Analysis of economic growth in Germany
based on the growth models of
Solow-Swan, Kaldor and Romer

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Declaration

I declare that this thesis is the result of my own research except as cited in the references. The thesis has not been submitted for a degree at any other tertiary education institution.

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Abstract

This thesis analyses West Germany’s economic growth from 1971 to 1990 and the economic growth of the reunited Germany from 1992 to 2011 using the growth models of Solow (1956) - Swan (1956), Kaldor (Kaldor 1957; Kaldor and Mirrlees 1962; Kaldor 1966) and Romer (1986).

Applying the Solow (1956) - Swan (1956) model, it was found that TFP growth was the main driver of Germany’s growth during both time periods. However, Germany’s economic growth after the reunification was significantly weaker than it had been before the reunification, mainly because TFP growth and capital accumulation was lower. The findings of this thesis also show that fluctuations in TFP can be explained by the propositions put forward by the Real Business Cycle theory. The German’s experience based on the both periods of study is consistent with the analysis found in Plosser (1989) in that there is a positive relationship between GDP growth and TFP growth.

The application of the technical progress function of Kaldor and Mirrlees (1962) suggested that Germany experienced more technical progress during the second
time period than during the first one. For the reunited Germany capital accumulation contributed 0.68 to every one percent increase in RGDP, whereas for West Germany it contributed 0.44 to every one percent increase in RGDP. The regression (Kaldor’s technical progress function) results suggested that lower TFP growth for the second time period was due to lower capital investments. In addition, it was found that West Germany’s production process from 1971 to 1990 was slightly more capital intensive than the production process of Germany from 1992 to 2011.

The thesis also tested Kaldor’s (1966) three growth laws on the growth experience of the reunited Germany. It was found that only the first proposition was confirmed, suggesting that the manufacturing sector was the driver of Germany’s economic growth. No evidence was found for Kaldor’s (1966) second and third propositions.

The application of Romer’s (1986) growth model was unsuccessful. Neither the use of the number of patents granted, R&D expenditure or R&D personnel as a proxy for knowledge did show a statistically significant relationship with TFP growth or with the evolution of the net capital stock. Therefore, it is concluded that in Germany knowledge accumulation does not lead to technological progress

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or capital accumulation. If the number of patents granted, R&D expenditure or R&D personnel did not played a positive impact on TFP growth, then what is a significant sector? One such sector could be "learning-by-doing" as proposed by Arrow (1962).
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List of Acronyms

**Solow-Swan model**

- $A_t$ the stance of technology at time period $t$
- $g$ the rate of technological progress
- $K_t$ Capital input in time period $t$
- $L_t$ Labour input in time period $t$
- $n$ the labour growth rate
- $r$ the capital to labour ratio ($\frac{K_t}{L_t}$)
- $s$ the marginal propensity to save
- $y$ the economic growth rate
- $Y_t$ Output in time period $Y$
- $\alpha$ the share of capital
- $\beta$ the share of labour

**Kaldor’s model**

- $h$ the time period within investment costs must be recovered
- $I_t$ investments in time period $t$
- $i_t$ the amount of investment per worker on machine in time period $t$
the amount of past periods an entrepreneur uses to form his wage expectations

the amount of workers available to operate new equipment in time period \( t \)

the size of the labour force in time period \( t \)

productivity in time period \( t \)

the amount of workers available to operate new equipment to the size of the labour force ratio \( \left( \frac{n_t}{N_t} \right) \)

the share of profits being saved in time period \( t \)

the period of obsolescence of equipment

wages in time period \( t \)

expected wages in time period \( t \)

the expected growth rate of wages

output per head at time \( t \)

the entrepreneurs estimation of the opportunity cost

share of profits in time period \( t \)

the radioactive physical depreciation rate

the population growth rate

**Romer’s model**

the consumption at time \( t \)

the optimal path of consumption

Hamiltonian

the firm-specific knowledge at time \( t \)

the optimal path of knowledge
\( K_t \) the economy wide aggregate knowledge at time \( t \)
\( S_t \) the amount of consumers at time \( t \)
\( x_t \) an aggregation of all labour and capital at time \( t \)
\( \lambda \) costate variable
\( \delta \) the discount rate of the utility function

**Empirical Analysis**

\( i_t \) the inflation rate at time \( t \)
\( I_t \) the gross fixed capital formation at time \( t \)
\( \dot{K}_t \) the gross capital stock in prices of 2000 at time \( t \)
\( K^*_t \) the gross capital stock in current prices of time \( t \)
\( \ddot{K}_t \) the gross capital stock in prices of 2005 at time \( t \)
\( \dot{K}_t \) the change rate of the net capital stock at time \( t \)
\( K_t \) the net capital stock at time \( t \)
\( \dot{P}_{2000} \) the price index in prices of 2000
\( P_{2005} \) the price index in prices of 2005