

From Micro to Macro: Public Policies and Aggregate Economic Performance

Timothy Besley*

London School of Economics
Houghton Street
London WC2A 2AE

1 Introduction

The link between public policies and aggregate economic performance, measured by growth rates in or levels of income per capita, has a central place in economic analysis. The aim of this paper is to offer a brief birds eye view of the issues and evidence. The focus is on reviewing the knowledge base on which we can draw in making claims about policy effectiveness and desirability.

The organizing question that I will take for the paper is what can we say about the optimal way for government to intervene in the economy when the objective is to promote national output. This is essentially a macro-economic question. However, I will argue that in understanding the answer to this it is essential to draw on the increasing body of evidence of the effects of government policies on behaviour at the micro-level. These are studies of the households and firms who are the key economic actors at the heart of the economy. By and large, the empirical evidence derived at a macro-level is too crude and fraught with difficulties of interpretation to be useful in specific policy analyses.

The case for government intervention comes to down to two main things:

- the behavioural response of the economic actors who are affected by policy, and
- the divergence between private and social returns to the activities that they produce.

The latter must rest on identifying the market failures that policy is trying to fix, with the policy solution being tailored to deal with the problem. Below, I will discuss source of estimates on social returns and their reliability. I will then discuss policies that promote capital accumulation (either by increasing the supply of savings or encouraging investment), provision of key public goods, fostering human capital accumulation and encouraging innovation.

When assessing aggregate economic performance, it is important at the outset to distinguish between level and growth effects from government policy. A focus on growth suggests that we are interested in policies that increase the rate of change of national income. While the theory is often precise about which kind of effect we are focusing on, the empirical analysis tends to be much less clear. At some level, it may not matter too much. Finding a policy with a level effect on national income that disappears in the long-run after period of adjustment will certainly be hard to distinguish empirically from a permanent growth effect in the kind of data that we have. It is equally unclear whether we would care very much in practice as to which kind of effect was at work. On the other hand, cost-benefit calculations of interventions may be highly sensitive to this.

The remainder of the paper is organized as follows. In the next section, I will discuss the welfare economics of growth. Section three does a basic growth accounting exercise. Section four looks at the evidence on the main components of growth. Section five considers issues surrounding imperfect competition and intermediate goods taxation. Section six offers a few concluding remarks.

2 Welfare Economics of Growth

Policy makers care about aggregate performance. However, it is also clear that aggregate indicators are only part of a complex set of multiple objectives that policy pursues. Moreover, it is obvious that there may be conflicts between them. The possibility that growth promotion comes at the expense of economic equality or environmental protection are two key concerns that are frequently voiced by those who suggest that too much attention is paid to the performance of the aggregate economy as a measure of societal well-being.

In the spirit of this seminar, I will take it as read that the main objective of policy is aggregate output. Once we know the policy links to achieve this, then we can go back and reassess the possibility of conflict with other objectives.

The theory of optimal economic growth began around 75 years ago with Ramsey's pathbreaking analysis, supposedly based on dinner time discussions with Keynes. The focus of that literature is on the optimal rate of saving out of national income to maximize some long-run discounted payoff. The literature concerns itself principally with the optimal time path for capital accumulation—ignoring the roles of human capital and innovation which have been so prominent in recent theories of growth. The basic conclusion of these models is that the “correct” rate of accumulation should balance the rate of time preference in society with the rate of return to capital. This is really an issue of inter-generational justice, resolved in the modeling exercise by positing an infinitely lived individual who represents a dynasty. The rate of accumulation within a society and its consequent path of progress affected the well-being of generations as yet unborn.

The issue of whether we should expect a market economy in which capital accumulation decisions are left to markets would accumulate in the way that the theory of optimal growth suggests that they should. As demonstrated by Diamond (1965) among others, there is scant reason to be optimistic in this regard. If generations who are currently alive fail to value the consumption of future generations, then they underaccumulate relative to the path chosen by a dynasty.¹ If a view is taken about the “correct” way to value these generations, then a judgement can be formed on the optimal time path. The most robust theoretical possibility in the literature is actually that of over-accumulation. It is possible that the

* Professor of Economics, London School of Economics; Research Fellow, IFS; and Program Director, CEPR. I am grateful to Steve Bond, Rachel Griffith and Steve Pischke for useful discussions. This paper was presented at HM Treasury Growth Seminar, October 2000. A revised and updated version will appear in a forthcoming edition of *Fiscal Studies*.

1 When individuals care about their heirs the economy behaves more like an infinitely lived consumer.

rate of savings (and investment) is so high that by reducing accumulation all generations (current and future) will be better off. (The future generations benefit from “inheriting” a higher marginal return to capital formation). Abel et al (1989) devises an ingenious test for whether this was true of the main OECD economies and conclude that it is not. I am not aware of any study that has updated their analysis to a more recent period. However, equally, there are no particular reasons to think that things are very different today.

Many of the policy concerns among OECD economies suggest a fear about under-accumulation. To rationalize this, it is common to select a particular growth path from among those that are dynamically efficient and compare the current rate of accumulation with it. A frequently used benchmark is the golden rule—loosely the rate of accumulation that maximizes the rate of consumption per capita. On that criterion, some have argued that there is a case for incentives to promote accumulation (particularly in the U.S.). However, before embracing this kind of finding, it should be clear that this embodies a particular judgement about the right distribution of consumption between generations. In effect, the implicit view is that the current generation is consuming too much and that they should be dissuaded to leave more resources for the future by subsidizing investment.

A more robust set of policy proposals can be approached by considering the possibility that there are important accumulation decisions that contribute to aggregate economic performance where the marginal private return is below the marginal social return leading to under-accumulation. This would generate the possibility of a classic market failure—in which the well-being of present and future generations can be raised by appropriate government intervention.

On this score, few would doubt the theoretical validity of the case for promoting infrastructure investments with large public goods components, where non-excludability of benefits leads to under-provision by the market. This may take the form of direct government construction, subsidizing private alternatives or simply promoting a legal environment that creates viable property rights for potential entrepreneurs.

Recent advances in growth theory have made much of two other cases where the prima facie case for private returns being below social returns is strong. The first of these is accumulation of human capital where it is posited that standard private rates of return to human capital ignore a social component that makes everyone else in society more productive. This is in addition to concerns that other market failures—for example in credit markets—lead to underinvestment and failure to reap the private returns by some groups. The other is the process of innovation—broadly defined. In spite of the elaborate legal protection of intellectual property, there are good reasons to suppose that innovators fail to capture the full social returns to what they produce. This again suggests a possible role for government in promoting such activities.

Before proceeding to the evidence, it is useful to review a simple “rule” for optimality of government spending to promote aggregate output. This will serve as organizing principle for our discussion of what we know about the effectiveness of policy to affect this objective. A similar rule could be restated for a growth objective. However, virtually all of the evidence that we have for divergence between private and social returns to accumulation is about effects on levels of aggregate output not on growth rates. Hence, from a practical point of view, the distinction is not particularly important.

Spending government resources to promote output has costs and benefits. The cost is simply the opportunity cost of the revenues used. From this point of view, it is well known that when tax revenue is scarce, then it is better to have higher taxes on goods that are demanded/supplied inelastically—the so-called inverse

elasticity rule. This basic result holds, regardless of the social objective being pursued. The benefit comes from using the tax revenue to promote an activity that is favourable to the objective being pursued. Here, we are interested in the divergence between private and social returns to accumulation. The case for offering a favourable tax treatment—even a subsidy will rest on that divergence being significant.

There is a simple formula that relates these costs and benefits. It is simply the product of saying that government should pursue its objective by setting the marginal cost and benefit equal. In the current context, this simply says:

$$\begin{aligned} & \text{(marginal social value of increasing } x \text{ by one unit)} \\ & (1 + \eta) * \text{marginal cost of public funds} \\ & = \text{marginal cost to government of increasing} \\ & \quad \text{activity } x \text{ by one unit.} \end{aligned}$$

where η is a parameter that reflects the policy sensitivity of x . A high value of η is a case where it is difficult to affect x by policy and a low value the case where it is easy.

In theory, this type of equation is useful for two things. It gives an absolute sense of the optimal government policy for a given marginal cost of public funds. Second, it can give a sense of the *relative* incentives used across an array of policies that contribute towards a particular social objective.

This formula is useful as an aide memoir for thinking about the link between the incentives that we might want to put in place to promote aggregate economic performance. In that case, the x 's are the inputs into aggregate production—see below. Their marginal social values are their social returns. The η is derived from studies of how effectively government can affect these aggregates via policy. For taxes and subsidies, the marginal cost term can be thought of as being roughly proportional to the size of the aggregate being affected. The formula suggests that it is the interplay between these factors that determines the case for government intervention.

For the remainder of the paper, we will consider how the existing state of empirical knowledge enables us to put some orders of magnitude for the different components in this formula.

3 Accounting for Growth

It is useful to begin with some basic growth accounting. Suppose that we consider a production function for national income:

$$Y = F(L, K, H, A)$$

where Y is income, L is labour input, K is capital input, H is human capital input and A is technology. Then growth can be decomposed in the following way:

$$g_y = \alpha_K g_K + \alpha_L g_L + \alpha_H g_H + \alpha_A g_A$$

where g_i is a growth rate and α_i is the share of the factor i in national income. In practice, this way of thinking about the issues is misleading—we cannot measure the contributions of H and A to output separately from their raw components K and L . However, the message is clear—that for public policy to have an impact on growth it has to have some impact on one or more components of growth. Hence, schematically, it is useful to think about the role of government by thinking of the ways in which it could potentially change these components.

This is pure accountancy—there is no underlying theory about the sources of accumulation. The most influential neoclassical theory was developed by Solow and Swan, emphasizing the importance of capital accumulation to a steady state set by exogenous technological change. More recent thinking has been dominated by

a variety of approaches collected under the heading of endogenous growth theory where greater weight is attached to the process of innovation and to human capital as an engine of growth. This is certainly not the place to review these contributions here—see Aghion and Howitt (1998) for an excellent review. Endogenous growth has proved somewhat liberating for the study of policy and other influences of growth—the traditional model suggested that we could identify sources of level effects on national income, but that this would not necessarily lead to changes in the long run rate of change of income per capita. In terms of the above accounting equation, endogenous growth theory is also a way of accounting for the growth residual that one finds after accounting for changes in capital and labour input.²

In taking growth theory to the data, one is left with the difficulty that only physical capital and raw labour input data are typically available for a large number of countries in a consistent basis. Even then the quality of the data vary enormously by country and over time. Hence, one is normally left with the task of explaining a residual (Total Factor Productivity)—that part of the change in income per capita that is not explained by increases in K and L .

A large literature has developed in recent years that considers policy effectiveness using cross-country evidence—see Agel, Lindh, and Ohlsson (1997) for a review. Typically this involves running a regression (normally a cross-section regression, but sometimes using panel data) with a particular set of policy variables as regressors. As a guide to policy, the literature is rather inconclusive. First, the comparison of policies across countries is extremely difficult. The authors are often reduced to using some kind of crude measure like the share of government in national income as a measure of government policy. Not surprisingly, therefore, studies often yield contradictory and unrobust findings. Second, the sources of policy influence and their link to changes in underlying behaviour is impossible to assess in broad brush growth regressions. Third, it is near impossible to assess the directions of causation in this framework.

A better guide for policy is needed. Staying within a macro-economic structure, there are a number of studies that have attempted to calibrate growth models to the data and using this as a basis for performing policy experiments. Stokey and Rebello (1995) is a good example of a quality analysis of this form. They investigate whether moving towards a flat tax, as proposed by a number of policy makers in the U.S., would lead to more growth. Their framework is an endogenous growth model with human capital. They pinpoint the key parameters that affect the growth consequences of tax reform. They show these to be the tax sensitivity of labour supply decisions and the rate of intertemporal substitution which affects consumers' willingness to substitute future for present consumption. When there is little responsiveness on this front—as the micro-evidence suggests that there should be, then there are modest overall growth effects of tax reform on growth. I am not aware of studies of this kind for the U.K.. They are clearly an important addition to the policy debate.

4 Components of Growth

The biggest growth area in public economics in the last twenty years has been our increased capacity to assess the impact of policy on the behaviour of households, firms and governments at a micro-economic level, studying the effect of incentives on outcomes. Economic theory gives a rather rich characterization of the possible sources of impact of government on behaviour. However, there is now a consensus that this is of limited value unless it is accompanied by measurement of the requisite effects.

The two margins that have been most widely studied in the context of households are labour supply and savings. Here, the key issue is how far taxes on labour and capital income affect these decisions. Some significant attention has also been paid to accumulation of human capital, and how government policy towards education shapes individuals' decisions to attend school and university. In the case of firms, investment decisions and financial policy are among the most studied.

The greatest limits on such studies are: access to data to study behavioural outcomes and finding a source of policy variation. Unless there is either cross-sectional or time-series variation in policy outcomes, there is little hope to identify a policy effect. Even then, there are all sorts of concerns that economists have worried about endlessly.

While the studies are often on micro-data, the implications for the macro-economy are profound. However, there are issues from moving to what are often case studies on particular kinds of households or firms to a larger picture.

The literatures on the study of policy impacts is too vast to attempt anything close to a survey here. Instead, let me focus a little bit on two of the key elasticities that come out of the growth literature that tries to calibrate theory to the data. As we discussed above, Stokey and Rebello (1995) find that assumptions on labour supply elasticities and intertemporal substitution elasticities are key contentious parameters.

4.1 Physical Capital

Growth accounting exercises and regression analysis all point to the centrality of capital accumulation in explaining economic performance. There are three important public policy angles on this: (i) factors that affect the supply of savings—through providing public substitutes for private savings through social security programs or taxation of capital income, (ii) factors that effect incentives of firms to invest in different assets (iii) complementarity and substitutability between public and private capital. I will discuss each of these in turn and the main lessons that we have learned.

4.1.1 Savings

There is a huge literature on the ability of the state to affect the supply of private savings. A key issue is whether taking a perspective of any particular economy is sensible in this context. To the extent that world capital markets are integrated, it is arguable that investors should be able to secure capital in a world market. Moreover, international capital mobility should limit the ability of states to effectively tax the return to saving.

While the open economy perspective is important, the literature is still highly influenced by Feldstein and Horioka (1980) which found that savings and investments rates within countries are highly correlated, making the supply of domestic capital through savings a key issue of concern. Moreover, many different countries of the world have enacted policies that are intended to stimulate private accumulation—which suggests that they are concerned about the level of savings.

The debate about savings is highly influenced by the U.S. perspective where influential economists have long been concerned about the low level of private savings. Moreover, the discussion has a paradoxical air since one of the main reasons for concern is public policy towards old age retirement, whence it is argued that social security financed on a pay as you go basis has undermined savings incentives. Thus, one kind of policy (improved savings incentives) is needed to correct for another kind of policy (payg social security).

² However, there has been an important revisionist view of the importance of total factor productivity growth (this residual) in the fast growing economies of East Asia. Young (1995) suggests that the residual for these economies in post war history may not be far out of line with the 2-3% rates that are more typical for the industrial economies. Nonetheless, there is still a question of explaining the determinants of this more standard rate of technological change in terms of improvements in human capital and technology.

Of course, the issues are often political—looking for a solution that will deliver gains to working and non-working generations alike.

In the wake of policy experiments aimed at increasing savings, there have been opportunities to test how responsive consumers are to changes in the returns to saving.³ In standard theory of the consumer, there is a close link between this and the intertemporal elasticity of substitution (a key parameter in the macro-growth literature discussed above). Efforts at measuring this elasticity in variety of ways have not yielded much evidence of responsiveness (although responses, such as they are, appear to be greater at lower income levels). The new literature on taxation and savings has exploited evidence on responses to newly created incentives—mainly in the United States, but also in the U.K.. The typical scenario is to look at how consumers respond to the government creating a tax-favoured form of savings, like the TESSA in the U.K.. The jury is still out. However, two things come clearly out of the literature. First, there is strong evidence that savers find tax efficient forms of savings. However, there is little evidence of strong aggregate savings effects from the kinds of government sponsored savings initiatives that we see.

The focus on taxation and savings is somewhat narrow. In recent work, Doug Bernheim and his co-authors have been looking at the response of saving behaviour to education programs.⁴ It is even possible that the effect of government programs may be the education component rather than the tax component. In the end, it is not obvious how much we should worry about these results from the micro-economic literature on savings. There is no particular strong evidence that there are strong divergences between private and social returns to savings.⁵

4.1.2 Investment

The literature on public policy and investment has three main aspects—effects on overall investment levels, effects on the type of assets in which firms invest and affects on the way in which investment is financed, and a firm's financial policy more generally.

Theoretical models of investment focus on the effect of government policy on investment through changes in the user cost of capital. First generation studies using time-series macro-evidence did not suggest that the user cost was an important determinant of investment. More recent cross-country evidence and studies of firm level data suggest a greater significance for the user cost in explaining investment levels. Hassett and Hubbard (1996) review the evidence and suggest a consensus estimate of the elasticity of investment with respect to changes in user cost of -0.5 to -1.00. This is similar to the range for R&D expenditures recently estimated by Bloom, Griffith and van Reenen (1999). Mapping these estimates into policy experiments is not straightforward given the complexity of the user cost and the way that it depends on taxes, depreciation allowances etc. However, it is no longer tenable, as it was sometimes argued historically, that prices do not matter when investment is at issue.

The magnitude of the behavioural response is only part of the story. The key issue is whether the social and private returns diverge creating an argument for subsidizing some particular types of investment. Based on the elasticity estimates above, it is not clear that there would be much of a case for treating R&D and other forms of investment differently on revenue raising grounds as they have similar elasticities.

In terms of private and social return, some economists (for example Hassett and Hubbard (1996)) argue that there is a case for believing that there is under-accumulation of physical capital in general and that the government should stimulate investment through tax incentives. As I argued above, this is really an argument about intergenerational justice rather than economic efficiency. However, this could, in principle provide the basis for believing in the need to promote investment in general.⁶

There is a literature that has argued that the optimal rate of capital income taxation is zero.⁷ This is a bit like a dynamic version of the Diamond and Mirrlees (1971) efficiency theorem saying that there should be no intermediate goods taxation. While capital may inelastically supplied in the short run and hence be a good source of tax revenue, its supply in the long-run is highly elastic.⁸ The latter effect can be shown to dominate in an economy with consumers with long time horizons. The result does, however, turn out to be quite special, holding only under very restrictive assumptions (see Aiyagari (1995)). Hence, it is not clear that the practical force of these models is particularly great. However, we will return to the general theme of production efficiency and intermediate goods taxation below.

More convincing is the possibility that there are divergences between private and social returns due to externalities in *particular* kinds of investment leading to a case for more favorable tax treatment. DeLong and Summers (1991) argues that there appear to be significant externalities from investments in equipment investment as opposed to other kinds of fixed capital. They estimate a social return in the region of 20% from a cross-section of 61 countries. However, their results are not without controversy as they themselves note.⁹ In the end, as acknowledged by DeLong and Summers, the quality of the cross-country data make the kind of exercise that they perform fraught with difficulty. This is a general difficulty using cross-country data to evaluate investment returns given the quality of the data and the difficulties of establishing causality.

Perhaps the most influential arguments for divergence between social and private returns come from investment in R&D. There is a large literature that has tried to argue for a divergence between the private and social returns to innovation. A useful survey is found in Jones and Williams (1998). Typical social rates of return to R&D investment are of the order of 25-30% compared with private returns in the 7-14% range. If correct, this would suggest the possibility of substantial under-investment in R&D by market economies and significant scope for encouragement by the state.

In this regard, the types of policy that governments can use to effectively promote R&D is important. Richard Freeman has already discussed the importance of science policy. However, there are other, more traditional instruments, such as tax credits that can play an important role. Bloom, Griffith and van Reenen (1999) find that such investment does appear to be responsive to changes in user costs, suggesting that government policy can be effective in promoting such investments.

4.1.3 Infrastructure

A central role of government is to ensure that there are adequate levels of infrastructure needed to support economic activity. This ranges from institutions for the enforcement of contracts and property rights through to construction of roads and bridges.

3 See Besley and Meghir (1998) for a review.

4 See Bernheim (1996), Bernheim, Garrett and Maki, (1997), and Bernheim, and Garrett (1996).

5 Of course, there can be other policy objectives at work — for example in discouraging reliance on the state in old-age. But these do have much to do with improving long-run economic performance.

6 There is good evidence, for example, Gordon and Lee (2000) that firms' financial policies are affected by taxation. However, the links between this and investment outcomes are far from clear.

7 The argument is originally due to Chamley and Judd. However, the exposition in Lucas (1990) is perhaps the most useful.

8 The argument can be extended to other factors such as human capital as shown by Judd (1999).

9 See Auerbach, Hassett and Oliner (1994), along with the reply by DeLong and Summers.

Aggregate models of economic performance (such as Barro and Sala-i-Martin (1992)) have explored some of the theoretical relationships and the possible reasons for divergences between private and social returns. However, the empirical evidence on this divergence is quite limited.

Estimates of the social rate of return to infrastructure projects are surprisingly few. Moreover, they tend to be in the form of aggregates such as “total infrastructural investment” rather than its components. Aschauer (1989) presented some of the earliest estimates of public spending on aggregate performance and found large effects. More recent work has reassessed this. For example, Holtz-Eakin and Schwartz (1995) look at evidence from across the United States and find modest productivity effects from infrastructure investments—around 1 % to 2% returns.

In the post-war period, a great deal of infrastructural investment was undertaken by the state. However, the PFI and other initiatives are shifting the balance. Moreover, telecommunications, a vital part of infrastructure, is now largely privatized. This raises a further issue of complementarity and substitutability of private and public spending which has not been considered in the empirical literature in this area.¹⁰

This is a key area in which knowledge is weakest and there is scope for much further research. I am not aware of any convincing micro-level studies of the effect of infrastructure investment on productivity.

4.2 Labour Input

The basic macro-models suggested that there are two main channels via which labour and growth interact—either by the supply of raw labour input or by quality improvements—particularly investment in human capital. There is also the possibility that there are benefits from labour organization—more flexible labour practices leading to increased innovation and greater growth.

4.2.1 Labour Supply

The labour supply has recently been comprehensively reviewed by Blundell and Macurdy (2000). It is useful to distinguish between incentives on the extensive margin (participation in the labour force) and on the intensive margin (effort or hours worked). The evidence suggests that responsiveness to taxes and income transfers is mainly on the former and that the latter is relatively inelastic. This is key as the results from Stokey and Rebello (1995) suggest that the growth effects from tax cuts on earnings will be modest when this is the case.

It is clear that there are significant one-off efficiency gains to be made by increasing the application of labour input. It is also reasonable to argue that the social returns to getting certain groups back into the labour force exceed the private benefits. Thus, studies of the effect on income transfers programs and tax changes on the extensive margin are of social consequence. However, there is no good reason to believe that there are strong interactions with growth from raw labour input effects.

Feldstein (1995) suggests that income declared to tax authorities is much more responsive to taxation than evidence on labour supply responses would suggest. This could be interpreted as suggesting that there is a wider disincentive effect of taxation than through hours of work adjustment—perhaps reductions in effort intensity or ambition for promotion. Alternatively, it could suggest that in the strive for greater tax efficiency in their affairs, individuals seek more effective tax avoidance measures at higher tax rates. The distinction is important as only the former is important from the point of view

of aggregate output—the latter being essentially a transfer. The jury is still out on the best way to interpret the data.

4.2.2 Human Capital

Human capital policy is an important focus for the link between public policy and growth. Many endogenous growth models (such as Lucas (1988)) place human capital formation at centre stage in exploring the reasons for long-run growth. However, as we argued above, the case for subsidizing human capital on a wide scale rests on there being important divergences between private and social returns. Otherwise, government provision would merely be crowding private provision by far sighted optimizing individuals.

Governments have a large array of tools aimed at promoting the accumulation of human capital. There is a large literature that attempts to estimate the mapping between these policies and human capital accumulation. Heckman (1999) reviews such studies and argues the case for believing that marginal resources have had a significant effect on human capital levels. The key exception, he argues is in the area of pre-school education. Vignoles et al (2000) provides a comprehensive review of evidence on the relationship between inputs and outputs for human capital, arguing that the knowledge base is far from complete and that widely held views (for examples those relating to the effects of class size) do not appear strongly in the empirical evidence assembled by economists.

There is a plethora of studies that estimates the private return to education from micro-studies (see Card (1999) for a review). There is a range of estimates of the return for different kinds of educational attainment. However a ball park figure of a 10% return to an extra year of education would constitute a reasonable “consensus” estimate. However, these returns are private and of no immediate significance for policy, unless some market failure is demonstrated that would lead to underinvestment. These failures may rest on imperfections in decision making—for example individuals who fail to perceive the return or parents who do not value their children’s well-being. They could also rest on failures in supporting markets—such as markets for credit and insurance. There is also the possibility that other government activity, such as redistributive taxation, necessitates an off-setting subsidy. In general, this underpins arguments for promoting human capital formation through government action.

There are plenty of good theoretical reasons to expect social and private returns to diverge. This could be because of some kind of technological spillover or the working of the labour market (see, for example, Acemoglu (1996)). However, the evidence on social returns to education is very limited. The large macro-growth literature that looks at aggregate returns to human capital in a cross-country setting yields rather inclusive findings (see the review in Krueger and Lindahl (2000)). A number of studies fail to find any significant effect of human capital on aggregate output while others find very large social returns—well in excess of the private returns that are characteristic of micro-data.¹¹ As argued persuasively by Krueger and Lindahl (2000), this may well be due to problems of measurement error and/or reverse causality. Moreover, the crude aggregate measures that are utilized make fairly difficult to know what kinds of human capital should be the focus.

Some recent work has tried to quantify the magnitude of human capital externalities in micro-data by looking to see how wages are affected by average levels of human capital after controlling for individual characteristics. The main contributions are by Moretti (2000) and Acemoglu and Angrist (2000). Moretti finds that 1% increase in the fraction of college graduates in a city raises the productivity of other groups of workers between 1.0% and 2.5%

¹⁰There is a literature on this that has mostly confined itself to the study of private charitable giving and the possibility that this is “crowded out” by state provision.

¹¹These high social returns typically come from using the initial level of human capital as a regressor in a growth regression.

depending upon the specification. This is of a similar magnitude to Acemoglu and Angrist's findings, although their effect is not statistically significant.

5 Intermediate Goods Taxation and Imperfect Competition

One of the central results of optimal tax theory is Diamond and Mirrlees (1971) efficiency theorem which gives a set of conditions under which it is optimal not to tax intermediate inputs. Their theory is static and rests on a world of perfect competition. Hence, it is not clear how far their analysis should carry over to practical situations. However, it is clear that VAT as a way of achieving the desired outcome. Taxation of income from capital and certain kinds of energy taxes are both examples of intermediate goods taxation that we observe in practice. Moreover, as we discussed above, there is a literature that has argued the case for zero taxation of capital on efficiency grounds. The question of whether there are significant aggregate efficiency effects from changing tax structure is ultimately an empirical one.

There is comparatively little research that has explored the growth effects of intermediate goods taxation in a dynamic setting. However, an important example is the work of Rotemberg and Woodford (1994) which considers the dynamic consequences of energy taxation. They use a calibrated general equilibrium model of the U.S. economy. Their work is important in showing that imperfect competition in the energy using sector can lead to a considerable amplification of the aggregate efficiency consequences of energy taxes. In a large class of cases, imperfect competition in product markets will lead to taxes and production costs increases being "overshifted" into prices, i.e. a one unit increase in taxation leads to a greater than one unit increase in price. This, in turn, implies a larger deadweight loss compared to the perfectly competitive scenario. To support the importance of this idea, Besley and Rosen (1999) finds that there is strong evidence consistent with the imperfect competition story using data on goods sold in super-markets in the United States. Overall, the Rotemberg and Woodford results present a sobering message for ongoing discussions about the future of energy taxation in the U.K.. Their results suggest that the aggregate output loss is similar to the revenue raised from such taxes for the U.S..

More generally, this type of message suggests that looking at the effect of tax policy on aggregate performance may not be confined to those tax policies that impinge directly on accumulating factors. Intermediate goods taxation needs also to be an important focus. The studies of Rotemberg and Woodford also suggest that racing through the effects of imperfect competition creates an important link between tax incidence and competition policy, with imperfect competition increasing the size of the distortionary effects of taxation. Judd (1997) has even argued that the optimal tax on capital income should be negative once imperfect competition is taken into account. In terms of our overall theme, the presence of imperfect competition creates its own wedge between private and social returns in the economy and hence may create reasons to change the optimal structure of taxes and subsidies.

6 Concluding Comments

The main message of my paper is summarized in Table 1. There are three steps to thinking about the link between public policy and growth. First, there is a need to consider the factors that promote growth. Second, we need to identify the key (behavioural) determinants of these inputs, in terms of how incentives for private action are affected by government policy. Third, we need to know what are the most important divergences between private and social returns.

Table 1

		L	K	H	A
Effectiveness	Taxes	Weak	Weak	?(+)	?(+)
	Spending	?(+)	?(+)	?(+)	?(+)
Desirability	Social-private Returns	Few believe so	?	+	+
	Conflict (–) or complement (+) with other objectives	?(+)	+	?	

Behavioural evidence is greatest on the effects of policy on labour supply and savings. Here I suggest that there is widespread evidence of compositional effects on savings and possibly on labour supply. However the evidence for large aggregate responses is weak. However, the case for there being externalities that need to be fixed here is also much weaker. The case where existing evidence is much less clear-cut is the effect of policy on technology and human capital formation. These are the areas where there is a more widespread view that private and social returns diverge. Yet, the behavioural studies give a much less good guide.

This all seems great for research—getting better estimates of social returns and of behavioural responses in the key growth sectors. However, it may also seem unsatisfactory for the exigencies of policy. However, the spotlight for policy and research are now shining firmly in the same part of the stage.

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Appendix

To derive the expression in the text, let t be a generic incentive that can be used to encourage or discourage x . Hence, $x = h(t)$. Let the cost to the government of having an incentive t be $c(h(t), t)$ and let $W(h(t))$ be the payoff function that the policy maker cares about. Then increasing the use of incentive t a bit has marginal social benefit

$$\frac{\partial W}{\partial x} \cdot \frac{\partial h}{\partial t} - \lambda \left[\frac{\partial c}{\partial h} \cdot \frac{\partial h}{\partial t} + \frac{\partial c}{\partial t} \right]$$

Setting this to

$$\frac{\partial W}{\partial t} = \lambda \frac{\partial c}{\partial h} \left[1 + \frac{\frac{\partial c}{\partial t}}{\frac{\partial c}{\partial h} \cdot \frac{\partial h}{\partial t}} \right]$$

which gives the formula in the text if

$$\eta = \frac{\frac{\partial c}{\partial t}}{\frac{\partial c}{\partial h} \cdot \frac{\partial h}{\partial t}}$$

In this case where $c(h(t), t) = th(t)$, $\eta = \frac{1}{\partial \log h / \partial \log t}$,

i.e., the elasticity of x with respect to the tax t .

