

# ON THE AMBIGUITY OF JOB SEARCH

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## Abstract

Unambiguously, a productivity distribution function is ambiguous. Interestingly, this ambiguous function provides references to make decisions including job creations, wage determinations, contract formulations, etc. To investigate how the ambiguity shapes labor markets, this paper incorporates ambiguity preferences into the Diamond-Mortensen-Pissarides (DMP) model. Ambiguity-averse job- and talent-hunters are conservative: they believe lower match-specific productivity levels to be more likely realized. Unsurprisingly, the belief incents both sides to accept a contract, deteriorating job qualities but depressing unemployment. Meanwhile, this belief reduces the valuation of future profits, depressing the creation of vacancies and thereby increasing unemployment. Our quantitative analysis indicates that but for the ambiguity, the American unemployment rate would have increased in the postwar era. This paper generalizes the DMP model, enhances our understanding of the labor market, and calls for policies concerning labor market information.

**Keywords:** Ambiguity Aversion; Unemployment; Volatility Shocks.

**JEL Classification Numbers:** D81, E24, E32, E7, J64.

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# 1 Introduction

Outside option values are important pieces of information in the labor market. Workers require this information to consider whether to accept a job offer by comparing the offer in hand with outside options. Firms make hiring decisions by comparing job candidates with alternatives. While these values depend largely on the productivity distribution in the labor market, such a distribution function is unknown to workers and firms. Prior literature assumes a common knowledge about the distribution function (Rogerson et al., 2005). Workers and firms make decisions inside a model economists construct based on a specified productivity distribution. Model misspecification may, therefore, arise: the underlying model workers and firms use to make decision is potentially misspecified. Meanwhile, which alternative model (e.g., the distribution function) should be used to make decisions is ambiguous to both workers and firms. Yet, little is known about how an aversion to this ambiguity and a fear about model misspecification affect the behaviors of workers and firms during a job search process.

To provide an in-depth study on the labor market effect of the ambiguity, this paper purposes to (i) construct an analytically tractable search-theoretical model featuring ambiguity preferences, (ii) uncover major mechanisms through which ambiguity preferences affect two key labor market variables—the unemployment and wage rates, (iii) quantify unemployment attributable to the ambiguity, and (iv) discuss policy implications concerning labor market information.

Such an in-depth study requires a search-theoretical model featuring ambiguity preferences. Similar to other preferences such as risk- and loss-aversion, collecting the preference parameter of ambiguity aversion is empirically challenging.<sup>1</sup> Therefore, we uncover the parameter through the calibration of a theoretical model. However, the incorporation of ambiguity preferences into a search-theoretical framework is easier said than done. The Diamond-Mortensen-Pissarides (DMP) model is popular and can be easily extended to incorporate other labor market features partly because of its analytical tractability and its comparative statics result that well describes the labor market. The tractability of the DMP model relies heavily on the linearity of value functions to one another. Hence, this model and its variants often assume risk- and ambiguity-neutral agents to avoid the nonlinearity of the value functions. We show that despite the nonlinearity, the DMP model featuring ambiguity preferences (Hansen and Sargent, 2008) preserves its analytical tractability and most of its intuitive comparative statics results.

The analytical tractability allows us to clearly uncover major mechanisms through which the ambiguity affects important macroeconomic variables. Workers with stronger ambiguity aversion tend to believe that lower productivity levels are more likely to be realized. This belief reduces unemployed workers' outside option values and thus reservation wages; hence, they are more likely to accept contracts from firms. As a result, the ambiguity deteriorates an average match quantity, providing a rationale to our traditional thought: the revelation of labor market information improves job qualities.

Meanwhile, the lower reservation wage requires firms to compensate employees less, thereby reducing wages. The reduction in this compensation increases expected profits, encouraging the creation

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<sup>1</sup>We acknowledge an experimental approach to uncover economic preference parameters (Borghans et al., 2009). Nevertheless, the micro-estimate from experiments may substantially differ from the macro-estimate from a calibrated model, which is more relevant in our content.

of vacancies. Hence, the ambiguity increases the contract acceptance rate and the supply of vacancies, both of which depress unemployment. Whereas conventional wisdom suggests that the revelation of labor market information helps job seekers get rid of unemployment, our result finds the opposite: the ambiguity towards the labor market helps the unemployed find jobs.

In contrast, the ambiguity may affect firms' behaviors differently. Due to the ambiguity, firms are conservative: they believe lower productivity levels to be more likely realized. The belief reduces their outside option values, making them more likely to sign contracts with job applicants. Meanwhile, firms with stronger ambiguity aversion formulate a belief of lower expected profits, discouraging their creation of vacancies. While the increased acceptance rate of job applications depresses unemployment, the reduction in the supply of vacancies lengthens an average unemployment spell. The two compelling forces make it uncertain how a firm's ambiguity aversion affects unemployment.

We further study the role of ambiguity in the labor market through quantitative analyses. We find that the ambiguity increases employment in the United States. If both workers and firms became ambiguity-neutral in reality, unemployment would have increased. While unemployment goes up and down closely with the volatility of total factor productivity (TFP) (Schaal, 2017; Bloom et al., 2018), we find that the high volatility of TFP in recessions intensifies the employment effect of ambiguity. As a result, the ambiguity depresses unemployment more in slumps than in booms, and the ambiguity weakens the close relationship between unemployment and the volatility of TFP in recession years.

An interesting policy dilemma concerning labor market information emerges. According to our quantitative analysis, the revelation of labor market information to workers increases unemployment, and the effect is substantial. Therefore, passing labor market information to workers is a tool to cool an overheated economy: it depresses employment and improves job qualities. However, the same tool hurts an economy in slumps by worsening unemployment. In contrast, the removal of firms' ambiguity depresses unemployment, but the impact is small. Quite often, policymakers may want to encourage the creation of job vacancies by providing firms with abundant labor market information. Our findings suggest that it helps, but they are simply *busy doing nothing*: the policy is inefficient.

This paper builds on insights from two sets of literatures. It incorporates the Hansen and Sargent (2008) type of ambiguity preferences into a search-theoretical model. The DMP model is chosen partly because its analytical tractability allows the model to be generally and easily extended to incorporate other labor market features including on-the-job searches (Dolado et al., 2009; Postel-Vinay and Turon, 2014), firing costs (Postel-Vinay and Turon, 2014; Vindigni et al., 2014), job referral (Calvó-Armengol and Zenou, 2005; Galenianos, 2014), heterogeneity in sectors (Acemoglu, 2001; Albrecht et al., 2018), discrimination (Sasaki, 1999; Rosén, 2003), human capital accumulation (Cairo and Cajner, 2018), etc. Our model generalizes the DMP model by allowing agents to be ambiguity averse without losing its analytical tractability. A similar generalization can therefore be applied to these broad literatures.

This paper's focus on the ambiguity in the labor market fits broadly within the application of robust control methods (Cao et al., 2005; Adam and Woodford, 2012; Athanassoglou and Xepapadeas, 2012; Croce et al., 2012; Djeutem and Kasa, 2013; Ilut and Schneider, 2014). Nishimura and Ozaki (2004) incorporates Knightian uncertainty into a job-seeker problem, showing that Knightian uncertainty re-

duces the reservation wage. In addition to the worker's problem, this paper studies vacancies' problems, completing the search process between workers and firms under ambiguity. Moreover, this paper quantifies unemployment attributable to workers' and firms' ambiguity and examines the relationship between ambiguity and unemployment over business cycles.

This paper also complements a series of influential papers that study the relationship between unemployment and productivity uncertainties (Bloom et al., 2007; Bloom, 2009; Schaal, 2017; Bloom et al., 2018). Schaal (2017) shows that unemployment fluctuations could be explained in large part by the volatility of TFP. We find that the relationship between unemployment fluctuations and the FTP volatility is weakened in recession because the TFP volatility in recession years amplifies the employment effect of ambiguity. This paper contributes to this literature by linking the ambiguity towards a productivity distribution to the relationship between unemployment and the volatility of TFP, enhancing our understanding of the labor market over business cycles. This linkage, though important in understanding unemployment fluctuations, has not been addressed in previous formal models.

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