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ON THE PRODUCTIVITY OF SOCIAL INVESTMENT

by

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M.A. University of Cape Town, 1982

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ABSTRACT

The dissertation studies theoretical and empirical issues concerning public sector factor productivity. The growing scope of government activities worldwide has been reflected in the expanding theoretical and empirical analysis of this sector. The present study is mainly a macroeconomic enquiry. Its objective is to examine international evidence using an aggregate productivity differential model of the economy.

The dissertation reviews the literature and extends the analysis germane to productivity of public undertakings. Basic conceptual issues such as 'production', 'government expenditure', and 'real sectoral contribution' are critically examined.

The link between economic growth and the expansion in government expenditure, a phenomenon known as Wagner's Law, is analyzed with emphasis on the theoretical and empirical complexities involved. South African national accounts data are used for illustration purposes.

In the main analysis, the dissertation introduces an aggregate model of differentiated factor productivity and uses the Summers & Heston (1984) data set for 115 countries over the 1960-80 period to offer an empirical econometric analysis. Both cross-country and time series tests are employed. The results are then used to examine the direction of causality between national income and government expenditure.

The empirical analysis offers no support for any positive factor productivity differential in favour of the government sector. The time series results suggest that government factor productivity is lower than in the rest of the economy. The externality effects of government activities, however, are established to be positive. Granger- causality tests have been used to assess the direction of causation. The results concur with the literature which support bi-directional causation if contemporaneous terms are admitted in regression equations. If contemporaneous terms are not admitted, the weight of evidence shifts considerably in favour of no causality either way.

Given positive externalities and lower factor productivities, public activity should continue to the point at which externality benefits equal productivity losses.

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INTRODUCTION

This is an enquiry into the theoretical and empirical issues concerning public sector factor productivity. The importance as well as the growing scope of government activities worldwide have been reflected in the theoretical and empirical analysis of this sector. Both macro and microeconomic approaches are used to illustrate the conceptual issues pertinent to the relative efficiency of the public sector. The present study is mainly a macroeconomic enquiry. Its prime objective is to examine the international evidence using an aggregate productivity differential model of the economy. To this end a number of conceptual and institutional issues need to be considered. The general theoretical concepts and their empirical evidence are presented before the international data is applied to the aggregate model. The analysis is structured as follows:

Chapter One reviews the literature on theoretical justification for public sector activities, particularly in the context of economic growth theories.

Chapter Two discusses the conceptual issues concerning the definition as well as the measurement of government output. Obviously government output is a subset of overall economic output, the measurement of which has been controversial in the literature. The discussion in this chapter has direct bearings on our empirical econometric tests of the data in Chapters 3 and 4.

Chapter Three analyzes the role of economic growth in the expansion of the public sector. In addition to the Wagnerian view this Chapter also presents and critically examines Heller's and Beck's hypotheses. Moreover this chapter discusses the most important statistical as well as conceptual problems facing any empirical test of the Wagner hypothesis.

Chapter Four introduces a model of differentiated factor productivity for the aggregate economy. It then uses Summers and Heston's (1984) internationally comparable data set to test the model empirically. Based on the econometric results of the model, the Granger-causality framework is then used to examine the direction of causality between national income and government expenditure.

Chapter Five deals with the two issues of (a) 'productive' vs. 'unproductive' government expenditure, and (b) the implications of the shifting of state borders for productivity analysis of this sector. The chapter ends with the conclusions of the study.

CHAPTER 1

SOCIAL INVESTMENT AND GROWTH THEORY

Social investment is defined as the contribution, both direct and indirect, of the state to the process of accumulation in general. Accumulation in turn is central to the process of economic growth.

Recently, theoretical interest in understanding the process of economic growth has been rekindled (see, for example, Romer 1990 and 1986, and Lucas 1988). There are both micro and macroeconomic reasons for this. From a microeconomic perspective, theories of industrial organization, invention, advancement of knowledge and human capital have been developed in a systematic and coherent way. They have offered fresh explanations for the economic growth process. On the macroeconomic front, an increasingly more accurate and well- documented data have made it possible to examine new questions.

Economic growth is essentially about the supply side in the medium to long run. It deals with capital accumulation, factor utilization, population growth, and technological change. In this context an important issue of increasing interest in recent years is the role of the state. The primary question is: Can the state influence (beneficially or otherwise) the rate of economic growth? A related question is: Should the state influence economic growth?

To lay the groundwork for answering these questions this chapter will review the literature on economic growth, focusing on the role of th state. Before that , however, it is useful to briefly outline the reasons for the state in the first place.

1.1 Why Social Investment?

The rationale for social investment stems primarily from philosophical and economic reasoning. The issue may be discussed within both the *value-judgement* and *instrumentalist* frameworks.

1.1.1. *The Value-judgement Framework*

At the heart of the philosophical debate lies the notion of individual freedom. As Isaih Berlin (1959) pointed out, there are both positive and negative concepts of freedom. Both concepts provide a rationale for the state, albeit with widely divergent roles.

In the negative concept of freedom the individual is abstracted out of society and needs to be protected against encroachment and societal constraints. This forms the foundation for much of liberal political theory-dating back to Hume, Locke, and Mill and championed in recent years by Nozick (1974) and Rawls (1971), resulting in Nozick's "minimal state", or a variation thereof. A positive concept of freedom, on the other hand, looks to enhance the individual's capacity to attain an acceptable standard of living. (Dasgupta, 1989 and Sen, 1984) Within the positive framework, the

role of the state extends far beyond the minimal state so as to provide those goods and services that are regarded as essential for empowering the individual to enjoy a reasonable standard of living. Among these goods and services are primary health care, basic education, productive infrastructure, and arguably subsistence nourishment and employment. While the definition of such basic social goods remains relative in respect of both time and location, the consequent role of the state nevertheless justifies some measure of social investment.

1.1.2. Instrumentalism and the State

Broadly speaking, instrumentalist arguments may be divided into two categories:

a. the Austrian School, and
b. the mainstream neo-classical theory.

The Austrian School focuses on the dynamics of competition and emphasizes the superiority of the price mechanism as the *modus operandi* of coordination. It assumes a world of uncertainty and imperfect competition. Given that the price mechanism is informationally undemanding, the state is denied any role greater than that of a 'minimal state'.

The Austrian proposition is challenged at two distinct levels. On the one hand, Helm points out from a logical point of view: "The decisive property of informational economy is advantageous if the prices are right, but quite

the opposite in a distorted economy." (Helm 1989, p. 20) On the other hand, in light of so-called macroeconomic failures, the Austrian proposition is simplistic. In this respect, four issues are pertinent.

a. In terms of Arrow's General Possibility Theorem, unless strict assumptions are made the sum of individual choices may not result in a consistent democratic social ordering of possibilities.

b. Given the prevalence of cases of Prisoners' Dilemma in the economy, the cooperative solutions that are superior outcomes would not emerge without state intervention. This will be explored further in our discussion of the neo-classical instrumentalist approach.

c. As Schelling (1978) points out, the macro consequences of individual behaviour can often be contrary to intended aims and objectives.

d. The private sector economy is prone to wide fluctuations and if unaided by the state it can reach and remain at an inferior equilibrium.

Against this backdrop, the Austrian Tradition of the superiority of the market mechanism, and hence a minimal state, is indefensible.

The mainstream neo-classical theory is based on the desirability of a perfectly competitive economy. Founded upon a set of assumptions about product homogeneity, constant return to scale, free and symmetric information, a costless auctioneer and no barriers to entry, the

neo-classical theory demonstrates that a perfectly competitive economy is Pareto-optimal. However, this model could be used to provide the rationale for state involvement by using its assumptions backwards to identify cases of market failure. Such cases might arise on the supply or demand side of the market. It is the existence of market failures that justifies the presence of governments. In other words where markets fail, governments may succeed. As Inman argues: "in many important instances governments are necessary for economic efficiency, and that the central feature of those instances is the need for the coercive enforcement of cooperative behaviour among self-seeking agents". (Inman, p. 653) Generally speaking, market failures may be divided into five categories.

a. Public Goods

In terms of the theory of public goods, the sum of the marginal private benefits of a public good (or an agent's marginal rate of substitution (MRS) of income for the good) must equal the marginal cost (MC) of an additional unit of the good Σ MRS_1 = MC. The market process fails to satisfy this efficiency condition. In fact, given self-seeking agents, too little of the good will be provided. At the extreme, no private agent would provide any. The standard proposition of the theory of pure public goods, as put forward by Samuelson (1954), has been challenged by Tiebout (1956) and Demsetz (1970). However, neither a Tiebout competitive solution nor a Demsetz process can overcome the free rider problem in the case of public goods. The mechanism which can extract true preferences calls for a single, non-competitive organization in charge of implementation. One possible

candidate is government.

b. Externalities

Similar to the case of pure public goods, externalities generate a conflict between individual maximizing behaviour and the attainment of socially efficient allocation of resources. The condition for the efficient allocation is also similar to the case of public goods; i.e. the sum of marginal benefits of the externality must equal the marginal cost of providing it. As the number of beneficiaries rises, the market process fails to achieve a Pareto-efficient allocation. Once again there exists a free-rider problem. The solution generally lies in a single, coercive institution of government. There are, however, exceptions.

The best known exception to the general conclusion is the case where there are two agents, there is costless bargaining, and complete information is symmetrically available. In this very special case, propagated by the Coase Theorem, the market process would achieve efficient allocation. Note that relaxing any of the assumptions of the Coase Theorem would impede the attainment of Pareto-optimality. Furthermore, even in the very special world of the Coase Theorem the institution of government has to exist in order to enforce property rights and agreements.

c. Increasing Returns to Scale

Whenever production requires a large start-up-cost, it is likely that average

cost exceeds marginal cost over all relevant levels of output. As a result, the private market would not be able to sustain marginal cost pricing; hence allocation *efficiency* and *Pareto* optimality would not result. The actual outcome would depend on the "contestability" of the market. With no credible threat of entry, price will exceed marginal cost, output will be less than the Pareto efficient level, and social welfare loss will result. If the market is contestable, the firm will reduce its price to deter entry by setting it equal to the average cc - the so-called "Ramsey Price" - thereby eliminating monopoly profits. Price equal AC is not however a Pareto efficient result, i.e. the output is below when P = MC.

"The first-best solution to this allocation problem", Inman writes, "is to price at MC and then to raise the required revenue to cover the long run losses from pricing below AC through a system of lump sum, non distortionary charges on all consumers". (p. 659) Clearly no existing firm would be able to force the consumer to pay such a lump-sum amount. In such cases when the market fails to arrive at the first-best outcome, the state has a clear function.

d. Incomplete Information

One of the strong assumptions required for a first-best outcome of the competitive market process is the presence of full information about all characteristics of the good. In practice, however, not only is full information often unavailable, but pervasive cases of asymmetric information

exist. As a result, problems of *moral hazard* or *adverse selection* arise. Problems of moral hazard emerge whenever sellers' service quality cannot be monitored, leaving the seller with every incentive to underprovide quality. Problems of adverse selection occur in situations when insurance companies are unable to separate low and high risks, when patients cannot distinguish between competent and incompetent physicians, and when consumers cannot tell bad second hand cars from good ones. The result, as shown by Ackerlof (1970), is either a decline in product quality or a total collapse of the market for the product.

Informational asymmetries may be overcome, at least partially, via the market mechanism. *Reputation investment*, as argued by Klein and Leffler (1981), is a potential device in this respect. The formation of *professional associations*, offering *contingent contracts*, and *investment in education* are other possible means of addressing informational asymmetries. While such market responses are prevalent, the question is: Are these responses sufficient to solve the problem at hand? The answer seems to be no for the following reasons:

1. While costless certification would result in efficient market outcome, *costly certification* would lead to externalities and the market allocation would, in all likelihood, be inefficient. Such externalities stem from the fact that certification confers benefits to high quality sellers and imposes losses on low quality sellers.

2. Professional associations offering certificates would also control

entry. They would thus have incentives to limit licenses in order to reap monopoly rents.

3. In general, information is a commodity with characteristics of a public good. Its market provision then is likely to be non-optimal.

Against this backdrop, the presence of asymmetric and imperfect information lends support to state involvement in the economy.

e. Unemployment

Concern for unemployment has been the most important factor prompting state intervention in economic life in this century.
The market operation, the argument goes, is subject to wide fluctuations resulting in unemployment, which is socially undesirable. Government intervention is thus necessary to improve the market outcome, i.e. to establish equilibrium at a higher level. The means of such intervention have been fiscal and monetary policies. This justification, however, is not conclusive. Firstly, unemployment could be socially beneficial. Consider search unemployment which helps match skills and positions, thereby raising total output. Secondly, the use of monetary and fiscal policies as remedies may well exacerbate the outcome. The case for government intervention thus needs to rest on much firmer ground. A stronger micro-economic foundation is needed.

Fundamentally, unemployment results from the failure of self-seeking agents to coordinate their demand and supply so as to attain additional mutually

beneficial trades. As such it is involuntary and its solution lies in a non-market coordinating agency like the state. Before accepting such a conclusion the question needs to be asked: Why such market failure in the labour market? Two possible answers are apparent:

1. *Informational asymmetries in the labour market.* Being subject to random shocks to demand for labour, and hence wide fluctuations in labour income, risk aversive workers will seek insurance against such uncertainties. With the presence of asymmetric information, adverse selection and moral hazard problems lead to inefficient insurance contracts. A non-market agent such as government is then required to either collect and distribute relevant information to all, or to offer unemployment insurance directly to labourers if such insurance does not eventuate privately.

2. *Economy-wide increasing returns to scale in production.* Note that constant returns to scale, particularly with symmetric information, must imply full employment. Any unemployed factor can, as Weitzman (1982) points out, "hire itself and any other factors it needs and sell the resulting output directly.... The operational requirement is that the efficient minimum-cost scale of production be sufficiently small, relative to the size of the market, that any one firm or plant cannot affect prices appreciably." (pp. 791-92) Assuming increasing returns to scale changes the situation completely. Now, firms are large relative to their markets, hence their products have downward sloping demand curves. On the part of each firm, expanding output means a

reduction in the price. No firm has any incentive to raise output. The resultant equilibrium is thus less than full-employment equilibrium. The only way to reach equilibrium is a concurrent rise in the output of all firms. Government is a candidate to effect the rise via an increase in aggregate demand through either monetary or fiscal policies.

The foregoing reasons for market failures underline the need for a non-market institution to effect cooperation among self-seeking individuals. In this respect, market failures are equivalent to cases of Prisoner's Dilemma. Cooperative behaviour, although beneficial to both parties, is not the dominant strategy. The non-cooperative strategy is dominant. Government thus has a role to enforce a cooperative outcome.

Such a prima-face case for government intervention for efficiency reasons must, however, be balanced against its costs. Just as markets fail, so too governments commonly fail. And government failure also has many facets. At its worst government failure involves corruption, bribery, and delibrate misallocation of resources. More commonly, however, government intervention is subject to the rent-seeking behaviour of bureaucrats, political entrepreneurs, and various interest groups within the society. (Wolf, 1979) Government intervention, therefore, should be considered in the light of a growing public choice literature on the theory of government of failure.(Mueller, 1989)

1.2 Growth Theories and Role of the State

The earliest model of economic growth is accredited to Harrod (1939). Cast

in the framework of the Keynesian savings- investment equilibrium, the Harrod model (better known as Harrod-Domar) simply derives the following condition:

$$\dot{y}/y = s/\nu$$

where: $\dot{y} \equiv$ National Income Increment

$y \equiv$ National Income

$S \equiv$ savings

$s \equiv \bar{S}/y$

$\nu \equiv \dot{K}/\dot{y}$; incremental capital-output ratio

$\dot{K} \equiv$ increment in capital stock

$K \equiv$ capital stock

Although simple in its structure, the Harrod-Domar model remains influential. Its policy implication is clear: to increase growth, 's' must rise. Theoretically, however, there is no role for the state in the model. A rise in 's' could arise from any sector capable of generating profits and thus savings. Nonetheless, much discussion in development planning was centered around the raising of savings ratios and the sectoral νs. (Gupta, 1989)

The neoclassical growth model (Solow, 1956, et al.) underlines the point that "whilst raising the rate of growth of capital could raise the rate of growth of output in the short or medium term, in the long run the rate of growth of the economy would be limited by the ratio of growth of non-produced factors, notably labour." (Stern, 1991)

Given the assumptions of constant return to scale, no technical progress and an exogenous labour supply, the model produced a long term growth rate which

is determined by, and is equivalent to, the growth rate of the labour force. The assumption of no technological progress was abandoned by Solow (1957) in an attempt to identify sources of economic growth, using an aggregate production function. The growth in output then was due to growth rates of factor inputs weighted by competitive factor shares plus a residual referred to as the *Solow residual*. Formally, assume the following production function:

$$Y = F(X_i, t) \qquad i = 1, \ldots, n \tag{1}$$

Differentiate with respect to time, we have:

$$\frac{\partial Y}{\partial t} = \Sigma \frac{\partial F}{\partial X_i} \frac{\partial X_i}{\partial t} + \frac{\partial F}{\partial t} \tag{2}$$

Let '.' denote changes overtime, then rewrite (2) by dividing both sides by 'Y', we have:

$$\dot{Y}/Y = \Sigma \alpha_i \left(\dot{X}_i / X \right) + F_t / Y \tag{3}$$

where $\alpha_i \equiv \frac{X_i}{Y} \cdot \frac{\partial F}{\partial X_i}$

This decomposition, suggestive as it was, left a major source of economic growth, i.e. technical progress, to be explained exogenously. As such it was unsatisfactory. Models of endogenous technical progress date back to Kaldor (1957), Arrow (1962), Sheshinski (1967) and Atkinson and Stiglitz (1969). By

incorporating 'learning by doing', these models endogenized the advance of factors productivity. For illustration purposes, the Sheshinski framework is the simplest; namely:

Consider N firms each with the following production function:

$$Y = F(K, Al)$$

where $Y \equiv$ output

$l \equiv$ labour in the firm

$A \equiv K^{\gamma}$, the level of knowledge

$K \equiv N.k$

$\gamma<1$: elasticity of labour effectiveness with reference to total past investment.

Knowledge has positive externalities, i.e. the firm learns from its own as well as from other firms' activities. While there will be increasing return to scale at the aggregate level, for the firm there are constant returns ('A' is fixed) thus enabling it to behave competitively.

Let $n\left(\equiv \dot{l}/l\right)$ equal the growth rate of L, the steady state solution of the model is where output and capital both grow at $\frac{n}{1-\gamma}$. Note, however, that despite endogenous technical progress, the long run growth is positive only if n>0; and this is policy-invariant.

It is noteworthy that Romer's model is a special case of the Arrow-Sheshinski model: i.e. when α is set at unity. Yet there is a role for government to affect the growth rate. Consider a Cobb-Douglas production function. Y =

$N^{1-\alpha}K$ where MPK = $N^{1-\alpha}$. Given an isoelastic utility function,

$\left[c^{1-\sigma}/_{1-\sigma}\right]e^{-\rho t}$ a fully informed government would maximize

$\int\left[c^{1-\sigma}/_{1-\sigma}\right]e^{-\rho t}dt$, where 'c' is per capita consumption.

The optimality condition, i.e. the equality between the MPK and MV of consumption yields an optimal growth rate which is $\left(N^{1-\alpha}-\rho\right)_{/\alpha}$. Each individual firm on the other hand regards 'A' as constant and consequently the optimality condition for private firms is $\frac{\alpha N^{1-\alpha}-\rho}{\sigma}$; i.e. less than $\frac{N^{1-\alpha}-\rho}{\sigma}$. Any taxation of capital income further lowers the growth rate. That is, let 'r' be the tax rate, then the resultant growth rate would be $\frac{\alpha(1-r)N^{1-\alpha}-\rho}{\sigma}$. By changing 'r', government could affect the long run growth of the economy.

As noted, the Romer model is a boundary case of the Arrow- Sheskinski model. Yet their policy implication is drastically different. As Stern (1991) notes: "that such important conclusions turn on such a fine distinction (which is unlikely to be settled empirically) should make us uneasy about relying on the Romer model as a basis of explaining the role of policy in determining the rate of growth". (p. 126)

Other models of endogenous technical progress follow the tradition of Uzawa (1965) and Shell (1973), and in recent years Romer (1990) and Lucas (1988). In these models technical progress is generated by a sector and improves

productivity in the economy at large. The MC of using the output of this sector is zero. The essential endogenous variable is the magnitude of resources allocated to the productivity enhancing sector. The resources allocation problem may be saved either by a model of optimal intertemporal allocation, or via the equilibrium of a market system.

The market outcome, however, would not be optimal given that the price would have to be positive. Government intervention then improves the flow of output in the productivity enhancing sector. The role of the state in this class of models is unequivocal. Government policy can increase the growth rate.

As may be gleamed from the foregoing cursory review, the theoretical growth models have highlighted three interrelated contributors to growth; namely:

a. *capital accumulation,*
b. *human capital, and*
c. *research, development and innovation.*

From this perspective the role of the state is at best a regulator, or a policy coordinator. Beyond the formal models, however, there are other factors that contribute to growth.
These include:

d. *Infrastructure.* i.e. *both physical and organization* utilities that are required in the production process. Deficiencies in such utilities undermine

factor productivity in general. Most private sector firms are dependant on reliable provision of electricity, water, telephone, transport, and mail services. These inputs are usually provided by the state. A broader definition of the term would include as infrastructure the socio-political and bureaucratic milieu in which the private sector operates. The spending of resources to combat dishonesty, bureaucratic obstacles, and ill-defined property rights could constitute substantial amounts. Together with its distortionary incentive effects, such misuse of resources may cause obstacles of economic growth. (Reynolds, 1983)

e. *Management or Organization.* Whereas human and other capital accumulation contributes to producing more output from given inputs, management and organization help provide better output from the same inputs. While the former is a quantitative input to growth, the latter is essentially qualitative. Yet its contribution to growth could be just as substantial. A particular case of such qualitative contribution is the extent to which price distortions are introduced into the economic system. This is particularly true in developing economies.

f. *Productive Sectoral Allocation of Resources.* Different sectors in the economy are subject to different institutional arrangements. Factor (resources) productivity across sectors thus differs. And it is unlikely that social marginal products in different sectors are equalized. It then follows that the reallocation of resources within sectors may have a substantial effect on the aggregate level of output. Chenery el al. (1986) provide empirical support for this effect.

In light of the foregoing theories of economic growth, the role of the state may be divided into two separate categories:

1. Within the formal models of growth, the state influences the rate of growth via the tax (subsidies) rate, support for research and development, and the contribution it makes to the process of capital accumulation, be it physical or human capital.

2. Extended beyond the formal models, the state's contribution to economic growth takes the form of an array of supplementary inputs into the production process. In this respect, the public sector output embodies clear externalities for private sector production.

Social investment is the sum total of resources allocated toward the above two categories. Like any other investment, social investment is a risky prospect. Its productivity is affected inter alia by both private and public sector variables. In the final analysis, the extent of the contribution of social investment to growth is an empirical question. Equally so is the nature of externalities inherent in the public output. While in subsequent chapters we will examine this question by using international cross-section and time series data, in the remainder of this chapter we will summarize the international growth experience with focus on the role of the state.

1.3 International Growth Experience and the State

Stimulated by the theories of growth, empirical studies of the growth process over the past four decades include both time series and cross-section analysis. Kuznets (1955) pioneered the field. Chenery and Syrquin (1975), Chenery, et al. (1986), Morris and Adelman (1988), and Reynolds (1983) made important contributions. In recent years a set of internationally comparable data has been made available by Summers and Heston (1984). Armed with new and more accurate data, a number of interesting issues have been examined. Building on the growth accounting approaches of Solow (1957) and Denison (1967), Chenery, et al. (1986) documented that the size of the unexplained residual was substantial. In the case of developed countries the residual was over 50% of the growth rate. The counterpart for middle-income developing countries was less than 25%. On the other contributors to growth a wide variety of issues, including privatisation, competitive environment, industrial policy, political instability and price distortions, have been examined by the aforementioned studies. Among other things, it has been pointed out that the establishment of an industrial base and technical skills constitute an important requirement for economic growth. In this respect the government can play a major role. As Stern comments: "the experience of growth provides some confirmation of the potential for government action through, for example, the provision of education and infrastructure, both physical and social, in stimulating the growth process. There is less in theory or experience, however, that tells us that public ownership of the means of production is a necessary or indeed a helpful element." (p. 131)

1.4 Summary

This chapter has reviewed the interaction between social investment and economic growth. To this end, section 1.1 briefly summarized the microeconomic rationale for social investment. Section 1.2 discussed the role of the state in the growth literature. Section 1.3 examined the empirical analysis of international growth experience. It was concluded that "significant weight should be attributed to public investment decisions - specially, additions to the stock of non-military structures such as highways, streets, water systems, and sewers - when assessing the role the government plays in the course of economic growth and productivity improvement." (Aschauer, 1989, pp. 199-200) This notwithstanding, public ownership of the means of production is seldom justified. Moreover, government intervention should be considered with respect to its costs in the form of government failure.

CHAPTER 2

GOVERNMENT OUTPUT: THEORY AND MEASUREMENT

Chapter 1 argued the case for state involvement in the economy. Such involvement in turn raises the question of government output quantification. This is particularly important from a growth-accounting view point. As in most other economic spheres, the calculation and analysis of government output have been the subject of much debate. In this respect both conceptual and empirical issues have been raised. This chapter will discuss these issues in some detail. The analysis that follows will have direct ramifications for the remaining chapters, particularly Chapter 4: Public Expenditure Externalities and Economic Growth.

The controversy surrounding the evaluation of economic activity, government included, dates back to the 18th century debates between the French Physiocrat, inter alia, Quesnay (1694 - 1774), Adam Smith (1723 - 1790), and the Italian economists including F. Galiani (1728 - 1787), P. Verri (1728 - 1797) and G. Palmieri (1721 - 1794). More recently the debate has continued between Matolcsy-Varga (1939), Hicks (1940, 1948) and Kuznets (1948), Herz-Reich (1982), Spindler (1982), and Reich (1986).

This chapter will present the most important issues, evaluate their relative merit, and discuss the current proposed method of conceptualizing the state's output and hence its evaluation. Section 2.1 will discuss conceptual issues; section 2.2 will review measurement problems and the proposal by the UN

Department of International Economic and Social Affairs for appropriate classification of state functions and expenditure; section 2.3 will summarize the discussion.

2.1 Conceptual Issues

The most crucial conceptual issue revolves around the definition of production. Having defined productive activity, the sum total of all economic activity would then constitute national income. Similarly, government output could be defined.

Historically, three concepts of production have emerged in the literature: (1) comprehensive production concept, (2) the material production concept, and (3) the restricted market production concept. Each of these will be briefly discussed below.

2.1.1 Comprehensive Production Concept (CPC)

Dating back to the Mercantilist era, CPC was first used by W. Petty in his *Political Arithmetick* (1676) and in Verbum Sapienti (1665). The concept received widespread currency among national and growth accountants. In 1968 it became the basis of the UN's manual, "A System of National Accounts". With the exception of the former Eastern Bloc countries, almost all other countries employed some version of the CPC in their national accounting system.

In terms of the CPC, any activity (process) is classified as production if it

satisfies human wants and has a determinable economic price or cost. This definition of production encompasses material goods as well as services (non-material goods). As such, government activities - whether provided via the market place or offered for collective use - are defined as production.

2.1.2. Material Production Concept (MPC)

The origin of this concept is Adam Smith's distinction between "productive" and "non-productive" labour. According to Smith labour is productive if it: "(a) produced a marketable material product, (b) produced a commodity whose price could command a quantity of labour necessary to produce it, and (c) added the value of its own maintenance plus the entrepreneur's profit to the raw materials." (Studenski, 1958, p. 182) Any other type of labour, Smith suggests, would be non-productive and, in fact, had to be supported by productive labour. For example, labour involved in the services sector was regarded as non-productive except when it helped to complete the utility of material goods.

This narrow definition of production stemmed from a confusion between wealth as a "stock" of goods as opposed to a "flow" of utilities. It further neglected the reciprocity between services and goods where the former imparts utility to the latter.

The Smithian MPC received powerful support from Karl Marx (1818 - 1883). In *Theories of Surplus Value*, Marx, while developing his notion of surplus value, knowingly disregarded the service sector on the ground that "all these

phenomena of capitalist production are insignificant compared to the whole. We can therefore disregard them altogether." (Marx, 1952, p. 327) In terms of the MPC, government services are, by and large, excluded from the field of production. For Adam Smith, this exclusion was justified because these services are mostly non-marketable and their utility is questionable. For Marx, the state is an agent of exploitation and oppression of workers, hence its activities cannot be regarded as productive.

The Smithian-Marxian concept of production has received expression in the national income statistics of the former Soviet Union, and with some modification in the other former Eastern Bloc countries. This notion of production is clearly ill-defined and inaccurate. This is particularly untrue in developed economies where the share of services has registered a steady expansion over time. As economic sophistication rises, so does the inaccuracy of the concept of material production as the only source of 'national wealth' or 'value'.

2.1.3. The Restricted Market Production Concept. (RMPC)

Marketability is the main criterion for this concept of production. It relies on forces of demand and supply as the only objective determinants of economic value. Consequently, while some services are classified as production and are included in national income, those of governments and other collectives not subject to market forces are excluded. The supply of and demand for such services, it has been argued, are determined by political or other forces that may have nothing to do with the economic interest of the

society.

The early adherents of this concept included Kalecki and Landau (1929) in Poland, and Matolcsy and Varga (1924/1925) in Hungary. Their contention that the inclusion of government services would lead to an overstatement of national income has found support from the proponents of Public Choice theory in recent years. Spindler (1982), for example, argues that "the CPC national accounting convention could result in an overstatement of national product (relative to a consistent measure). The 'modern transfer' view, which is developed here from recent innovations in the theory of bureaucracy and representative government, provides a positive rationale for overstatement by the CPC convention when employed in modern, centralized democracies". (p. 193)

As an implication of the new theories of the positive public economics, propagated by Public Choice theorists such as Niskanen (1971), Migue and Belanger (1974), and Tullock (1971), government undertakings are interpreted as transfer activities rather than production activities. There is a grain of truth in this interpretation. This is not, however, sufficient justification to exclude government services altogether from the realm of national production. Furthermore, in democratic societies government resource allocation is openly and continuously monitored. It is unlikely that politicians would be able to afford any systematic disregard for voter's self-interest objective. Therefore, as Studenski argues:

> Government decisions in a free society may be as rational and objective as the private decisions of producers and consumers, and sometimes may be more so. They take into account the long range interests of the members of society often much more closely than do the private decisions

> of consumers and producers meeting in the market. The services of government are frequently more useful economically and are worth more to society than alternative outlays for privately produced goods and services; e.g. public education, hygiene and sanitation as against private expenditures for conspicuous consumption, not to speak of the expenditures for narcotics or vice. (Studenski, 1958, p. 187)

Of the three concepts of production, the CPC is the most sensible, and widely used. Its implication for the evaluation of government output is that, for most part, the cost of undertakings is taken as best proxy for their value. For computation purposes, this boils down to the sum of employee compensation plus certain interest costs on the portion of public debt that is used in production activities. As a general rule, however, interest costs of public debt is regarded as a transfer and is not a part of the government value added.

The underlying assumption that public services are worth their cost has been controversial. Firstly, in countries where the public sector is not run efficiently this could lead to an obvious overstatement of government output. Secondly, in situations where allocative efficiency is overshadowed by either Keynesian macroeconomic management objectives or outright redistributionist goals, factor compensation policies of the state would grossly overestimate the value added from the public sector. Thirdly, where the private sector is valued at market prices and that of the public sector is assessed in terms of factor compensation, we have a non-comparability problem and hence an aggregation problem in the computation of the national income. If instead of an 'income approach' we choose an 'expenditure approach' to evaluate government output, another problem, no less controversial, will arise. That is the distinction between the final versus intermediate government

expenditure (or services).

Historically three schools of thought have emerged. At one extreme lies the view that all government services are intermediate products. According to this view, the government apparatus with all its multiple functions does not produce values in addition to the existing value of consumer goods, or it simply maintains the present level of production. Put it differently, the current consumer goods embody whatever value public services may have had. Matolcsy and Varga thus argue

> we do not dispute the usefulness of the public service but it seems to us that the result of its usefulness appears in the value of the goods and services produced, and an inclusion of the cost of public services as such would mean double counting. (Quoted in Studenski, 1958, p. 196)

This proposition might well be true for some public services, but in general it does not correspond to reality. Many government services generate utilities of their own. Consider primary health and education, museums, parks and physical infrastructure in general - all of which have independent values not embodied in private goods and services. The same is true in the case of defense and police services. The feeling of security provided by such services is clearly additional to the value of consumer goods and services. Despite these serious shortcomings and inconsistencies of considering all government services as intermediary, modern Public Choice theorists find the concept appealing. For them the nature of government expenditure is essentially redistributionist; to the extent that it is productive, its value is reflected in the worth of private goods and services.

At the other extreme lies the view that all government services are final

products. Advocates of this view include Gerard Colm and at one time J.R. Hicks. While they do not deny that some government services are technically intermediate, they consider their relative magnitudes as insignificant. Furthermore, any attempt to separate government expenditure into final and intermediate would introduce its own sources of error. "Therefore", Colm writes, "I believe now that it is best to make no deduction of the cost services of government, directly or indirectly, but to include all government services in the national product and national income." (Quoted in Studenski, 1958, p. 197)

Without any clear theoretical foundation, this proposition appeals mainly to statistical convenience. Much theoretical and empirical work has been done to refute the proposition. The outcome has been a third view, namely the theory that government services are partly intermediate and partly final products.

Simon Kuznets (1948) was an early advocate of this theory. In terms of his twin criteria, only direct services by government to ultimate consumers and additions by government to capital stock constitute the final products of government. Subsequent theorists have taken a broader definition of the functional classification of government output. In its latest effort to improve official statistics, the UN's Department of International Economic and Social Affairs (1980) issued a "Classification of the Functions of Government" (COFOG). According to COFOG, the problem of isolating intermediate government output has become feasible. COFOG reclassified the 127 categories of government undertakings into 14 categories, which may be further classified into the following four groups:

a. *General government services* (headings 1 to 3) including government activities that cannot be associated with services to individuals or businesses.

b. *Community and social services* (headings 4 to 8), comprising all activities that provide services to communities and individuals directly.

c. *Economic services* (headings 9 to 13), covering all government services associated with the operation, regulation and better functioning of business firms.

d. *Other functions* (heading 14) include government functions that are of a transfer nature, i.e. interest on public debt, general interdepartmental transfers, etc.

COFOG's fundamental criterion is the principle of directness. It argues that while all government output may somehow affect all households, certain services have direct effects, i.e. community and social services. An immediate complication is the fact that public goods, by their nature, are non-rivalerous; and the summation of their direct benefits to individuals would result in double-counting. This has been a long-standing issue in the literature. The solution leads us to the distinction between the two concepts of measurement as proposed by Hicks (1940), i.e. the *welfare* and *production* measurement concepts. As the focus of the present chapter is government output, our concern is about production, not about welfare.

With regard to production, whatever flow back into the production process is considered intermediate. Thus "economic services" (group 3 above) and other functions (group 4) are intermediate, while "general government services" (group 1) and community and social services (group 2) are not.

In line with these classifications, Reich (1986) and Horz and Reich (1982) have made estimates of the intermediate use of government output for Canada and Germany. Table 1 below shows their results.

TABLE 2.1: Intermediate and Final Uses of Government Output as Percentage of Total Government Consumption

Country	INTERMEDIATE		Final Use
	By Enterprise	By Govt.	
Germany (1975)	3,6	7,9	88,4
Canada (1978)	15,9	7,0	77,1

Source: Horz & Reich 86 & 82

* Note: In their 1982 study, Horz and Reich estimated a total intermediate output of 16.31% for Germany (1974), 13.6% for UK (1974), and 14.1% for Sweden (1974).

Intermediateness from a welfare point of view is broader in the sense that only individual consumption enters the utility function. Collective consumption is therefore non-final; i.e. intermediate. Whatever measure of intermediateness is used, it is noteworthy that it amounts to 1 to 1.4 percent of the GDP. (Reich, 1986) This is so small a percentage that it

makes no notable impact on the accuracy of national output calculations. In other words, estimates of the relative magnitude of intermediate services of government output lend support to Colm, who contends:

> I have come to the conclusion that such classification of government services (into intermediate and final products) would introduce sources of error which may be larger than the errors resulting from leaving the intermediate services of government in the national product or national income totals. Therefore, I believe now that it is best to make no deduction of the cost services of government, directly or indirectly, but to include all government services in the national product and national income. (quoted in Studenski, 1958, p. 197)

2.2 Performance Measurement Problems

As is evident from the foregoing analysis, the contribution of government to a country's output is measured by total factor cost; in fact it is measured more precisely by public sector's employees' compensation. While this might be the best that can be done within the national accounting framework, it is by no means a concept that lends itself to performance measurement analysis. It falls short in two areas in particular. One is in the calculation of government output in real terms; the other is in productivity analysis.

2.2.1. Real Government Output

Government output deflator is calculated on the basis of full-time equivalent employment, i.e. real government output for any year is derived as the product of full-time employment in that year and base-year compensation per full-time equivalent employee.

This calculation is far from satisfactory in that it does not incorporate any measure of public output. Factors not taken into account are the amount of education, defense, and infrastructure provided from government expenditure. In addition, there is no output index for any of these major public sector functions. The deflator, therefore, is constructed using inputs as a proxy. To improve accuracy, full-time employment equivalent is estimated for different categories of public sector functions such as military personnel, education employees, and so on. Depending on the scope of the public sector, countries differ in the number of categories they use in their public sector deflator.

This method of deflating government output may be defined in a number of ways. Two methods have gained prominence in the literature and among practitioners. One is by what Denison (1989) calls specification pricing for employment inputs. This approach seeks to identify as "specifications" those properties which:

a. are readily identifiable and are constant over time so that continuous series can be made;

b. are reliably correlated with the biggest price differentials;

c. are present in varying degrees in commodities and services under study.

Note that Denison's specification pricing emphasizes the use of the product or service. It would require the classification of public services and their associated labour, or employee compensation.

Alternatively, the U.S. Bureau of Economic Analysis (BEA) suggests specification pricing in terms of age, occupation, and education - all the characteristics closely associated with earnings differentials. To arrive at real compensation, base-year compensation of age/occupation/education groups would be extrapolated by hours worked. "The proposition," as Searle and Waite (1980) explain, "is that work by government employees in the same age/occupation/education group with the same amount of hours worked represents a purchase of the same quality of labour at different dates.... The functional distribution of labour is irrelevant". (p. 335)
While such refinements improve the method in use, they nonetheless leave the real issue intact. The problem is our inability to derive market values for government services and price them; hence it is not possible to compute a real value for government output. The basic difficulty is in the very nature of collective goods.

2.2.2. Government Output and Productivity

Measuring government output poses similar problems that are formed in estimating output in the private service sector. The essential difficulty with measuring the quality and quantity of service output arises due to the lack of a physical unit of standard quality. How does one measure police protection in the public sector or auto repair in the private sector?

Generally, there are two methods: One is the number of direct output, i.e. the number of arrests made or cars repaired. This method, however, does not

take into account quality changes, nor does it represent the desired service output. In other words, while the number of brake pads replaced is a good measure of output, it is not indicative of the quantity of well-functioning motorcars. Likewise, while the number of police arrests may be a direct output, it may not lead to a decline in crime which is the service output. To address these problems, a second concept of government output may be used, namely that of measuring the consequences of the service. This would be the number of well-functioning motor vehicles on the road as regards auto repair services or a lower crime rate in the case of police services. This method is subject to the confusion between *'services output'* and *'consequences of output'*. There may be no causality between consequences and service. The number of inoperative motorcars may be a function of many other variables such as bad roads, harsh winters, etc. Similarly, the level of crime might be effected by such factors as the availability of guns or socio-economic conditions and not because too few arrests are made.

Although private and public services face common or similar measurement problems, the private sector has a distinct advantage over the public: it has a market price and thus its total value can be measured. In the case of government services we have neither a market value nor a consensus on what is being measured as government output in the national account. The value added calculation is neither an estimate of direct output (i.e. number of arrests made or amount of garbage collected), nor a measure of consequences or service output such as a secure environment or a better-off society. From this discussion we may conclude that the national accounts measure of government output does not lend itself well to the application of

productivity measurement, and that measurement by direct output and by the consequences of the service must be used outside the national accounts framework. While measurement by direct output estimates changes in output from changes in the quantity of direct outputs, measurement by consequence of service estimates changes in output from changes in consequence.

Bradford, Malt and Oates (1969) introduced a similar classification by suggesting a division of public output into two categories: "D-output", the services directly produced, such a classroom hours taught, and "C-output", the results of primary interest to consumers, such as the ability to read. Clearly, in many cases the C-output is functionally related to the D-output of that service and the D-output of any other relevant public service. Thus choosing C-output instead of D-output complicates the problem of measuring public sector productivity. Moreover, adjusting for quality changes becomes particularly difficult. For these reasons, studies of productivity in specific public sector activity have focused on D-output. Furthermore, changes in D-output are more closely comparable to measures of output changes in the private sector. The basis of output changes in private sector is physical units and not the consequences, although consequences play a role in determining value, or relative values, in the market place.

While this approach to productivity analysis could suit specific public sector functions, it could not apply to the public sector in general. As mentioned earlier, the main obstacle is the lack of quantitative measures of comprehensive output for the public sector. Thus any productivity index for the sector as a whole needs to be based on a suitable measure with which to adjust the sector's value added. In other words, some form of link between

input price and output price has to be assumed. Output price, for example, could be assumed to be a function of input prices and productivity.

Whatever formulation is used, government productivity measures require certain assumptions and compromises. For example, in the national accounts framework it is assumed that output change is proportional to employment change. If so, employment series should be modified by suitable productivity measures. Indirectly then government output would be properly deflated. Alternatively, output price may be estimated by applying a productivity index to the input price indexes. In this case the productivity index needs to be based on labour and materials as inputs. If one further assumes that the material requirement per unit of output remains constant in the short run, then the appropriate productivity index would be reduced to a labour productivity measure such as output per man-hour.

In line with our analysis, Searle and Waite (1980) propose the following:

> For usefulness as adjustment factors in the national accounts, it would seem that the appropriate productivity measure would be one which consists of component unit-man-hour series weighted with labour cost - not with labour requirements (man-hours) as is used in most of the Bureau of Labour Statistics industrial productivity series. The BLS series are conceptually suitable for technological-change analysis. The national accounts, on the other hand, requires dollar weights in order to attain consistency with the value and price series of the national accounts. It follows that the total man-hours indexes used to obtain the productivity measures would be weighted by the wage or salary rate in each job category. (p. 338)

The quantification of government output then would depend on the availability of data necessary for weighting systems of departments, functions and

activities. Thus the accuracy of the resultant estimates would vary depending on coverage, representativeness, and reliability of component data used. However, a more substantial issue is whether or not such a combination of various series can be made in a conceptually meaningful way. To illustrate the point consider the following example: Assume a production process that requires labour and two other inputs, 'A' and 'B', both of which are labour-complementary factors. An innovation results in the use of less input 'A' and hence less labour input in general. Yet labour's ability to utilize 'A' per unit of time has not changed. In other words, although productivity based on 'A'-per-hour of labour has not changed in terms of output-per-hour, productivity has risen. Likewise if better quality 'B' results in using half as much of 'B' as before, productivity with respect to 'B' would double, whereas if measured by 'B'-per-hour of labour it would show no change. Clearly a composite index of productivity based on 'A'-per-hour of labour and 'B'-per-hour of labour would show no improvement. Meanwhile output per unit of 'A' and 'B' has increased.

This analysis highlights the significance of choosing an appropriate measure of output. Furthermore, where the final output is the result of numerous processes, the interaction among different activities can generate a final index. Therefore, a simple averaging of all processes involved would be unlikely to capture improvements that stem from a reduction in processes or an addition of new processes. The result would be a built-in downward bias in the index.

Against this backdrop, productivity indexes for public sector activities

would only be conceptually meaningful and empirically accurate if:

a. the output of the activity is well-defined and relatively homogeneous;

b. the constituent processes are clearly identifiable;

c. the factor (labour) requirement of the component processes is relatively stable; and

d. adjustment for quality changes is feasible.

The total productivity measure then would be a weighted average of the component productivity changes. In general, the more aggregate the productivity index, the less accurate it becomes. In other words, it is likely to compute more accurately the productivity of the mail delivery service within the post office than to estimate the productivity of the post office as a whole. By the same token, the productivity of the post office is more precisely calculable than that of the public sector in general.

Given the difficulties of constructing a public sector productivity index, the common measures of efficiency enhancement as applied to the private sector do not apply to the public sector. Meanwhile, governments worldwide are known for inefficiency, albeit in varying degrees. This ubiquitous inefficiency stems from the fact that provision of collective goods, and goods with extensive externalities, is inefficient. Olson (1973) argues the point:

> As long as an organization has some measure of the volume or level of its outputs, it can produce whatever amount of each output it chooses to produce with as much efficiency as it could have attained had it known what each output was worth to its clients (i.e. had preferences been revealed). That is, it can obtain maximum technical efficiency.... The problem of weeding out inefficiency, rewarding productivity, and maintaining effectiveness over time stem not so much from the familiar revelation of preferences problem as from the fact that collective goods by their very nature make it difficult to get a measure of the volume of output. (p. 369)

Can the problem of inefficiency in the provision of public and collective goods be solved? Not entirely, although to some extent it may be ameliorated. Two properties characterize publicly provided goods and complicate the task at hand: non-exclusion and non-diminishability (jointness). Yet in some cases it is possible to exclude free riders and thereby improve efficiency. Television is often used in the literature as an example of a collective good which could be made excludable. Technological advancement made pay television economically feasible. Consequently what used to be a public service replete with preference revealing difficulties became a private service subject to market forces. Although efficiency improvement measures for this service became possible, from a social point of view pay television is not optimal. This is because it charges a positive price for a service that has zero marginal social cost. Theoretically, the optimal arrangement would be a public television system which meets its expenses from tax revenues and offers free programming. Of course, empirically single state television agencies have been associated with disadvantages. Given the significance of information, a single government television agency is bound to give monopolistic powers to the regime in control and to create opportunities for misuse of the medium, something which

could well involve inefficiencies of its own. Moreover, single state-owned television stations would in all likelihood be run by bureaucrats who would not necessarily cater to consumers' tastes or run the operation efficiently. Because the personnel would presumably be appointed on their professional merits, they would follow prevailing professional ethics as opposed to the consumers' taste. Should consumers be permitted to influence their appointment, the service would then turn into an organ of the dominant party. On the cost side, consumers cannot be expected to know the cost structure of television production, and thus would be unable to assess whether the state system is as efficient as it could be. In essence, a single state television would be a public good, and like all other public goods there would be no measure of its output.

Clearly, neither pay television nor a single state system is optimal overall. One partial solution might be to use a random sample of potential viewers to establish how relevant different programmes are to consumers' choice. For example, viewers could be given a lump sum of money and then forced to pay for the programme of their choice. The outcome of the exercise may in turn be used to determine the rewards given to various program producers, directors, etc. A similar technique may be used to establish the level of subsidies for different channels and networks. A more sophisticated reward structure could also monitor other factors such as professional assessment of artistic quality, moral standard, educational value, objectivity in reporting of news, and other programming aspects.

There is yet another source of efficiency improvement. Both collective, and private goods use intermediate products in the production process. By using

markets to their fullest possible extent in the intermediate processes, it is possible to minimize the inefficiency of the whole production process. Consider the case of national security. A great number of intermediate products used in the provision of national defense are in fact private goods such as weapons, uniforms, training of pilots, vehicles, etc. Clearly, the use of a market mechanism for all such component parts is bound to increase the overall efficiency of the provision of public goods. The scope for this method of productivity improvement is vast. A great number of activities and their intermediate processes lend themselves to such market-oriented provision. In general, wherever the exclusion principle could be applied, the use of market forces would be feasible, and hence productivity enhancement could be effected.

In cases where the exclusion of non-purchasers is impossible, i.e. where the preference revelation problem prevails, the best that can be done is the use of social indicators. Olson (1973) defines a social indicator as "a non-monetary measure of social output or performance - a measure of welfare or illfare to which no price has yet been attached." (p. 381) Of course, the use of social indicators is bedeviled by the confusion between 'services output' and 'consequences of output', as discussed above. Theoretically, nonetheless, controlled experimentation should be able to resolve the problem satisfactorily. In most cases, however, such experiments are either impractical or morally indefensible. Consider family problems, child abuse, or unemployment which could be causes of crime but experimentation with which is out of the question. As the next best alternative, statistical estimation is another method of approximating social output functions. The reliability

of this method would depend as much on the model used as on the accuracy of data collected. Very frequently the critical data required to raise the confidence level are unlikely to obtain. Again, consider the case of crime: while an unhappy home environment is a potential contributing factor, the 'nature' or personality of the individual is also a primary factor. Not all individuals from unhappy homes commit crimes. The fact that data on such a critical aspect of the process may be lacking renders the application of the statistical estimation approach limited.

Finally, and from a totally different perspective, productivity improvement could result from institutional changes within bureaucracies. Most bureaucracies follow time-honoured rules and procedures. Moreover, there is a great deal of inbreeding within each bureaucracy. Through institutional restructuring it might well be possible for people to come in at any level from outside of the bureau, pernaps from areas where productivity is measurable and the mentality is different. One such institutional change is the transferability of pension rights; another is promotion criteria. When the inbreeding process is discontinued and bureau insiders are exposed to outsiders and visa versa, the bureau is likely to enjoy performance improvement. In fact, the less measurable the bureau's output, the higher its productivity gain would likely to be.

2.3 Summary

This chapter has discussed issues surrounding government output. Of all the issues associate with economic performance measurement, these problems are

perhaps the most frequently debated and least resolved. Their conceptual roots, as explained in some detail, can be traced back to the definition of what constitutes production. The concept of production itself serves to define the framework for national accounts. Within the prevailing national accounting conventions, i.e. the UN System of National Accounts, the Comprehensive Production Concept has gained widespread currency. Accordingly, national output is inclusive of government contribution - measured in terms of government value added, which is not necessarily the same as government output.

Much controversy surrounds the definition of government output, the most prominent one being whether government output is 'final' or 'intermediate'. Even if we resolve the conceptual issues, empirically the measurement of government output is riddled with numerous difficulties, some of which are insurmountable. This is primarily due to the fact that government output consists mainly of public goods and activities with more than average externalities.

The inability to measure output results in the lack of appropriate productivity measures. This in turn complicates the task of efficiency improvement in the public sector. Without any direct productivity index, any attempt to improve allocation efficiency in the public sector has to rely on either (a) innovations that would make the production process more market oriented, or (b) use indirect or partial indicators as means of productivity enhancement. In either case there is no perfect arrangement.

The quantification of government output, and by implication means of raising its productivity, has thus far defied accurate measurement. Yet much research has gone into the empirical link between government output and economic growth. This and the associated issues will be discussed in the next two chapters.

CHAPTER 3

GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH

The link between government output and economic growth, or visa versa, has been the subject study of large and expanding literature over the past one-hundred years. In 1877 Adolph Wagner hypothesized a "Law of the Increasing Extension of State Activity". Subsequently known as the Wagner's Law, it essentially regarded government output as endogenous to economic development and industrialization. According to Wagner, the direction of causality was clearly from economic growth to public sector output.

While Wagner's Law considers government expenditure as a behavioural variable, conventional macroeconomic theories, following Keynes (1936), have generally assumed that government expenditure is an exogenous policy instrument. As such it is designed to correct short-term cyclical fluctuations in aggregate output.[1] Thus increases in government expenditure cause growth in national income. The causality in this case would run from the public sector to economic expansion.

A third, and a more contemporary school of thought, under the general rubric of Public Choice, holds the view that the expansion of the government sector

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[1] *Keynes himself had argued, ever since 1924, for public works and other direct government investment as a matter of longer-term growth policy. For details see Leijonhufvud (1968), p. 407.*

neither causes, nor is caused by, economic growth. Its growth is caused by the dynamics of bureaucratic behaviour and interaction among various interest groups in society. As there is no a priori reason to believe that the bureaucrat's objective function includes economic growth, it is then quite likely that the government sector expands even in the presence of poor economic performance. Public Choice theorists would argue that the expansion of government requires higher taxes, distorts incentives, and generally reduces efficient resource allocation. Hence it follows that increases in government spending will reduce the level of national output.

An alternative explanation, still within the broad definition of the Public Choice paradigm, propagated by Morris Beck, attributes the expanding relative size of the government sector to the rising relative magnitude of public transfers.

This Chapter will focus on Wagner's Hypothesis. In our analysis, and in our search for an empirical evaluation of Wagner's Hypothesis, we will examine widely divergent views in the literature. Before we review the debates in the literature, however, we need to clarify a number of technical issues involved. The most important issue is the definition of 'G'. Wagner's Law of the increasing extension of state activity gives no unique and generally applicable definition of 'state activity'. The lack of precision and unanimity in turn has meant that different researchers have used different definitions of 'G'; hence many of their results are not comparable.

In general, three definitions of 'G' may be suggested: 1) 'G' may be defined as the government sector contribution to the GDP. In this case and in line

with national accounting conventions, 'G' would represent the government sector's value added, consisting mainly of compensation of employees; 2) 'G' could represent government expenditure, commonly defined as the sum of consumption and investment expenditure plus transfers; and, 3) 'G' may be so defined as to include not only government expenditure but also some or all expenses of parastatals. As can readily be seen, the latter two definitions could have variants of their own. For example, one researcher might well decide to define 'G' as the sum of consumption and investment expenditure only. Lybeck (1986), for instance, defines 13 different measures on the size of the public sector in Sweden in 1970.

Equally important is the choice of deflators in deriving the real values of various measures such as 'G' and 'Y'. This is particularly important in light of the potential divergent behaviour of private and public prices. In this respect this Chapter will discuss Baumol's 'productivity gap hypothesis' and proceed to examine the pattern of public sector 'real' shares.

A further technical issue is the difference between 'nominal' and 'real' public sector ratios. Here Beck and Heller offer competing hypotheses. We will analyze their methodology in this Chapter and use the South African data to illustrate the differences in trends and interpretations that arise from those methods.

In addition to these statistical issues, we will examine how the 'actual' and 'desired' government output may not necessarily correspond. The implications of this lack of correspondence for an empirical analysis of Wagner's Law will then be discussed.

3.1 From Economic Development to Rising Government Expenditure

Wagner's empirical observation that the public sector had a tendency to expand its share as economic progress took place has been widely supported by fiscal scholars. Numerous time series as well as cross-country empirical testing of the Wagner's Law in developed and developing countries have produced empirical support for the Law. There have also been cases to the contrary. Cross-country studies in particular have generated mostly weak or negative evidence. (See Ram, 1987) This raises the question of definition and appropriate testing of the hypothesis.

In principle, Wagner's Law of increasing extension of state activity is too broad and lends itself to various interpretations. The definition of 'state activity' itself has undergone substantial changes from Wagner's time to the present. For example, theoretical and political support for the 'welfare state' helped expand the domain of state activities in the 1950s, 1960s and 1970s. The developments since the early 1980s, on the other hand have led to the privatisation of some state activities in many countries. Technological innovations have further reinforced this process.[2] These changes have altered the number of functions and activities that fall under the state sector.

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[2] *Innovations in electronic sciences and communications, for example, have substantially weakened the role of governments in services such as TV and post and telecommunications. In many less developed countries, however, these services are still run exclusively by the government.*

For empirical research purposes the question is: Which measure of 'G' is the best proxy for state activities? In other words, should we use government sector value added, or should we employ government expenditure as the best and most relevant measure of state activities? As we will show later, each of these measures has its own implications.

In the remainder of this section we will discuss the theoretical issues involved in formulating Wagner's Hypothesis and examine empirical problems in testing the hypothesis.

3.1.1. Wagner's Hypothesis - Proper Formulation

In the description of Wagner's Law it is generally postulated that $G_i/Y = f(Y/N)$, where G_i is public spending on the ith expenditure category, Y is a measure of national income, and N is the country's population. Note that Y/N represents the proxy for economic development. In much of the empirical testing, however, $G_i = f(Y)$ is employed which results in income elasticities. Income elasticities larger than unity are seen as support for Wager's Law. (See Bird (1970), Musgrave (1969) and Goffman (1968).) Clearly there is an inconsistency between the description and empirical tests of the law in these studies.

To remove the inconsistency, either of the following formulations of Wagner's Hypothesis is appropriate.

(1) $G/Y = f\ (Y/N)$

(2) $G/N = f\ (Y/N)$

Note that the direction of causality is simply hypothesized to run from 'Y' to 'G'.[3]

The elasticities derived from (1) and (2) are monotonically related. The relationship may be derived as follows:

By definition elasticities from (1) and (2) respectively are:

(3) $$\frac{d\ (G/Y)}{G/Y} \Big/ \frac{d\ (Y/N)}{Y/N} \equiv \eta_1$$

(4) $$\frac{d\ (G/N)}{G/N} \Big/ \frac{d\ (Y/N)}{Y/N} \equiv \eta_2$$

Let $Z \equiv \frac{G}{Y}$, $X \equiv \frac{G}{N}$ and $K \equiv \frac{Y}{N}$; then

(5) $$Z = \frac{X}{K}$$

Taking the log difference of (5), we have:

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[3] *A full discussion of the issues related to the direction of causality is presented in Chapter 4.*

$$d \log Z = d \log X - d \log K \text{ , or}$$

$$(6) \qquad \frac{dz}{z} = \frac{dx}{x} - \frac{dk}{k}$$

Dividing (6) by $\frac{dk}{k}$ we have:

$$\frac{dz}{z} \Big/ \frac{dk}{k} = \frac{dx}{x} \Big/ \frac{dk}{k} - 1, \text{ or}$$

$$(7) \qquad \eta_1 = \eta_2 - 1$$

This precisely defines the monotonic relationship between the ratio-income elasticity derived from equation (1) and the income elasticity estimated in equation (2).

Empirically, any testing of Wayner's Law has to rely on estimates of η; i.e. by using equation (1) or equation (2). Thus, if we adopt a simple income elasticity approach, then both government expenditure and national income (or whatever other aggregate measure of economic development is used) would need to be in per capita terms. Other than equations (1) and (2) above, any other formulation would not correspond to a reasonable interpretation of Wagner's Law.

In terms of Wagner's hypothesis, η is expected to exceed unity. The empirical testing of this statement, however, faces a number of technical problems which are discussed below.

3.1.2 Empirical Testing of Wagner's Hypothesis

To establish whether or not η exceeds unity we have to work with data on 'G' and 'Y'. Typically, time series data on 'G' and 'Y' would be used for an extended period of time using one or more countries as case studies.

Note that the results, whether supporting or rejecting the hypothesis, would be acceptable only if 'G' and 'Y' are subject to the same underlying price structure. Only then one could make some deduction about the magnitude of the elasticity. But if 'G' relative to 'Y' rises (or declines) due to differing price structures, then any inference about the resultant elasticity would be meaningless.

The divergence between private and public sector prices is explained in terms of the 'productivity gap' between the two sectors. A common exposition of this hypothesis is that of Baumol (1967) in which the productivity differential is largely responsible for 'the urban crises' of the mid-1960s. The underlying premises of Baumol's Disease, as his hypothesis is sometimes called, are as follows:

a. government activities are mostly labour intensive;
b. the technological innovations have little effect on the public sector's labour requirement;
c. in the absence of competition, government agencies have little incentive to increase efficiency and productivity; and
d. the demand for public services emanates from the need for a variety of public services that are essential for the quality of life.

In terms of the hypothesis, the real cost of government services must rise when compared with the more productive private sector. Furthermore the unionization of public servants is likely to result in wage rates in line with those of the private sector. Consequently, the nominal size of the public sector is expected to rise over time.

Thus, in an empirical test of Wagner's Law the use of the nominal G/Y ratio can be problematic. In other words the G/Y ratio may rise because 'G' has risen over time due to the productivity gap. The fact that in terms of national accounting conventions 'G' is measured via input costs only reinforces this possibility because to deliver additional services, the government may end up using relatively more resources due to its comparatively less productive production processes.

If a productivity gap exists, and if Baumol's Disease has any empirical relevance, the effects would be expected to reflect in the sectoral deflators of the economy. Note that the implicit deflators of various sectors are designed to represent the underlying price structure of each sector. Therefore a comparison between the implicit deflator of the government sector and the rest of the economy can illustrate the point.

Table 3.1: Government Sector Deflator - GDP DeflatorRatios 1970 - 1988

YEAR	AUSTRIA 1982=100	BELGIUM 1980=100	JAPAN 1975=100	SOUTH KOREA 985=100	SOUTH AFRICA 1985=100
1970	0.83	0.82	0.76	0.59	0.98
75	0.97	0.93	1.00	0.77	0.98
79	0.99	0.96	0.99	0.84	0.93
80	0.98	1.00	1.02	0.88	0.89
81	0.99	1.04	1.02	0.90	0.94
82	1.00	1.04	1.02	0.96	0.98
83	1.00	1.02	1.03	0.97	0.95
84	0.99	1.01	1.04	0.98	1.01
85	1.02	1.00	1.06	1.00	1.00
86	1.02	0.98	1.03	1.02	1.02
87	1.03	0.97	1.06	1.06	1.04
88	1.03	0.96	1.08	1.08	1.01

Source: UN National Accounts Statistics, 1988

Table 3.1 illustrates the relative size of the government sector deflator in comparison with GDP deflator for selected countries over the 1970 - 1988

period. (The choice of countries was due to the availability of data.[4])

In terms of the productivity gap hypothesis, government sector prices (costs) exceed that of the rest of the economy. In other words its deflator is at a higher level, and is possibly rising faster than the GDP deflator. For this to be true, the value of ratios in the table for years other than the base year should be greater than unity for all the years after the base year and less than unity for all the years preceding the base year. As can be seen, there is almost a consistent pattern. The ratios by and large support

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[4] *For the purpose of this exercise we require data on government sector value added (GVA) in nominal and real terms. In the published international data, i.e. the World Bank's World Tables 1991, data are available on General Government Consumption Expenditure (GGCE) in nominal and real terms for almost all countries. GGCE data, however, cannot be used because it differs from GVA. Conceptually GGCE includes government purchases (adjusted for sales of consumer goods and services); hence it is larger than GVA. As such the implicit price deflator of GGCE would also be expected to differ from that of GVA. Empirically this is shown below, using South African data.*

DIFFERENCE BETWEEN GGCE AND GVA; SOUTH AFRICA 1985 - 1991
(RAND MILLION; 1985 = 100)

YEAR	GGCE	AS A % GDP	GGCE DEF	% CHANGE IN DEF	GVA	AS A % GDP	GVA DEF	% CHANGE IN DEF
1985	21297	18.9	100.0	-	13901	12.4	100.0	-
1986	25672	19.8	117.8	17.8	16465	12.7	114.4	14.4
1987	30599	20.4	135.4	14.9	19636	13.1	130.7	14.2
1988	35276	19.8	153.5	13.3	22495	12.6	145.2	11.1
1989	43946	21.1	184.5	20.2	28006	13.5	177.1	21.9
1990	51421	21.7	210.5	14.1	33690	14.2	211.2	19.2
1991	61988	23.1	237.9	13.1	40012	14.9	246.9	16.9

Source : SA Reserve Bank Quarterly Bulletin, Dec. 1992

The above comparison confirms the theoretical differences between the two measures. Noteably, the two deflators differ in levels and rates of annual change. Also as a % of the GDP, the two measures differ markedly. The difference basically amounts to the share of government purchases as illustrated in the above theoretical analysis.

Baumol's Hypothesis.

The productivity gap hypothesis explains the rising trend of the deflator ratios in terms of the public sector's inability to take advantage of on-going productivity enhancing innovations. Where the trend of deflator ratios is variable, it may be attributed to the speed of technological improvements in the public sector. Data on such countries are consistent with the interpretation that the incorporation of innovations in this sector is discrete. This may be explicable in terms of the decision making and budgetary lags that characterize the public sector.

In an updated and revised version of Baumol (1967), Baumol, Blackman and Wolff (1985), using the U.S. data conclude:

> All the empirical data we have found seem consistent with the predictions of the amended unbalanced growth model. Similar trends are also found internationally.... In sum, the cost disease of the stagnant services may affect more of the economy than was previously thought. (pp. 815-16)

If accepted, the productivity gap would imply a more rapid rise in the price of public goods than the general price level. This would explain much of the increase in the nominal percentage share of public expenditure out of the national product. This in turn would raise doubts about the use of nominal values for the calculation of the income elasticity of demand for public services.

The obvious way to rectify this problem would be to work with 'real' 'G' and 'Y', thereby removing the price effect. The critical issue then would be the choice of deflators for 'G' and 'Y'. While in the case of 'Y', the GDP (or

GNP deflator) is commonly used, in the case of 'G' there is no generally agreed deflator. The choice of a price deflator for 'G' would, in the first place, depend on the definition of 'G' itself.[5] As shown in Chapter 2, there are numerous issues, some of them unresolved, in respect of the measurement of government output. These in turn complicate the choice of a deflator for 'G' and the calculation thereof.

3.1.3. Relative Prices and Public Sector "Real" Shares

To illustrate the effect of relative price changes, Table 3.2 compares the nominal and real shares of the public sector for a selected group of countries. Once again the choice of countries was limited by the availability of data from the UN Yearbook of National Accounts Statistics.

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[5] *For an illustration of the importance of the definition of 'G', see footnote 4.*

Table 3.2: Nominal and Real Ratio of Government Sector out of GDP, Selected countries: 1970-1988

YEAR	AUSTRALIA 1981=100		AUSTRIA 1982=100		JAPAN 1975=100		SOUTH KOREA 1985=100	
	N	R	N	R	N	R	N	R
1970	14,0	15,2	13,9	15.1	7.6	9,8	9,4	14.6
75	17,3	11.5	17,2	11,4	10,2	10,2	10,9	13,6
79	17,3	18,3	17,3	18,2	9,9	10,0	9,9	4,7
80	17,8	18,5	17,7	18,5	10,0	9,8	11,5	12,7
81	18,0	18,0	18,1	17,9	10,1	9,9	11,5	12,6
82	18,9	19,1	18,9	18.9	9,9	9,8	11,4	11,8
83	18,6	19,0	18,5	19,0	10,0	9,8	10,7	10,9
84	18,7	19,0	18,7	18,1	10,0	9,6	9,9	10,1
85	18,7	19,0	18,6	8,7	9,8	9,3	10,0	10,0
86	18,5	19,2	18,5	19,2	9,8	9,6	10,0	9,9
87	17,7	18,8	17,6	18,7	9,6	9,2	9,9	9,4
88	16,8	18,3	16,8	18,2	9,5	8,9	10,1	9,5

Source: UN National Accounts Statistics, 1988

The divergence between the nominal and real ratios shown in the table is partly due to the choice of deflators for both variables; i.e. for 'G' and GDP. To a large extent Table 3.2 reflects the results shown in Table 3.1. In other words, to the extent that the deflators for 'G' and GDP have divergent trends, the real and nominal G/GDP ratios would diverge accordingly. To a lesser degree, however, the choice of the base year would affect this gap. It is worth noting that the choice of the base year would not cause the gap, but would tend to accentuate or dampen it. Furthermore,

the choice of the base year would affect the sign of the gap between the real and nominal ratios. The share of the public sector in real terms becomes larger if the base year is later than the year under consideration. The opposite occurs if the base year is earlier than the year under study. The following example illustrates the point:

Public Consumption as a Share of GDP in Sweden 1975 (percent)

Constant Price	(1968 = base)	22.0
Current Price	(1975)	24.1
Constant Price	(1980 = base)	26.1

SOURCE: Lybeck (1985), p. 30

In the final analysis it is the composition of the two aforementioned deflators that create the discrepancy.

In official national accounts statistics, public sector expenditure, 'G', is deflated using the government purchases deflator. For the statistical transformation of the denominator, the GDP deflator is generally used.

The difference between nominal and real ratios over time, and across countries, requires explanation. To this end two competing hypotheses have emerged in the fiscal literature: (a) the Beck Hypothesis, and (b) the Heller Hypothesis. Both focus on the role of the appropriate deflator for government expenditure. We will discuss both hypotheses below and use South African data to demonstrate their implications.

3.1.4. The Beck Hypothesis

Beck uses government expenditure as opposed to government sector value added to proxy Wagner's "state activity". For empirical analysis Beck's measure of 'G' consists of government consumption expenditure and government transfers. Emphasizing the significance of a suitable deflator for 'G', Beck (1976, 1974) focuses on the composition of 'G'. Since 'G' is composed of both government consumption (G_c) and government transfers (G_t), an appropriate deflator, Beck argues, should be a weighted index of government purchase deflator (GCDEF) and the deflator for private consumption expenditure (PCDEF). The latter index is used for two reasons: Firstly, from a purely technical point of view, in order to maintain compatibility with the government purchase deflator, the price index used for the deflation of government transfers must also be a Paasche index.[6] Secondly, since the bulk of government transfers is to households, its real value can best be derived by using the index of private consumption expenditure. Beck's proposed deflator for total government expenditure (GDEF) may then be expressed as follows:

(1) $$GDEF = (G_c/G)\ GCDEF + (G_t/G)\ PCDEF$$

Using such a price index, Beck's empirical study concentrated on thirteen

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[6] *Note that the alternative would be to use a Laspeyres-type of price index to deflate government transfers. In that case we would have a situation where part of 'G' would be deflated by a Paasche-type of price index and the other part by a Laspeyres-type index.*

industrial countries over the 1950-70 period. He calculates the G/GDP index as expressed in Equation (1) above with 1950 = 100. Furthermore he distinguishes between total government expenditure and government consumption expenditure. His study, updated and expanded in Beck (1979 and 1981), drew two prominent conclusions:

a. all real G/GDP ratios were smaller than nominal G/GDP ratios; and
b. while G and G_t rose in all thirteen cases, the real G_c share of the GDP declined in seven of those countries.

The second result lead to the so-called 'Beck Hypothesis', in terms of which the expansion of the relative size of the public sector is attributed to the rising magnitude of government transfers. This, in effect, could constitute a refutation of Wagner's Law. For if one assumes that government has responded to public demand, a decline in G_c is prime facia evidence contrary to Wagner's hypothesis. Table 3.3 tests Beck's hypothesis for South Africa, summarizing the relevant data.

Table 3.3: Real and Nominal Ratios of Government Expenditure in GDP 1960-1990

	NOMINAL			REAL (1960=100)		
YEAR	G_c	G_t	G	G_c	G_t	G
1960	9.8	2.6	12.5	9.8	2.6	12.5
61	10.0	2.6	12.7	10.1	2.6	12.7
62	11.1	2.7	13.8	10.9	2.6	13.5
63	11.2	2.5	13.7	10.7	2.5	13.2
64	11.6	2.5	14.0	10.8	2.5	13.3
65	11.7	2.5	14.3	11.0	2.5	13.6
66	12.1	2.5	14.6	11.1	2.5	13.6
67	11.6	2.3	13.9	10.9	2.0	12.9
68	11.7	2.4	14.1	11.1	2.4	13.6
69	12.1	2.5	14.6	11.2	2.6	13.8
70	13.0	2.5	15.5	11.5	2.5	14.0
71	14.2	2.6	16.8	11.9	2.6	14.4
72	13.3	2.6	15.9	11.6	2.6	14.3
73	12.3	2.4	14.7	11.7	2.7	14.4
74	12.5	2.5	15.0	11.9	3.0	15.0
75	14.7	2.7	17.4	13.1	3.2	16.3
76	15.8	2.8	18.6	13.5	3.3	16.7
77	16.2	3.0	19.2	14.0	3.5	17.5
78	15.5	2.8	18.4	13.7	3.3	17.0
79	14.9	2.8	17.7	13.8	3.3	17.1
80	14.5	2.3	16.8	14.2	2.9	17.1
81	14.9	2.2	17.1	13.8	2.8	16.5
82	16.7	2.6	19.3	14.7	3.2	17.9
83	16.7	2.8	19.5	15.3	3.6	18.9
84	18.2	2.8	21.0	15.6	3.5	19.0
85	18.9	3.0	21.9	16.2	3.7	19.9
86	19.8	3.2	23.0	16.5	3.9	20.4
87	20.4	3.2	23.6	16.9	3.9	20.8
88	19.8	3.0	22.8	16.5	3.7	20.2
89	21.4	2.4	23.9	16.7	3.0	19.7
90	21.5	2.5	24.1	17.1	3.1	20.2

Source: South African Reserve Bank National Accounts, 1946-1990

As the table demonstrates, the first of Beck's conclusions holds for South Africa. Nominal G/GDP ratios exceed their real counterparts in almost all cases during the period under study. Given Beck's proposed deflator, as expressed in Equation (1), the discrepancy between nominal and real ratios implies that the GDP deflator grew at a slower rate than Beck's deflator.

Beck's second result is rejected in the case of the South African data. Government consumption ratio in real terms has maintained its upward trend, and G_c consisting of more than 75% of 'G' has been the main contributor to the relative size of the State. Yet, as for substantially larger increases during the period, this trend can be seen from the comparison of the indices for G_t and G_c, using 1960 as the base year as shown below in Table 3.4.

Table 3.4: Indices of Government Expenditure in GDP 1960 - 1990

	N O M I N A L			REAL (1960 = 100)		
YEAR	G_c /GDP	G_t/GD P	G /GDP	G_c /GDP	G_t/GDP	G/GDP
1960	100.	100.0	100.0	100.0	100.0	100.0
61	102.	100.6	101.7	102.4	100.7	102.0
62	113.	101.2	110.6	111.0	100.0	108.7
63	114.	95.7	109.7	108.7	96.5	106.1
64	118.	95.0	112.7	109.3	95.3	106.3
65	120.	96.6	114.4	112.3	96.4	108.9
66	124.	93.4	116.8	112.9	93.5	108.8
67	118.	89.2	111.5	110.9	76.6	103.7
68	120.	90.6	113.3	113.2	92.3	108.8
69	123.	95.2	116.8	113.8	97.7	110.4
70	133.	94.6	124.5	116.9	95.6	112.4
71	145.	97.7	134.9	120.8	97.4	115.9
72	136.	97.3	127.5	118.0	100.9	114.4
73	125.	91.6	118.0	118.7	104.4	115.7
74	128.	96.2	120.7	121.4	115.3	120.1
75	150.	102.9	139.4	133.4	121.7	130.9
76	161.	106.9	149.3	136.8	124.3	134.2
77	165.	112.8	153.8	142.0	134.2	140.4
78	159.	108.6	147.6	139.0	126.3	136.3
79	152.	107.9	142.3	140.2	127.6	137.6
80	148.	87.2	134.5	144.1	111.2	137.2
81	152.	85.1	137.5	139.9	105.3	132.6
82	171.	99.6	155.2	149.8	120.8	143.6
83	171.	106.5	156.6	155.8	135.5	151.6
84	186.	105.4	168.6	158.2	132.9	152.8
85	193.	112.9	175.8	164.2	142.3	159.6
86	202.	120.2	184.4	168.0	148.3	163.8
87	208.	122.2	189.5	171.6	149.1	166.8
88	202.	114.7	182.9	168.0	141.4	162.4
89	219.	92.7	191.5	170.3	112.7	158.2
90	219.	97.1	193.0	173.8	118.4	162.1

Source: South African Reserve Bank National Accounts, 1946-1990

The index of the real G_t/GDP ratio increased from 100 in 1960 to 118.4 in 1990. Over the same period, the index of the real G_c/GDP ratio rose to 173.8 from the same base. To the extent that the growth rate of G_t/GDP was smaller than that of G_c/GDP, it contributed less to the rise of the real G/GDP index which rose from 100 in 1960 to 162.1 in 1990.

Not only did the G_c/GDP index exceed that of G_t/GDP, but the share of G_c in G also increased from an average of 80% in the early 1960s to 88% in the late 1980s (and 1990s). Given Equation (1), it follows that this rising share further reinforces the adverse relative price effect. The sum total of these two effects is reflected in the index of the real G/GDP ratio.

In contrast to the cases studied by Beck, the real G/GDP ratio in South Africa has risen mainly due to rising government consumption expenditure.

3.1.5. The Heller Hypothesis

The other alternative to the conventional government sector deflator has been expounded by Heller (1981). Analyzing it from the taxpayer's perspective, Heller argues that the appropriate deflator for government expenditure is the private consumption price index. This is justified on the ground that it is the tax payers who have to forego consumption so that 'G' can be financed.[7] Using such an opportunity cost deflator, Heller's results contrast sharply with Beck's. In this case, real shares are larger than the nominal shares,

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[7] *Note that Heller uses the same 'G' as Beck.*

and are also larger than the real shares derived by Beck.[8]

Applying the Heller's approach to the South African data, we derive the following results:

Table 3.5: Real and Nominal Ratio of Government Expenditure in GDP Using Heller's Approach, South Africa 1960-1990

YEAR	REAL $G_{/GDP}$	NOMINAL $G_{/GDP}$	GDP DEFLATOR	PRIVATE CONSUMPTION DEFLATOR
1960	12.5	12.5	100.0	100.0
61	12.7	12.7	101.6	101.5
62	13.6	13.8	102.2	103.5
63	13.8	13.7	106.2	105.4
64	14.1	14.0	108.4	108.0
65	14.2	14.3	112.4	112.6
66	14.6	14.6	117.3	117.2
67	11.9	13.9	123.9	144.1
68	14.4	14.1	127.7	125.4
69	14.9	14.6	134.8	131.4
70	15.7	15.5	140.2	138.7
71	16.8	16.8	148.1	148.5
72	16.5	15.9	164.5	158.6
73	16.8	14.7	196.8	172.7
74	18.0	15.0	231.7	193.2
75	20.5	17.4	255.0	215.7
76	21.6	18.6	278.8	239.7
77	22.8	19.2	306.5	257.7
78	21.4	18.4	341.0	293.0
79	21.0	17.7	391.9	331.3
80	21.4	16.8	490.2	384.6
81	21.2	17.1	548.7	443.3
82	23.5	19.3	616.0	508.0
83	24.8	19.5	719.4	571.0
84	26.5	21.0	796.0	631.7
85	27.6	21.9	914.1	725.2
86	28.4	23.0	1052.5	853.1
87	28.8	23.6	1199.9	983.6
88	28.1	22.8	1374.5	1114.2
89	29.0	23.9	1560.8	1283.5
90	29.3	24.1	1790.0	1468.0

Source: South African Reserve Bank National Accounts 1946-1990

[8] *Real G/GDP ratios in Table 3.5 should be compared with the last column in Table 3.3.*

As can be seen from a comparison of columns (1) and (2), in all but five cases the real G/GDP ratio exceeds its nominal counterpart, implying that Heller's hypothesis does hold in the case of South Africa. This implies that if the private consumption expenditure deflator is the correct price index from the tax payer's perspective, government expenditure in South Africa has benefited from favourable relative price effect. This is more clearly shown in the last two columns of Table 3.5. As the index of the GDP deflator has risen substantially more than that of the private consumption deflator, it implies a gradual change in the relative price of public and private goods in favour of public goods. This result differs markedly from that of Beck as stated earlier. Moreover, this divergence widens the further we move away from the base year.

The discrepancy between Beck's and Heller's results is not unique to the South African data. Their two approaches provide substantially divergent results in most cases. To cite but one example, for Heller (1981) the real share of government in Austria is 20,2% of GDP in 1977 while for the same year Beck (1985) arrives at a ratio of only 7,5% percent. (Beck, 1985) Such discrepancies are particularly noteworthy given that (1) the base year for both approaches was the same; and, (2) the same measure for 'G' was used in both studies.

The startling differences between Beck's and Heller's results underscore the significance of deflators in the measurement of the relative share of the public sector and its growth over time. Meanwhile, the notion of the 'real' share of the government sector remains indeterminable. What constitutes the realness of the relative size of the sector becomes functional to the

objective of the study under consideration, the measure of 'G' used, and the deflator applied.

Generally, discrepancies in nominal and real ratios (whatever measure of realness is used) may arise from the following sources:

a. a productivity gap between the public and private sectors;

b. the tendency for the government sector to buy goods and services from those industries that experience relatively low productivity;

c. the emphasis placed on indexation of public transfers (in most cases indexation is implicit in the calculation of budgetary procedures);[9]

d. as Heller (1981) points out, rigidities exist in the public sector production function that could limit the government's ability to respond to relative input price changes; and

e. the inability to accurately measure changes in public sector productivity.

In addition to the above factors, the definition of 'G' itself is one of the most important contributory factors to the divergent results in the empirical

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[9] *Indexation is commonly calculated on the basis of CPI, especially where transfers are concerned. CPI in turn does not necessarily follow the same trend as the GDP deflator or government expenditure deflator. Consequently this creates some divergence between the real and nominal ratios.*

literature. In the absence of a standard definition of 'G', each study chooses its own measure, depending largely on the availability of data.

To illustrate the impact of the definition of 'G', South African data has been used to compare three G/GDP ratios in Table 3.6 below:

TABLE 3.6: Government Expenditure - GDP Ratios - South Africa 1960 - 1990

Year	G_1	G_2	G_3
1960	8.6	14.1	41.8
1961	8.7	14.3	42.0
1962	8.7	15.5	41.2
1963	8.6	15.4	41.3
1964	8.6	15.7	43.1
1965	8.5	16.1	43.6
1966	9.0	16.6	45.8
1967	8.9	16.1	45.7
1968	9.2	16.5	45.5
1969	9.0	17.4	47.5
1970	9.3	18.3	48.3
1971	10.3	19.7	53.7
1972	10.0	18.8	51.5
1973	9.5	17.3	48.4
1974	9.1	17.6	48.0
1975	9.6	20.1	52.6
1976	10.2	22.0	58.7
1977	10.3	22.7	62.9
1978	10.3	22.3	59.6
1979	10.0	22.7	58.7
1980	9.3	21.0	55.2
1981	10.0	21.4	55.3
1982	10.9	25.0	61.5
1983	11.1	25.7	61.6
1984	12.4	27.8	61.3
1985	12.4	29.4	61.1
1986	12.7	30.2	61.0
1987	13.1	30.9	60.6
1988	12.5	29.7	60.2
1989	13.4	31.4	60.2
1990	13.7	31.1	59.9

SOURCE : South African Reserve Bank National Accounts, 1946-1990 and Own Calculations

The definitions used are as follows:

G1 : Government sector contribution to the GDP as a percentageof GDP.

G2 : Government expenditure (government consumption and government investment and transfers) as a ratio of GDP.

G3 : Government and government-owned corporations expenditure as a ratio of GDP.

As can be seen from the above table, different measures of 'G' have different trends over time. Moreover, given the substantial differences in the composition of these different measures of 'G', different deflators would be needed to calculate their 'real ratios'. This in turn would introduce its own sources of discrepancy.

The forgoing analysis has clear implications for empirical studies of not only the Wagner Hypothesis, but of any fiscal study using G/GDP ratios. Thus the theoretical and policy prescriptions of any such study needs to be evaluated in the light of the specific measure of the G/GDP ratio used.

In addition to the above statistical factors, any empirical testing of Wagner's Law has to deal with the question of 'speed of adjustment' within the government sector. There is no a priori reason why 'actual G' should be equal to 'desired G' (desired from the demand point of view). To the contrary, due to the well-known inefficiencies within this sector, it is likely that 'actual G' would differ substantially from 'desired G'. This in turn would complicate the result of any empirical testing of the Wagner's Hypothesis. To illustrate the point, we use a simple model and apply the South African data in the next section.

3.2 Income Elasticity of Public Expenditure: The Case of South Africa

Wagner's assertion that the voting population has an income elasticity with respect to public goods greater than that with respect to private goods has been criticized on two grounds:
(1) there is no a priori reason why the elasticities should be as predicted and, (2) the analysis fails to recognize that factors other than demand for public goods and services could influence the size and operation of the government sector. The self-interest of public servants, the influence of various interest groups, and the election victory of politicians are among these factors.

Econometric modeling of Public Choice theories and their empirical testing of Wagner's Law have come to conflicting conclusions. Borcherding's 1985 survey of the empirical literature, for instance, finds an income elasticity of 0.75 as a central tendency for state expenditure over time. Other studies (Henning and Tossing, 1974) show elasticities greater than one. All the studies, excluding Henning and Tussing, have regressed 'G' or $^{G}/_{Y}$ against national income (Y), e.g.:

$$G = a + bY + ... + Ut \quad .$$

This formulation has two implications: First, it is necessary to interpret the income elasticity of 'G', i.e. the value of coefficient 'b' in the logarithmic form of the above equation as merely the ratio $\frac{\Delta G\%}{\Delta Y\%}$. At this stage the analysis does not deal with the arguments over the direction of

causality between 'G' and 'Y'. (We will discuss the causality between 'G' and 'Y' in Chapter 4.) Second, and uncontroversially, as 'G' is by definition a component of 'Y', the statistical conditions for the use of the ordinary least squares (OLS) method of establishing the relation between 'Y' and 'G' are not satisfied. Thus the results of many of the published studies in this field, all of which have employed the OLS method - including Peltzman (1980)- are not reliable in rejecting or accepting Wagner's Law.

A proper testing of Wagner's hypothesis requires two qualifications. Firstly, it needs to ensure that the proper measure of 'G' is used. We see this measure as being government expenditure towards the provision of public goods and services.[10] Thus transfer payments to households and other redistributionist expenditures are excluded.

The second qualification is more critical. Most of the studies of state expenditure presuppose that the supply of public goods has always kept up with demand. This assumption is implied when 'G' is regressed against 'Y' and income elasticity is derived. In reality, however, whether the supply and demand for public goods are equal depends primarily on the speed with which the state adjusts its provision of goods and services. Should the 'coefficient of state responsiveness' be less than one, there would emerge a wedge between the 'actual' and the 'desired' levels of public goods. This distinction needs to be incorporated in any model analyzing state expenditure.

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[10] *This is equivalent to G_2 in Table 3.6, minus transfers.*

In the light of the above, a model for the estimation of income elasticity of state expenditure is discussed and its application to the South African data is tested.

3.2.1. A Model of National Income and State Expenditure

As mentioned earlier, any attempt to establish the relation between 'Y' and 'G' is bound to regress 'G' partly on itself. One way to avoid this is the method of indirect least squares. That is, if Y = C + I + G + (X-M), instead of regressing 'G' against 'Y', it could be fitted to private expenditures, i.e. 'Y' - G (where Y - G = A). This enables one to directly estimate the private expenditure elasticity (η_a) of 'G' and from this the total expenditure (income) elasticity (η_y) of 'G'. The relationship between the two elasticities is derived below:

The general macroeconomic identity, Y ≡ C + I + G + X-M, could be rewritten in the following forms:

(1) $Y = A + G$

where $A = C + I + X - M.$

Assuming that 'G' is some linear function of 'A', we can write:

(2) $G = f(A)$

$= \alpha_0 + \alpha_1 A$

Thus the elasticity of 'G' with respect to 'A' would be

$$(3) \qquad \eta_{G/A} = \eta_a = \frac{\partial G}{\partial A} \cdot \frac{A}{G}$$

$$= \alpha_1 \cdot \frac{A}{G}$$

From (2) we have:

$$(4) \qquad A = \frac{G - \alpha_0}{\alpha_1}$$

$$= \frac{G}{\alpha_1} - \frac{\alpha_0}{\alpha_1}$$

Substituting (4) into (1) we get

$$(5) \qquad Y = \frac{G}{\alpha_1} - \frac{\alpha_1}{\alpha_1} + G$$

$$= \frac{(1 + \alpha_1)G}{\alpha_1} - \frac{\alpha_0}{\alpha_1}$$

Rewriting (5) for 'G' we have:

$$(6) \qquad G = \frac{\alpha_1}{1 + \alpha_1} Y + \frac{\alpha_0}{1 + \alpha_1}$$

Thus the elasticity of 'G' with respect to 'Y' would be:

$$(7) \qquad \eta_{G/Y} \equiv \eta_Y = \frac{\partial G}{\partial Y} \cdot \frac{Y}{G} = \frac{\alpha_1}{1 + \alpha_1} \cdot \frac{Y}{G}$$

Replacing 'Y' by its equivalent A + G from (1), Equation (7) would become:

$$(8) \qquad \eta_y = \frac{\alpha_1}{1 + \alpha_1} \left(\frac{G + A}{G} \right)$$

$$= \frac{\alpha_1}{1 + \alpha_1} \left(1 + \frac{A}{G} \right)$$

$$= \frac{\alpha_1 + \alpha_1 \left(\frac{A}{G} \right)}{1 + \alpha_1}$$

$$= \frac{1 + \alpha_1 + \alpha_1 \left(\frac{A}{G} \right) - 1}{1 + \alpha_1}$$

$$= 1 + \frac{\alpha_1 \left(\frac{A}{G} \right) - 1}{1 + \alpha_1}$$

Deriving α_1 from (3); $\alpha_1 = \eta_a \left(\frac{G}{A} \right)$, and substituting in (8) we get:

$$(9) \qquad \eta_y = 1 + \frac{\eta_a - 1}{(G/A)\eta_a + 1}$$

which establishes the relationship between η_y and η_a, suggesting that the latter is as usable as the former in the analysis of the growth of state expenditure.

In equation (9), G/A is the ratio of state to private spending. As η_a and η_y are definitionally related, η_a is as important a tool of analysis as η_y, although conventionally the latter has been the focus of studies. To estimate these elasticities, the following model is defined:

$$(10) \qquad G_t^e = a\, Y_t^b\, Z_t^d\, Ut$$

which states that the desired (or the equilibrium) level of 'G' is dependent on 'Y' and the level of urbanization, Z_t. For Wagner's Law to be true, 'b' would have to be larger than unity. This latter variable is particularly important in the context of developing economies. Urbanization, as a ubiquitous phenomenon in the developing world, creates huge demands for expensive public goods and services in the form of physical and social infrastructure. For developed countries, where urbanization has more or less stabilized, this variable would have little explanatory value. Annual increase or decrease of 'G' is, on the other hand, determined as:

$$(11) \qquad \frac{G_t}{G_{t-1}} = \left(\frac{G_t^e}{G_{t-1}}\right)^k$$

which implies that the actual change in 'G' between period t and t-1 depends on: G_t^e / G_{t-1}, the wedge between the (current) desired level of 'G' and the immediate past level of actual non-military 'G'.[11]

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[11] *Military expenditure has been excluded on the assumption that actual and desired military expenditures are identical.*

Taking the log-linear forms of Equations (10) and (11), Equations (10.1) and (11.1) are derived:

$$(10.1) \qquad g_t^e = a + by_t + d.z_t + u_t$$

$$(11.1) \qquad g_t - g_{t-1} = k\left(g_t^e - g_{t-1}\right)$$

where:

g_t = real non-defence state expenditure per capita,[12] in period t; (g_t is the logarithm of G_t, the same is true of all abbreviations). G_t is the sum of non-defense central government consumption expenditures. The main source of data on G_t is the government budget.

g_t^e = desired (or equilibrium) level of 'G' in period t;

y_t = real GDP minus 'G' per capita, in period t; (the GDP deflator is used to derive the real GDP) Y_t is derived from national accounts data and 'G' above.

z_t = ratio of urban population to total population.

u_t = random error term

a, b, d and k are the parameters to be estimated. The hypothesized value of

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[12] *National population data for South Africa are made available every five years. Extrapolation and interpolation methods are used to construct the time series for population.*

k is k = 1.

Substituting (10.1) in (11.1) gives us a testable version of the model below:

(12) $$g_t = ak + bky_t + dkz_t + (1-k)\, g_{t-1} + ku_t$$

In the model 'bk' is the short-run private expenditure elasticity of 'G' while 'b' is its counterpart in the long-run. To test the model Equation (12) requires a transformation, of the Hildreth-Lu type, to take account of the probable autocorrelation in the error term u_t. To measure the coefficient of autocorrelation, Equation (13) can be used:

(13) $$u_t = \alpha u_{t-1} + e_t$$

where α is the autocorrelation coefficient and e_t is the random error term with standard characteristics. After the transformation of (12), the following equation lends itself to empirical testing with no a priori expected autocorrelation in the residual:

(14)

$$g_t - \alpha g_{t-1} = ak(1-\alpha) + bk(y_t - \alpha y_{t-1}) + d(\Delta z_t - \alpha \Delta z_{t-1}) + (1-k)(g_{t-1} - \alpha g_{t-2}) + e_t$$

Applying the OLS method, we tested the model using the South African data for the period 1960-90. The testable form of the model, as stated in Equation (14), involves large degrees of multicollinearity between Y_t, Δz_t and g_{t-1}, something which is not unusual when time series data are used. As such, the size of the estimated parameters would not be necessarily accurate, and their reliability (as measured against the value of t-student) could not be measured. To improve the stability of the estimated coefficients, their

Ridge estimates are provided in Table 3.7.[13]

For the entire period, i.e. 1960-90, income elasticity η_y as stated in column (9) is 1,076. Note that η_y^L is derived by using estimates in columns (2) and (4), both of which are estimates with t-stats larger than 2. The calculations are done in terms of Equation (9). Overall, the estimates are consistent with Wagner's Law for the South African economy during the period.

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[13] *Note that the Ridge estimator will introduce bias into the estimate but reduce the variance of the estimates. That is:*

Mean Square Error = (Bias)^2 + Variance of Ridge estimator of β

will for certain values of (Ridge) K be less than the ordinary least squares estimate of β. For a discussion of the Ridge estimates, see Vinad, H.D. (1978).

TABLE 3.7 : Income Elasticity of Demand for Non-Defence State Expenditure in South Africa 1960-1990

	$ak +$	$bky_t +$	$dkz_t +$	$(1-k)g_{t-1}$	K	η_a^S	η_a^L	η_y^S	η_y^L	R^2
Period	Constant Term	Private National Income Variable	Urban-ization Variable	Lagged Dependent Variable	Speed of Adjust-ment	Short-Run Private-Expend. Elasticity	Long-Run Private-Expend. Elasticity	Short-Run Income Elasticity	Long-Run Income Elasticity	Measure of fitness of multiple regression
	1	2	3	4	5	6	7	8	9	10
1960-1990	0,057	0,812*	0,451*	0,325*	0,675	0,812	1,202	0,911	1,076	0,83

(i) The variables with (*) had t-stats values larger than 2 when estimated with the help of the OLS method (after transformation).

(ii) Columns (9) and (10) are calculated by using Expression (1) in the text (G/A for the 1978-82 is 1,36).

(iii) Superscript (S) and (L) refer to 'Short-run' and 'Long-run', respectively.

(iv) Note that 'y-g' is used for y.

(v) To calculate columns (9) and (10), G/A is taken to be equal to the average for the 1978-82 period.

As illustrated in the table, the speed of adjustment k (0<k<1) for the entire period is 0.675, indicating the speed with which the state is approaching the desired level of public goods and services. This implies an accumulated divergence between G^{e} and 'G' over time. This has clear ramifications for the conventional empirical testing of the Wagner Hypothesis. This is particularly important in cases where the data do not support the hypothesis. Then a case of 'observational equivalence' will arise; in such cases either the underlying demand for public sector output does not conform to the hypothesis, or the low speed of responsiveness on the part of government explains the results.

The speed of responsiveness itself may fluctuate over time. Henning and Tussing (1974) document this for the US economy. Using a similar model, they apply the US data to the periods 1900-1971 and 1929-1971. They estimate k = 0.516 for 1900 - 1971 and k = 0.306 for 1929 - 1971. Henning and Tussing (1974) suggest one reason for such changes:

> government expenditure responses have been slowing down as government becomes larger not only absolutely but also relative to GNP. The expansion of government responsibilities and the growth of bureaucracies may have contributed to this observed increasing inflexibility. (p. 335)

The change can be explained another way: 'k' is a function of the wedge between G_t and G_t^e, and as such is not constant. Thus the State might respond rapidly to small gaps between G_t and G_t^e but be unable to respond to the larger gaps with the same speed.

3.3 Conclusion

This chapter has discussed the link between economic growth and the relative expansion of the public sector. Fundamental to this analysis is the direction of causality between economic growth and the government sector. While the question of causality, per se, will be discussed in Chapter 4, we examined Wagner's Hypothesis, which presupposes that causality runs from economic growth to the expansion of the public sector and demonstrated that a correct expression of the hypothesis is either: (i) $G/Y = f(Y/N)$; or (ii) $G/N = f(Y/N)$.

Theoretically, the hypothesis has no a priori justification; and its validity rests mainly on empirical support. In this regard, the economic literature has a wealth of case studies, but they show mixed results.

The inconclusive outcome of empirical research in this field, we argued, is caused by a number of factors, the most important of which are:

1. *Ambiguity in the definition of the hypothesis.* It was argued that lack of clarity of definition has lead to various measures being used in different studies. Their results have differed accordingly.

2. *The lack of a generally accepted measure of government.* In this respect, equally important is the absence of a proper price deflator. It was argued that the calculation of a suitable price index for the government sector is complicated by factors such as (a) the inability to accurately measure productivity changes, and (b) the rigidities in the

public sector production function that limit responses to relative price changes. In the absence of a commonly accepted government sector deflator, different approaches have been suggested by Beck and Heller, among others. The divergence between their results, however, underlines the significance of a suitable price index for government.

In addition to the above factors, any empirical test of Wagner's Law has to take account of 'the speed of adjustment' within the government sector, i.e. the speed with which government responds to variations in demand for public output. In other words 'actual G' many not necessarily correspond to the 'desired G'. To demonstrate the implications of this factor we introduced a simple model of specifying Wagner's Law for a country like South Africa. Using the South African data for the period 1960-90, we estimated a speed of adjustment coefficient of $k = 0.675$, with a hypothesized value of $k = 1$. The regression results support the Law. The estimated $K < 1$ further reinforces this conclusion.

In general, however, in cases where $K<1$ and the empirical testing does not support the Law, the acceptance or rejection of the Law is rendered doubtful due to the impact of the speed of adjustment. Moreover, in light of the aforementioned definitional and measurement ambiguities, as well as the effect of governments speed of responsiveness, the results of empirical testings of the Wagner Hypothesis should be treated with due circumspection.

CHAPTER 4

PUBLIC EXPENDITURE EXTERNALITIES AND ECONOMIC GROWTH

A particularly contentious issue in the analysis of the economic growth process has been the role of government. In contrast to our analysis in Chapter 3, government output may be hypothesized as exogenous, and hence potentially capable of spurring economic growth. This line of argument is analyzed in the present Chapter, which is organized as follows: section 4.1 describes sources of public sector positive externalities; section 4.2 discusses an analytical model based on factor productivity differential; section 4.3 tests this model empirically using Summers - Heston's data set; section 4.4 examines the direction of causality between 'G' and 'Y'; section 4.5 critically evaluates our empirical test in the context of the existing literature; Section 4.6 discusses the link between government externalities and economic development in light of a theoretical and empirical analysis; and section 4.7 concludes by exploring the analytical and policy implications of our analysis.

4.1 **Positive Externalities of Public Expenditure**

As discussed in Chapter 1, public undertaking is justified provided the activity concerned embodies sufficient positive externalities. Such externalities in turn may be sub-divided into two categories: (1)complementary externality; and (2)supplementary externality. These two categories will be discussed next.

Complementary externalities exist mostly where some government output enters the production function together with private factors of production. Much of public sector output traditionally belongs to this category, i.e. the provision of infrastructure such as roads and communications networks. Clearly, private inputs in the national production function are not close substitutes for such public inputs. In addition to the provision of physical infrastructure, expenditure on human development (i.e. education,training, primary health, preventative hygiene and environmental measures) embodies similar externalities. This is particularly significant in the case of less developed economies in which public expenditure on such outlays generates the bulk of infrastructure provision. As economic development occurs and the organizational potential of the society expands, the importance of public provision of certain public inputs diminishes accordingly. For example, private provision of education is far more common in developed than in underdeveloped economies. The same is true for transportation systems. In fact, one of the distinguishing features of the more successful of the less developed economies is the degree to which they have invested in infrastructures that tend to enhance private sector productivity. In a recent survey, Easterly (1992) of the World Bank concludes:

> The lack of such transportation investment is said to have severely hampered development in countries like Myanmar (formerly known as Burma). Similarly, the lack of sufficient public infrastructure in Nigeria has lowered private capital productivity, because firms are forced to invest in their own inefficient electrical generators and water treatment plants. (p. 12)

The policy implications of these observations, Easterly asserts, are that "Governments can ... play a positive role by themselves investing in capital that is unlikely to be provided by the private sector in a market economy, such as legal systems, basic health and education, roads, water supply, and electrical distribution systems. Such investments raise the productivity of private capital and thus increase the incentive for private investors." (p. 12)

Supplementary externalities occur wherever an activity affects production without entering the production function per se. For the private sector a case in point is the economies of agglomeration. As for government activities, the maintenance of law and order (property rights enforcement), the nature of economic policy, and in general the efficacy of government in generating a socio-political environment conducive to productive undertakings, are common sources of supplementary externalities.

Given the qualitative nature of supplementary externalities, their direct quantitative measurement is virtually impossible. Furthermore such externalities emanate from a wide variety of government undertakings to a lesser or greater degree. In two areas of government undertakings, however, supplementary externalities are most prevalent. These are: (1) expenditure on maintaining an efficient and neutral legal system; and (2)efficient economic policy formulation. Each is discussed in turn.

1. A sound judicial system is indispensable for the efficiency of the private sector. The maintenance of proprietorship is the primary foundation of an

efficient incentive structure. An essential concomitant is the existence of honest law enforcement agencies and speedy and affordable court administration.

Closely related to the efficiency of the overall incentive structure is political and bureaucratic accountability. This requires monitoring the performance of bureaucrats and an effective system to correct abuses and inefficiencies. There is an inverse relationship between the level of economic development and the prevalence of bureaucratic abuses and inefficiencies. Eradicating such inefficiencies pays a high social dividend. An objective, efficient and reliable judicial system is a prerequisite for effective political and bureaucratic accountability.

2. The role of economic policy in the process of growth and development is central. At one level, economic policy determines capital productivity (other things being equal)and hence it influences not only the level of growth, but whether growth takes place in the first place. More generally, however, inefficient policies - such as price controls, interest rate ceilings, trade quotas, and sectorally differentiated tax policies - influence not only short term growth but also the long term growth capacity of the economy. The evidence that inefficient policies have permanent effects on growth is substantial. By implication, efficient policies have lasting positive influence on growth.

Supplementary externalities may then be summarized in the presence of a sound judicial system and an efficient set of economic policies. Broadly speaking,

the distinction between complementary and supplementary externalities may be associated with the 'intermediate' as opposed to the 'final' nature of public output. When the public sector produces intermediate goods, i.e. roads, power supply, and research and development services, its output embodies externalities that complement other factors (inputs) in the aggregate production process. However, when public output is a final product its externalities may be termed supplementary insofar as they tend to influence total output (hence welfare) over and above the production process.

Whilst analytically helpful, the distinction between complementary and supplementary externalities is often of little use in empirical work due mainly to their co-existence in most public undertakings.

The presence of complementary and supplementary externalities imparts characteristics into public production (expenditure) that enable us to treat it as a factor of production in an aggregated national production function. In the following section we will discuss one such treatment of government output.

4.2 A Factor Productivity Differential Model

In light of the foregoing discussion, in a number of recent studies on growth and fiscal analysis, government expenditure -or a variant thereof - enters the national production function as an input. Barro (1990), for example, argues:

> I consider initially the role of public services as an input to private production. It is this productive role that creates a potentially positive linkage between government and growth.... The general idea of including 'g' as a separate argument of the production function is that private inputs ... are not a close substitute for public inputs. (pp. S106 & S107)

Barro uses a simple aggregate production function as follows:

$$y = \phi (k,g)$$

where,

g = the quantity of public services provided to each household-producer.

k = representative producer's quantity of capital, which would correspond to the per capita amount of aggregate capital.

Note that the inclusion of 'g' in the production function does not mean that government has any 'own-production'. Barro (1990) is, in fact, explicit in this regard: "conceptually, it is satisfactory to think of the government as doing no production and owning no capital. Then the government just buys a flow of output (including services of highways, sewers, battleships, etc.) from the private sector." (p. S107) Furthermore, Barro's model "...abstracts from externalities associated with the use of public services." (p. S106) This is a major departure from the common and objective presumption that much of government undertakings are done due to the existence of externalities. In other words, if such externalities did not exist, in most cases the government would not get involved in the first place. However, in Barro's conceptualization, the government taxes incomes and provides services so as

to maximize the utility of the representative household. Alternatively the government may be assumed to be run by an agent who seeks to maximize its own utility.

A more objective modeling of the role of government in the growth process has to take account of the fact that governments worldwide participate in the production of national output both directly and indirectly. In so doing they share the stock of capital and labour with the private sector. Within this framework, and in line with Ram (1986), consider the economy where growth is related to changes in capital and labour through an underlying production function. The economy consists of two sectors, private and governmental. The stock of capital and labour is divided between the two and no joint operations exist. Furthermore, the output of the private sector depends on the productive government output. This formulation incorporates the externality effect of productive public good that would not have been provided by the private sector. Thus we have:

$$(1) \quad Y = G + N$$

$$(2) \quad G = G(K_g, L_g)$$

$$(3) \quad N = N(K_n, L_n, G)$$

where: Y: Total output (i.e. GDP)

G: output of the government sector

N: output of the private sector

K_g, K_n: respective sector capital stocks

L_g, L_n: respective sector labour forces.

Factor productivities in the two sectors differ. Suppose this productivity

difference is δ and is the same for all factors:

$$(4) \qquad G_l/N_l = G_k/N_k = 1 + \delta$$

where the subscripts denote partial derivatives. Note that in the absence of externalities, given a set of prices, δ=0 would indicate an allocation of resources which maximizes national output.

A total differentiation of equations (1), (2) and (3) provides:

$$(5) \quad dY = dG + dN$$

$$(6) \quad dG = G_k.dk_g + G_l.dL_g$$

$$(7) \quad dN = N_k.dK_n + N_l.dL_n + n_g.dG$$

Substitute (6) and (7) in (5) and replace 'G_k' & 'G_l' by their equivalent $(1+\delta)N_k$ and $(1+\delta)N_l$ respectively;

$$(7') \quad dY = (1+\delta)N_k.dKg + (1+\delta)N_l.dLg + N_k.dKn + N_l.dLn + N_g.dG$$
$$= N_k(dKg + dKn) + N_l(dLg + dLn) + \delta(N_k.dkg + N_l.dLg) + N_g.dG$$

As $dK = dK_g + dK_n$ and $dL = dL_g + dL_n$ and given $N_k = \frac{G_k}{1+\delta}$,

$N_l = \frac{G_l}{1+\delta}$, substitute these in (7') we have:

$$(7'') \quad dY = N_k.dK + N_l.dL + \delta\left[\frac{1}{1+\delta}\left(G_k.dK_g + G_l.dL_g\right)\right] + Ng.dG$$

$$= N_k.d_k + N_l.dL + \left[\frac{\delta}{1+\delta} + N_g\right]dG$$

Divide (7") by 'Y', to get:

$$(7''') \quad \hat{Y} = \alpha\left(\frac{d\,k}{Y}\right) + \frac{N_{\_}.L}{Y}\hat{L} + \left[\frac{\delta}{1+\delta} + N_g\right]\frac{dG}{Y}$$

$$= \alpha\left(\frac{I}{Y}\right) + \beta\hat{L} + \left[\frac{\delta}{1+\delta} - N_g\left(\frac{G}{N}\right)\right]\frac{dG}{G}\left(\frac{G}{Y}\right) + \frac{dG}{Y}N_g + N_g\left(\frac{G}{N}\right)\left(\frac{dG}{Y}\right)$$

Re-arrange the second last and the last arguments as follows:

$$(7''') \quad \hat{Y} = \ldots\ldots + (dG/Y)Ng + Ng(G/N)(dG/Y)$$

$$= \ldots\ldots + (dG/Y)(G/G)Ng + Ng(G/N)(dG/Y)(G/G)$$

$$= \ldots\ldots + Ng.\hat{G}.\ G/Y + Ng(G/N)(G/Y).\hat{G}$$

$$= \ldots\ldots + Ng.\hat{G}.(G/Y)\left(\frac{N}{N}\right) + Ng(G/N)(G/Y).\hat{G}$$

as $N/Y + G/Y = 1$, then;

$$= \ldots\ldots + Ng(G/N)\hat{G}$$

Let $N_g\left(\frac{G}{N}\right) \equiv \theta$, we then have:

$$(8) \quad \hat{Y} = \alpha(I/Y) + \beta.(\hat{L}) + [(\delta/1+\delta) - \theta]\hat{G}\ (G/y) + \theta.\hat{G}$$

where: $\alpha \equiv N_k = dN/dK$ <==> MPK_n

$\beta \equiv N_l(L/Y)$: (semi-)elasticity of private output w.r.t. 'L'

$\theta \equiv N_g(G/N) = (dN/d\mathbf{G})(G/N)$: elasticity of private output w.r.t.'G'

$I \equiv dK = dK_g + dK_n$: Investment

$\hat{\mathbf{Y}}$, $\hat{\mathbf{L}}$, $\hat{\mathbf{G}}$ ≡ Growth rate of respective variables. Equation (8) could be tested econometrically, provided 'θ' is assumed to be constant over the period under study. This would provide estimates for 'δ' and 'θ'. Thus we would establish:

1. the factor productivity differential, i.e. δ between the private and government sectors. This would enable us to examine the hypothesis that such differential is positive.

2. estimate the marginal externality impact of the government output on the private sector growth,

3. determine whether the growth of government hurts economic growth.

In addition to the time series testing, Equation (8) could also be subjected to cross-section analysis to establish whether or not the effect of government output changes as the economy advances from an underdeveloped to a developed condition. It is hypothesized that the less developed the economy, the more substantial the role of government externality for the growth process.

To examine the validity of the hypothesis, we compare the magnitude of $[(\delta/1 + \delta)-\theta]$ across countries. This coefficient in effect quantifies the size-externality of the government sector. Furthermore, our estimates of 'θ' will shed light on the contribution the growth of government makes to the growth process; eg. the hypothesis that the expansion of government is detrimental to economic growth could be tested.

4.3 Data and Empirical Testing

4.3.1 *General Observations*

Given the cross-country nature of our econometric analysis, international comparability of the data is clearly significant. Summers and Heston (1984) provide such data for 115 countries covering macroeconomic aggregates such as output, investment, population, and government services (government consumption) for the period 1960 to 1980. For a number of countries, the data set contains statistics for the 1950-1960 period as well. For the analyses that follow we have used the 1960-1980 data set.

4.3.2 Variables and Empirical Testing

For an econometric analysis of Equation (8), the following variables and proxies, from Summers & Heston (1984), are used:

$\hat{Y}$: rate of increase of real GDP at 1975 international prices is used as a measure of economic growth.

I: National investment. The data set contains information on percentage of real GDP devoted to gross domestic investment. This is a good enough proxy for our purposes.

Y: Real GDP at current international prices.[1]

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1 *This is the real GDP of each country expressed in U.S. dollar terms of each year.*

G: In terms of the theoretical model, 'G' is expenditure on the production of goods and services by the public sector. The data set provides estimates on percentage of real GDP devoted to government. As a proxy, these are satisfactory, although they leave much room for intra-country institutional variations, and hence inconsistencies.

$\hat{L}$: the rate of increase in labour input has been proxied by the rate of change in population. It is commonly known that internationally comparable data on labour are not available, especially in the case of the LDCs. Thus population statistics offer the next best estimates of variations in the labour force.

For the purpose of cross-section estimates for the entire sample, mean values of the above variables are calculated for the entire 1960-1980 period, as well as for the two decades and for the five-yearly intervals over the period. These mean values are then used to generate regression results that are summarized in Table 4.1[2].

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[2] *Regressions are done with the help of econometric programme TSP (version 7).*

TABLE 4.1 : Estimates of Equation (8) for the 1960-1980 Period for the Complete Sample[a] (N=115)(t-stat in brackets)

Period	α	β	$[(\delta/1+\delta)-\theta]$	θ	$\bar{R}^2$ (F)[b]
1960-1980	0.058	-0.650	-6.529	0.129	0.12
	(2.16)	*(-3.01)*	*(-1.78)*	*(1.32)*	*(3.65)*
1960-1970	0.034	-0.829	-6.176	0.057	0.16
	(1.92)	*(-3.89)*	*(-2.03)*	*(0.82)*	*(5.41)*
1970-1980	0.068	-0.460	-0.807	0.099	0.06
	(2.11)	*(-1.58)*	*(-0.24)*	*(0.85)*	*(1.61)*
1960-1965	0.013	-0.457	-4.853	0.047	0.06
	(0.98)	*(-1.52)*	*(-1.92)*	*(0.82)*	*(1.74)*
1966-1970	0.060	-1.02	-4.837	-0.038	0.21
	(2.27)	*(-3.96)*	*(-1.31)*	*(-0.36)*	*(7.57)*
1971-1975	0.280	-0.720	0.388	0.096	0.23
	(5.52)	*(-1.87)*	*(0.16)*	*(0.93)*	*(8.18)*
1976-1980	0.033	-0.557	-4.863	0.052	0.07
	(1.45)	*(-1.71)*	*(-0.906)*	*(0.353)*	*(2.11)*

(a) All regressions were done with a constant term, but its estimates are not included.

(b) The brackets under $\bar{R}^2$s contain the regression F-statistics.

A number of observations may be made from the data. First, neither for the entire period nor for any sub-periods is the fitness of regression significant: R^2s range from 0.06 to 0.23. Second, the statistical significance of individual coefficients, as indicated by their associated t-statistics, is generally poor. One exception is that of αs which is mostly significant. This underlines the importance of investment, above all else, for economic growth. In none of the cases reported is 'θ' statistically significant. With the exception of one period (1966-1970) the coefficients have the expected (positive) sign. Third, in all cases considered 'β' has a negative sign - something which is unexpected. In light

of the low values of t-stats for βs, we cannot attach any reliable interpretation on the sign of the coefficients in any case. Theoretically, changes in the labour force are expected to correlate positively with output changes. In most cases in Table 4.1, this does not hold.

From this analysis we may conclude that the cross-section testing of the model for the entire sample (N=115) of Summers-Heston data does not provide reliable estimates to establish either the nature of factor productivity differentials between the government and the private sectors or the effect of government externalities. In line with Ram (1986) we have further examined the data for three sub-sets of the data to establish if the division into developed, developing and underdeveloped countries has any impact on the empirical results. To this end, guided by the World Bank classification of countries, the data set is divided into three segments:

1. Developed countries consisting of 31 countries with the highest per capita income;
2. Undeveloped countries consisting of the 40 poorest countries based on their relative per capita income; and
3. Developing countries being a total of 44 countries bracketed by the developed and undeveloped ones.

Using the aforementioned time intervals, Equation (8) is tested for the above three groups of countries. The results are summarized in Table 4.2, 4.3 and 4.4.

TABLE 4.2: Estimates of Equation (8) for the 1960-1980 Period for Developed Countries[a] (N=31)(t-STAT in Brackets)

PERIOD	α	β	$[(\delta/1+\delta)-\theta]$	θ	R^2 (F)[b]
1960-1980	0.654	-0.507	4.59	0.322	0.33
	(2.35)	*(-1.24)*	*(0.90)*	*(2.31)*	*(3.18)*
1960-1970	0.432	-0.786	34.814	0.122	0.28
	(2.11)	*(-1.552)*	*(0.503)*	*(0.58)*	*(2.54)*
1970-1980	0.438	-0.058	4.342	0.066	0.39
	(2.57)	*(-0.095)*	*(1.22)*	*(0.235)*	*(4.11)*
1960-1965	0.294	-0.143	72.073	-0.080	0.32
	(2.32)	*(-0.34)*	*(0.97)*	*(-0.39)*	*(3.06)*
1966-1970	0.138	-1.620	174.51	-0.890	0.40
	(0.78)	*(-2.58)*	*(2.23)*	*(-2.35)*	*(4.26)*
1971-1975	0.620	-1.356	-0.301	-0.031	0.75
	(8.58)	*(-2.16)*	*(-0.17)*	*(-0.15)*	*(19.70)*
1976-1980	0.128	-0.117	78.656	-0.290	0.19
	(0.93)	*(-0.19)*	*(1.12)*	*(-0.68)*	*(1.57)*

(a) & (b): See notes to Table 4.1.

TABLE 4.3: Estimates of Equation (8) for the 1960-1980 Period for Developing Countries[a] (N=44) (t-stats in Brackets)

PERIOD	α	β	$[(\delta/1+\delta)-\theta]$	θ	R^2 (F)[b]
1960-1980	0.016	-0.328	-51.52	0.508	0.33
	(0.35)	*(-0.86)*	*(-3.93)*	*(3.49)*	*(5.10)*
1960-1970	0.147	-0.917	-14.27	0.104	0.46
	(4.52)	*(-3.63)*	*(-1.53)*	*(0.70)*	*(8.77)*
1970-1980	0.027	0.494	-28.901	0.263	0.13
	(0.83)	*(1.03)*	*(-1.52)*	*(1.01)*	*(1.53)*
1960-1965	0.145	-0.386	0.893	-0.226	0.25
	(2.71)	*(-0.96)*	*(0.16)*	*(-1.42)*	*(3.44)*
1966-1970	0.084	-1.278	-12.101	0.162	0.47
	(2.36)	*(-3.63)*	*(-1.12)*	*(0.87)*	*(8.96)*
1971-1975	0.195	0.279	-35.179	0.343	0.21
	(2.56)	*(0.43)*	*(-1.67)*	*(1.38)*	*(2.77)*
1976-1980	-0.004	0.082	0.016	-0.261	0.11
	(-0.14)	*(0.10)*	*(0.001)*	*(-0.75)*	*(1.21)*

(a) & (b): See notes to Table 4.1.

TABLE 4.4: Estimates of Equation (8) for the 1960-1980 Period for Underdeveloped Countries[a] (N=41)(t-Stats in Brackets)

PERIOD	α	β	$[(\delta/1+\delta)-\theta]$	θ	$\bar{R}^2$ (F)[b]
1960-1980	0.117	1.229	2.672	-0.253	0.32
	(3.85)	*(1.66)*	*(0.41)*	*(-1.00)*	*(4.03)*
1960-1970	0.034	0.149	2.85	-0.23	0.19
	(1.96)	*(0.24)*	*(0.72)*	*(-1.63)*	*(2.14)*
1970-1980	0.218	0.594	11.854	-0.473	0.32
	(2.59)	*(0.52)*	*(1.6)*	*(-1.63)*	*(2.39)*
1966-1970	-0.082	-0.742	3.489	-0.263	0.09
	(-1.39)	*(-0.78)*	*(0.55)*	*(-1.06)*	*(0.95)*
1971-1975	0.178	0.614	12.830	-0.314	0.33
	(2.80)	*(0.53)*	*(2.36)*	*(-1.43)*	*(4.34)*
1976-1980	0.185	-0.35	5.719	-0.301	0.20
	(2.24)	*(-0.22)*	*(0.56)*	*(-0.82)*	*(2.17)*

(a) & (b): See notes to Table 4.1.

While slight general improvements in R^2s and 't-statistics' are evident, our previous comments on the results of cross-section regression for the entire sample apply equally well in the case of these three sub-divisions. That is, the fitness of regression is generally poor, and the t-stats for all but αs remain, by and large, unacceptably low. The fact that in over 70% of cases, αs have the correct and statistically significant values points to the importance of investment for economic growth. Investment in turn is influenced to a great extent by economic policy. As such the supplementary externalities of the government sector inclusive *inter alia* of economic policy is a major contributor in the process of economic growth.

The regression results seem to be insensitive to the partition of countries

into developed, developing and underdeveloped categories. Thus, whether divided in terms of the level of development or 5-yearly time periods, the cross-section empirical testing does not provide any support for testing the hypothesis of the model.

Such cross-section analysis imply strong parametric restrictions across very diverse countries. Note that the data set used in the analysis consists of observations 'at point in time', each of which belongs to a different country. Each country-specific time series in turn has its own distribution structure with its associated disturbance term. The use of cross-section regression presumes that all the countries under study share the same economic structure, and hence their data series have a common distribution pattern. This is clearly not the case. Consequently the analysis violates the assumption of homoscedasticity (equal variance) of OLS; i.e. we have heteroscedasticity. Therefore, at best their results are not more than broad indications.[3] As such it is useful to subject the model to a time-series empirical testing too. On the assumption of a first-order autoregressive disturbance, regressions are done with ordinary least squares as well as (AR1). The latter estimates are reported in cases where the autoregressive parameter is statistically significant; i.e. t-stat > 2.

The time series results may be summarized as follows: in 109 out of 115 cases

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[3] *For further problems with the empirical testing of this particular model, see next section.*

under study, the coefficient of $\hat{G}$ had a negative sign. In 91.7% of such cases, the t-stats were significant. Only one out of the six positive coefficients had a statistically significant t-value. The results thus clearly support the view that the growth of government has negative impact on economic growth.

As for the impact of government size externality on economic performance, as approximated by the coefficient of $\hat{G}(G/Y)$, in 108 of the 115 cases the coefficient is positive. Only seven cases of negative coefficients were recorded. Furthermore none of the negative coefficients were statistically significant, whereas 90.7% of the positive coefficients were statistically significant. Moreover, in the majority of cases, Durbin-Watson indexes were within acceptable range, ruling out the case of strong autocorrelation. With the exception of very few cases, R^2s were relatively high (nearly 74% were 0.72 and above), indicating the joint explanatory strength of the independent variables.

Overall the results in Table 4.5 support the case for the positive size-externality of the government sector and the negative impact of the growth rate of government expenditure, i.e. $\frac{\Delta G}{G}$. Furthermore, these results enable us to establish the nature of the productivity differential between the private and public sectors, i.e. δ.

TABLE 4.5: Estimated Coefficients of Government Variables in Equation (8) Derived From Time-Series Data for 115 Countries1960-1980 (t-stat in Parentheses)

COUNTRY	METHOD	α	β	$[(\delta/1+\delta)-\theta]$	θ	$R^2(F)^b$	D.W.
1 ALGERIA	OLS	-0.0015	3.3977	0.057	-0.8591	0.78	2.53
		(-0.41)	(0.66)	(6.98)	(-4.30)	(13.44)	
2 ANGOLA	OLS	-0.0072	-0.7419	0.0547	-1.0828	0.92	2.22
		(-1.27)	(-0.38)	(6.04)	(-11.85	(49.13)	
3 BENIN	OLS	0.00002	4.2473	0.0532	-1.1293	0.74	1.97
		(0.005)	(1.73)	(6.48)	(-6.41)	(11.20)	
4 BOTSWANA	OLS	0.0001	-0.0009	0.0428	-1.012	0.94	1.50
		(0.44)	(-0.001	(10.74)	(-14.48	(59.58)	
5 BURUNDI	OLS	0.0085	-2.2679	0.0468	-0.4646	0.69	2.13
		(1.21)	(-0.83)	(4.90)	(-3.78)	(8.56)	
6 CAMEROON	OLS	-0.0013	-1.2407	0.0445	-1.011	0.83	2.59
		(-0.65)	(-0.65)	(8.11)	(-6.82)	(19.48)	
7 CENTRAL AFRICA	OLS	0.0002	-0.1031	0.0406	-0.9755	0.97	2.38
		(0.31)	(-0.25)	(20.64)	(-19.28	(127.85)	
8 CHAD	OLS	0.0005	-1.1739	0.0564	-1.018	0.97	2.08
		(0.25)	(-0.63)	(16.01)	(-21.39	(153.91)	
9 CONGO, PEOP	OLS	0.0002	1.1405	0.0547	-0.9348	0.86	2.13
		(0.28)	(0.62)	(8.57)	(-7.18)	(23.67)	
10 EGYPT, ARAB	OLS	0.0031	-2.184	0.0374	-0.7667	0.84	1.85
		(2.35)	(-0.54)	(7.69)	(-7.01)	(20.65)	
11 ETHIOPIA	OLS	-0.0006	-7.0388	0.0402	-0.7903	0.54	2.35
		(-0.26)	(-1.42)	(3.27)	(-3.58)	(4.43)	
12 GABON	OLS	0.0018	0.1556	0.0845	-1.1935	0.64	2.28
		(0.85)	(0.04)	(4.01)	(-4.66	(6.92)	
13 GAMBIE, THE	AR(1)	-0.0128	1.7954	0.0569	-1.307	0.94	1.86
	(2.78)	(-3.35	(1.88)	(20.36)	(-18.48	(48.04)	
14 GHANA	OLS	0.0016	-8.5022	0.0517	-0.979	0.96	1.32
		(1.02)	(-0.55)	(18.59)	(-15.55	(102.16)	
15 GUINEA	AR(1)	0.0063	-1.901	0.058	-1.097	0.94	1.93
	(4.35)	(2.40)	(-1.08)	(12.38)	(-14.05	(46.44)	
16 IVORY COAST	OLS	-0.0014	-0.1011	0.0618	-1.0485	0.78	2.24
		(-0.62	(-0.06)	(7.35)	(-5.64)	(13.70)	
17 KENYA	OLS	-0.0004	-4.0284	0.0539	-0.846	0.86	2.44
		(-0.27)	(-1.66)	(8.11)	(-8.54)	(23.08)	
18 LESOTHO	OLS	-0.0004	-4.0284	0.0539	-0.846	0.86	2.44
		(-0.27)	(-1.66)	(8.11)	(-8.54)	(23.08)	
19 LIBERIA	OLS	0.0012	1.1409	0.0313	-0.6668	0.65	2.06
		(1.52)	(0.41)	(4.40)	(-3.70)	(6.99)	
20 MADAGASCAR	OLS	-0.0001	-0.9663	0.0425	-1.0446	0.93	1.90
		(-0.06)	(-1.06)	(10.19)	(-6.86)	(53.77)	
21 MALAWI	OLS	-0.0004	-0.3706	0.038	-0.8697	0.94	2.29
		(-0.53)	(-0.23)	(15.19)	(-13.83	(63.76)	
22 MALI	OLS	-0.0091	-2.603	0.0402	-0.8777	0.95	2.76
		(-0.18)	(-1.94)	(17.63)	(-12.90	(87.76)	
23 MAURITANIA	OLS	-0.0005	-1.4729	0.0341	-0.8865	0.83	1.50
		(-0.51)	(-0.65)	(7.85)	(-8.28)	(19.29)	
24 MAURITIUS	OLS	0.0039	5.0514	-0.0037	5.7634	0.42	2.03
		(0.89)	(3.07)	(-1.91)	(3.18)	(2.60)	
25 MOROCCO	OLS	0.0016	-6.3139	0.0393	-0.796	0.76	1.91
		(0.56)	(-1.48)	(5.75)	(-5.48)	(12.38)	
26 MOZAMBIQUE	OLS	-0.0009	-1.3803	0.0443	-0.8554	0.98	1.96
		(-0.45)	(-1.28)	(22.67)	(-10.22	(231.30)	
27 NIGER	OLS	0.0029	-0.6581	0.052	-1.1427	0.99	2.34
		(1.76)	(-1.45)	(32.80)	(-37.27	(463.92)	
28 NIGERIA	AR(1)	-0.0093	26.001	0.1004	-0.8774	0.74	2.35
	(-3.25)	(-3.83	(2.10)	(8.27)	(-8.11	(7.77)	
29 RWANDA	OLS	0.0004	-2.3144	0.0671	-1.1158	0.95	2.12
		(0.08)	(-0.65)	(16.16)	(-12.25	(71.84)	
30 SENEGAL	OLS	-0.0003	-0.2421	0.0464	-1.0549	0.92	2.19
		(-0.15)	(-0.16)	(12.42)	(-8.26)	(43.81)	
31 SIERRA LEONE	AR(1)	0.0072	-7.6885	0.0078	-0.9325	0.51	2.19
	(-3.11)	(0.56)	(-0.61	(0.19)	(-1.36)	(2.72)	
32 SOMALIA	OLS	-0.0012	1.058	0.0441	-0.9876	0.93	2.53
		(-0.63)	(0.36)	(13.26)	(-13.02	(54.76)	
33 S. AFRICA	OLS	-0.0003	-0.0595	0.0637	-1.1146	0.89	1.71
		(-0.36)	(-1.28)	(9.93)	(-8.85)	(30.66)	
34 SUDAN	OLS	0.0065	-15.7707	0.0531	-1.048	0.95	1.57
		(2.64)	(-4.02)	(12.32)	(-17.19	(75.17)	
35 SWAZILAND	OLS	0.0035	0.3219	0.0387	-0.5411	0.47	2.19
		(0.78)	(0.14)	(3.04)	(-1.63)	(3.38)	

	COUNTRY	METHOD	α	β	[(δ/1+δ)−θ]	θ	R^2 (F)[b]	D.W.
36	TANZANIA, UN	AR(1)	−0.0007	−1.7285	0.0424	−0.7458	0.94	2.46
		(−3.97)	(−0.78)	(−1.45)	(10.87)	(−9.97)	(43.45)	
37	TOGO	OLS	−0.0006	−0.0967	0.072	−1.2518	0.77	2.43
			(−0.54)	(−0.04)	(7.04)	(−6.79)	(13.02)	
38	TUNISIA	OLS	−0.0046	0.7466	0.0534	−1.044	0.86	2.26
			(−2.38)	(0.50)	(7.91)	(−9.44)	(24.23)	
39	UGANDA	AR(1)	−0.001	0.4774	0.0642	−1.0139	0.96	2.01
		(−4.41)	(−1.10)	(1.02)	(15.21)	(−12.6	(79.29)	
40	UPPER VOLTA	OLS	0.0005	−7.0521	0.0434	−0.8891	0.86	2.34
			(0.19)	(−1.16)	(6.82)	(−4.56)	(24.14)	
41	ZAIRE	OLS	−0.0019	3.242	0.033	−0.7637	0.86	2.52
			(−0.97)	(0.60)	(7.20)	(−3.86)	(24.54)	
42	ZAMBIA	AR(1)	−0.0045	−29.8286	0.0087	−0.6822	0.78	1.82
		(2.69)	(−2.32)	(−3.78)	(1.87)	(−5.42	(9.69)	
43	ZIMBABWE	AR(1)	0.0036	−1.3402	0.0481	−0.9314	0.91	2.09
		(−2.40)	(4.51)	(−1.01)	(10.36)	(−12.47	(29.38)	
44	AFGHANISTAN	OLS	−0.0005	0.4249	0.0656	−0.8095	0.97	1.98
			(−0.33)	(0.54)	(18.81)	(−13.22	(126.54)	
45	BANGLADESH	OLS	−0.0022	1.7533	0.0451	−0.7035	0.86	1.81
			(−0.51)	(0.49)	(9.32)	(−7.94)	23.05	
46	BURMA	AR(1)	−0.001	−1.6041	0.0525	−1.2891	0.99	2.23
		(−5.29)	(−1.81)	(−2.45)	(47.39)	(−12.89	(548.91)	
47	HONK KONG	OLS	0.0018	0.9971	0.0882	−0.4846	0.49	2.24
			(0.39)	(0.56)	(2.87)	(−2.45)	(3.66)	
48	INDIA	AR(1)	0.0034	59.3124	0.0339	−0.5761	0.95	2.22
		(−3.25)	(3.03)	(5.96)	(10.06)	(−6.22)	(50.28)	
49	IRAN	OLS	−0.0054	21.3416	0.0616	−0.6808	0.94	2.46
			(−2.48)	(2.05)	(13.02)	(−6.31)	(68.38)	
50	IRAQ	AR(1)	0.0024	−13.8312	0.0566	−1.2354	0.78	1.85
		(−2.08)	(0.94)	(−1.32)	(4.94)	(−4.83)	(9.69)	
51	ISRAEL	OLS	−0.0043	−4.6454	0.0008	−4.5197	0.34	1.80
			(−0.58)	(−1.35)	(0.29)	(−2.69)	(1.88)	
52	JAPAN	OLS	0.001	1.0319	0.1314	−1.0269	0.93	1.58
			(0.93)	(0.58)	(12.75)	(−14.25	(56.58)	
53	JORDAN	OLS	−0.0005	−1.0042	0.0329	−1.0001	0.97	1.98
			(−1.05)	(−0.58)	(24.44)	(−18.04	(155.61)	
54	KOREA, REP	OLS	0.0002	1.3554	0.0833	−1.0767	0.97	1.34
			(0.26)	(0.52)	(21.69)	(−13.94	(141.52)	
55	MALAYSIA	OLS	0.0009	5.875	0.0816	−1.3365	0.85	2.29
			(0.47)	(0.79)	(6.53)	(−7.67)	(22.17)	
56	NEPAL	OLS	−0.0006	1.2122	0.033	−0.5443	0.63	2.79
			(−0.14)	(0.20)	(4.42)	(−3.42)	(6.52)	
57	PAKISTAN	OLS	0.0064	0.2117	−0.0053	1.37	0.09	2.12
			(0.58)	(0.25)	(−0.36)	(0.97)	(0.34)	
58	PHILIPPINES	OLS	−0.0001	4.5016	0.0535	−0.8982	0.75	1.78
			(−0.24)	(1.61)	(6.25)	(−6.05)	(11.51)	
59	SINGAPORE	AR(1)	0.0009	−1.7092	0.0834	−1.0152	0.87	1.59
		(3.37)	(0.51)	(−0.70)	(6.61)	(−5.44)	(17.77)	
60	SRI LANKA	OLS	−0.0005	−0.1479	0.0301	−0.6689	0.95	1.83
			(−0.45)	(−0.09)	(16.14)	(−6.89)	(87.73)	
61	SYRIAN ARAB	OLS	−0.0046	−2.1081	0.0717	−1.153	0.95	2.54
			(−2.12)	(−0.28)	(13.53)	(−16.33	(81.98)	
62	TAIWAN	OLS	0.0001	0.0228	0.0447	−0.8765	0.78	2.20
			(0.15)	(0.03)	(6.82)	(−6.15)	(13.34)	
63	THAILAND	OLS	−0.001	8.0065	0.076	−0.8986	0.68	2.08
			(−0.72)	(2.08)	(5.04)	(−5.43)	(8.04)	
64	AUSTRIA	AR(1)	0.0008	0.5144	0.0736	−0.9756	0.91	2.00
		(−3.0)	(0.87)	(1.52)	(8.20)	(−10.29	(28.88)	
65	BELGIUM	AR(1)	0.0027	0.5475	0.1211	−1.1088	0.92	2.16
		(−2.80)	(2.26)	(0.68)	(12.37)	(−11.99	(34.26)	
66	CYPRUS	OLS	0.0005	0.0901	0.0588	−1.0236	0.97	2.64
			(0.39)	(0.14)	(9.10)	(−20.79	(145.63)	
67	DENMARK	OLS	−0.0003	4.1438	0.0555	−1.1193	0.9	2.42
			(−0.24)	(3.15)	(6.73)	(−9.09)	(36.13)	
68	FINLAND	OLS	0.0011	0.1093	0.0877	−1.0376	0.91	1.36
			(1.62)	(0.09)	(9.52)	(−12.09	(41.55)	
69	FRANCE	OLS	−0.0009	−0.944	0.095	−1.171	0.84	2.59
			(0.74)	(−1.25)	(7.54)	(−6.94)	20.27	
70	GERMANY, FED	AR(1)	0.037	−8.6592	−0.0356	0.624	0.4	2.35
		(−2.64)	(1.42)	(−1.10)	(−0.17)	(0.29)	(1.73)	
71	GREECE	OLS	0.004	−18.3584	−0.0027	−0.3259	0.57	2.04
			(1.99)	(−1.66)	(−1.24)	(−2.68)	(5.16)	
72	ICELAND	OLS	−0.0001	−0.6873	0.0084	−0.3941	0.09	1.41
			(−0.03)	(−0.71)	(0.64)	(−0.93)	(0.38)	
73	IRELAND	OLS	0.0036	−5.4088	−0.0014	−0.0486	0.17	1.50
			(0.91)	(−1.58)	(−0.45)	(−0.20)	(0.80)	
74	ITALY	OLS	0.006	−5.7469	0.0034	−0.3057	0.69	1.52
			(3.06)	(−2.06)	(0.84)	(−3.32)	(8.63)	

COUNTRY	METHOD	α	β	$[(\delta/1+\delta)-\theta]$	θ	R^2 (F)[b]	D.W.
75 LUXEMBOURG	OLS	−0.0052	−0.7032	−0.0158	−0.2398	0.37	1.91
		(−1.25)	(−0.62)	(−1.28)	(−1.11)	(2.22)	
76 MALTA	AR(1)	0.0009	−0.3344	−0.0009	0.0723	0.37	1.73
	(2.51)	(0.37)	(−0.43)	(−1.43)	(0.54)	(1.57)	
77 NETHERLANDS	OLS	0.0045	0.4917	0.0013	−0.1852	0.56	2.23
		(1.82)	(0.23)	(1.36)	(−1.49)	(4.87)	
78 NORWAY	OLS	−0.0028	−0.6818	0.0154	−0.4137	0.44	1.83
		(−2.42)	(−0.33)	(0.66)	(−1.56)	(3.01)	
79 PORTUGAL	AR(1)	0.002	−0.3145	0.06	−0.9914	0.97	2.30
	(2.08)	(1.90)	(−0.99)	(10.77)	(−16.42	(106.19)	
80 SPAIN	AR(1)	0.0014	3.4488	0.1252	−0.8452	0.54	2.31
	(−2.45)	(0.38)	(0.33)	(3.82)	(−4.08)	(3.06)	
81 SWEDEN	AR(1)	0.0033	0.0123	0.0722	−0.9976	0.87	2.76
	(−2.08)	(3.19)	(0.01)	(6.87)	(−9.37)	(17.97)	
82 SWITZERLAND	OLS	−0.001	1.141	0.0743	−0.6166	0.65	2.06
		(−0.61)	(2.02)	(3.52)	(−3.65)	(7.17)	
83 TURKEY	AR(1)	0.001	1.4719	0.0381	−0.8877	0.72	1.91
	(−2.08)	(0.74)	(0.15)	(4.54)	(−4.34)	(6.90)	
84 UNITED KINGDOM	OLS	−0.0028	−0.6429	0.0473	−1.0832	0.81	1.92
		(−1.69)	(−0.80)	(7.05)	(−7.67)	(16.95)	
85 BARBADOS	OLS	0.0064	−2.9324	0.0002	0.3932	0.61	2.54
		(1.11)	(−2.87)	(0.01)	(1.05)	(6.05)	
86 CANADA	OLS	0.0032	−0.4843	0.0932	−1.0726	0.93	1.85
		(2.99)	(−0.90)	(12.11)	(−13.77	(55.77)	
87 COSTA RICA	OLS	−0.0015	−0.5167	0.0687	−1.1298	0.76	1.77
		(0.74)	(−0.48)	(6.10)	(−5.15)	(12.16)	
88 DOMINICAN RE	OLS	0.0132	19.9286	0.0262	−0.3219	0.72	2.59
		(2.64)	(2.70)	(3.89)	(−2.41)	(9.83)	
89 EL SALVADOR	OLS	−0.0012	0.1676	0.0707	−1.1649	0.94	2.08
		(−0.88)	(0.12)	(10.62)	(−12.72	(58.89)	
90 GUATEMALA	OLS	−0.001	0.5162	0.084	−1.1848	0.86	2.18
		(−0.80)	(0.19)	(8.02)	(−8.07)	(23.19)	
91 HAITI	OLS	−0.0005	2.0423	0.0643	−1.324	0.86	2.31
		(−0.20)	(0.33)	(7.84)	(−6.00)	(23.90)	
92 HONDURAS	OLS	−0.0002	−0.1445	0.0553	−0.931	0.87	2.29
		(−0.27)	(−0.20)	(9.97)	(−10.00	(26.58)	
93 JAMAICA	OLS	0.0043	−4.6074	0.0162	−0.3353	0.61	2.42
		(2.42)	(−1.48)	(1.88)	(−1.98)	(6.04)	
94 MEXICO	OLS	−0.0022	−3.4678	0.1232	−0.9439	0.88	1.81
		(−1.92)	(−0.71)	(10.07)	(−9.78)	(27.50)	
95 NICARAGUA	OLS	0.0058	−3.204	0.0338	−0.7665	0.85	2.33
		(3.01)	(−1.04)	(5.91)	(−7.54)	(21.46)	
96 PANAMA	OLS	−0.0007	1.2	0.065	−1.152	0.87	2.03
		(−0.89)	(1.41)	(7.70)	(−8.59)	(27.29)	
97 TRINIDAD	OLS	−5.700000E−05	−1.0853	0.0353	−0.4004	0.15	2.06
		(−0.01)	(−0.61)	(1.03)	(−0.99)	(0.67)	
98 UNITED STATES	OLS	−0.0004	0.0629	0.0735	−1.1049	0.98	1.95
		(−0.58)	(0.16)	(20.69)	(−22.91	(197.31)	
99 ARGENTINA	OLS	−0.0005	2.1089	0.0988	−0.9613	0.98	2.46
		(−0.76)	(9.71)	(25.95)	(−24.93	(187.03)	
100 BOLIVIA	OLS	−0.004	1.7686	0.0434	−0.4792	0.75	2.17
		(−2.60)	(1.62)	(5.35)	(−3.54)	(11.69)	
101 BRAZIL	OLS	0.0004	0.5872	0.0638	−1.0054	0.97	1.26
		(0.81)	(0.03)	(22.48)	(−17.71	(135.69)	
102 CHILA	OLS	−8.080000E−05	0.9417	0.0747	−0.9835	0.97	2.24
		(−0.05)	(0.71)	(15.81)	(−16.89	(128.89)	
103 COLOMBIA	OLS	0.0007	0.2605	0.1179	−1.1581	0.94	2.34
		(0.48)	(0.42)	(11.69)	(−10.69	(59.30)	
104 ECUADOR	OLS	0.0031	−2.3507	0.036	−0.7518	0.62	2.53
		(1.67)	(−0.31)	(4.42)	(−2.97)	(6.15)	
105 GUYANA	OLS	0.0013	−2.38	0.0616	−0.9979	0.77	1.98
		(1.28)	(−0.92)	(3.48)	(−3.66)	(12.63)	
106 PARAGUAY	OLS	0.0013	−2.38	0.0616	−0.9979	0.77	1.98
		(1.28)	(−0.92)	(3.48)	(−3.66)	(12.63)	
107 PERU	OLS	−0.0011	5.7463	0.0655	−1.1748	0.89	2.28
		(0.84)	(1.07)	(9.12)	(−9.19)	(31.11)	
108 SURINAM	OLS	0.0015	−0.8282	0.0391	−0.704	0.87	1.45
		(1.67)	(−1.67)	(8.98)	(−6.66)	(25.12)	
109 URUGUAY	OLS	−0.0007	0.92	0.055	−1.1067	0.91	2.36
		(−0.48)	(1.38)	(11.71)	(−9.41)	(40.85)	
110 VENEZUELA	OLS	0.0008	6.8227	0.0116	0.0042	0.1	2.24
		(0.51)	(0.94)	(0.47)	(0.01)	(0.44)	
111 AUSTRALIA	OLS	0.0003	1.442	0.0741	−0.8294	0.78	2.24
		(0.17)	(1.07)	(3.31)	(−4.37)	(13.42)	
112 FIJI	AR(1)	0.0005	2.1936	0.0447	−0.688	0.82	1.91
	(2.18)	(0.19)	(2.25)	(7.71)	(−5.97)	(12.14)	
113 INDONESIA	OLS	0.0018	7.7976	0.0592	−1.0462	0.89	2.09
		(0.81)	(0.94)	(6.54)	(−6.19)	(33.26)	
114 NEW ZEALAND	OLS	−0.0033	0.3017	0.1202	−1.4658	0.74	1.48
		(−2.18)	(0.18)	(5.77)	(−5.14)	(10.98)	
115 PAPUA NEW GUINEA	AR(1)	−5.737000E−05	−1.2168	0.0293	−0.9757	0.95	2.35
	(−2.89)	(−0.16)	(−0.64)	(20.19)	(−16.74	(53.04)	

Table 4.6 summarizes the results for the entire sample. The countries are ranked according to USA per capita income = 100, and then sorted in ascending order. Given our estimates of $[(\delta/1+\delta)-\theta]$ and θ in Table 4.5, δ has been calculated using the following steps:

Let: $[(\delta/1+\delta)-\theta] = K$, then:

$\delta/1+\delta = K+\theta$, and

$$\delta = \frac{K+\theta}{1-(K+\theta)}$$

As shown in Table 4.6, δs are consistently negative. Note that the only positive value belongs to Germany (Fed) which, according to Table 4.5, is among 17 countries whose coefficient estimates are not statistically acceptable.

Our time series results thus suggest a negative factor productivity differential for the public sector activities.[4] In conjunction with the positive externality effect, this would suggest that - all other thing being the same - to maximize national output, public production should be undertaken only in cases where the externality effect is larger, or at least equal to, the productivity loss in factor utilization.

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[4] *These results reinforce our theoretical analysis of Chapter 2; see Section 2.3.2. 'Government Output and Productivity'.*

Table 4.6: Development Index and Measure of Productivity Differential

	COUNTRIES	DEVINDEX	$[(\delta/1+\delta)-\theta]$	θ	δ
60	UPPER VOLTA	3.90	0.043	-0.869	-0.46
21	MALAWI	4.00	0.038	-0.870	-0.45
22	MALAWI	4.05	0.040	-0.878	-0.46
29	RWANDA	4.43	0.067	-1.116	-0.51
46	BURMA	4.67	0.053	-1.289	-0.55
11	ETHIOPIA	4.71	0.040	-0.795	-0.43
41	ZAIRE	5.29	0.033	-0.764	-0.42
54	NEPAL	5.33	0.033	-0.544	-0.14
5	BURUNDI	5.43	0.047	-0.663	-0.29
44	AFGHANISTAN	5.48	0.004	-0.810	-0.43
18	LESOTHO	5.67	0.054	-0.846	-0.44
91	HAITI	5.67	0.064	-1.124	-0.56
36	TANZANIA, UN	5.71	0.042	-0.766	-0.41
45	BANGLADESH	5.71	0.045	-0.704	-0.40
32	SOMALIA	6.33	0.044	-0.988	-0.49
17	KENYA	6.52	0.054	-0.846	-0.44
48	INDIA	6.62	0.034	-0.376	-0.15
8	CHAD	6.81	0.056	-1.018	-0.49
3	BENIN	6.90	0.053	-1.129	-0.57
27	NIGER	6.95	0.052	-1.143	-0.57
7	CENTRAL AFRICA	7.86	0.041	-0.978	-0.48
57	PAKISTAN*	8.19	-0.005	1.170	-3.74
31	SIERRA LEONE	8.24	0.008	-0.913	-0.48
37	TOGO	8.38	0.072	-1.252	-0.56
111	INDONESIA	8.90	0.059	-1.046	-0.50
20	MADAGASCAR	9.00	0.043	-1.045	-0.50
39	UGANDA	9.19	0.064	-1.014	-0.49
23	MAURITANIA	9.62	0.034	-0.887	-0.46
15	GAMBIE, THE	10.29	0.057	-1.307	-0.56
4	BOTSWANA	10.90	0.043	-1.012	-0.49
13	GUINEA	11.00	0.058	-1.097	-0.51
6	CAMEROUN	11.10	0.045	-1.011	-0.49
10	EGYPT, ARAB	11.57	0.017	-0.767	-0.42
65	THAILAND	11.71	0.076	-0.899	-0.45
42	ZAMBIA*	12.00	0.009	-0.687	-0.40
58	PHILIPPINES	12.10	0.054	-0.898	-0.48
34	SUDAN	12.33	0.053	-1.048	-0.50
9	CONGO, PEOP	12.38	0.055	-0.935	-0.47
60	SRI LANKA	12.43	0.030	-0.669	-0.39
19	LIBERIA	12.62	0.031	-0.667	-0.39
35	SWAZILAND	12.90	0.039	-0.541	-0.33
92	HONDURAS	13.05	0.055	-0.931	-0.47
24	MOZAMBIQUE	13.19	0.044	-0.855	-0.45
30	SENEGAL	13.24	0.046	-1.055	-0.50
100	BOLIVIA	13.62	0.045	-0.479	-0.30
89	EL SALVADOR	14.00	0.071	-1.165	-0.52
43	ZIMBABWE	14.14	0.048	-0.931	-0.47
25	MOROCCO	14.19	0.039	-0.798	-0.43
28	NIGERIA	14.24	0.100	-0.877	-0.44
14	GHANA	14.57	0.052	-0.979	-0.48
115	PAPUA NEW GUINEA	14.95	0.029	-0.976	-0.49
105	GUYANA	15.05	0.062	-0.998	-0.48
53	JORDAN	15.19	0.033	-1.000	-0.49
16	IVORY COAST	15.48	0.062	-1.049	-0.50
2	ANGOLA	15.48	0.055	-1.083	-0.51
24	MAURITIUS*	15.67	-0.004	5.763	-1.21
104	ECUADOR	15.71	0.036	-0.752	-0.42
108	PARAGUAY	16.24	0.062	-0.998	-0.48
66	DOMINICAN RB	16.62	0.026	-0.322	-0.23
38	TUNISIA	17.05	0.053	-1.044	-0.50
90	GUATEMALA	17.10	0.064	-1.185	-0.52
54	KOREA, REP	17.24	0.083	-1.077	-0.50
61	SYRIAN ARAB	18.33	0.072	-1.153	-0.52
1	ALGERIA	18.36	0.057	-0.859	-0.45
95	NICARAGUA	18.90	0.034	-0.747	-0.42
101	BRAZIL	19.05	0.064	-1.005	-0.48
63	TAIWAN	20.10	0.045	-0.877	-0.43
55	MALAYSIA	20.43	0.082	-1.337	-0.56
103	COLOMBIA	20.76	0.118	-1.158	-0.51
112	FIJI	20.95	0.045	-0.668	-0.39
83	TURKEY	21.52	0.038	-0.888	-0.46
50	IRAQ	22.24	0.057	-1.235	-0.54
40	IRAN	23.24	0.062	-0.881	-0.38
93	JAMAICA*	23.33	0.018	-0.335	-0.24
107	PERU	24.05	0.066	-1.175	-0.53
87	COSTA RICA	26.57	0.069	-1.130	-0.51
76	MALTA*	23.52	-0.001	0.072	0.08
96	PANAMA	25.67	0.083	-1.152	-0.52
85	BARBADOS*	26.52	0.000	0.393	0.65
94	MEXICO	28.48	0.123	-0.944	-0.45
106	SURINAM	29.67	0.039	-0.796	-0.40
33	S. AFRICA	29.86	0.064	-1.115	-0.51
59	SINGAPORE	30.14	0.083	-1.015	-0.48
102	CHILA	30.33	0.075	-0.984	-0.48
79	PORTUGAL	30.62	0.060	-0.991	-0.48
47	HONK KONG	30.62	0.088	-0.485	-0.28
66	CYPRUS	31.48	0.059	-1.024	-0.49
12	GABON	33.81	0.085	-1.194	-0.53
71	GREECE*	34.86	-0.003	-0.326	-0.25
99	ARGENTINA	39.67	0.099	-0.981	-0.46
109	URUGUAY	40.00	0.055	-1.107	-0.51
73	IRELAND*	40.00	-0.001	-0.049	-0.05
97	TRINIDAD*	40.86	0.055	-0.400	-0.27
110	VENEZUELA*	41.81	0.012	0.004	0.02
80	SPAIN	46.86	0.125	-0.845	-0.42
51	ISRAEL*	50.05	0.001	-4.520	-0.82
74	ITALY*	51.90	0.003	-0.306	-0.23
52	JAPAN	56.24	0.131	-1.027	-0.47
64	AUSTRIA	61.05	0.074	-0.976	-0.47
114	NEW ZEALAND	63.10	0.120	-1.446	-0.57
68	FINLAND	63.33	0.088	-1.038	-0.49
84	UNITED KINGDOM	63.62	0.047	-1.083	-0.51
72	ICELAND*	66.90	0.008	-0.394	-0.28
77	NETHERLANDS*	68.14	0.001	-0.185	-0.16
63	BELGIUM	68.95	0.121	-1.109	-0.50
78	NORWAY*	69.52	0.015	-0.414	-0.28
69	FRANCE	72.67	0.095	-1.171	-0.52
111	AUSTRALIA	74.24	0.074	-0.829	-0.43
70	GERMANY, FED*	75.76	-0.036	0.624	1.43
67	DENMARK	79.86	0.056	-1.119	-0.52
75	LUXEMBOURG*	80.38	-0.018	-0.240	-0.20
82	SWITZERLAND	83.57	0.074	-0.617	-0.35
86	CANADA	84.43	0.093	-1.073	-0.49
81	SWEDEN	84.81	0.072	-0.998	-0.48
98	UNITED STATES	100.00	0.074	-1.105	-0.51

Note: '*' means t-ests for the estimates were less than 2

4.4 Testing for Direction of Causality

The direction of causality is fundamental to our present analysis as well as to that of Chapter 3. The question is whether the causation is from 'G' to 'Y', as specified in this Chapter, or from 'Y' to 'G' as hypothesized by Wagner, or bi-directional. In line with the literature, a number of forms of Granger causality may be employed in this section to address the question.

For our purpose, we may write the general causal model of Granger's test as follows:

$$Y_t = b_o + a_o G_t + \sum_{j=1}^{m} a_j G_{t-j} + \sum_{i=1}^{n} b_i Y_{t-i} + u_t \qquad (1)$$

and

$$G_t = C_o + d_o Y_t + \sum_{i=1}^{n} C_i G_{t-i} + \sum_{j=1}^{m} d_j Y_{t-j} + v_t \qquad (2)$$

Where u_t and v_t are white noise series such that $Eu_t.u_{t'} = Ev_t.v_{t'} = 0$ for all t and t' ($t \neq t'$). For an appropriate test of causality, it is important that these equations be free from any kind of misspecification. In other words, should u_t and/or v_t be not purely white noise series, either because some relevant variable is left out or otherwise, these equations may produce completely wrong results.

To test the above patterns of causality, Equations (1) and (2) may be estimated by the OLS procedure and then the null hypothesis that $a_j = d_j = 0$ for all j(j = 0,1,...m) be tested against the alternative hypothesis that $a_j \neq 0$ and $d_j \neq 0$ for at least some js.

In general, the acceptance of the null hypothesis, $a_j = d_j = 0$, for all js implies the lack of causality between 'G' and 'Y'. Accepting $a_j=0$ implies that 'G' does not cause 'Y', and accepting $d_j=0$ implies that 'Y' does not cause 'G'. By implication, the fact that 'G' causes 'Y' requires that 'Y' does not cause 'G'. With respect to the 100 (out of 109) regressions where the coefficient of $\hat{G}$ is statistically significant, the following forms of testing for Granger causality are used:

I : (a) $\hat{Y}_t$ on $\hat{Y}_{t-1}$, $\hat{G}_t$, $\hat{G}_{t-1}$

(b) $\hat{Y}_t$ on $\hat{Y}_{t-1}$, $\hat{G}_t$

(c) $\hat{Y}_t$ on $\hat{Y}_{t-1}$, $\hat{G}_{t-1}$

(d) $\hat{Y}_t$ on $\hat{Y}_{t-1}$

(e) $\hat{G}$ on $\hat{G}_{t-1}$, $\hat{Y}_t$, $\hat{Y}_{t-1}$

(f) $\hat{G}_t$ on $\hat{G}_{t-1}$, $\hat{Y}_t$

(g) $\hat{G}_t$ on $\hat{G}_{t-1}$, $\hat{Y}_{t-1}$

(h) $\hat{G}_t$ on $\hat{G}_{t-1}$

F-ratios and t-statistics are used to make inferences on direction of causality.

II : Same as 'I' above except that a method of pre-filtering the data is used.[5]

III : $\hat{Y}_i$ and $\hat{G}_i$ are regressed on $\hat{Y}_{t-1}$, $\hat{G}_{t-1}$; where i = 1, 2, 3.

A total of 800 original regressions, together with additional cases of various filters, have been estimated using TSP (version 7) computer software. The results are summarized in Table 4.7.

TABLE 4.7: Summary of Results of Granger Causality Analysis for 100 Countries

	NUMBER OF COUNTRIES BY TYPE OF CAUSALITY			
Regression Set	Bi-Directional	From G to Y	From Y to G	No Relation Either Way
I	83	6	11	0
II	72	19	9	0
III	27	22	16	35

The regression set I suggests 83% cases of bi-directional causality, with only 6 cases of unidirectional causation from 'G' to 'Y' and 11 cases of 'Y'

[5] *The pre-filtering method is similar to the one used by Rao (1989). Consider the estimated residuals* u'_t, u'_{t-1}, u'_{t-2}, *and* u'_{t-3} *from equation I(a) the following regressions are estimated:*

(i) u'_t *on* u'_{t-1} *and* u'_{t-2}

(ii) u'_t *on* u'_{t-1}, u'_{t-2} *and* u'_{t-3}

If the "t-ratios" of the partial regression coefficients in both (i) and (ii) are less than unity, then no pre-filtering is required. Otherwise pre-filtering is applied.

to 'G'. After minimizing auto-correlation by data pre-filtering in regression set II, the results were altered somewhat. The number of bi-directional cases diminished to 72, whereas the cases of unidirectional causation from 'G' to 'Y' increased from 6 to 19. Meanwhile the number of countries with unidirectional causation from 'Y' to 'G' declined to 9. In both sets (I and II) there were no evidence of no causation either way.

It may be argued that a causal reaction must take time and as such the presence of contemporaneous terms in Equations I(a), I(b), I(e) and I(f), as well as in the equations of set II, is not justified. (Rao 1989 and Ram 1986) To examine the implications of this argument, regression set III was estimated. The results differed considerably. In this case the number of countries with no causation either way increased to 35, while the cases of bi-directional causality declined sharply.[6]

The regression sets I and II demonstrate how easy it is to obtain simple cases that show causation between 'Y' and 'G' running either way.[7] However, by excluding contemporaneous terms and adding lagged variables, the

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[6] *Rao (1989) examines Granger causality for 48 countries. By ex-excluding contemporaneous terms the cases of bi-directional causation drop from 46 to 2 and that of "no relation either way" rises from zero to 40.*

[7] *Ahsan, Kwan and Sahri (1989) studied the data for 24 OECD countries and reported the following pattern of causality:*

Bi-directional	*11*
From G ——> Y	*5*
From Y ——> G	*3*
No Causality	*5*

prevalence of bi-directional causality declines considerably.

As Chow (1983) points out: "A favourite saying in regression analysis is that regression can measure the degrees of association between variables but cannot confirm causation." (p. 212) This issue of causation and correlation is pivotal to the correct interpretation of the test. Simon (1953) and Wold (1954), among others, have emphasized that causality is a theoretical concept which must be interpreted in the context of a formal theoretical model which would postulate the direction of the functional relationship.
Thus in analyzing the nature of causality between 'G' an 'Y', our attention should turn to the underlying causative process before carrying out an empirical investigation. Given a justifiable theoretical foundation, the lack of causality between 'G' and 'Y', in Granger's sense, does not necessarily imply that the variables are functionally unrelated. Moreover, empirical investigations are, to a large extent, influenced by the time span of the study. The direction of causality then could well be influenced by the time sequence. To illustrate the point, Singh and Sahni (1984) use the classical example of "the chicken or the egg":

> let t_o be the instant at which the hen lays the egg and t_{o+T} be the instant when the egg is hatched and the chicken comes out of it. Now if we focus only from t_{o-s} to t_o, the period from the birth of the hen up to the point when she lays the egg, clearly the hen precedes the egg. Therefore, hen causes egg. Similarly, should we look at the time period from t_o to t_{o+T}, egg precedes the chicken, therefore, egg is the cause of hen. Finally, if we enlarge our sample period from t_{o-K} to t_{o+K}, the causality may become bi-directional. It is thus clear that proper timing of observation may help us unscramble cause and effect and that lengthening of the period of observation may change the cause-effect

relationship into a feedback relationship. (Singh & Sahni, p.632)

In addition to and possibly interrelated with the time factor, the link between 'G' and 'Y' is also a function of the developmental stage of the economy. As such, seen over the entire economic development spectrum, the direction of causality between 'G' and 'Y' could be unidirectional, in either way, or bi-directional. This might well explain why empirical studies, among others the ones referred to in this Chapter, provide a mixed evidence in support of all three possibilities.

4.5 **Empirical Testing in Perspective**

There are a number of studies that focus on empirical cross-country and time series analysis of the impact of government expenditure on economic growth. Prominent among these are Daniel Landau (1976, 1983) and Rati Ram (1986). Landau's study examines the link between government consumption expenditure and the rate of growth of real per capita GDP. This study is not based on an explicit theoretical model. Instead, Landau outlines a number of factors that are believed to impact on economic growth. To carry out his empirical test, Landau explains: "The long list of potential influence on the growth rate had to be narrowed down. The procedure chosen was a stepwise regression." (p. 786) In his reported empirical results the following multiple-regression approach within the framework of a pooled cross-section is used to evaluate the effects of a number of government expenditure variables on economic growth:

$$y = a + b(GS) + c(TIE) + d(Z13) + e(Z19)\ f(EC)$$

where the variables are defined as follows:

y : per capita GDP

GS : share of government consumption expenditure in GDP

TIE : Total investment in education; current school enrollment

Z13 : Dummy for Mediterranean Climate Zone

Z19 : Dummy for Tropical Rain Forest Climate Zone; and

EC : Energy consumption per capita

Landau's conclusions, derived from the application of the above regression to a cross-section data for 65 LDCs, are:

> Government consumption expenditure excluding military and educational expenditure ... appears to have noticeably reduced economic growth. Military and transfer expenditures do not appear to have had much impact on economic growth. Governmental educational expenditures seem to be inefficient of generating actual education .... Government capital development expenditure appears to do nothing to accelerate economic growth. (p.73)

These conclusions need to be assessed in light of Landau's conceptualization of the regression equations. Two major criticisms are justified in this respect. One is the use of $^{G}/_{y}$ as a regressor. As Rati Ram (1986) points out: "the appropriate variables to investigate whether 'growth of government hurts economic growth' are $\dot{G}$ and/or $\dot{G}(G/Y)$, and not G/Y". (p. 197). As discussed in Chapter 3, a regression analysis of $^{G}/_{y}$ and GDP per capita is tantamount to a test of the Wagner Hypothesis regarding the scale of state activity and does not measure the impact of rise in 'G' on 'Y'. The second criticism of Landau's growth equation is the absence of any investment variable. Neither 'I' nor '$^{I}/_{y}$' features in the equation. The use of human capital measures as proxied by contemporaneous school enrollment rates is

hard to justify. There are clear lags between expenditure on education and economic growth. Some measure of educational attainment seems to be more appropriate for Landau's purposes. In light of these criticisms, Landau's conclusions remain doubtful.

Ram's (1986) study uses a theoretical model similar to the one discussed in this Chapter. Its basic estimating equation is equivalent to our Equation (9). For estimation purposes, however, Ram makes further simplifying assumptions. By equating $\delta/1+\delta = \theta$, Ram derives and tests the following equation:

$$\hat{Y} = \alpha(I/y) + \beta \hat{L} + \theta \hat{G} \qquad (1)$$

Note that in such formulation, the externality effect, i.e. the coefficient of (dG/y) disappears altogether. Ram further tests other variations of the basic equation that include the coefficient of (dG/y):

$$\hat{Y} = \alpha(I/Y) + \beta\hat{L} + \gamma(\hat{G})(G/Y) \qquad (2)$$

The prime reason for the change of variables is the collinearity between $(\hat{G})$ and $\hat{G}(G/Y)$. To avoid this effect, their impact is measured separately. For regression purposes, Ram calculates growth rates by "fitting exponential trend equations to variable values for the period." (p.194)

Ram's cross-section and time series tests concluded that a strong overall positive impact of government size, a positive externality effect, and factor productivity in the government sector are higher than the productivity in the rest of the economy.

Ram's analytical procedure and results have attracted criticism from, among others, Rao (1989) and Carr (1989). Rao questions Ram's assumptions as well as his results As we noted, Ram's simplifying assumption makes it impossible to separate the impact of government size on economic growth into productivity and externality effects. Rao re-examines Ram's regression analysis using the averages of annual growth rates as opposed to Ram's exponential trends method. For Equation (2) above, Rao and Ram results for coefficient γ are compared below:

	Ram	Rao
1960-70	1,286	1,340
1970-80	1,744	1,360

Highlighting the sensitivity of such analysis to various statistical procedures, Rao points out a major flaw in Ram's methodology:

> Ram ... recognizes that the collinearity between (dG/G) and (dG/Y) "may lower precision in the estimation...", yet, while interpreting the cross-section results, he uses the statistical insignificance of the coefficient of (dG/Y) ... to drop the term; to infer that $(\delta/1+\delta) = \sigma$ ... to estimate σ as well as to infer the magnitude of the externality effect. Clearly, since both (dG/Y) and (dG/G) appear ... and ... may be correlated, the statistical insignificance of the coefficient of one of them in the sample may not be a sufficient basis to assume that its value in the model is zero. (p. 274)

Rao furthermore examines the direction of causality between 'G' and 'Y', calling into question Ram's conclusions. He notes:

> the overall positive impact of government size, observed in the cross-country regressions, may be biased due to the specification

> problem..., in regard to the positive and relatively large impact identified in time-series regressions, the result is of limited significance since causation at best is bidirectional in a few countries, and there is little direct evidence to support the type of causation implied in the Ram model. (p. 279)

Carr's (1986) criticism of Ram's results is more fundamental. It has to do with the use of national accounts data to measure government efficiency in producing goods and services.

> The mislabeling of government intermediate goods as final goods induces a positive bias in the relationship between government size and economic growth. This bias in the data makes it difficult if not impossible to measure the exact effect of government on the growth process. (p. 271)

Carr's basic contention, if accepted, could apply as well to our empirical analysis in this Chapter. However, in line with our discussion in Chapter 2, it should be noted that:

1. the relative size of 'intermediate' vs. 'final' government goods is not clearly known. Some would even argue that it is basically indeterminate. However, in terms of the existing research, i.e. Herz and Reich (1982), and Reich (1986), intermediate output is approximately 16% for Germany, 14% for UK and 14% for Sweden in 1974. For Germany in 1975 and Canada in 1978 these ratios are 11.5% and 22.9%, respectively.
2. Whatever the ratio of intermediate to final goods, it is the stability of this ratio that matters for empirical analysis and not its magnitude per se.

3. Any attempt to divide government services into final and intermediate is likely to introduce larger errors than inaccuracies

resulting from leaving the intermediate services of government in the national account estimates.

Thus the grain of truth in Carr's criticism is not enough to invalidate the use of national accounts estimates in this respect. With the use of national income data, and within the conceptual framework used by Ram, we have shown that Ram's results are by and large questionable. Our cross-country results, as summarized in Tables 4.1 to 4.4, contradict Ram's findings. In terms of time-series empirical testing, our results confirm what Ram calls an overall positive externality of the government sector. However, as illustrated in Table 4.6, our results demonstrate a lower productivity in the public sector for all countries in the sample considered. These results, calculated directly from our estimated coefficients of the model, are in stark contrast with Ram's inferred conclusion that productivity in the government sector is higher than the productivity in the rest of the economy.

4.6 **Development Stage and Government Externality**

It is both of theoretical and policy interest to establish if the effect of government on growth varies as economic development takes place. Rubinson (1977) concluded that the positive effect of government on growth was inversely related to the stage of economic development. His conclusion followed from an empirical regression of growth of real output against population growth, a trade variable, the share of government revenue in GNP, and a variable for government size. Ram (1986) correlated the coefficients of $\hat{G}$ and $\hat{G}(^{G}/y)$ (see Equation 8 above), with real GDP per capita for 1970.

He concludes: "there is some evidence to suggest that the positive effect of government on growth is typically stronger at lower income levels." (p. 202)

Theoretically, two main forces are at work: One is the impact of government taxation and debt on growth, the other is the influence of government scale on factor productivity in the economy. (Barro, 1990, p. 109) Typically, economic development expands the taxable capacity of the economy. Governments in turn have a tendency to raise their tax collection accordingly. This has a negative impact on growth, mainly due to its disincentive effects. At the same time, more resources available to the government enable it to provide, inter alia, goods and services that improve factor productivity in the economy in general. Similar to income and substitution effects, it is difficult to conclude a priori which effect would dominate. In the final analysis, it is an empirical issue that strongly depends on the specific country under consideration. Nevertheless certain general observations may be made using government externality coefficients derived from our time series analysis.

Table 4.8 summarizes these coefficients arranged in terms of average per capita real GDP. The results reported include only 98 out of a total of 115 cases. These were the cases with statistically significant coefficients. Generally there is a positive relationship between the government externality coefficient (GEC) and the rise in economic development as proxied by real GDP per capita. An ordinary least-squares regression of GEC and development index for the 98 countries had the following results:

Regression coefficient: 0.0006 (t-stat: 6.09)

$\bar{R}^2$: 0.28

Durbin-Watson stat : 1.93

While the magnitude of the coefficient is not large its sign and statistical significance - as measured by its t-stat - point to the existence of a positive correlation between the two aforementioned variables. However, the relationship between GEC and 'Y' is much more complex.

Table 4.8: Government Externality Coefficient and Development Index

COUNTRY	AVERAGE PER CAP. REAL GDP(US$)	GEC	DEVELOPMENT INDEX
40 UPPER VOLTA	264	0.043	3.90
21 MALAWI	270	0.038	4.00
22 MALI	273	0.040	4.05
29 RWANDA	299	0.067	4.43
46 BURMA	315	0.053	4.67
11 ETHIOPIA	318	0.040	4.71
41 ZAIRE	357	0.033	5.29
54 NEPAL	360	0.033	5.33
5 BURUNDI	366	0.047	5.43
44 AFGHANISTAN	370	0.066	5.48
18 LESOTHO	379	0.054	5.62
91 HAITI	382	0.064	5.67
36 TANZANIA, UN	386	0.042	5.71
45 BANGLADESH	386	0.045	5.71
32 SOMALIA	427	0.044	6.33
17 KENYA	440	0.054	6.52
48 INDIA	447	0.034	6.62
8 CHAD	460	0.056	6.81
3 BENIN	466	0.053	6.90
27 NIGER	469	0.052	6.95
7 CENTRAL AFRICA	530	0.041	7.86
31 SIERRA LEONE	556	0.008	8.24
37 TOGO	566	0.072	8.38
113 INDONESIA	601	0.059	8.90
20 MADAGASCAR	607	0.043	9.00
39 UGANDA	620	0.064	9.19
23 MAURITANIA	649	0.034	9.62
13 GAMBIE, THE	694	0.057	10.29
4 BOTSWANA	736	0.043	10.90
15 GUINEA	742	0.058	11.00
6 CAMEROON	749	0.045	11.10
10 EGYPT, ARAB	781	0.037	11.57
63 THAILAND	791	0.076	11.71
58 PHILIPPINES	816	0.054	12.10
34 SUDAN	832	0.053	12.33
9 CONGO, PEOP	836	0.055	12.38
60 SRI LANKA	839	0.030	12.43
19 LIBERIA	852	0.031	12.62
35 SWAZILAND	871	0.039	12.90
92 HONDURAS	881	0.055	13.05
26 MOZAMBIQUE	890	0.044	13.19
30 SENEGAL	893	0.046	13.24
100 BOLIVIA	919	0.043	13.62
89 EL SALVADOR	945	0.071	14.00
43 ZIMBABWE	955	0.048	14.14
25 MOROCCO	958	0.039	14.19
28 NIGERIA	961	0.100	14.24
14 GHANA	983	0.052	14.57
115 PAPUA NEW GUINEA	1009	0.029	14.95
105 GUYANA	1016	0.062	15.05
53 JORDAN	1025	0.003	15.19
16 IVORY COAST	1044	0.062	15.48
2 ANGOLA	1044	0.055	15.48
104 ECUADOR	1061	0.036	15.71
106 PARAGUAY	1096	0.062	16.24
88 DOMINICAN RE	1122	0.026	16.62
38 TUNISIA	1151	0.053	17.05
90 GUATEMALA	1154	0.084	17.10
54 KOREA, REP	1163	0.083	17.24
61 SYRIAN ARAB	1237	0.072	18.33
1 ALGERIA	1241	0.057	18.38
95 NICARAGUA	1276	0.034	18.90
101 BRAZIL	1353	0.064	20.05
62 TAIWAN	1356	0.045	20.10
55 MALAYSIA	1379	0.082	20.43
103 COLOMBIA	1401	0.118	20.76
112 FIJI	1414	0.045	20.95
83 TURKEY	1453	0.038	21.52
50 IRAQ	1501	0.057	22.24
49 IRAN	1568	0.062	23.24
107 PERU	1623	0.066	24.05
87 COSTA RICA	1658	0.069	24.57
96 PANAMA	1732	0.065	25.67
94 MEXICO	1922	0.123	28.48
108 SURINAM	2002	0.039	29.67
33 S. AFRICA	2015	0.064	29.86
59 SINGAPORE	2034	0.083	30.14
102 CHILA	2047	0.075	30.33
79 PORTUGAL	2066	0.060	30.62
47 HONK KONG	2066	0.088	30.62
66 CYPRUS	2124	0.059	31.48
12 GABON	2417	0.085	35.81
99 ARGENTINA	2677	0.099	39.67
109 URUGUAY	2700	0.055	40.00
80 SPAIN	3162	0.125	46.86
52 JAPAN	3796	0.131	56.24
64 AUSTRIA	4120	0.074	61.05
114 NEW ZEALAND	4258	0.120	63.10
68 FINLAND	4274	0.088	63.33
84 UNITED KINGDOM	4294	0.047	63.62
65 BELGIUM	4654	0.121	68.95
69 FRANCE	4904	0.095	72.67
111 AUSTRALIA	5010	0.074	74.24
67 DENMARK	5390	0.056	79.86
82 SWITZERLAND	5640	0.074	83.57
86 CANADA	5698	0.093	84.43
81 SWEDEN	5724	0.072	84.81
98 UNITED STATES	6749	0.074	100.00

The underdevelopment of the economy (i.e. low per capita GDP) is synonymous with poor infrastructure, poor public services, and generally inefficient economic organization. In such a milieu, on the one hand complementary and supplementary government externalities are meagre in themselves and on the other the economy at large is not capable of augmenting such externalities.

As economic growth (and development) take place, government's resource base expands and its quantitative and qualitative contributions, in the form of the two aforementioned externalities, augment the overall growth process. Along the development path in this phase, government's contribution is the largest and most critical. When the economy enters the developed stage, however, government's positive externalities decline. A number of factors may contribute to this phenomenon. One is the inefficiency resulting from the diseconomies of scale associated with an enlarged government sector that emerges in line with the Wagner's Law. Another is the shift in the allocation priorities of government expenditure as economic development occurs.

Our analysis of the Beck Hypothesis in the Chapter 3 demonstrated that over time governments tend to increase their redistributionist allocations at the expense of other outlays. This tendency is the strongest in the most developed countries. (Beck 1979) While some of the redistributionist outlays do have positive social externalities, in terms of generating economic growth their spin-off effects are not comparable to expenditure on outlays such as the provision of infrastructure, research and development,

and improvement in the provision of public services. At the same time, as less resources are devoted to these more productive allocations, the complementary factor in government externalities declines in absolute terms, as well as in comparison with the private sector. The combination of these factors is responsible for the fall in government externality effects in highly developed economies.

4.7 Conclusions

This Chapter has presented a factor productivity differential model of the government sector against the backdrop of government sector externalities. It has thus assigned the public sector a production role alongside with the private sector. This is a departure from common growth models, i.e. Barro (1990), in which the government assumes no production role - rather its objective is to maximize the utility of the representative household. Realistically, governments do have production roles. Moreover, much of their output enters as input in the private sector production function. It is then an empirical question to establish whether there is a positive (or negative) factor productivity differential in the government sector.

Using the Summers - Heston (1984) data for 115 countries over the 1960-80 period, we have established - using cross-section analysis - that there is no support for any positive factor productivity differential in favour of the government sector. This result contradicts, *inter alia*, Ram's (1989) conclusion in this respect. As for the externality effect of government activities, our time series analysis supported the existence of positive

externalities. However, the time series results produced estimates unambiguously suggesting that government factor productivity is lower than its counterpart in the rest of the economy. Generally, this conclusion contrasts sharply with results derived by Aschauer (1989), Ram (1989), and Reich (1991). Against this background, a more detailed analysis of the issues involved will be presented in the next Chapter.

Central to the analysis of this Chapter and Chapter 3 is the direction of causality between 'G' and 'Y'. Using the Granger causality framework, we used three sets of regressions to examine the direction of causality for a group of 100 countries. Our results concurred with the literature that the balance of Granger-causality evidence will support bi-directional causation if contemporaneous terms are admitted in regression equations. However, if contemporaneous terms are not admitted, the weight of evidence shifts considerably in favour of no causality either way.

A further examination of the results showed that the economic impact of government seems to be positively related to the stage of economic development at lower levels of development. This relationship tends to reverse as the economy enters advanced stages of economic development. This phenomenon can be explained in terms of the allocation of government resources between public goods (items with high positive externalities) and distributional outlays (items with low positive externalities).

CHAPTER 5

ON THE PRODUCTIVITY OF GOVERNMENT EXPENDITURE: CONCLUSIONS

In the preceding Chapters we have examined the theoretical framework, as well as the empirical analysis, of government expenditure, its expansion over time and its effects on economic growth. Against this backdrop, this Chapter has three objectives.

One objective is to critically analyze 'productive' versus 'unproductive' public expenditure. Our results in Chapter 4 unambiguously support the view that factor productivity in the government sector is below that of the economy in general. However, there is an opposing view in the literature. Section 5.1 compares and contrasts these two views.

The second objective is to re-examine government expenditure productivity. Much of the analysis of productivity-measurement-related issues was presented in Chapter 2, Section 2. Section 5.2 analyzes the implications of the evolving role of government for public expenditure productivity.

The third and final objective, pursued in section 5.3, is to present the theoretical and policy implications of our results.

5.1 Productive vs. Unproductive Public Expenditure

The debate on the productivity of government expenditure has been carried out almost entirely at an aggregate level. The conceptual foundation of this approach is based on the assumption of an aggregate production function. Within the context of the analysis of economic growth, two general alternatives exist. One is to assume a stable relation between input and output, postulate a particular functional form for this relation, and proceed to estimate the parameters of this functional form. The other is to use nonparametric index number techniques to measure the contribution of the various inputs to the growth of output. The latter methodology is commonly known as "sources of growth analysis".

The contribution of public expenditure to output growth may be measured using either of the above alternatives. As detailed in previous Chapters, government output is partly an input into the aggregate production function, and partly a contributor to the overall productivity factor in the economy.

Consider an aggregate production function as follows:

(1) $$Y_t = A_t . F(K_t, L_t, G_t)$$

where: Y_t = Total Output

K_t = Aggregate Stock of Capital

L_t = Aggregate Labour Services Employed

A_t = A measure of productivity or Hicks neutral technical change

G_t = Flow of services from the government sector

Assume a generalized Cobb-Douglas form for (1) and in logarithmic form we have:

(2) $$Y_t = a_t + e_l.l_t + e_k.k_t + e_g.g_t$$

where e_i = elasticity of output w.r.t. the factor i;

i = L, K, G.

From (2) we derive a measure of total factor productivity, P_t, as follows:

(3) $$P_t = Y_t - S_l.l_t - S_K.K_t = a_t + e_g.g_t$$

where S_i = factor share in output, i = L,K

Note that in cases where the production function exhibits constant return to scale over the private inputs L_t and K_t but increasing return over all inputs, private factors are paid in accordance with their respective marginal product.

Equation (3) illustrates the positive relation between P_t and government services. If the assumption of increasing return over all inputs is seen as inappropriate, due inter alia to congestion effects, then Equation (3) would have to be modified to read as follows:

(4) $$P_t = a_t + e_t.(g_t - i_t) \text{ where } i_t = K_t + S_l.L_t$$

Equations (3) and (4) enable us to examine the appropriateness of the two specifications of return to scale.

Within such a theoretical framework, it is possible to test the contribution not only of aggregate government expenditure, but its various constituent components.

Utilizing annual US data for the period 1949 to 1985, Aschauer (1989) carries out a number of tests on a range of possible definitions of 'G'. The salient points of his results are:

a. If G ≡ government spending, net of public investment,

> there are offsetting effects of government spending, net of public investment, on productivity in the private sector. While police services may enhance productivity, government resources devoted to the regulating process may detract from measured output per unit of input thereby leaving, on net, no discernible input. (p. 191)

b. If G ≡ 'Core' Infrastructure,

> The estimated elasticity for the core infrastructure, which accounted for 55% of the total nonmilitary stock, equals 0.24 and is highly significant. (p. 193)

c. If G ≡ Military Capital Stock,

> Although the coefficient value on the military capital ratio is negative, its insignificance indicates that it aids little in understanding productivity movements during the sample period.(p. 191)

In general, Aschauer concludes that "significant weight should be attributed to public investment decisions - specifically, additions to the stock of nonmilitary structures such as highways, streets water systems, and sewers - when assessing the role the government plays in the course of economic growth and productivity improvements". (p. 197)

These conclusions have substantial policy implications. As Reich (1991) has shown, these results imply that public capital is four times more productive at the margin than private capital, and that a $10 billion increase in public capital stock would lead to a $7 billion increase in US GNP the following

year. (Hult & Schwab, 1992)

These estimates, however, have not gone unchallenged. Critics, inter alia, Aaron (1991), Schultze (1990) and Hulton and Schwab (1992) have raised methodological issues in regard to the direction of causality and the potential problem of spurious correlation in a macroeconomic approach. Furthermore, it is worth noting that Aschauer's results seem to be at odds with other empirical results on the subject which use different statistical methods. For example, Holtz-Eakin (1988) uses data similar to Aschauer's (1989a), but employs an econometric technique that takes account of the non-stationarity of the data. He finds an elasticity of aggregate output with respect to state and local capital stock of about 0.3, but due to its large standard error, Holtz-Eakin cannot reject the hypothesis that the elasticity is zero. (Hulten & Schwab, 1992)

The unambiguous empirical support by the proponents of relatively higher productivity of public investment may also be explained in terms of the conceptual framework within which these studies are done. These studies, including Aschauer (1990, 1989a, 1989b, 1988), Munnell (1990) and Reich (1991), employ the so-called "Solow-residual" as the proxy for variations in factor productivity in the economy. The multifactor productivity residual, being approximated as a residual, is subject, inter alia, to measurement and omitted variable errors. A further potential source of error is the common assumption of constant return to scale in the aggregate production function. Equation (1), above, can be used to illustrate the issues relating to the multifactor productivity residual. Note that government capital may act as

an environmental factor to enhance the productivity of some or all private inputs. In essence, such influences are externalities, as demonstrated by Romer (1986) and Lucas (1988).

In special circumstances in which such externality effects augment all inputs proportionately, variations in government capital correspond to a Hicks-neutral shift in the production function. Equation (1) can thus be re-written as

$$(1') \qquad Y_t = A(Q(t), t)\ F(K_t, L_t, G_t)$$

where Q(t) is public capital.[1] The residual now has two separate components:

$$(5) \qquad A(t) = \alpha(t)\ Q(t) + H(t)$$

where $\alpha(t)$ is the elasticity of the measured residual (and thus output) with respect to government capital, and H(t) is the true Hicksian efficiency measure. However, Q(t) is a major part of G_t, which complicates empirical testing of Equation (1').

Furthermore, if this production function exhibits constant return to scale in all inputs but not in the private inputs, our empirical test would be subject to a serious price-of- capital-bias. Euler's Theorem, based on the

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[1] *Alternatively, we could specify the aggregate production function as Y=A(Q(t),t).F(K,L,M) where M is non-government intermediary inputs. In this case the total effect of government expenditure would be embodied in the residual.*

assumption of constant return to scale, is commonly invoked to establish the share of capital. Using our above-mentioned production function, this would mean:

$$(6) \qquad P_x(t).K(t) = P_y(t).Y(t) - P_L(t) - P_g(t).G(t)$$

But this introduces an upward bias in the share of capital. This bias is at least equal to the unpaid implicit income of public capital due to Q(t)-effect on the efficiency of capital. The commonly measured multi-factor productivity residual is therefore comprised of three components: the contribution of non-market factors such as public capital, a correction measure if the assumption of constant return to scale does not hold, and the 'true' multi-factor productivity. (Hulten and Schwab, 1992)

Within such a framework, Hulten and Schwab (1992) use the US manufacturing data for the period 1965-86 to examine the link between public infrastructure and productivity. They conclude: "There appears to be no systematic relationship between the regional growth rate of public capital and the regional growth rate of productivity." (p. 130-33) Their conclusion, they assert, "casts doubt on the importance of public infrastructure as a determinant of regional growth." (p. 123)

As is evident, the empirical result for or against the role of public investment in the growth process is sensitive to the theoretical specifications of the underlying model. As such it is hard to reconcile the debate at a macro level. In general, such models are subject to two

important drawbacks: the omitted variable error and the well-known aggregation problem. Thus macro-analyses of public expenditure productivity should ideally be supplemented by micro-theoretic studies of the productivity of public expenditure.[2]

5.2 Expenditure Productivity and Shifting Borders of the State

Productivity measures reveal the efficiency with which resources are utilized. Commonly, productivity is based on an input-output relation. The narrow concept of efficiency then refers to increased output derived from the same amount of inputs, or the same amount of output obtained from a lower quantity of inputs.[3]

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[2] *Microeconomic analysis of the productivity of public expenditure has focused almost entirely on the comparative efficiency of public enterprises. This is justifiable on the ground that public enterprises, more often than not, produce what could just as well have been produced by private firms. As such, relative analysis of factor (expenditure) productivity is meaningful. However, by implication, such micro studies are unable to supplement our aforementioned macro analysis for two reasons: First, by focussing on specific public enterprises they are unable to shed light on the overall externality effect of public investment. Second, and more importantly, public enterprises are not necessarily labour-intensive or subject to the broader government sector inefficiencies. (For a comprehensive survey of the literature, see Vining and Boardman, 1992)*

[3] *The broader concepts of efficiency, i.e. economic efficiency, refers to allocative efficiency and increase in consumer welfare. For practical purposes, this may be referred to as 'effectiveness'. (see Burkhead and Ross, 1974)*

Government expenditure may be classified into three categories: public goods, quasi-commercial goods, and transfers. While transfers are primarily money intensive, public and quasi- communal goods are money and labour intensive. Productivity enhancement, as well as productivity measurement, can be better applied to these two groups of expenditure, although transfers form the highest share of the budget in developed countries.

Productivity in government, however, is influenced by a complex of factors such as design of organizations, programs, laws, and resources (money and people). Productivity of government expenditure thus cannot be an abstraction in the context of widely heterogeneous and diversified public services.

Sources of productivity gain are either technical change (embodied in capital equipment) or the acquisition of new or improved skills. As discussed in Chapter 3, government services are mostly labour intensive. While traditional service activities become more reliant on capital equipment, such reliance in governments may well lead to better services, rather than raising productivity.[4]

In addition to factor-mix, there are organizational aspects unique to governments. Unlike private sector firms that are commonly controlled and

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[4] *Premchand (1992) argues: "In fact, adherents of national income accounts assume no gains in the productivity of government employees and that increases in the volume of services are achieved only through manpower increases." (p. 399)*

relatively closed organizations, governments are complex and more open entities. Two related features are of direct relevance to productivity analysis. One relates to uncertainty about the economy; the other pertains to the ever-evolving, ever-changing functions of government. Combined, these constitute the shifting borders of the state.

Uncertainty about the economy results in volatile variations in resource availability. Variable budget allocations in turn may add to unit costs given rigid overhead expenses. Consider a reduction in budgetary resources that leads to a decline in the volume of public services. In the presence of fixed overhead costs this results in a rising unit costs or in declining productivity. An increase in budgetary resources, on the other hand, is likely to reverse the outcome, i.e. an increase in the volume of services reduces unit costs and leads to a rise in productivity.

5.3 Conclusions

Economic analysis of expenditure has received fresh impetus in the renewed and expanding literature on economic growth. On grounds of positive externalities, increasing return to scale, incomplete information, coordination function, and the existence of public goods, inter alia, economic theory assigns a definite role to government. These arguments were revised in Chapter 1. Furthermore, we pointed out that within the framework of formal theoretical growth models, the role of the state is policy coordination with regulating powers. The rate of economic growth is thus affected by the state's tax/subsidy structures, the contribution it makes to

capital accumulation and the support it provides to research and development in the economy.

At the same time, theoretical and empirical evidence demonstrates the presence of inefficiency, malfunction and bureaucratic inertia within governments. The net effect of these two opposing conclusions is an empirical question, the measurement of which is fraught with numerous technical difficulties. First and foremost among them, as discussed in Chapter 2, is the very concept of government output.

Influenced mainly by the national accounting conventions, government output is by and large cost-based.[5] This in principle imparts an upward bias into the measurement of this sector's output. This is particularly problematic given the large and expanding theoretical and empirical Public Choice literature on the bureaucratic tendency toward excessive spending. A related issue is the distinction between intermediate and final government output.

We argued that first the notion of intermediateness itself depends upon whether we seek to measure *welfare* or *production*. Second, based on the empirical work on German, Canadian, UK and Swedish data, it has been established that government's intermediate output is about 7 to 10 percent of its total consumption; eg. 1 to 1.4 percent of GDP.[6]

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[5] *In line with the other national accounts measures, government output calculation is mainly a convention (albeit with some theoretical justification) which is commonly used.*

[6] *This is so if we use intermediateness within the production*

These conceptual and empirical complexities have direct ramifications for performance measurement of the public sector. Moreover, Chapter 2 illustrated how our inability to measure government output complicates the task of efficiency improvement in this sector.

Notwithstanding the conceptual and practical measurement problem, the link between government output (expenditure) and economic growth, and visa versa, has been studied extensively. Adolph Wagner's hypothesis of the 'law of the increasing extension of state activity' (1877) has been the point of departure for a growing empirical literature that seeks to establish support for government output as endogenous to economic growth and industrialization.

In addition to the aforementioned measurement problems, the literature on Wagner's Hypothesis faces a number of definitional issues related to the size of the government sector and the choice of deflators for the derivation of real values.

Chapter 3 discussed these issues in detail. Moreover it pointed out that the 'actual' and 'desired' government output may not necessarily correspond, something which would have clear impact on any empirical "test" of Wagner's Hypothesis.

In contrast to the literature on the Wagner's Law, a competing paradigm in economic literature regards government expenditure as exogenous and theoretically capable of generating economic growth. Chapter 4 considered *concept*.

this possibility. Introducing a dual factor productivity model, Chapter 4 utilized Summers - Heston's (1984) data set for 115 countries to examine the impact of government on economic growth. Our econometric estimates were made by using both cross-section and time series data.

The cross-section testing of the model did not provide acceptable estimates to support the hypothesis that a factor productivity differential exists between the government sector and the rest of the economy. Nor could the estimates establish the effect of government externalities. These results were not affected by subdividing countries into developed, undeveloped, and developing.

Our time series results were much more indicative. They clearly supported the view that the growth of government has a negative effect on economic growth. Thus we established that in 114 (out of 115) cases the factor productivity differential of the public sector was negative. At the same time our results imply government positive externality effects. The co-existence of these two results suggests that public production should be undertaken only in cases where the externality effect is greater or at least equal to the productivity loss in resource utilization.

Central to our analysis of the link between government expenditure and economic growth was the direction of causality between the two. Within the Granger causality framework, we used 100 (out of 109) regressions, with statistically significant coefficients, to test the direction of causality. In line with similar studies, our results showed that the balance of Granger

causality evidence supports bi-directional causation where contemporaneous terms are present. In the absence of contemporaneous terms the overall results are in favour of no causality either way.

Our analysis in Chapter 4 suggested that the effect of government on economic growth seems to be positively related to the stage of economic development for less developed economies, and negatively related for advanced economies. This result we explained with respect to the rise in distributional expenditure in the case of developed countries.

Generally, the analysis of the productiveness of government expenditure may be carried out at either macro or micro-economic level. Our macroeconomic examination of the issue in the preceding four chapters should ideally be contrasted with micro-theoretic studies of productivity of public expenditure.

The survey of micro-theoretic evidence, as available in the literature, confirms the view that the private corporate sector enjoys higher productivity than the public sector enterprise. While this cannot, strictly speaking, lend support to our above-mentioned macroeconomic results, it is worth noting that the ever-shifting borders of the state, combined with the measurement difficulties referred to before, render the interpretation of government expenditure productivity a hazardous task.

Given positive externalities and lower factor productivities, public activity should continue to the point at which externality benefits equal productivity

losses. However, from the perspective of policy, these guidelines are not easily implementable. Socio-economic reality is often far too complex. Moreover, the empirical measurement of the aforementioned benefits and losses, with the presence of the well-known aggregation problems, is commonly fraught with inaccuracies. These in turn lend themselves to various interpretations, and hence support by different interest groups. In general, however, when private and public undertakings are both feasible, private ownership is superior from an efficiency viewpoint. In practice, this requires full contestability of the ownership market.

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