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Why does employment in all major sectors move together over the business cycle? ☆



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ABSTRACT

The labor input is correlated across all major sectors. I argue that this mostly stems from fluctuations in employment, rather than hours. Therefore, it is crucial to understand the cross-sector correlation of the extensive margin. This paper advances the literature on cross-sector correlations by making unemployment an explicit feature of the model. I construct a two-sector model with search and matching friction, wage rigidity, and capital adjustment costs. The model explains the positive cross-sector correlation through characterizing movements into and out of unemployment in both sectors. Moreover, the results suggest a link between the “co-movement” and the “unemployment volatility” puzzles.

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1. Introduction

It is well established that total labor input in the US economy is positively correlated across sectors over the business cycle.¹ The positive cross-sectoral correlation is a key characteristic of business cycle data that also appears in the definition of a recession set by the Business Cycle Dating Committee of the National Bureau of Economic Research:

“...a recession is a broad contraction of the economy, not confined to one sector...”

The positive correlation of total hours stems from positive cross-sector correlations of both the extensive and the intensive margins. In this paper I show that the correlations between the *number of workers* across different sectors are slightly higher than the correlations between sectoral *hours per worker*. Moreover, the variability of the number of workers in a sector is on average more than 3 times as high as the variability of average hours worked per worker. Taken together, these

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¹ Christiano and Fitzgerald (1998), Rebelo (2005), Cassou and Vazquez (2011).

two facts imply that the extensive margin is the crucial margin in understanding the positive sectoral correlation of labor input.

Motivated by this observation, I construct a two-sector business cycle model that explicitly characterizes the behavior of sectoral employment. The key feature of the model is a search and matching friction in the style of [Diamond \(1982\)](#), [Mortensen \(1982\)](#), and [Pissarides \(1985\)](#) (DMP). The model generates substantially higher correlations of labor market variables relative to a frictionless model when incorporating two additional elements: (1) partial wage stickiness, and (2) capital adjustment costs.

The model explains the positive correlation of employment in the two sectors through a number of key properties. First is the incorporation of an additional sector, where unemployed workers look for jobs. Absent this third, countercyclical sector, workers mainly switch between sectors, generating a negative correlation of labor across sectors. In a model with explicit treatment of unemployment the value of working in production sectors is higher during high productivity periods, and, as is standard in the DMP class of models, individuals move from unemployment into market activity in both production sectors. This process is further enhanced when wages are sticky, as firms allocate more resources towards recruiting. The second property is the fact that search and matching friction imposes a cost on reallocation of workers across sectors, delaying the flow of workers from the consumption-goods sector to the investment-goods sector during high productivity periods. Finally, capital adjustment costs impose a cost on reallocation of capital, and, because of complementarity in production, weaken the incentives to reallocate labor from the consumption sector to the investment sector. In what follows, I describe these mechanisms in more detail.

I start by investigating a two-sector economy with frictional labor markets as in the baseline search and matching model by [Pissarides \(1985\)](#). Relative to a frictionless model, the model predicts slightly higher correlation of total hours of work across the two sectors. However, total hours worked and the number of workers in the consumption-goods sector are negatively correlated with the same variables in the investment-goods sector. The intuition is that during high-productivity periods, households want to smooth consumption over time and increase the capital stock. This results in reallocation of resources from the consumption sector to the investment sector. In the model, reallocation is achieved through a vigorous response of vacancies in the investment sector, while vacancies in the consumption sector hardly respond. Because the consumption sector is larger, aggregate vacancies and unemployment have low variability.

The behavior of unemployment, aggregate vacancies, and consumption sector vacancies mimics a well-known shortcoming of one sector search and matching models, known as the unemployment volatility puzzle. In an influential paper, [Shimer \(2005\)](#) shows that the [Mortensen and Pissarides \(1994\)](#) model with conventional parameter values predicts very low volatility of vacancies and unemployment, while in the data these variables are very volatile.² The results of this paper suggest that in the context of the two-sector model, the main source of the aggregate volatility puzzle is the lack of responsiveness of vacancies in the consumption sector. An interpretation of these observations is that the source, and therefore the resolution of the unemployment volatility puzzle, may also correct the structure of cross-sector employment correlation.

A literature stimulated by Shimer's paper has introduced a new concept of wage stickiness suited to the search and matching model. [Hall \(2005a\)](#) calls this "equilibrium wage stickiness" because, in a bargaining setup, a sticky wage that remains within the bargaining set of the worker and employer is an economic equilibrium. A key insight of this literature is that when wages are sticky, employers do not fully compensate their workers for a gain in productivity, effectively increasing the employers' share of the match surplus.³ Employers respond by putting more resources into recruiting workers, which causes a tightening of the labor market with lower unemployment.

Motivated by these findings, I incorporate partial wage stickiness into the model. Partial wage stickiness generates positive cross-sectoral correlation of total hours, vacancies, and employment. The labor market tightens in all sectors when an increase in productivity raises the payoff to employers from recruiting.

This paper advances the literature on sectoral labor "co-movement puzzle" in real business cycles (RBC) models. In sharp contrast to the data, a two-sector RBC model driven only by aggregate total factor productivity (TFP) shocks, generates strong negative correlation of total hours worked in the two sectors. In a frictionless model, the desire to smooth consumption induces households to increase their demand for investment goods, leading to an expansion of total hours worked in the investment-goods sector coupled with a contraction of total hours worked in the consumption-goods sector. Output in the consumption sector increases due to higher productivity.⁴

Several studies have proposed mechanisms that resolve the co-movement puzzle.⁵ This paper suggest an improvement over the existing set of results along two dimensions. First, existing models neglect the distinction between the extensive and intensive margins, and focus on total hours of work. Within the context of my model, I show examples of mechanisms that give rise to pro-cyclical total hours worked in the consumption sector, yet fail to achieve positive cross-sector correlation

² [Shimer \(2010\)](#) consider the conditions under which vacancies in the model are neutral to productivity shocks.

³ See, for example, [Hall and Milgrom \(2008\)](#), [Gertler and Trigari \(2009\)](#), [Rudanko \(2011\)](#), and the discussions in [Hall \(2009\)](#) and [Brugemann and Moscarini \(2010\)](#).

⁴ See [Christiano and Fitzgerald \(1998\)](#) for more details.

⁵ [Benhabib et al. \(1991\)](#), [Hornstein and Praschnik \(1997\)](#), [Huffman and Wynne \(1999\)](#), [Boldrin et al. \(2001\)](#), [Jaimovich and Rebelo \(2009\)](#), [DiCecio \(2009\)](#). Studies by [Long and Plosser \(1983\)](#), [Horvath \(1998\)](#), and [Horvath \(2000\)](#) take a different route to explain to correlation of sectoral outputs, using the inter-linkages in production as implied by input-output tables. These studies do not focus on the correlation of labor input per se, but rather on the implications with respect to output.

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