



# Capital values and job values<sup>☆</sup>

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## ABSTRACT

This paper explores how the joint behavior of hiring and investment is governed by the expected present values of capital and of jobs. It uses a model of frictions, which is a combination of a search model of the labor market and a q-type model of the capital market, emphasizing the interaction of capital and labor frictions. Relying on structural estimation of private sector U.S. data, it studies the future determinants of capital and job values and the implications for U.S. labor market developments.

Key findings include: (i) complementarity between the hiring and investment processes; (ii) important cross effects of the value of capital on the mean and the volatility of the hiring rate, and vice versa; (iii) future returns are shown to play a dominant role in determining capital and job values; and (iv) U.S. labor market developments, including the outward shift of the Beveridge curve in the Great Recession and its aftermath 2007–2013, can be accounted for by changes in job and capital values. A relatively surprising finding is that job values went up, not down, in the Great Recession.

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## 1. Introduction

This paper explores how the joint behavior of hiring and investment is governed by the expected present value of capital and labor in a model of frictions. The model is a combination of a search model of the labor market and a q-type model of the capital market, emphasizing the interaction of capital and labor frictions. Hiring and investment are modeled as the outcomes of a dynamic, intertemporal optimization problem of the representative firm. The paper uses structural estimation of private sector U.S. data to answer the following four specific questions: (i) how do capital and labor expected present values determine hiring and investment, including cross effects (capital values on hiring and job values on investment)? (ii) how big are these values, which is equivalent to asking how big are the relevant hiring and investment frictions? (iii) what are the relative roles of the determinants which drive expected present values? (iv) how can recent U.S. labor market developments – including the Great Recession period – be understood in terms of capital and job (labor) values?

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The answers to these questions are important for a number of key issues. The evolution of employment and of the capital stock are essential for the understanding of macroeconomic fluctuations. It has been shown that gross hiring is a major factor for understanding employment and unemployment dynamics.<sup>1</sup> Hiring frictions were shown to play a key role in determining the business cycle properties of labor productivity (including its declining pro-cyclicality) and of the job finding rate (including its high volatility).<sup>2</sup> Investment is key for the understanding of the evolution of the capital stock and consequently of firm market value.<sup>3</sup>

Key findings, which serve to answer the afore-cited questions, include the following:

a. Complementarity between the hiring and investment processes. There are important cross effects of the value of capital on the mean and the volatility of the hiring rate, and vice versa. The analysis takes into account the distinct, specific roles played by vacancy creation, gross hiring from non-employment, and job to job movements (as well as the separation flows involved).

b. Hiring and investment can be treated as forward-looking variables, reflecting the expectations of future discounted profits from employing labor and capital. Using the results of estimation, I employ a restricted VAR analysis, such as the one used in the asset pricing literature, to study this forward-looking aspect. The analysis shows how investment and hiring are related to their expected, future determinants, with future returns turning out to play the dominant role. This is akin to the findings in the asset pricing literature and imply that a rise in capital and job values is associated with future declines in returns ( $r$ ), for both investment and hiring. This means high values prices predict low subsequent returns, as found in the Finance literature.

This approach naturally links up with stock prices that are also forward-looking and relate to the same expected discounted future profits. Indeed, in previous work, joint with Monika Merz (Merz and Yashiv, 2007), we have shown that this set-up allows one to define asset values for hiring and for investment and that these values can be used to explain the time variation of equity values of firms in the U.S. economy. The current paper retains the focus on forward-looking behavior but does not make use of stock market data or tries to explain them. It updates the previous estimates, using a longer sample period, one that includes the Great Recession and its aftermath, and then proceeds to examine a totally different set of empirical implications.

c. U.S. labor market developments can be accounted for by changes in job and capital values. The results of this inquiry can explain the outward shift of the Beveridge curve and the big rise in unemployment in the Great Recession using changes in capital and job values. In this context, a relatively surprising finding is that job values went up, not down, in the Great Recession. These findings have implications for business cycle modeling, such as the importance of incorporating joint investment and hiring costs, complete with the cited interaction, into DSGE models.

This paper appears in a volume dedicated to the memory of Dale Mortensen and has connections with his work. Dale was the editor handling my Review of Economic Dynamics 2000 paper (Yashiv, 2000), which set out to explore job values. That paper pertained to Israeli data and used a much more limited model with no capital. Dale suggested Monika Merz and I work together and that culminated in the American Economic Review 2007 paper (Merz and Yashiv, 2007) mentioned above. The key specification explored below features both hiring and investment costs, an issue explored by Dale in an Econometrica paper four decades ago (Mortensen, 1973). Dale and Melvyn Coles used the Merz and Yashiv (2007) results in two recent papers; see Coles and Mortensen (2013, 2015).

The paper is structured as follows: Section 2 briefly discusses the relevant strands of literature. Section 3 presents the firm's optimization problem and the resulting optimality conditions to be estimated. Section 4 discusses estimation issues and presents the results. It uses the results to look at the implied magnitude of frictions and to gauge the plausibility of the estimates. Section 5 discusses hiring and investment as driven by their present values and compares the derived job values to those implied by the standard matching model. Section 6 undertakes the VAR analysis and decomposes the present value relationships embodied in the model. Section 7 looks at the ability of the results to provide a stylized account of U.S. labor market developments, including the shift of the Beveridge curve and the high unemployment rate of the Great Recession. Section 8 concludes. Technical matters and data issues are treated in appendices.

## 2. Background literature

The literature on hiring and on investment is very large. In what follows I allude to those papers that relate directly to the focus of this paper.

First is the literature on search and matching models, which feature dynamic, optimal vacancy decisions by firms in the face of frictions; see Pissarides (2000), Yashiv (2007), and Rogerson and Shimer (2011) for overviews and surveys. Recruiting costs and time lags are the expression of frictions in these models. The first order condition for optimal vacancy creation is a key ingredient and this is one of the two estimating equations examined here. The finding in this literature, as indicated above, is that gross hiring, subject to these frictions, is key in accounting for employment and unemployment dynamics.

<sup>1</sup> See, for example, Hall (2007) and Rogerson and Shimer (2011).

<sup>2</sup> Gali and van Rens (2014) show that a lower degree of hiring frictions may lower the cyclicity of labor productivity in ways which are consistent with actual U.S. aggregate data dynamics. Coles and Mortensen (2013, 2015) study the role of hiring costs in dynamic environments which generate a result whereby there is no Shimer "puzzle" and the job finding rate volatility matches the data.

<sup>3</sup> See, for example, Cochrane (2011).

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