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Can the information technology revolution explain the incidence of co-movement of skill premium and stock prices?

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ABSTRACT

We investigate for a long-run relationship between skill premium and stock prices by using the panel cointegration tests for six OECD countries. A cointegrating relationship is observed in the panel data for the period 1984–2005. The evidence for co-movement of skill premium and stock prices is also found in the US data. Next, we develop a three-sector model to explain this co-movement. We demonstrate that technological revolution not only widens the skilled–unskilled wage gap, but also increases firms' profit and, thus, higher stock prices. Finally, we calibrate our model to the US data for the Information Technology revolution that happened in the 1980s and demonstrate that our model can moderately explain the data. Our model concludes that, unless any further revolutionary surge in productivity of the R&D sector happens, the skill premium will augment no more and stock prices will register no further unusual growth.

1. Introduction

The rise in skill premium, defined as wage of skilled labor relative to unskilled labor, in the U.S. during 1980s has been well documented in the literature (Bound and Johnson, 1992). Arguably, rise in skill premium has primarily been manifested through a wider dispersion in the wage distribution. Interestingly, the U.S. stock market has also registered a very high growth in terms of market capitalization during the same period (Greenwood and Jovanovic, 1999). Such co-movement (Fig. 1) of skill premium and stock prices during 1980s was not only confined to the U.S., it was also observed in the U.K. during the same period (Gosling et al., 2000; Shiller, 1989). These two phenomena – rise in skill premium and growth of stock prices – have been analyzed in the existing literature to a large extent, but separately.[1] We conjecture that these two observations are different consequences of the same phenomenon of technological revolution.

The rise in skill premium is considered to be one of the main reasons for the rise in inequality in the society. It is also well documented that a change in skill premium has significant effect on labor force participation rate, education and migration incentives of citizens (see, for example, Saez and M.V., 2005; Bjorvatn and Cappelen, 2010; Lustig et al., 2013). Therefore, a change in skill premium has both direct and indirect, through its influence on incentives for schooling, labor force participation and migration, implications to redistributive policies.

Existing literature also demonstrates that the vast majority of population does not participate in the stock market. Moreover, stock wealth is concentrated among a few stockholders in most of the countries, if not all, including the US. For example, Poterba and Samwick (1995) demonstrated that more than two-thirds of the US households did not own any stocks at all, while the richest 1% held 48% of all stocks in the 1990s. Although owning stock became more pervasive in the 2000s with approximately half of the US households holding stock, a small minority of stockholders continue to own the majority of stocks (Guvenen, 2009). It implies that a rise in stock prices leads to increase in income of stockholders, and such increase is disproportionately large for a small minority of stockholders. Clearly, if stock prices increase, income inequality is likely to be worsened.

A number of studies support the hypothesis of positive relationship between stock prices and economic inequality. For example, Takayama (1991) and Spant (1987) documented that the influence of asset price changes on wealth inequality has been considerably large in Sweden and Japan, respectively; Weicher (1995) found that increase in stock prices had significant positive effect on the Gini coefficient for wealth in the US between 1983 and 1989; Wolff (1992) documented that during the 1980s the contribution of an increase in stock prices, relative to house values, to the rise in wealth inequality in the US was almost the same as that of increasing income inequality; so on so forth. Overall, it

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[1] For example, Bound and Johnson (1992), Berman et al. (1998), Caselli (1999), Krusell et al. (2000) and Mitchell (2005), to name a few, examined the reasons for the rise in skill premium. On the other hand, Greenwood and Jovanovic (1999), Datta and Dixon (2002), Madsen and Davis (2006) and Pastor and Veronesi (2009), among others, studied the factors associated with changes in stock prices.

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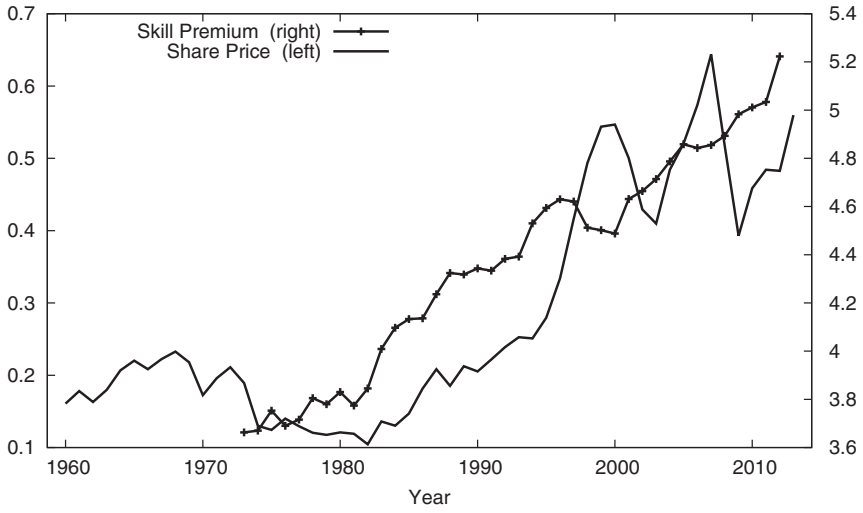

Fig. 1. For the United States, the ratio of decile 9 to decile 1 earnings (Skill Premium) and share price index deflated by consumer price index (Share Price) are plotted for the years 1960–2013.

follows that both stock price and skill premium are important drivers of inequality in society. Therefore, studying co-movement of skill premium and stock prices may be in the interest of understanding evolution of wealth and income inequality as well.

Though a visual representation of the data may suggest co-movement of skill premium and stock prices, concluding the same requires examination using econometric methods. In this paper, we rigorously examine the long run relationship between stock prices and skill premium. First, using data from the U.S. for the period 1984–2012 we performed econometric tests under Johansen's cointegrating procedure, and concluded a cointegrating relationship between the variables of our interest. We clarify here that we measure skill premium as the ratio of average gross earnings of full-time employees at the ninth decile to the corresponding figure at the first decile, and stock prices through yearly average share price index expressed in real terms. Next, we extended our analysis by considering data from selected countries belonging to the Organization for Economic Co-operation and Development (OECD), using panel data econometric techniques. Various panel unit root tests and panel cointegration test by Westerlund (2007) affirmed our hypothesis for those selected OECD countries.

After empirical examination and confirmation of our hypothesis, we posit a theoretical explanation for this co-movement. Our basic idea revolves around connectivity of firms' profitability to the skill premium. This idea was indirectly expressed in Acemoglu (1998) (also see Acemoglu (2003) and Afonso and Thompson (2011)) who developed an economic framework in which firms, to ensure their profit, choose skill-complementary technology. Adoption of this particular technology is not by nature but by economic profit maximization motive of the firm. Building on a three sector model of endogenous growth through Schumpeterian creative destruction as proposed by Aghion and Howitt (1992), we demonstrate that a technological revolution[2] – technological progress beyond expectation – can lead to rise in both skill premium and stock prices. We, in a single model, reconcile these two apparently different ideas that (a) technological progress is a major driving force to rise in skill premium, and (b) innovation leads to increase in firm value.

The intuition behind our result is as follows. A technological revolution increases the productivity of the skilled labor. The increased demand for skilled labor leads to disproportionate increase in their wage. On the other hand, technological revolution corresponds to unanticipated larger size for innovation. As a result, increase in the revenue of firms is larger than the associated increase in costs. As a result, technological revolution increases the stock prices as well. Additionally, we calibrate our theoretical model to the US data in order to quantitatively assess its explanatory power. Results of this calibration exercise suggests that an important part of the empirically observed changes can be explained by our proposed model with few parameters.

We note here that Hall et al. (2000) and Manuelli (2000) also attempted to explain the co-movement of skill premium and stock prices. Hall et al. (2000) described emergence of e-capital in the four-sector model, which changed firm valuations and skill premium too. Introduction of e-capital is similar to technological revolution of our model. In spite of this apparent similarity, the mechanism driving the result in Hall et al. (2000) model is different from its counterpart discussed in this paper. For Hall et al. (2000), calibration is focussed on stock prices issue. Manuelli (2000), on the other hand, presents the phenomenon of co-movement in the light of a modified version of Mortensen and Pissarides (1994) search theory framework and predicts an initial diminish in the skill premium followed by a surge in skill premium. This is obviously a different path than ours. Manuelli (2000) model is short of any calibration exercise.

The rest of the paper proceeds as follows. In Section 2 presents the results of our econometric analysis. Section 3 narrates the theoretical model. Results of the calibration exercise are presented in Section 4 which also discusses performance of our model compared to the previous ones. Section 5 concludes.

2. Empirical findings

2.1. Data sources

The Organization for Economic Co-operation and Development (OECD) maintains data on various economic variables. The share price indices are part of the Monthly Monetary and Financial Statistics (MEI) database (Organisation for Economic Co-operation and Development, 2014), which are usually calculated by the stock exchange. Monthly data are averages of daily quotations, quarterly and annual data are averages of monthly figures. Since share price indices are in nominal terms, we considered consumer price index of respective country as deflator in order to obtain share prices in real terms, which we denote by the variable *SP*. Data on wages came from the Labour Force Statistics (LFS) database, OECD. We calculated skill premium as the ratio of average gross earnings of full-time employees at the ninth decile to the corresponding figure at the first decile, which we denote by *DR*. Fig. 1 plots these two series (*SP* and *DR*) for the United States. Fig. 2

[2] Schaefer et al. (2014) enlist an interesting set of technical revolutions for the entire span of human civilization.