

# DELIS



Dynamically Evolving,  
Large-scale Information Systems

# Learning without Earning

Knowledge-Based Jobs and Long-Term Firms' Strategy

## Overview

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### Introduction

We built an agent-based model to simulate a market where employees, bearing skills, bargain their salaries with firms that, by imitating successful competitors, learn how to select and reward employees.

Knowledge-based economy creates jobs which generate value when embedded into an organizational network and become firm-specific.

Successful firms search for skills that fit into specific organizational networks. These skills have to be embedded into the organizational network. The more time they spend within an organization, the larger is their contribution to the value generated by the network. The value depends, for example, on socialization processes and learning of firm-specific language and tacit knowledge. Thus, if the skill to be embedded into an organizational network is scarce, firms have an incentive to capture these skills with a long-term employment.

Yet, if a firm's environment is dynamic, that is, if skills scarcity varies as a function of time, then long-term employment may result in a failing strategy given firms' needs to update their skill endowments frequently. The problem worsens if availability of skilled workers decreases. To speculate on outcomes of alternative employment strategies, we take an evolutionary approach:

We do not take an individual maximizing point of view rather we explore how strategies emerge from interconnected variation, selection and retention processes within a network of interplaying firms.

### The FirmWorld Model

The model comprises: Company (Firm) agents (50) and employee (Worker) agents (200). Companies attempt to keep in profit whereas employees are motivated by salary level and security of employment. Company income, each month, is determined by workforce skill set composition. The optimal skill set is determined by the exogenous "master model". Income is a function of the distance from the master model. The master model represents the "economy". The master model is not known to any company; instead, they store their own "company model" indicating what a company "believes" the optimal skill set to be. The master model changes randomly over time – the optimal skill set is therefore a moving target (dynamic economy).

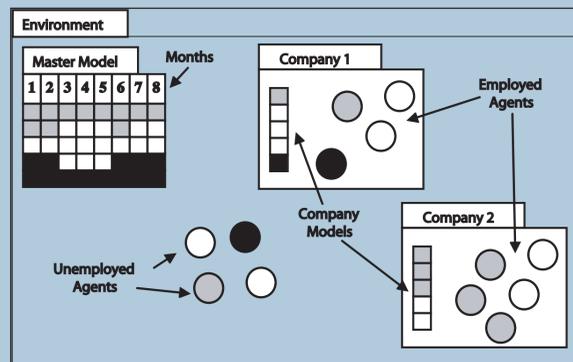


Fig. 1. A schematic of the FirmWorld. Companies employ agents with skills matching their company models (here shades represent different skills). The master model stores the actual optimal skill set and this changes over time.

### Employee agents

Employee agents have a single skill that does not change. There are five unique discrete skills. Companies post job adds for the skills they required. All unemployed and some proportion of employed agents approach a proportion of these companies for job offers. Job offers comprise a salary and a status (permanent or contract). Permanent jobs are secure but contractors can be fired. Employees choose the most desirable offer made. The longer an employee is employed by a particular company the higher their "specificity" becomes – their skills become more valuable to their current employer – hence existing employers can get more value from highly specialized employees. Those employees without permanent status may be fired by companies if they decide they are not value for money. If a company determines a skill is scarce, it will offer permanent contracts (see figure 1).

#### A cycle (month) in FirmWorld:

1. Companies recruit / fire employees
2. Income distributed to companies
3. Salaries and fixed costs paid
4. Bankrupt companies removed
5. New companies created

### Evolution in the Model

If a company goes bankrupt then all employees become unemployed. A new company is immediately formed. The new company samples the population and "copies" the company model (plus information determining higher and firing policies) of an existing company that has a high profit. Some of the copied information is changed randomly with low probability and hence the copied information represents a kind of "gene" defining company behavior that evolves over time. In this way, successful companies tend to get copied and hence their models and behaviors are propagated.

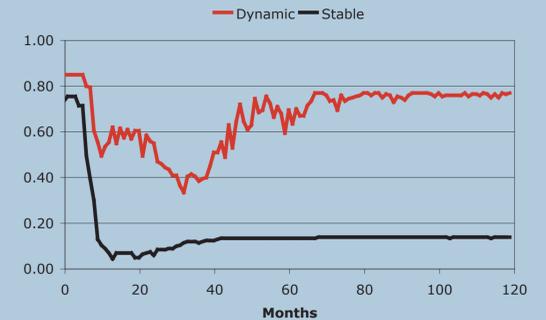


Fig. 2. The graph shows the evolution of proportion of long-term employment relationships in both stable and dynamic environment. Each curve illustrates evolution of averages this values for the whole set of firms at each point in time.



Fig. 3. The graph shows the evolution of salaries as proportions of value created by each employer. The curve illustrates evolution of averages values for the whole set of firms at each point in time.

### Results

We simulated our model comparing scenarios with different environmental dynamics; that is, we compared a scenario where skills' marginal productivity evolves rapidly over time with one where marginal productivity of skills is stable. In addition, we assumed a limited supply of skilled labor. In our experiments, firms tend to increase the proportion of long-term employment in the dynamic environment (see figure 2). Why should firms prefer long-term employment when environment requires adapting frequently a firm's skill endowment?

The explanation is the emerging of idiosyncratic skills within each company. Given a dynamic environment, non-strategic skills may suddenly become scarce and valuable. If already within a firm, these skills cannot be easily transferred to other firms without losing a portion of their productivity.

Thus, firms which in the previous cycles have preferred long-term contracts can now both offer higher salaries than competitors and still extract a rent. That is, they can retain valuable skills and limit the role of bargaining processes in inflating salaries as to erode rents. Thus, surviving firms extract larger rents from skills (see figure 3).

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