ARTICLE IN PRESS

Economic Modelling xxx (2017) 1–7

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/econmod

A theoretic analysis of key person insurance

Pu-yan Nie [a], Chan Wang [a,*], Zi-yue Chen [b], You-hua Chen [c]

[a] School of Finance, Institute of Guangdong Economy & Social Development, Collaborative Innovation Center of Scientific Finance & Industry, Guangdong University of Finance & Economics(GDUFE), Guangzhou, 510320, PR China

[b] School of Management, Xiamen University, Xiamen, 361005, PR China

[c] College of Economics and Management, Guangdong Center for Rural Economic Studies, South China Agricultural University, Guangzhou 510642, PR China

ARTICLE INFO

JEL:
J24
J17

Keywords:
Key person insurance
Employees
Risk

ABSTRACT

As the death or a major accident of a key person will bring a firm with disastrous losses, key person insurance has attracted increasing attention worldwide. But key person insurance is a double-edged sword because it has both positive and negative effects on a firm's performance. Different from prior papers, this study proposes to capture the two opposite effects of key person insurance by using a microeconomic analysis. The novel contribution of this paper is that besides risk-reducing effects of key person insurance, we find that key person insurance reduces the salaries of employees, output and excepted profit of the firm. More importantly, we illustrate that strong ability of the key person will promote the efficiency of employees. So this paper offers a full evaluation of firms' purchase behavior of key person insurance and also develops the theory of key person insurance.

1. Introduction

Key person insurance, also called key man insurance, is an important form of business insurance. It is an insurance policy taken out by a business to protect from financial losses that would arise from the death or extended incapacity of a crucial member of the business. Key person insurance is necessary if the sudden loss of a key executive could have a significant negative effect on a company's operations. In recent years an increasing number of insurance companies have started to offer key person insurance policies.

Key persons have significant effects on a firm's performance in the short-term. For example, in the case of Baidu.com Inc., owner of China's most popular internet search site, the company's shares fell sharply following the death of its chief financial officer (CFO), Shawn Wang, on Dec. 27, 2008. In the two days following his death, the share price fell 4.7%. In another case, when Steve Jobs, the co-founder, chairman and chief executive officer (CEO) of Apple, resigned from the company on Aug. 24, 2011, and then passed away on Oct. 5, 2011, there was a huge shock to the company's stock (the share price fell 6% on the day after his death), which greatly affected the interests of investors. As we know, these sudden events have considerable effects on firms' profits, and key person insurance can protect firms' losses because these losses will be covered by the insurers. Therefore, key person insurance attracts attention from both firms and insurance companies because the risk for the key persons can be eliminated.

Very few papers on key person insurance have been published. However, there is a vast literature on the effects of insurance on economic activities in industries and on the economy. For example, in microeconomics, Wang et al. (2017) and Pieper et al. (2015) addressed the effects of insurance on firms' innovation in improving environmental quality. In industrial economics, competitive relationships between insurance companies and hospitals are discussed by Wang and Nie (2016), and the factors that affect the insurance industry have been confirmed by Biener et al. (2016). In macroeconomics, existing literature focuses on economic growth under insurance (Lee et al., 2016; Courbage and Rey, 2016; Nie, 2007; Eling and Schaper, 2017; Nie et al., 2016; Wang and Nie, 2018). Lee, Chang, Arouri & Lee (2016) recently examined the negative relationship between insurance and growth. Also, Bertrand & Prigent (2016) argued that insurance significantly impacts the equilibrium in portfolios, and they showed that the equilibrium risk-neutral density is equal to the product of a factor corresponding to the total risk tolerance with exogenous insurance constraint.

Because life insurance relates to almost everyone, most of the literature highlights the effects of life insurance on human capital (Israelsen and Yonker, 2017; Nie, 2014; Dineen and Allen, 2016). Below we briefly introduce the related research about the effects of life insurance on human capital.

Many papers highlight the effects of some types of insurance on labor.

* Corresponding author.
E-mail address: pynie2013@163.com (C. Wang).

https://doi.org/10.1016/j.econmod.2017.12.020
Received 14 May 2017; Received in revised form 29 December 2017; Accepted 29 December 2017
Available online xxxx

Please cite this article in press as: Nie, P.-y., et al., A theoretic analysis of key person insurance, Economic Modelling (2017), https://doi.org/10.1016/j.econmod.2017.12.020

Olsson and Thoursie (2015) analyzed how health insurance affects labor supply. Dillender, Heinrich & Houseman (2016) identified the effects of health insurance on part-time employees, and argued that employer mandates on health insurance increase part-time employment among workers without a college degree. Further, Gatzert & Maegebier (2015) captured the effects of critical illness insurance on human capital supply.

As a special type of life insurance, key person insurance has attracted increasing attention in recent years, but few researchers have focused on key person insurance. Compared with general life insurance, key person insurance is taken out by firms. Chandy, Davidson, Garrison & Worrell (1986) examined the relationship between key man insurance and market reaction. Block, Keenan & Malone (2006) introduced the key person claim in detail and Nicholson and Corbett (1987) examined the market reaction to key person insurance. Furthermore, Owusu et al. (2016) addressed the effects of key person life insurance in Ghana. Johnson, Magee, Nagarajan & Newman (1985) investigated a sample of executives who were corporate founders, and observed significant positive returns associated with the sudden deaths of these executives. Nicholson and Corbett (1987) addressed the results of Chandy et al. (1986) and supported the conclusions of Johnson et al. (1985). In summary, most researchers agree that key person insurance affects firms' performance in the short-term.

Although key person insurance is critical for the development of some firms in reality, a systematic theory that can be used to guide practice is absent. On the one hand, nearly all the existing research about key person insurance does not establish a necessary theory or capture the effects of key person insurance on employees, firms' risk or expected profits by considering the ability of the key person. These factors are very important both in theory and for decision-makers. On the other hand, empirical data about key person insurance are very scarce, which results in difficulty to carry out an empirical study. So this article aims to establish a theory about key person insurance, and tries to identify the effects of key man insurance on employees and firm's performance.

Interestingly, by establishing a theoretic model, we argue that key person insurance reduces the salaries of employees, expected profits and the risks for insured firms. Moreover, the choice of a firm on whether to buy key man life insurance is supported by decision-makers.

The main contributions of this article lie in the following three areas. First, we establish a microeconomic theory about key person insurance. The theory of key person insurance will attract the attention of scholars. Second, based on our theoretic model, the effects of key person insurance are captured. The model in this article supports further research in key person insurance. Finally, in the application of the model, this article supports a theory about decision-makers and key person insurance. Moreover, our conclusions will help governments to regulate key person insurance.

The rest of this article is organized as follows: The model is established in Section 2. In the model, both the key person and the employees are considered. Section 3 analyzes in detail the benchmark model without key person insurance. Section 4 addresses key person insurance and compares the results with those in Section 3. The primary results are explained in this section. Conclusions are discussed in the final section.

2. Model of key person insurance

We focus on key person insurance of a risk-averse firm. This firm would choose such an insurance scheme to shield itself from the uncertainties associated with the loss of services provided by its key persons.

The model of a firm with key person insurance is established. The state of the key person in the firm is θ, where $\theta \in \{0,1\}$. In this article, the state reflects the marginal effects of the key person on each employee in production, or the ability of the key person. The price of the firm's final product is assumed to be $p = 1$.

Employees: We assume that there are N identical employees in the firm, and will consider a representative employee below. The effort level of an employee is denoted by e. The production of this employee is $(1+\theta)e$ and the costs incurred by the employee for exerting effort e are $\frac{e^2}{2}$. The salary of this employee is $S_0 + \tau(1+\theta)e$, where $S_0 > 0$ and $\tau > 0$. S_0 is the employee's reservation salary. τ represents the marginal human capital cost of a unit of output, and $\tau(1+\theta)e$ is the reward for the employee's effort. In practice, τ may be the salary incentive intensity for the key person, which is consistent with the work situation associated with the pay (annual salary and incentives) of individuals (Joshi et al., 2006). This type of compensation model is utilized by many firms, and is also employed in this article. Therefore, the utility of the employee is

$$u(e,\theta) = S_0 + \tau(1+\theta)e - \frac{e^2}{2} \tag{1}$$

In (1), $S_0 + \tau(1+\theta)e$ is the employee's salary, and $\frac{e^2}{2}$ is the costs incurred by the employee for exerting effort e. It is easy to see that the optimal effort level for the employee is $e^* = \tau(1+\theta)$. In equation (1), the key person improves the marginal products of each employee.

Key person: We assume that other key persons in this firm are fixed, and will focus on one key person. To simplify the problem, we assume that the objective of the key person is consistent with the firm's profits or revenues. Therefore, the key person aims to maximize the following function

$$U(\theta,\tau) = \varsigma[N(1-\tau)(1+\theta)e - NS_0 - c_0N(1+\theta)e], \tag{2}$$

where $1 > c_0 > 0$ is the marginal cost to sell the product, and $c_0N(1+\theta)e$ is the total cost to sell all outputs. The constant $\varsigma \in (0,1)$ is the proportional gain of the key person to the firm's revenues. Because we assume that the objective of the key person is consistent with the firm's profits (revenues), the firm is not addressed in this article. Moreover, if the salary of the key person is proportional to the firm's revenues, this assumption is rational.

When considering key person insurance, we assume that the probability of "good" state is α, and the probability of "bad" state is $1-\alpha$, where $0 < \alpha < 1$ and $\alpha > 0.9$. Namely, the probability of "good" state is much larger than that of "bad" state. The expected objective function of the key person is

$$EU(\theta,\tau,\alpha) = F(\theta,\tau,\alpha) = \varsigma[\alpha N(1-\tau)(1+\theta)e + (1-\alpha)N(1-\tau)e - NS_0]. \tag{3}$$

In function (3), when the key person is in "bad" state, he/she has no effect on employees. In "good" state, the key person affects both the marginal production of each employee and the profits of the firm. Before analyzing the model, we make the following assumption.

Assumption: α is close to 1, c_0 is sufficiently large, and ς is very small.

α being close to 1 means that the probability of "good" state is much greater than that of "bad" state. This is an important condition for an insurance company. A large c_0 depicts fierce competition in this industry. A small ς indicates that the salary of the key person is only a small part of the firm's revenues. In reality these assumptions are rational.

The timing of decisions is as follows. In the first stage, the insurance company determines the insurance premium. In the second stage, the firm determines whether to buy key person insurance or not. In the final stage, the key person decides the marginal salaries of employees, and the employees determine their effort levels (see Fig. 1).

3. The benchmark model

Here we address the benchmark model without key person insurance. On the basis of the formulation $e^* = \tau(1+\theta)$, (1) and (2), the key person can select the parameter τ to maximize the objective function. Function (2) is restated as

$$U(\theta,\tau) = \varsigma\left[N(1-\tau)\tau(1+\theta)^2 - NS_0 - c_0N\tau(1+\theta)^2\right]. \tag{4}$$

Apparently, the function (4) is concave in τ, and a unique solution exists, which satisfies the first-order conditions. Therefore, when the key