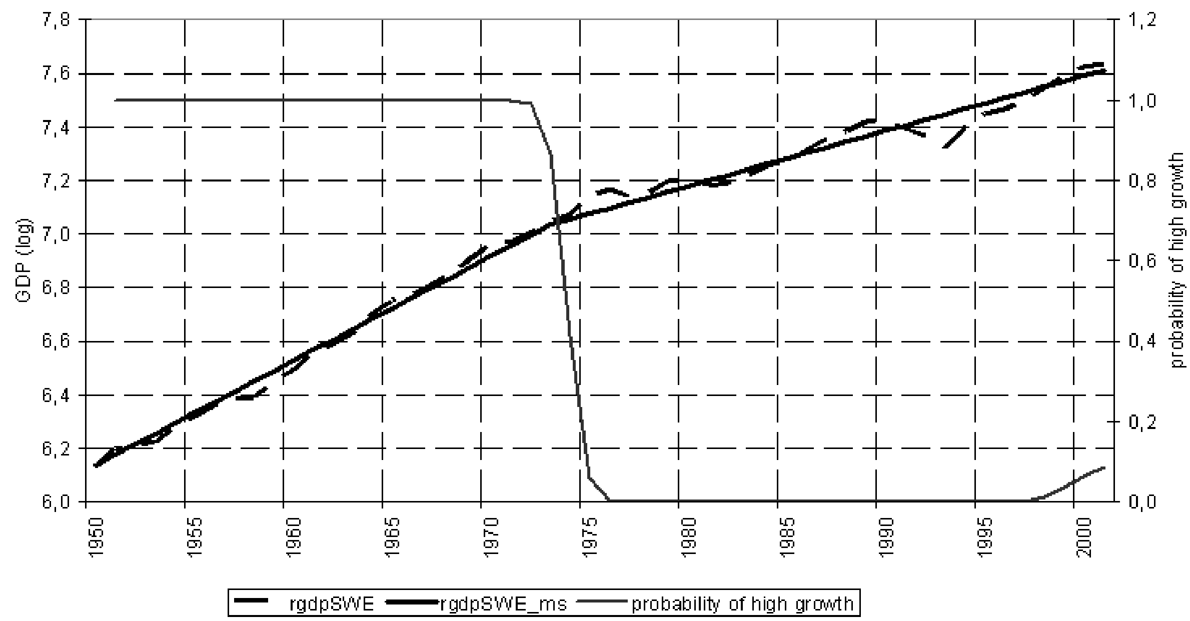

Figure 7: Sweden - Real GDP Growth Rate

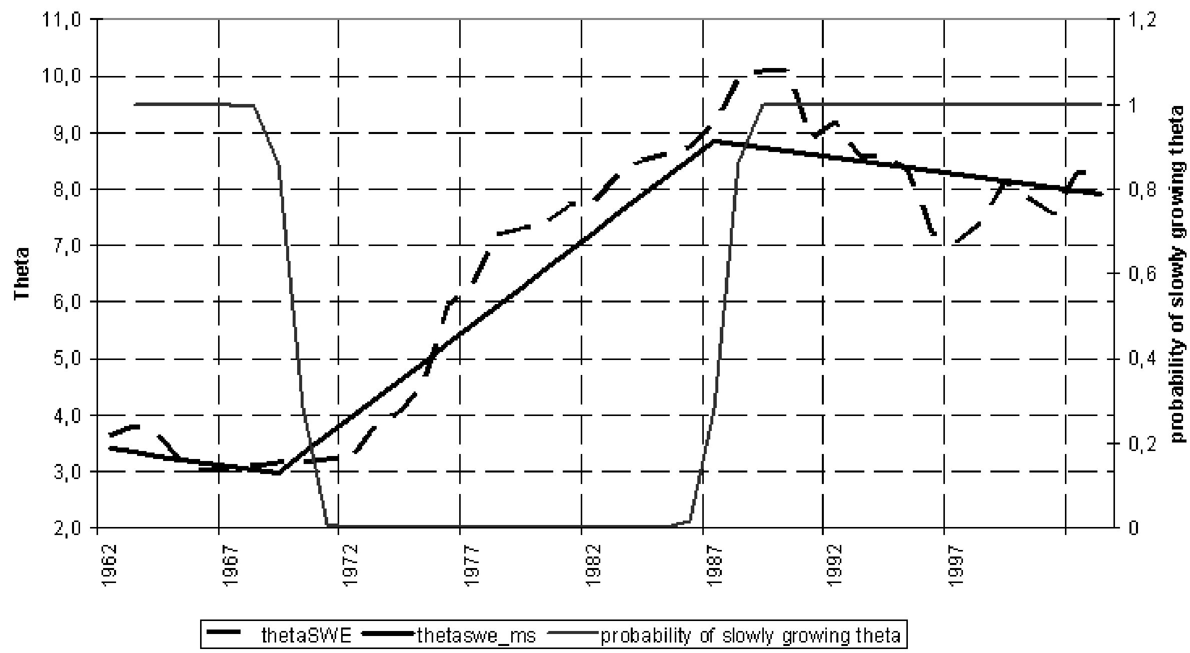

Figure 8: SWEDEN - θ GROWTH RATE

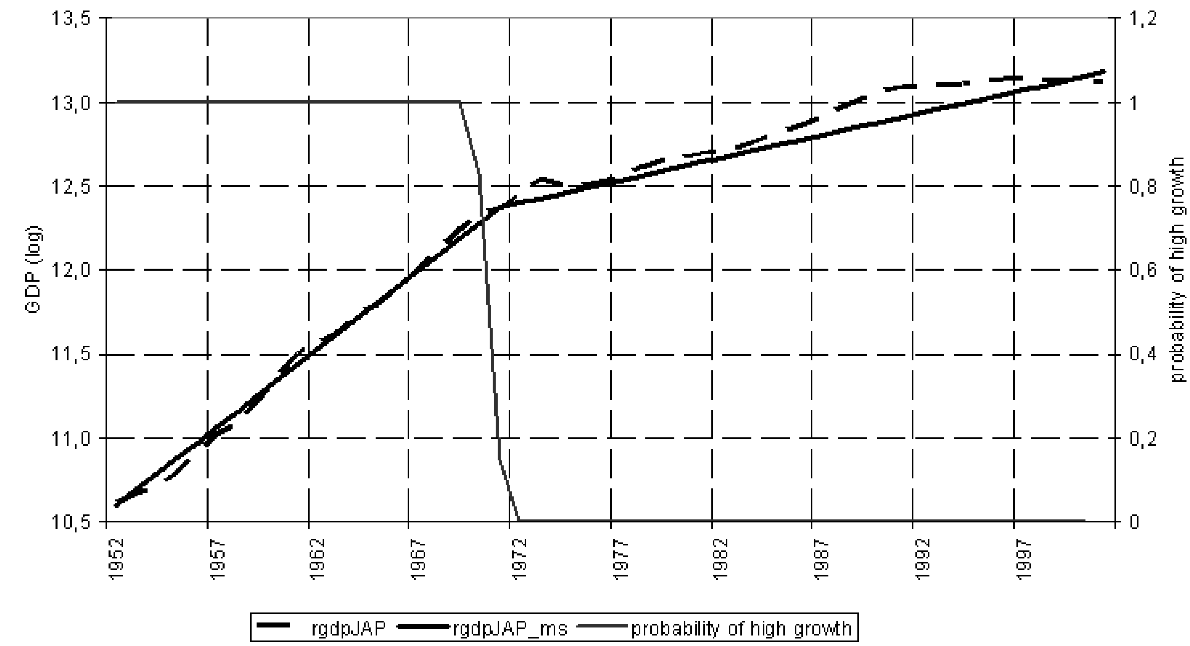

Figure 9: Japan - Real GDP Growth Rate

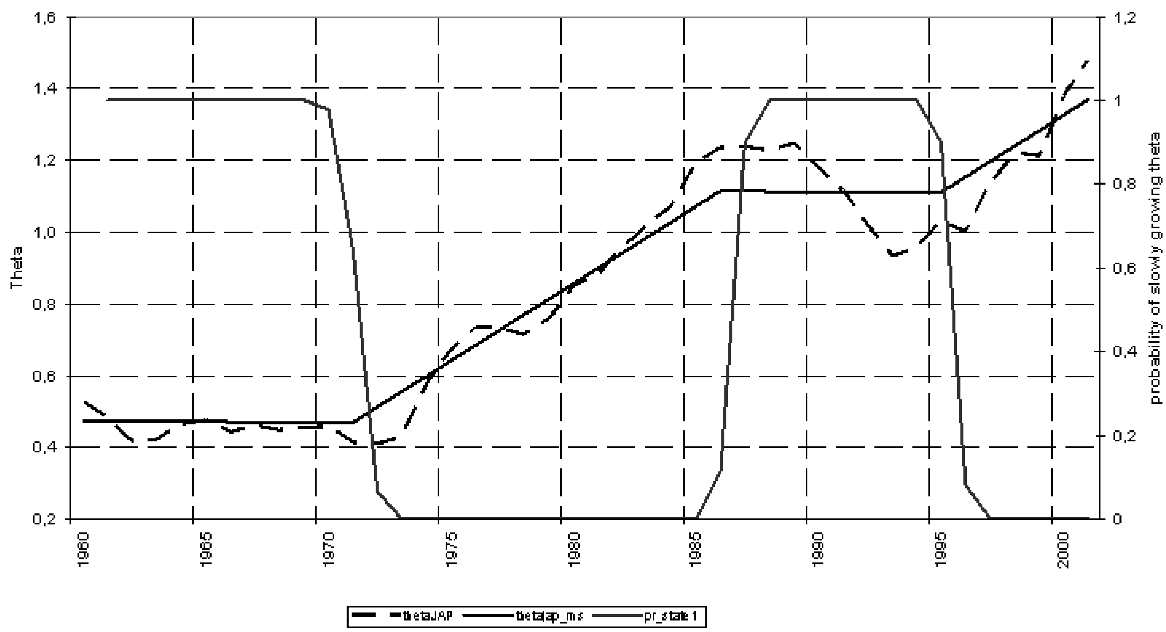

Figure 10: Japan - θ Growth Rate

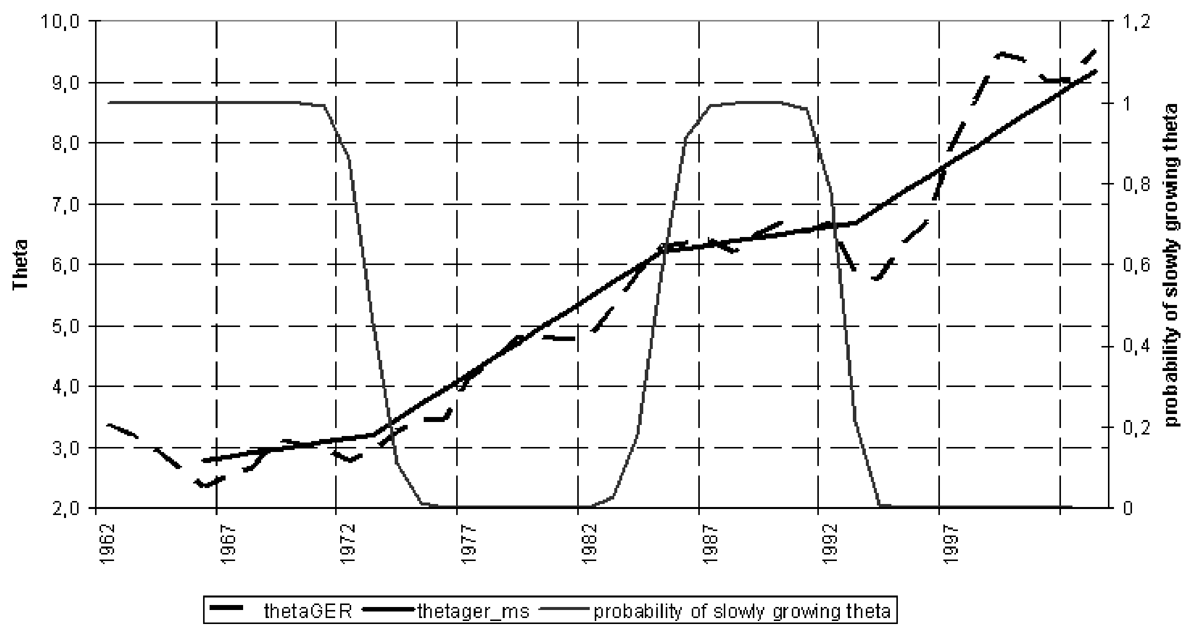

Figure 11: Germany - θ Growth Rate

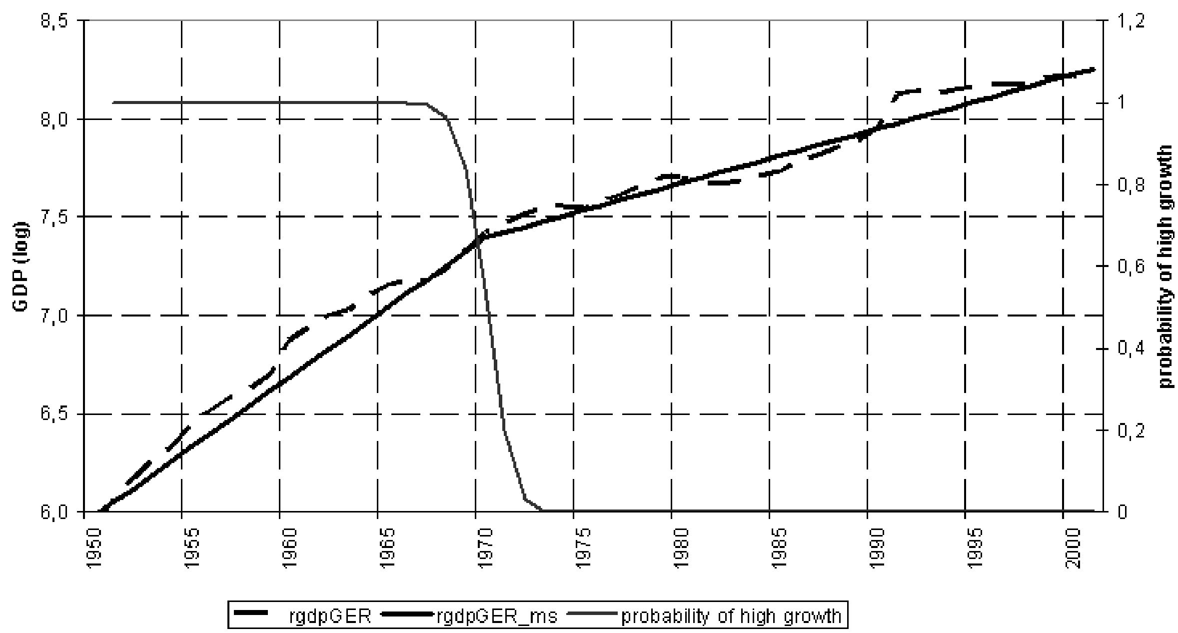

Figure 12: Germany - Real GDP Growth Rate