Overview of the Role of Education and Human Capital Investment in the Relative Growth of Nations

Outline

Theories of Economic Growth
Current Consensus—Endogenous Growth Model
Mechanisms of Endogenous Growth
Country Groupings Based on Growth Mechanism
Issues/Implications for Naval Education
Summary of the Empirical Work Examining the Link Between Education and Growth

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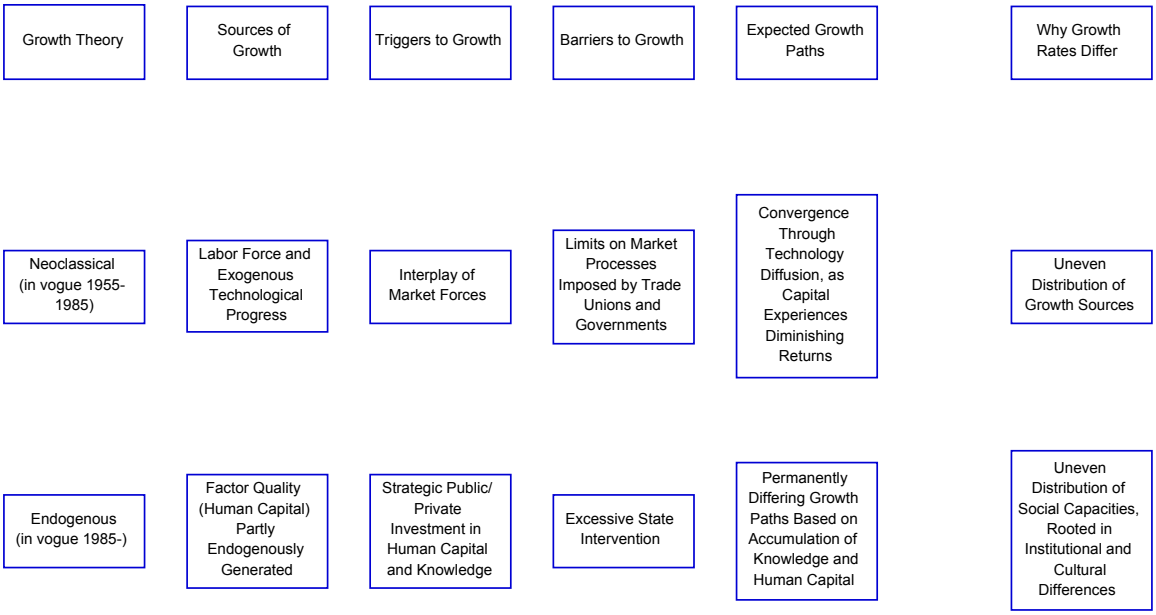
Figure 1
Main Elements of the Neo-Classical and Endogenous Growth Models



Based on David Coates, Why Growth Rates Differ (New Political Economy, 1999), p.93.

Neo-Classical and Endogenous Growth are the current mainstream economic theories. Other approaches include:

- Schumpeterian – focus on the entrepreneur and incentives for risk taking.
- Post-Keynesian – focus on demand, income distribution.
- Marxian – focus on exploitation, concentration of capital, social tensions.

These last three approaches have not withstood rigorous empirical testing, nor does education or investment in human capital play a central role in their construct.

Empirically, the five stylized facts of economic growth found to-date are:

- The residual (total factor productivity, TEP) rather than factor accumulation accounts for most of the income and growth differences across countries.

- Income diverges over the long run.

- Factor accumulation is persistent while growth is not, and the growth path of countries exhibits remarkable variation.

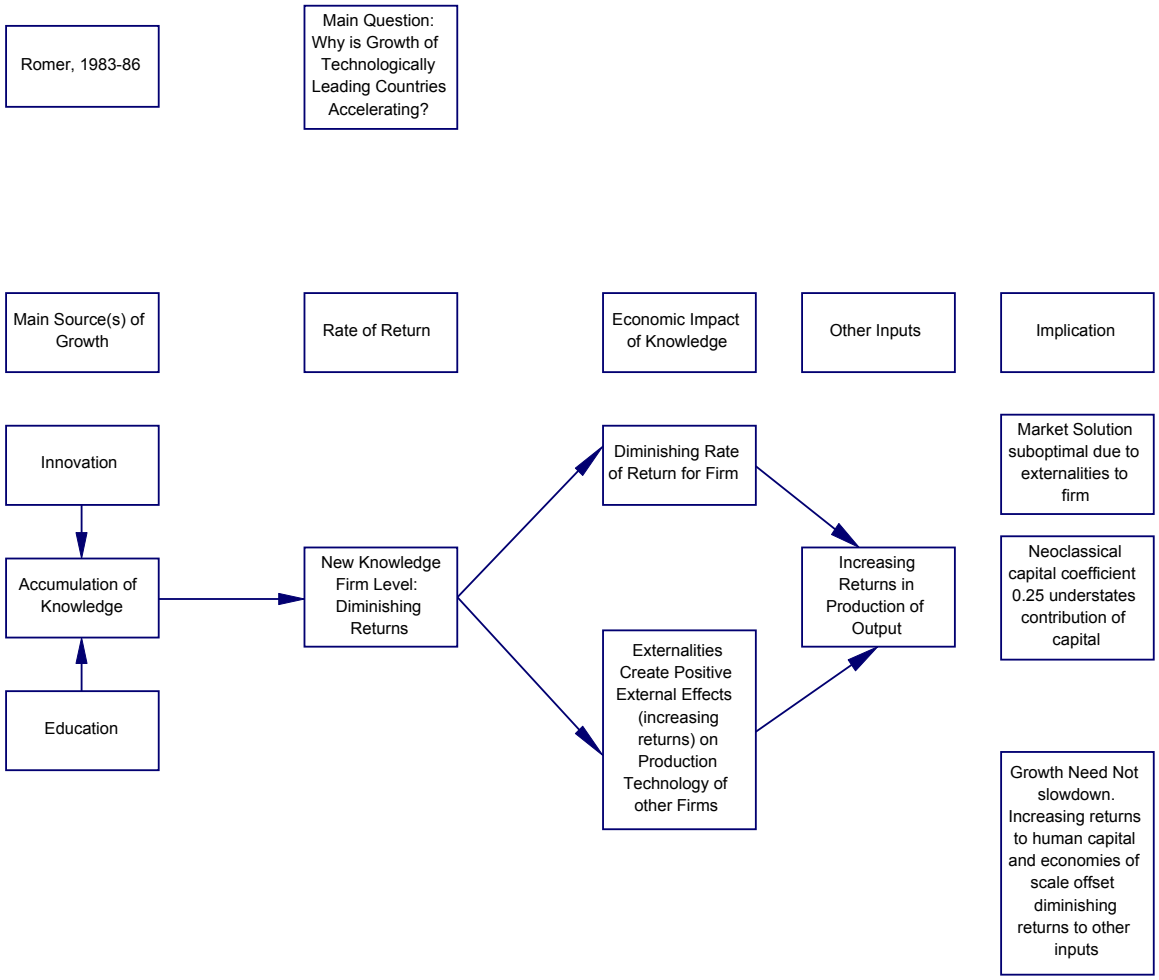
- Economic activity is highly concentrated, with all factor of production flowing to the richest areas

- National policies are closely associated with long run economic growth rates

These facts do not support models with diminishing returns, constant returns to scale, some fixed factor of production or an emphasis on factor accumulation. Hence the endogenous growth approach is preferred over the neo-classical explanation of growth patterns

Figure 2

Paul Romer's Development of Endogenous Growth Theory



Romer's latter works have focused even more specifically on the role of human capital in the growth process.

Figure 3

Robert Lucas' Contribution to Endogenous Growth Theory

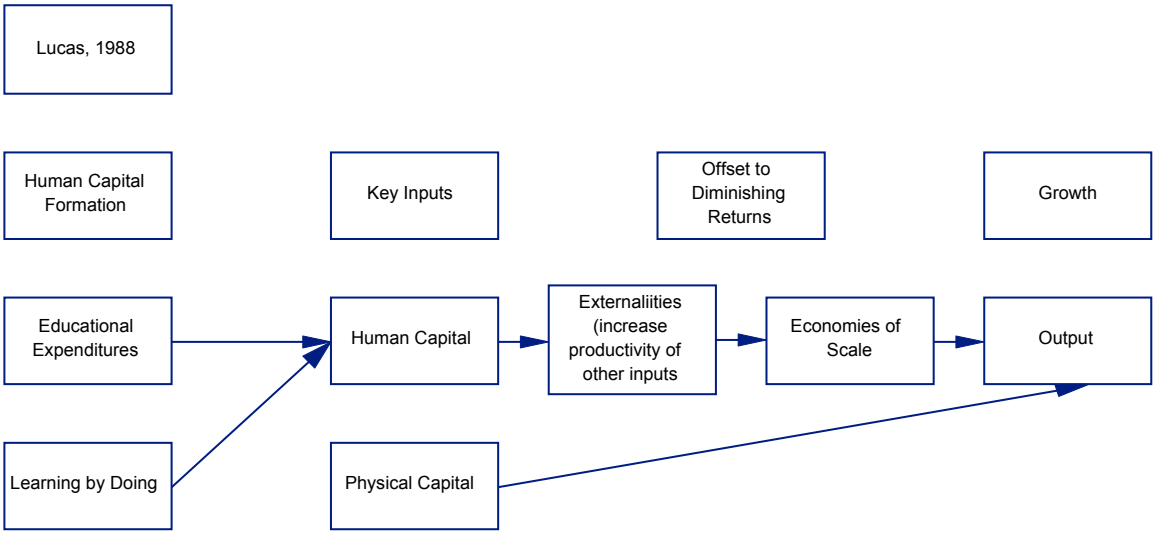
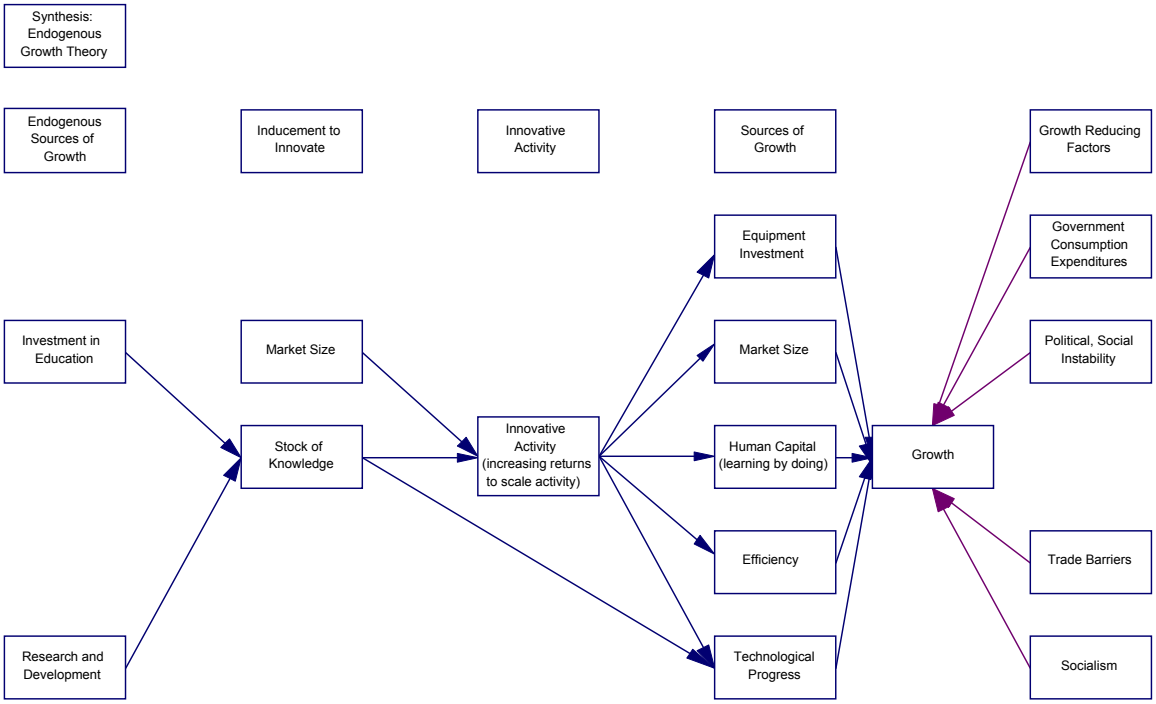


Figure 4

Generalized Endogenous Growth Model



Model most applicable to the advanced industrial countries. Other country groupings do not appear to have reached self sustaining or accelerating growth paths.

Figure 5

Country Groupings Based On Active Growth Mechanisms

Country Growth Classifications	Characteristics	Role of Education/Human Capital	Outcome
Endogenous Growth	Self Sustained Increases in Income	Technological Innovation Facilitated by Human Capital	Innovation raised income which stimulates further innovation
Catching Up Growth	Capital Flows and Technological Diffusion	Aids in absorbing of technology	In time, investment in education may create start of endogenous cycle
Resource Based Growth	Raw Material Booms and Busts	Limited Schooling often foreign no technological links	Growth dictated by external events
Malthusian Decline	Falling Incomes--Population Outstripping Capacity of Resources	Limited due to financial constraints	Brain Drain
Economic Isolation	Physical or Policy Induced Isolation from Word Markets	Isolation limits absorption new ideas/methods	Sub-optimal Growth and Development

Assumption: Countries largely separated by domestic stocks of human capital. Transition from catching up to endogenous growth occurs when human capital component extensive enough so that technological discoveries come indigenously rather than imported.

See: Jeffrey Sachs, Globalization and Patterns of Economic Development (Weltwirtschaftliches Archiv, 2000), vol. 136, no.4, pp.579-600.

Issues for the Role of Naval Education

The standard neo-classical models assumed diminishing returns to factor inputs. Technology is assumed exogenous and not under the control of government policy. These assumptions lead to the prediction of convergence of income levels around the world.

In contrast, endogenous growth theories largely assume that innovation is a private sector activity, drawing on public sponsored education and to a lesser extent, public funded R&D. In these models education and human capital largely facilitate the spread of ideas and the diffusion of technologies through the economy. This process increases knowledge which in turn facilitates increased innovation and economic growth. The process can feed upon itself though increasing returns to scale, leading to acceleration in economic growth. The net result can be a divergence of income levels around the world.

Empirical work to date has verified that educational investment is a key determinate of the relative rates of economic growth and thus the relative levels of income between nations.

In the current context, the key question for Naval education is whether the endogenous mechanism or a modified version is valid. Specifically:

- Does NPS through the creation of a certain type of Naval Human Capital facilitate the introduction of new ideas and technologies to the fleet?

- Does this innovation process itself increase the need for additional human capital investment best provided by NPS? Does investment in Naval education achieve increasing returns so that the services' capabilities increase more rapidly than other nations?

- If this is the case, how can the mechanism best be verified?

- If it is not the case, what alterations to the curriculum is needed to make NPS human capital more productive than that derived through a civilian university?

In short, are there analogies based on the endogenous growth mechanism that are applicable for the role that NPS plays vis a vie the Navy as a whole? The economy in general?

Empirical Work on the Impact of Education and Other Government Expenditures on the Relative Growth of Nations

Table 1

THE IMPACT OF GOVERNMENT CONSUMPTION ON LONG-RUN GROWTH

	Cross-Section Regression Analysis	*Time-Series Regression Analysis*	*Pooled Cross-Section / Time Series Regression Analysis*	Other Methods
Significantly Positive Effect	Cronovich (1998)	Bairam (1988)	Ram (1986)x 2 Sattar (1993) Maenair,Murdoch Pi &Sandle(1995) Devarajan,Swar & Zou 1	
Significantly Negative Effect	Landau(1983) Seully (1989) Barro (1991) Durden & Ell-edge (1993) Hansson & Hen-rekson (1994)	Karikari (1995)	Landau (1985) Landau (1986) Grier & Tullock (1989) Assane and Pourgerami(1994) Barro (1997) Guseh 199	
Inconclusive/ No Effect/ Complex Effects	Kormendi & Me-guire (1985) Grossman (1990) Levine & Renelt (1992) Sheehey (1993) Lee & Lin(1994) Lin (1994) x 2 Garrison & Lee (1995)	Grossman (1988) Hansen (1994b) Hsieh & Lai (1994)	Gemmell (1983) Saunders (1985) Rao (1989) x 2 Bairam (1990) Sattar (1993) Evans & Karras (1994) Hansen (1994a) Andr6s, Dom6nech & Molinas (1996) Zhang & Zhou 1998	Sala-i-Martin (1994)

Table 2

THE IMPACT OF EDUCATION EXPENDITURE ON LONG-RUN GROWTH

	Cross-Section Regression Analysis	Time-Series Regression Analysis	Pooled Cross-Section / Time Series Regression Ana sis	Other Methods
Significantly Positive *Effect*	Landau (1983) Barro (1991) Moomaw & Williams (1991) Hansson & Henrekson 1994	Ansari & Singh (1997) Singh & Weber (1997)	Evans & Karras (1994) Barro (1997) Baffes and Shah (1998)	Sala-i-Martin (1994) Glomm and Ravdcumar (1997)
Significantly Negative Effect				
Inconclusive/ No *Effect*/ Com lex *Effects*	Levine & Renelt (1992)			-

Table 3

The Im pact of Defense S)ending on Long-Run

	Cross-Section Regression Analysis	*Time-Series Regression Analysis*	*Pooled Cross-Section / Time Series Regression Ana sis*	*Other Methods*
Significantly Positive Effect	Brumm (1997)			
Significantly Negative Efect	Deger & Smith (1983) Lim (1983)	Roux (1996)	Cappelen, Gleditseh & Bjerkholt (1984) Faini, Annez & Taylor (1984) Gyirnah-Brempong (1989) Marnair, Murdoch, Pi and Sandler (1995) Baffes and Shah 1998	Lindgren (1984) Grobar and Porter (1989) Berth6lemy, Herrera & Son (1995)
Inconclusive/ No *Effect/* Complex *Effects*		Chowdhury (1991) Park (1993) Kusi (1994) Chletsos & Kollias (1995) Kocherlakota & Yi(1996) Kollias & Makrydakis 1997	Biswas & Ram (1986)	Mohammed (1993) Dunne (1996)

Table 4

. The Impact of Public Infrastructure and/or Public Investment on on -g-Run Growth

	Cross-Section Regression Analysis	*Time-Series Regression Analysis*	*Pooled Cross-Section / Time Series Regression Analysis*	*Other*
Significant-ly Positive Effect	Da Silva Costa, Ellson & Martin (1987) Munnell (1990b) Moomaw & Williams (1991) Binswanger, Khandker and Rosenzweig (1993) Easterly & Rebelo (1993) Sanchez-Robles (1998) x 2	Ratner (1983) Aschauer (1989b) Aschauer (1989c) Munnell (1990a) Lynde & Richmond (1992) Bajo-Rubio & Sosvilla-Rivero (1993) Lynde and Richmond (1993) Harmatuck (1996) Kocherlakota & Yi (1996) Wylie (1996) Kocherlakota & Yi (1997) Lau & Sin 199	Aschauer (1989a) Easterly and Rebelo (1993) Andrews & Swanson (1995) Morrison and Schwartz (1996) Odedokun (1997)	Eisner (1991) Munnell Glomm and Ravikumar (1997) Button (1998)
Significant-ly Negative Effect			Landau (1985) Evans & Karras (1994) Devarajan, Swaroop & Zou 1996	.
Inconclu-sive/ No Effect/ Complex Effects	Mullen & Williams (1990) Barro (1991) Hansson & Henrekson(1994)		Landau (1986) Hulten and Schwab (1991) Holtz-Eakin (1994) Holtz-Eakin & Schwartz 1995	Hulten & Schwab

Table 5

RELATIVE FREQUENCY-BASED MEASURES OF EMPIRICAL SUPPORT FOR CONVENTIONAL HYPOTHESES REGARDING THE IMPACT OF FISCAL POLICIES ON LONG RUN ECONOMIC GROWTH

Type of fiscal policy	No. of studies	Propor-tion with positive impact	Proportion with Negative Impact	Propor-tion with inconclu-sive impact	Null hypo-thesis of expected impact	95% confidence interval for the proportion of studies supporting the null h7j~t~othesis'
Education	12	0.92	0.00	0.08	+	(0,57,0.W)
Infrastruc-ture	39	0.72	0.08	0.20	+	(0.58,0.86)
Taxation	10	0.00	0.60	0.40	-	0.26 0.89
Defense	21	0.05	0.52	0.43	-	0.30 0.74
Consump-tion	41	0.17	0.29	0.54	-	(0.15,0.43)
	123	0.38	0.26	0.36	±	(0.29,0.47)

Using a normal approximation for infrastructure, defense and consumption; and exact binomial confidence intervals from Clopper and Pearson (1934) for education and taxation.