Public and private education expenditures, variable elasticity of substitution and economic growth

Sharmila Gamlath [a], Radhika Lahiri [b],[*],[1]

[a] School of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia
[b] School of Economics and Finance, Queensland University of Technology, Brisbane, Australia

A B S T R A C T

We develop an overlapping generations model to examine how public and private education expenditures impacts on an economy's long run outcomes. Young agents' education is "produced" according to a variable elasticity of substitution production function where the inputs are public education and private expenditures undertaken by parents. Results reveal that higher substitutability between these inputs enables agents to reduce private education expenditures and spend more on consumption and investment, leading to better economic outcomes. Higher aggregate substitutability therefore also implies that a higher tax rate is optimal, since this reduces the need for private educational expenditures to supplement public education expenditures. Analytical results reveal that, depending on initial conditions, the economy could either achieve smooth convergence towards the long run outcome or experience fluctuations during transition. However, numerical analysis suggests that a smooth transition is more likely. Fluctuations during transition may occur when the share of parental human capital in determining an agent's human capital is high. Hence, institutional reforms that reduce the importance of inherited human capital by providing everyone better access to high quality education could facilitate smooth convergence to the long run outcome.

1. Introduction

Given conventional wisdom regarding the positive externalities associated with education, its provision by the state is often regarded as desirable. Accordingly, there is a voluminous literature in macroeconomics that explores the long run growth outcomes associated with various aspects of public funding of education (see, for instance, W. F. Blankenau and Simpson, 2004; Dissou et al., 2016; Glomm & Ravikumar, 1997; Voyvoda and Yeldan, 2015). However, in addition to the state, parents also play a critical role in educating their children. According to Article 26 of the 1948 Universal Declaration of Human Rights "parents have a prior right to choose the kind of education that shall be given to their children" (Tooley, 2004). Generally, most decisions about a child's education, at least until the tertiary level, are made by parents.[2] As Becker (2009, pp. 367–369) and Bräuninger and Vidal (2000) point out, in the presence of borrowing constraints, children cannot resort to

the market to finance their education, and hence, expenditures by parents can play a major role in children's human capital outcomes. Such *private* education expenditures, which often depend on parental altruism, can exacerbate inequality, as more affluent parents typically spend more on their children's education. Hence, in addition to considering the role of public education expenditure for human capital accumulation and growth in an economy, as noted by Glomm (1997) and Das (2007), any macroeconomic modelling construct should also consider the impacts of private expenditures undertaken by parents on educating their children.

Studying public and private expenditures in conjunction with one another naturally brings into play another dimension of relevance to this issue, which is the degree to which agents view these expenditures to be substitutable or complementary to each other. This paper aims to address this consideration, by examining, within a theoretical framework, how the *degree of substitutability* between public and private educational

expenditures impacts on an economy's transitional and long run economic performance.

Most extant studies that explore private and public education expenditures regard them as either substitutes or complements to one another. For instance, studies such as Glomm & Ravikumar (1992), Epple and Romano (1996a) de la Croix and Doepke (2004) and Goldhaber (1999), that study the public-private school divide, regard these expenditures as *substitutes*. On the other hand, private supplementation of publicly provided goods like education and health care, where the state provides a baseline level of service that individuals can *complement* with additional out-of-pocket spending, has been the focus of studies such as Epple and Romano (1996b) and Gouveia (1997). Another dimension of complementarity, explored in studies such as Kaganovich and Zilcha (1999), Blankenau et al. (2007), and Arcalean and Schiopu (2010), is where publicly provided school education is a prerequisite for undertaking tertiary education, financed either by parents or through student loans.

In practice however, these expenditures are neither perfectly substitutable nor complementary. Rather, they are likely to be *imperfect substitutes* for each other, with the individual's ability and willingness to substitute between them depending, among other things, on *perceptions* of the quality of public versus private education, and the *mix* of the two types of expenditures utilised by the individual to "produce" a certain level of education. Such variations in the *degree of substitutability* between the two types of expenditure could have important implications for human capital accumulation and other macroeconomic outcomes.

As noted by Bearse et al. (2005), extant research on the macroeconomic impacts associated with the degree of substitutability between public and private education inputs is sparse, possibly due to the lack of empirical evidence relating to this issue. Nevertheless, Bearse et al. (2005) make a notable contribution to the theoretical literature on this subject by explicitly exploring the political economy ramifications associated with different values of the elasticity of substitution between public and private education inputs within a theoretical model. These authors incorporate publicly and privately provided educational services into a constant elasticity of substitution (CES) education production function. For the special case of perfect substitutes, their model reveals that parents never enrol their children in private schools. In the general CES case, they demonstrate that a higher elasticity of substitution between public and private education expenditures results in everybody selecting public schooling. However, as the relative efficiency of the private sector declines, although public school enrolment diminishes, agents vote for a higher tax rate to fund public education, resulting in higher public education expenditure per student.

While Bearse et al. (2005) provide interesting insights into the issue of substitutability between public and private education expenditures, especially in relation to political economy outcomes, the use of a CES education production function implies an *invariant* degree of substitutability between public and private inputs. While assuming a constant elasticity of substitution may be reasonable in the context of a standard production function with capital and labour as inputs, it is, arguably, less applicable in the case of an education production function where the elasticity of substitution between public and private expenditures and the mix of these expenditures chosen by individuals could be conditioned by several cultural and institutional factors.

In view of these considerations, the aim of this paper is explore how the degree of substitutability between public and private education can affect the dynamics of human and physical accumulation, as well as optimal policy in an economy in the long run. To this end we develop an overlapping generations model where an individual's adult age human capital is determined by the education she receives in childhood and her parent's human capital. Output in the economy is produced using a Cobb-Douglas aggregate production function with physical and human capital as inputs. A key point of distinction in our model is that education is

"produced" using a *variable* elasticity of substitution (VES) production function with public and private expenditures as inputs[3] The VES specification, originally discussed in Sato and Hoffman (1968) and Revankar (1971), when applied to the context of education, provides a tractable functional form, in addition to having some appealing properties of relevance in the context of education.

In the VES form, the institutional and cultural factors that influence the representative agent's ability to substitute between public and private education expenditures can be captured by a parameter labelled *b*, which we refer to as the "aggregate substitutability parameter". The elasticity of substitution between public and private education expenditures is positively related to this parameter. In our interpretation, it captures the relative uniformity of public education compared to private education, with a higher value of *b* being associated with a greater degree of uniformity between these expenditures, as well as a greater degree of similarity in their quality. The parameter is therefore an indicator of the quality of the education system. In most modern societies, parents can choose between sending their children to a public or private school. Furthermore, they can choose how much to spend on supplementing their children's school education with privately provided education services. The aggregate substitutability parameter can be interpreted as an amalgam of all these individual decisions.

In our model, public and private education are not considered to be completely independent alternatives for one another, nor do we assume that they are perfectly complementary to one another. Rather, we abstract from the two extremes of perfect substitutes and perfect complements in the context of public and private education expenditures and use the VES form to pay attention to a range of intermediate values of the elasticity of substitution that fall between these two extremes. In addition to the aggregate substitutability parameter, the elasticity of substitution in the VES form is also determined by the mix of public and private expenditures. Consequently, the elasticity of substitution between public and private education inputs in the VES form varies between input combinations as well as over time.

In order to provide further motivation for the choice of the VES form education production function, we consider the case of South Korea, where the cultural emphasis on educational attainment and the intense competition for admission to top universities led to the development of a large private tutoring industry over time (Kim and Lee, 2010). Institutional and cultural factors have therefore resulted in South Korean parents perceiving supplementary tutoring to be a vital complement to publicly provided school education, resulting in lower aggregate substitutability between public and private education inputs. However, in recent years, policy reforms, such as improvements in the quality of public schooling, granting greater autonomy of operations to individual schools and the establishment of national standards for public exams, have been implemented in South Korea in an effort to reduce the demand for private tutoring (Lee et al., 2010). A key indication of these changes was the increase in public expenditure on education as a percentage of GDP from 3.43% in 1998 to 5.05% between 1998 and 2015 (World Bank, 2017). As a result of these reforms, enrolments in private institutions at the secondary level in South Korea declined from 41.45% in 1998 to 31.14% in 2013 (UNESCO, 2016), while parental private tutoring expenditures also reduced gradually in recent years (Jones, 2013). In the context of the VES education production function, these institutional changes have resulted in a higher ratio of public-to-private expenditures and also improved aggregate substitutability between public and private education in the South Korean context.

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[3] According to our interpretation, private education expenditure is incurred by parents on education services provided by third parties during a child's formal school years. It does not involve the time and opportunity costs associated with parents educating their children in various ways such as teaching a child to walk and talk. These private efforts by parents, especially during the formative years of a child's life, are an essential determinant of a child's success in later life. However, these private efforts of parents to educate their children are not considered in our model.