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# Measuring the stock of human capital in New Zealand

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## Abstract

Human capital is increasingly believed to play an important role in the growth process; however, adequately measuring its stock remains controversial. Because the estimated impact that human capital has on economic growth is sensitive to the measures or proxies of human capital, accurate and consistent measures of human capital are needed. While many measures of human capital have been developed, most rely on some crude proxy of educational experience and are thus plagued with limitations. In this study, we adopt the lifetime labour income approach outlined by Jorgenson and Fraumeni [D.W. Jorgenson, B.M. Fraumeni, The accumulation of human and non-human capital, 1948–1984, in: R.E. Lipsey, H.S. Tice, The Measurement of Savings, Investment and Wealth, The University of Chicago Press, Chicago, IL, 1989, pp. 227–282; D.W. Jorgenson, B.M. Fraumeni, The output of the education sector, in: Z. Griliches (Ed.), Output Measurement in the Services Sector, The University of Chicago Press, Chicago, IL, 1992, pp. 303–338] to measure the monetary value of the stock of human capital for New Zealand. Jorgenson and Fraumeni's method is innovative in that it simplifies the estimation process, as well as taking into account the potential value of current schooling in addition to that of past schooling. Based on data from the New Zealand Census of Population, we find that the human capital stock of the country's employed work force grew by half between 1981 and 2001, mostly due to the rise in employment level.

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## 1. Introduction

Human capital is frequently discussed but poorly measured. Modern theories of economic growth, such as those of [26] and [15], emphasise human capital in their explanation of the growth process. While

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there is an empirical counterpart to this growth literature, the proxy measures of human capital used by authors such as Barro and Lee have attracted considerable criticism [27]. Few existing measures of human capital are in monetary terms. Moreover, even in countries where attempts are made to estimate the value of human capital, it is not yet standard practice for official statistical agencies to include human capital in their capital stock measures [29]. This is a surprising omission because estimates of the value of human capital predate the formal development of National Accounts statistics. For example, Petty [24], estimated the total human capital of England to be £520 million or £80 per capita, and Dublin and Lotka [9] also made important early contributions.

Instead of placing a value on human capital, the more recent practice in economics has been to estimate human capital on the basis of years of schooling or formal educational attainment levels, regardless of actual productive capacity [22]. Barro and Lee [2–4] provide prominent examples on this subject. In New Zealand, most published research on human capital has dealt with either changing prices – the returns to particular educational qualifications [19] – or changing quantities, such as the compositional shift implied by the rising importance of the “information workforce” [10]. There are also many studies that use proxy indicators within the educational stock approach, such as [28].

Because of the deficiencies in the educational stock-based approach, Jorgenson and Fraumeni [16,17] have returned to the earlier approach to valuing human capital, introduced by Farr [11] and Dublin and Lotka [9]. The basic idea, as will be shown in detail below, is to value the human capital embodied in individuals as the total income that could be generated in the labour market over their lifetime. These expected labour earnings contribute to an extended notion of capital, which Jorgenson and Fraumeni include in a proposed new system of national accounts for the US economy. Outside the United States, this method has been applied to the estimate the human capital stock for Sweden [1] and Australia [29], both of which studies find the stock of human capital to greatly exceed that of physical capital.

In this paper we modify the formula outlined by Jorgenson and Fraumeni [16,17] and Wei [29] to place a value on the stock of human capital of the employed work force for New Zealand. We focus only on those individuals in employment, since these people are directly participating in economic production and so their human capital is arguably a better measure of the country’s productive capacity. Our estimates are based on the discounted present value of expected lifetime labour market incomes. Thus, our study is an example of a forward-looking (or prospective) method of measuring human capital. Such methods contrast with backward-looking (retrospective) methods based on cost of production concepts, and with the widely used educational stock approach.

In the empirical part of the paper we work mainly with New Zealand Census of Population data from 1981–2001 to calculate the future stream of incomes that a worker of a given age, gender and education level can expect to earn. This expected income is based on cross-sectional age–income profiles, which are then combined with the probability of enrolment in further education (allowing the worker to “jump” from one profile to another), the probabilities of participating in the labour force and of continued employment, and age-specific mortality rates. After incorporating expected growth rates, following [21], and a discount factor, it is possible to calculate the present value of lifetime income, for a person of a given gender and education level. When these per capita estimates are combined with information on the population size of each cohort, the aggregate value of human capital can be calculated. Of course, these estimates relate only to market income so the value of human capital stocks used in non-market production may be missed, but such a restricted focus is also common in studies measuring the returns to education.

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