

Since the start of the Great Recession, the unemployment rate rose from 4.6% in 2007 to 9.6% in 2010 in the US and from 7.3% to 9.6% over the same period in the European Union. Unemployment is expected to remain high in both areas for months, if not years, to come. These large fluctuations in the unemployment rate are arguably the main reason why macroeconomists care about business cycles. Yet, our models do not seem to satisfactorily describe the size, the persistence or the welfare effects of these fluctuations. My research is on the macroeconomics of labor markets and most, although not all, of my work focuses on unemployment fluctuations.

My best known paper is probably *Wage Rigidity and Job Creation* (Haefke, Sonntag and Van Rens 2008).<sup>1</sup> In this paper, we aim to evaluate whether the high volatility of unemployment fluctuations may be due to wage rigidities, as suggested by many recent studies (Hall 2005, Shimer 2005, Gertler and Trigari 2009, Blanchard and Gali 2010, Hall and Milgrom 2008, Braun 2006, Shimer 2010 and Christiano, Trabandt and Wallentin 2010, among many others). We argue that the wage of newly hired workers is more informative than the average wage about the cyclical nature of the expected net present value of matches, which is what determines job creation in standard labor market models with search frictions. We then show that the elasticity of the wage of new hires with respect to labor productivity is close to one, consistent with perfectly flexible wages (period-by-period Nash bargaining) in a standard search model. These estimates suggest that the amount of wage rigidity needed to match the data for unemployment is much higher than the amount of rigidity that matches the data for wages.

With two other papers, which independently made a similar argument (Pissarides 2009, Kudlyak 2011), our paper provides an additional target to discipline our attempt to describe business cycle fluctuations in unemployment. Unfortunately, the standard errors of our estimates are fairly large, so that we cannot rule out a modest degree of wage rigidity. But our estimates have proven to be robust to various criticisms. In particular, the results are robust to controlling for job characteristics, evidence against the idea that our estimates are driven by changes in the composition of jobs over the business cycle.<sup>2</sup> A more important critique of our work is due to Rogerson and Shimer (2010), who argue that with

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<sup>1</sup> We circulated the first version of this paper in April 2007 and submitted a revised draft for publication in September 2008. The paper received considerable attention (121 citations on Google scholar as of October 26, 2011), but the publication process has been slow. In March 2011, we finally received a revise and resubmit at the *Journal of Monetary Economics*.

<sup>2</sup> US data do not allow to control for job characteristics, but data for some other countries do. Carneiro, Guimaraes and Portugal (2009) use matched employer-employee data for Portugal 1986-2005 and show that controlling for firm fixed effects, entry wages are much more procyclical than wages in ongoing jobs, consistent with our results.

diminishing returns to labor, the elasticity of the wage with respect to productivity is not informative about the degree of wage rigidity. The idea is that even if the wage is rigid, employment adjustments will equate the marginal product of labor to the wage. In ongoing work (Petrosky-Nadeau and Van Rens 2011), we evaluate this argument and explore whether there are other statistics that are more informative about the degree of wage rigidity in the data.

Recent literature, starting with Shimer (2005), has focused primarily on the volatility of unemployment. But it is important to remember that standard labor market models also fail to match the persistence of unemployment fluctuations in the data (Cole and Rogerson 1999). This failure has become more pronounced in the last three recessions, which were followed by long periods of weak job creation and high unemployment, the jobless recoveries. My job market paper, *Organizational Capital and Employment Fluctuations* (Van Rens 2004), was one of the first attempts to provide an explanation for the jobless recoveries. I argue that production requires frequent as well as infrequent tasks, which makes it possible for firms to ‘store’ labor input by assigning workers to infrequent tasks (e.g. maintenance). I call this stored labor organizational capital. By running down their organizational capital (i.e. by postponing infrequent tasks), firms can allocate more labor to production without hiring new workers. I show that this intertemporal substitution of labor input, in combination with adjustment costs in employment, can generate hump-shaped impulse responses of employment to productivity shocks, replicating the jobless recoveries.<sup>3</sup> To explain why the 1991 and 2001 recessions were followed by jobless recoveries but previous recessions were not, I point out that these recessions followed very long booms, which allowed firms to accumulate unprecedentedly large organizational capital stocks. This paper also makes a methodological contribution by showing that in the presence of intertemporal substitution of labor, the model displays labor hoarding in the presence of convex as well as non-convex adjustment costs.<sup>4</sup>

What type of labor market model matches both the volatility and the persistence of fluctuations in unemployment as well as wages? In my recent work, I focus on heterogeneities across workers or firms, which I consider to be a promising ingredient for such a model. One view of unemployment fluctuations that relies on heterogeneity was put forward by Kocherlakota (2010). Kocherlakota argued that the increase in unemployment in the Great Recession was at least in part due to increased mismatch, and that

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<sup>3</sup> Notice that I obtain the jobless recoveries as an impulse response, not as a potential realization depending on the stochastic process for productivity, as in Bachmann (2009).

<sup>4</sup> In contrast, models without intertemporal substitution of labor predict labor hoarding in the presence of non-convex adjustment costs, but if adjustment costs are convex, the largest amount of hiring happens immediately following the shock.

increased mismatch explains both the large size of the increase in unemployment and the slow speed of the recovery. If the labor market is segmented, for example by geographic area, occupations or skills, mismatch occurs if unemployed workers and vacant jobs cannot match because they exist in different segments or submarkets. Kocherlakota argues that unemployment due to mismatch is more structural than the overall unemployment rate, in the sense that it is more persistent and cannot be cured using stabilization policy.

In *Structural Unemployment* (Herz and Van Rens 2011), we estimate unemployment due to mismatch and address the question whether there was a structural increase in mismatch unemployment. We first formalize what causes mismatch and how it generates unemployment, in a model of a segmented labor market. Within labor market segments, search frictions generate unemployment. Adjustment costs between segments generate mismatch: dispersion in labor market conditions, which generates additional unemployment. We then use this model to estimate unemployment due to mismatch on the US labor market, using data on job and worker finding rates, wages and profits by states and industries. The model allows us to decompose total unemployment due to mismatch into the contribution of the various adjustment costs, including worker and job mobility costs and wage setting frictions.

We find no evidence that the increase in mismatch in the Great Recession was structural. First of all, the contribution of mismatch to total unemployment is very small: of the 5%-point increase in unemployment in the Great Recession, at most 0.1%-points are due to mismatch across states, and mismatch across industries contributes between 0.03 and 0.6%-points, roughly consistent with studies by Sahin, Song, Topa and Violante (2011) and Barnichon and Figura (2011). More importantly, we find that fluctuations in mismatch unemployment are equally cyclical as fluctuations in the overall unemployment rate, and no more persistent. Dispersion in labor market conditions rises in recessions, not only in the Great Recession, and falls in booms. This finding casts doubt on Kocherlakota's claim that stabilization policy cannot be used to cure unemployment due to mismatch. The main source of mismatch are wage setting frictions. This last result suggests that policies aimed at increasing worker mobility, as advocated e.g. by Katz (2010), are likely to have small effects.

Our results do not imply that mismatch is not important. The finding that the contribution of mismatch is small depends crucially on the level of disaggregation. In the limit, if labor markets segments are sufficiently small such that each unemployed worker and each vacancy lives in a separate submarket, by construction all unemployment is due to mismatch. In addition, ideally we would use neither states nor industries as labor market segments, but occupational groups, defined based on the skills a worker needs to perform these occupations. Since these occupational groups are likely to be overlapping, they require a different approach to measure mismatch, something we are thinking about for future research. My

interpretation of our results is that it is more accurate to think of mismatch as a micro-foundation for search frictions, as in Shimer (2007), than as an alternative source of unemployment.

A second reason why labor market model with heterogeneity are interesting, is that these models may be more suitable for welfare analysis. In the standard models, we often assume that workers are homogeneous and markets are complete. Combined, these assumptions eliminate the most important source of welfare costs of unemployment: the fact that unemployment is unequally distributed across workers. Attempts to re-evaluate the cost of business cycles have focused on relaxing the complete markets assumption. With incomplete markets, ex ante identical workers cannot share unemployment risk, making these workers heterogeneous ex post. But because workers are ex ante homogeneous, welfare costs of unemployment and business cycles in these models are still small (Krusell and Smith 1998).

In *Selective Hiring and Welfare Analysis in Labor Market Models* (Merkl and Van Rens 2011), we propose a framework, in which workers are ex ante heterogeneous. Some workers are more attractive to employers than others, for instance because they are less productive or have larger training costs. With this type of heterogeneity, hiring decisions are selective: some workers have a higher probability to find a job than others. We set up the model in such a way that it is isomorphic to the standard Mortensen and Pissarides (1994) search and matching model in terms of aggregate job creation. Thus, we provide a framework that on the one hand maintains most of the insights from standard models about the dynamics of the labor market, but on the other hand has very different implications for welfare analysis.

In our model of selective hiring, unemployment is costly because it is spread unequally. Some workers are always employed, while others are always unemployed. As a consequence, with risk averse workers, optimal unemployment insurance is more generous than in the case of random hiring. The data strongly suggest that hiring decisions are partly random and partly selective. For example, if hiring is fully random, job finding rates are independent of unemployment duration, whereas if hiring is perfectly selective, the job finding probability equals one for workers with unemployment duration up to one period and zero for workers with longer unemployment durations. In the data, job finding rates decline with unemployment duration (Abraham and Shimer 2002). Partially selective hiring can also explain why the skill level of both the employment and the unemployment pool is countercyclical (Solon, Barsky and Parker 1994, Mueller 2010).<sup>5</sup> Our model allows us to use these data to assess quantitatively the degree of selectivity in hiring decisions.

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<sup>5</sup> Workers that find jobs in booms but may lose these jobs again in recessions are relatively low skilled compared to the average employed worker, but relatively skilled compared to the average unemployed worker.

In addition to the papers described above, I have several other papers that are not directly related to my main line of research. I discuss these papers briefly, starting with the most recent.

*The Vanishing Procyclicality of Labor Productivity* (Gali and Van Rens 2010) documents three changes in business cycle dynamics in the US around the time of the Great Moderation: (1) labor productivity ceased to be procyclical, (2) labor input became more volatile compared to output, and (3) wages became more volatile, not only compared to output but even in absolute terms. We argue that these three observations, when taken together, suggest that the Great Moderation is related to changes on the labor market. We show that a reduction in labor market frictions can explain all three facts, as well as explain (a small) part of the Great Moderation. Two model elements are crucial for this result. First, effort provides an intensive margin of labor adjustment, which is not subject to the labor market frictions. This is what generates the first two facts: as labor market frictions decrease, the extensive margin does more, and the intensive margin less of the adjustment in total labor input, making employment more volatile compared to output and productivity less procyclical.<sup>6</sup> Second, we assume that wages are rigid within the bargaining set, but wage rigidity does not lead to privately inefficient job destruction. Thus, the degree of wage rigidity becomes endogenous: as labor market frictions decrease, the width of the bargaining set shrinks and wages have to be adjusted more often. This mechanism generates the increase in the volatility of wages and the Great Moderation.

In *Skill-Biased Technological Change and the Business Cycle* (Balleer and Van Rens 2011), we explore the implications of skill-biased technology shocks for business cycle fluctuations. This paper was motivated by the observation that we know skill-biased technological progress is important for economic growth and to explain trends in the skill premium and inequality, but on the other hand most business cycle studies still assume technology shocks are skill-neutral. Yet, we also know that the nature of technology shocks matters for business cycles, as can be seen by comparing the response of hours worked to TFP shocks as in Gali (1999) to the response to investment-specific shocks as in Fisher (2006). We identify skill-biased technology shocks in a structural VAR as the only shocks that change the skill premium in the long run.<sup>7</sup> We find that skill-biased technology shocks, like skill-neutral technology shocks, increase labor productivity. Skill-biased improvements in technology shocks also cause a large decline in total hours worked. This finding suggests that the fall in hours in response to technology shocks, which has been interpreted as evidence for price rigidities, may instead be driven by compositional changes in the labor force.

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<sup>6</sup> In the paper, we focus on employment as the extensive margin. But the results can be made consistent with data on hours per worker if we assume there are frictions associated with adjusting (observed) hours per worker. Interestingly, in my Carnegie-Rochester discussion *How Important is the Intensive Margin of Labor Adjustment?* (Van Rens 2011), I find that frictions on adjusting hours per worker seem at least as high as frictions in adjusting employment.

<sup>7</sup> Except for shocks to the supply of skill, for which we control separately using a short-run restriction.

The paper on *Heterogeneous Life-Cycle Profiles, Income Risk and Consumption Inequality* (Primiceri and Van Rens 2009) was motivated by the observation that the increase in income inequality in the US in the 1980s did not translate into an increase in consumption inequality over the same period. This observation, documented among others by Krueger and Perri (2006), has recently been disputed by Attanasio, Battistin and Ichimura (2007) and Aguiar and Bils (2011). However, it gave rise to a small but active literature, including Heathcote, Storesletten and Violante (2010), Blundell, Pistaferri and Preston (2008) and our paper. In our paper, we try to reconcile the finding that the increase in income inequality was mostly due to permanent shocks if we identify permanent versus transitory shocks using the time series properties of individual income data, as in Gottschalk and Moffitt (1994), with the finding that the increase in inequality was due largely to transitory shocks if identification comes from the co-movement of income and consumption inequality, as in Blundell and Preston (1998). We show that with a simple model, in which individual-specific income trends, as in Guvenen (2007) are largely predictable to consumers, we can match both sets of moments. In an earlier, related, paper, *Inequality over the Business Cycle: Estimating Income Risk using Consumption Data* (Primiceri and Van Rens 2004), we show that our data do not support the finding in Storesletten, Telmer and Yaron (2004) that risk is countercyclical, albeit our standard errors are too large to be sure.<sup>8</sup>

In *Education, Growth and Income Inequality* (Teulings and Van Rens 2008), we present a model to show how income inequality is informative about the return to human capital. The model has a continuum of worker skill types and job complexity levels, but we are nevertheless able to derive closed-form expressions for the private and social return to schooling by assuming skill and complexity are both normally distributed with the same variance. We then use cross-country panel data on inequality and GDP to estimate private and social return, consistent with the model. Our estimates of the private return are well in line with evidence from micro-data. We find that in the short run, the social equals the private return, but in the long run there are strong positive externalities of investments in education. *Should Higher Education Subsidies Depend on Parental Income?* (Dur, Teulings and Van Rens 2004) is a spinoff of this project, in which we argue that subsidizing education may be part of an optimal redistribution policy because a higher average education level reduces the return to schooling and therefore inequality.

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<sup>8</sup> One way, in which we tried to strengthen these results, is to use differences in inequality between cohorts of different ages in our dataset to ‘backcast’ changes in the variances of shocks prior to the sample, similar to Storesletten et al. (2004). However, there are two problems with this approach, which also apply to the results in Storesletten et al. First, the year prior to the sample period, to which the age effects are attributed depends crucially on an assumption at which age cohorts enter the labor market. Changing that entry age from 23, as in Storesletten et al, so 20 years old, changes recessions to booms and vice versa. Second, the usual identification problem between age, cohort and time effects is more severe in this case. Cohort and time effects that realized prior to the sample period, both reveal themselves as age effects in the sample, but with opposite signs.

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