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Examining the impact of capital on academic achievement

John T. Jones^a, Ron W. Zimmer^{b,*}

^a Georgetown College, Business Administration and Economic Department, 400 E. College Street, Georgetown, KY 40324-1696, USA

^b RAND Corporation, 1700 Main Street, Santa Monica, CA 90407-2138, USA

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Abstract

While a growing body of literature on education production looks at the impact school inputs have on academic achievement, virtually no research is examining the impact capital is having on academic achievement. In this study, we take an initial step towards that end. By using school districts' level of bond indebtedness as a proxy for capital, we find evidence that capital stock does affect academic achievement. In light of these findings along with the general lack of research on capital inputs, we conclude that capital expenditures should be given greater attention in future research. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Currently, there is a large and growing literature that examines the impact of school and family inputs on educational outcomes. This vast literature is exemplified in Hanushek's summary of over 377 estimates in 90 separate articles of the effect resources have on a range of different educational outcomes. These inputs include not only school-specific inputs (expenditures, teacher characteristics, etc.) and school organization inputs (class and school size, student-to-administration ratios, etc.), but also environmental characteristics (peer groups) and socioeconomic (family) characteristics. However, conspicuously absent from the literature is the effect of capital inputs, such as buildings and equipment, on educational outcomes.¹ This gap in the literature exists

despite the emphasis capital has received in school budgets. In 1999, over \$20.5 billion was spent on school construction alone² and a GAO report suggests that an additional \$112 billion is needed to bring buildings to "good" condition (GAO, 1995). The allocation of resources of this magnitude represents a significant investment into an input whose value to the education process is unclear. This paper begins to fill the void in the literature by investigating capital's impact on student achievement. We define capital as the physical assets of a school, which include but are not limited to buildings, contents of buildings, parking lots, athletic facilities, and buses. Under current public accounting standards, direct measures of these assets do not exist. A reasonably imperfect surrogate measure for these assets is the level of school districts' bond indebtedness. Using bond indebtedness as a proxy for school capital in school districts in Michigan, we find evidence that variations across school districts' capital stock significantly affect academic achievement. These results have potentially

* Corresponding author. Tel.: +1-310-393-0411 ext 7546; fax: +1-310-451-7059.

E-mail addresses: jjones1@georgetowncollege.edu (J.T. Jones), rzimmer@rand.org (R. W. Zimmer).

¹ One notable exception is Strauss & Sawyer (1986).

² Source: National Center for Education Statistics, 1995.

weighty policy implications concerning the efficient allocation of resources for public education. Also, they illuminate the importance of a typically omitted variable in education production analysis. Compelling, yet far from conclusive, these results open the door for future research into the question “does capital matter in public education?”

The remainder of this paper is divided into seven sections. In Section 2 we discuss the possible importance of capital in the production process, while Section 3 discusses the benefits and limitations of our proxy. In Section 4 we develop a model of education production with emphasis placed on measuring capital stock’s impact on academic achievement and in Section 5 we provide an overview of the data. In Section 6 and Section 7 we display and discuss our results and conclusions.

2. Capital

In recent years, many states have prescribed a host of policies, ranging from innovation in curriculum to reorganization of classrooms, as a solution to improving the quality of education (Goldhaber & Brewer, 1997). Most of these policy prescriptions require significant increases in expenditures. In many cases, these policies are being implemented despite the lack of evidence of a strong relationship between school expenditures and academic achievement (Hanushek 1986, 1996).³ This is especially true for capital expenditures. As noted earlier, a recent GAO report suggested that the United States needs to spend an additional \$112 billion to get schools in good condition (GAO, 1995). However, such an investment (in maintaining or improving school facilities) will be made without any real knowledge of the impact physical facilities have on student achievement.

On theoretical grounds, a safe, clean, and controlled

³ Recent research, however, has provided greater support that such a relationship does exist. For instance, Ferguson (1991) along with Ehrenberg & Brewer (1995), reported that a teacher’s ability has a positive effect on academic achievement. Further, Sander (1993) reported that increases in teachers’ average salaries correspond to increases in ACT scores and in the percentage of college-bound students, while an increase in pupil–teacher ratios reduces graduation rates and the percentage of college-bound students. Similarly, Card & Kruger (1992) found that decreases in pupil–teacher ratios have a significant effect on the economic returns to education. Monk & King (1994) reported that a teacher’s subject-matter preparation in math and science can positively affect academic achievement. Notwithstanding the recent articles, the vast majority of existing literature, including a second comprehensive review by Hanushek (1997), has found little evidence for a strong relationship between expenditures and educational outcomes.

environment may have an impact on student achievement in a number of ways. Overcrowded schools may lead to greater distractions within the classrooms and, therefore, to less instructional time (Rivera-Batiz & Marti, 1995). A school in disrepair may affect the morale and health of students, which in turn may have a negative effect on their performance (Carnegie Foundation, 1988). Inadequate lighting may affect a student’s ability to concentrate, in turn negatively affecting achievement (Tinker, 1939). Older schools that have not been renovated may lack the infrastructure for the latest technology, including computer hardware, networks, and the internet (Lyons, 1999).

Together, these arguments suggest that the state and quality of a school’s physical facilities may in fact have an impact on student achievement. However, the past literature has failed to examine this impact. We address this shortcoming by examining whether variations in capital stock across school districts have an impact on student achievement.

3. Proxy for capital

We use the term “capital” to represent all physical assets owned by schools that are essential inputs in the production of education. Such assets are physical structures, such as school buildings, recreational facilities, school buses, and even parking lots. Thus, we define capital in a generic sense to encompass all physical assets that are used as inputs in education production. If we want to assess the effect capital has on student achievement, we obviously need to accurately measure capital as an input. The ideal measure for a school’s capital would be the market value of the schools’ physical assets. Unfortunately, school assets are tax-exempt, and as a result, records of their market value do not exist which led us to search for alternative means of approximating capital.

Two possible alternatives are recorded values of capital outlays or insurance values. However, the variable capital outlays is usually reported only for the single year in which they occur and consequently do not necessarily correspond to the years in which capital provides a benefit. For example, in a particular year a school district may record a large capital outlay of \$10 million for the construction of a new school building. However, if no new construction occurs in the following year, the capital outlay level would be recorded as zero. Therefore the recorded value of capital outlays is misleading. The second alternative is the insured replacement value of the schools’ assets.⁴ However, the methods used to

⁴ Strauss & Sawyer (1986) utilized insurance values as proxy for capital.

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