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Are Turbulences of Sargent and Ljungqvist consistent with lower Aggregate Volatility?

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Are turbulences of Sargent and Ljungqvist consistent with lower aggregate volatility?*

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Abstract

Ljungqvist and Sargent (1998, 2008, 2007a, 2007b) impute the persistence of long term unemployment in Europe since 80s to the welfare state's inability to cope with more turbulent times. They claim that global economic conditions have been more turbulent in the 80s and 90s, comparing to the earlier decades, and construct a model based on search with a turbulence at the micro level to reproduce the evolution of unemployment in laissez-faire and welfare economies. Plethora of research, among others Stock and Watson (2002, 2005), document on the other hand a fall in the aggregate volatility of macro series in the USA and G7 countries since 80s. We attempt to reconcile these two findings. Can the model of Ljungqvist and Sargent (1998) based on the micro turbulence be consistent with the macro data? We look at the macro series of productivity and real wages (plus real GDP and employment) for a number of countries and find a decline in the aggregate volatility since the 80s. We then generate the macro series based on Ljungqvist and Sargent (1998) search model and establish what sort of aggregate volatility it predicts for welfare and laissez-faire economies under different degrees of turbulence. We find that, although the model fails to match the data exactly, it has a potential to be consistent with labor market outcomes but is unable to match broader aggregate measures.

Keywords: Search unemployment, turbulences, volatility

JEL-Code: J64, C52, E32

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1 Introduction

According to Ljungqvist and Sargent (1998, 2008, 2007a, 2007b) global economies have become more turbulent since 80s as a result of rapid technological progress, financial markets deregulation, sectoral reallocation, increased international competition and alike. The authors quote indirect empirical evidence in favor of their claim, construct a search model with turbulences applied to agents' individual human capital levels and succeed in reproducing the evolution of unemployment in laissez-faire and welfare economies. A large body of research, on the other hand, for example Stock and Watson (2002, 2005), document a fall in aggregate volatility of macro series in the USA and G7 countries since 80s. In our paper, given potentially divergent trends in micro and macro variables, we show that Ljungqvist and Sargent (1998) model — although it fails to match the data exactly — could potentially be consistent with aggregate labor market variables. That paves a new way to thinking about search frictions as giving rise to certain aggregate patterns, consistent with micro turbulence, and labor market policy as a potential driver of international differences in macro-level volatility moderation.

In particular, we find a decline in the volatility of real wages, employment, GDP and productivity both in the American and European economies. Moreover, over the last four decades, we observe the tendency of the European economies to exhibit a larger moderation in the fluctuations of GDP, and in some cases of real wages, and somehow weaker moderation in the fluctuations of productivity and employment.

The model predicts a decline in the volatility of real wages and employment for both laissez-faire and welfare economies when micro-turbulence increases. The culprit are search frictions. Moreover, for the baseline parameters, the decline in the volatility of wages and employment is larger for the welfare economy, which derives from the discouragement effect that the welfare state has on unemployed searchers. The effect of turbulence on the reduction in the volatility of employment in the welfare economy is moderated as turbulence increases, when search cost are higher and the variance of offered wages lower. This finding points out to it being potentially possible to reconcile the data on wages and employment in the USA and Europe, although for the most realistic combinations of parameters we fail to match the data exactly. However, the model predicts an increase in the volatility of GDP, and hence of productivity, which is counterfactual. Because the variance of individual earnings increases with turbulence, the measure of GDP as defined in the model becomes more volatile. One possible solution is to compare the model-generated GDP data with a different measure of wage income. We do so, using the data on both the total and average compensations of employees in the USA and Europe. Unfortunately, this exercise does not allow us to conclude in favor of the model.

Specifically, Ljungqvist and Sargent (1998) is a general equilibrium search model along the lines of McCall (1970) with human capital accumulation during employment and human capital obsolescence when unemployed. The degrees of economic turbulence are defined as the amounts of skills lost when a worker is laid off. In a welfare — as opposed to a laissez-faire — economy government provides unemployment benefits determined by workers' past earnings and financed by proportional taxation on wage income. The model is capable of explaining how in a relatively tranquil time until the mid-70s both the US and Europe maintained similar unemployment rates, however Europe's generous welfare states have been unable thereafter to cope with the increased turbulence in the economic environment.

In the model, transient shocks applied to both economies lead to a prolonged period of long-term unemployment in a welfare state, while a laissez-faire economy recovers promptly. Persistent turbulence, on the other hand, results in a higher steady-state unemployment in a welfare economy.

The authors quote Gottschalk and Moffitt (1994) result as indirect evidence that the economic environment has become more turbulent since 80s. Specifically, Gottschalk and Moffitt find between the periods of 1970-1978 and 1979-1987 an increase in the dispersion of both permanent and transitory components of individual earnings, which Ljungqvist and Sargent interpret as an increase in the degree of economic turbulence. They use their model to successfully replicate these data and in this way check the model's validity. Moreover, they successfully replicate the result of Jacobson, LaLonde, and Sullivan (1993) of income losses experienced by long-tenured displaced workers in 80s.

Subsequent studies of Ljungqvist and Sargent (2008, 2007a, 2007b) are used to corroborate the results so far obtained. Ljungqvist and Sargent (2008) extend the former model by adding firing costs, aging and stochastic on-the-job wage changes. These allow to explain (1) the European success story of 60s, when Europe — while offering higher unemployment protection — maintained lower unemployment rates than the USA, and (2) a substantial rise from 70s onwards in long-term unemployment among older workers. Ljungqvist and Sargent (2007a) and Ljungqvist and Sargent (2007b), on the other hand, place the model into representative family, matching and search-island frameworks. The reason why in this study we focus on Ljungqvist and Sargent (1998) paper is that the model presented here, an extension of McCall's, is a general equilibrium model in the sense that it is closed via the government's budget constraint and its equilibrium is calculated as a fixed point in the tax rate which balances the government's budget.

In turn, the phenomenon of the Great Moderation — a decline in the volatility at the aggregate level in the US and internationally — has been well documented, starting with Kim and Nelson (1999) and Blanchard and Simon (2001). Since then a lot of work has been done to uncover and explain the fall in volatility in numerous macro series for numerous countries (for survey and some analysis see Cecchetti, Flores-Lagunes, and Krause (2006), Summers (2005), Trehan (2005)). Most commonly advocated as lying behind the Great Moderation are monetary policy (Clarida, Gali, and Gertler (2000), Castelnuovo (2006)), good luck in the form of favorable shocks (Stock and Watson (2002), Stock and Watson (2005), Gordon (2005)), or structural change. The latter includes the popular hypotheses of improved inventory management influenced by advances in information technology (McConnell and Perez-Quiros (2000), Khan, McConnell, and Perez-Quiros (2002)), financial markets deregulation (Dynan, Elmendorf, and Sichel (2005)), sectoral reallocation away from volatile manufacturing (Eggers and Ioannides (2006)) and opening to international competition (Barrell and Gottschalk (2004)). In reality it is likely that many of the above have taken place simultaneously[1].

[1] A lot of effort has gone into attempts to reconcile these claims. Khan and McConnell (2005)) argue that new inventory control is consistent with smaller shocks hypothesis as agents make smaller mistakes and better neutralise external shocks. This is parallel to improved monetary policy where central banks create themselves smaller shocks and better react to the arriving disturbances. Hence, if structural change is not explicitly captured in a macro model, the estimation may wrongly attribute the reduction in volatility to good luck. Moreover, smaller shocks can be confused with monetary policy if not carefully modelled. Gordon (2005) finds that, controlling for supply shocks, monetary policy has not contributed to reducing volatility. In fact the volatility of output gap is in 1/3 due to favorable supply shocks (different price variables included) and in 2/3 due to favorable demand

Can the model of Ljungqvist and Sargent (1998) based on micro turbulence be consistent with macro data? Interestingly, the structural drivers of micro level turbulence to human capital as named by Ljungqvist and Sargent (1998) are identical to those identified in literature as the drivers of declining aggregate volatility. Moreover, there is observed dichotomy between declining aggregate volatility and growing instability at the disaggregated level. For example, while the volatility of aggregate consumption and residential housing component of GDP fell, individual consumption became more unstable (Blundell and Preston (1998)), which could well reflect higher dispersion of incomes *à la* Gottschalk and Moffitt (1994). Further, Comin and Mulani (2005) and Comin and Mulani (2006) document discrepancy at firm versus aggregate level volatility in sales and productivity. Comin and Philippon (2005) set a decline in aggregate volatility against a rise in different measures of firm volatility (sales, equity returns, credit rankings, credit spreads). Comin and co-authors show through variance decomposition of their series that the fall in volatility at the aggregate is due to a fall in the correlation between sectors, and propose an endogenous growth model with RnD and General Innovation to explain jointly the diverging micro and macro trends in the time of structural change such as financial innovation.

Directly of interest to our focus on labor markets are the findings that relate firm level volatility to labor market outcomes. Comin, Groshen, and Rabin (2006) show a positive relationship between firm level volatility and dispersion of wages at occupational levels. Hence there are real economic risks pertaining to firm volatility. Guvenen and Philippon (2006) conclude that firm level volatility measured across industries in COMPUSTAT is a good predictor of employment risk and wage inequality in PSID. Consequently, there is a clear link between structural change, leading to firm level volatility, and turbulent individual labor market outcomes that could be modeled as an idiosyncratic shock at micro level as in Ljungqvist and Sargent (1998).

Our aim is to uncover implications for the volatility at the aggregate (productivity, real wages, GDP, employment) arising from frictions and adjustment costs inherent in a search model, and labor market policy, when micro turbulence increases. Dichotomy in the volatility and correlation of hours and employment at plant and aggregate levels can already to some extent be explained by accounting for employment adjustment costs. Work on adjustment costs on the demand side (Cooper, Haltiwanger, and Willis (2004)) shows that non-convexities of costs are crucial, but not sufficient, to explaining plant level moments consistent with aggregate observations. A broader treatment of frictions is desired. However, a search model with non-convex vacancy costs (Cooper, Haltiwanger, and Willis (2007)), while matching well micro-data, is not successful in replicating well the moments of hours and employment at the aggregate on a quarterly basis. Model simulations on monthly basis fare much better as the relationship between hours and employment adjustment is otherwise obscured by the lack of persistence of the idiosyncratic shock. Frictions on the supply side, with agent heterogeneity, are another potential candi-

shocks (less volatile government spending due to lower military expenditures; less volatile inventories due to improvements in information technology and alike; and less volatile residential housing due to financial market reforms). Bivin (2006) shows that smaller shocks indeed account for most of stabilisation of GDP, and the components affected are predominantly inventories and residential investment. Finally, it is difficult to distinguish the effects due to monetary policy from the effects due to changes in institutional environment and financial structure (Cecchetti, Flores-Lagunes, and Krause (2006)). As for the timing of volatility decline and its underlying causes, while most view the Great Moderation as a break point in 80s, which could be consistent with monetary policy change, there is also some evidence that the Great Moderation has been a trend (Blanchard and Simon (2001), or Stock and Watson (2002) and Stock and Watson (2005) for only some series and some countries), which could be consistent with more gradual structural change.

date. McCall (1970) search model as applied by Ljungqvist and Sargent (1998) is the simplest model of one-sided search, here enriched with heterogenous agents, and inertia created by human capital losses.

There exists the work by denHaan, Haefke, and Ramey (2001) and denHaan, Haefke, and Ramey (2005) showing that the turbulence approach might not be an appropriate explanation for Europe's unemployment dilemma if applied to a matching model where job destruction is endogenised, and workers have even a small probability of losing skills not only when laid off but also when quitting. In the latter case, an increased turbulence reduces the incentives of workers to quit and Sargent and Ljungqvist's predictions are reversed. In this work we offer another test for Sargent and Ljungqvist's hypothesis by looking at the volatility of the model-predicted data.

2 Aggregate volatility in the data

2.1 Stock and Watson (2002, 2005)

Stock and Watson's is probably the most comprehensive in literature documentation of volatility moderation. Stock and Watson (2002, 2005) analyse the volatility of aggregate variables for the period 1960-2000. First they use a large number of time series for the US only. Subsequently, they study the real GDP per capita for the US, UK, Canada, France, Germany, Italy and Japan. Their aim is to provide a concise summary of empirical facts pertaining to the moderation of volatility and to search for possible explanations of the phenomenon.

Stock and Watson (2002) use 1959-2001 NIPA decomposition of real GDP and a number of series such as employment, money, credit, industrial production and alike in quarterly data, seasonally adjusted. Sample standard deviations are reported by decades relative to the full sample standard deviations. Smooth instantaneous time-varying standard deviations are estimated with non-Gaussian smoother, based on AR(4) with time-varying parameters and stochastic volatility. Historical volatility description points out to lower aggregate volatility in 80s and significantly lower aggregate volatility in 90s. Stock and Watson (2002) uncover the source of the moderation to be predominantly a break (and not a trend) in the variance (rather than the mean) of AR process around 1983 for the US. They also find that the break results from a change in impulse, rather than propagation. Finally they estimate that 20-30% of the improvement is due to better policy, 20-30% is due to favorable productivity and commodity price shocks and 40-60% is due to other good-luck factors.

Stock and Watson (2005) look at the quarterly real GDP per capita of G7 countries for 1960-2002 and find a moderation in aggregate volatility. Moreover, they show that business cycles have not become more synchronized although trade flows have increased, financial markets developed and economies have become more integrated. They attribute the reduction in volatility largely to the reduction in the magnitude of common international shocks. Similarly to the previous study, standard deviations are reported by decades. Smoothed instantaneous standard deviations are calculated using non-Gaussian smoother for two alternatives: quarterly GDP growth and band-pass filtered GDP (equivalent result). The exercise shows a fall in volatility in all countries, although the pattern of change is not identical: volatility reduction is less marked in France, it is gradual in Germany, starts in the UK in 70s and resurfaces in Japan in 90s. Regarding the source and dating of the moderation, in five countries the tests of constant conditional mean are rejected (except the US and Germany) and most commonly the mean breaks in mid 70s. In six countries the tests of constant conditional variance are rejected (except Japan) and most commonly the variance breaks around 1980. Tests for the moderation in conditional variance being a trend or a break, and their timing, show mixed patterns[2].

2.2 Data description

We look at real wage, productivity (real GDP per worker), real GDP and employment series for the USA — an example of a laissez-faire economy — and three European countries: Italy, France and Germany. Series are quarterly and seasonally adjusted data, checked for outliers. German data is treated for reunification with reunification intercept and trend dummies.

The source of the series for nominal hourly wages is the IMF World Economic Outlook Database: for the USA, Italy and France (1960-2001), and Germany (1962-2001). CPI for all countries (1960-2005) comes from the Comparative Subject Tables in the OECD Main Economic Indicators. Hence real wages are calculated for the USA, Italy and France (1969-2001), and Germany (1962-2001). Real GDP series for the USA, Italy, France and Germany (1960-2002) are Stock and Watson series available online. Employment data for the USA (1960-2005), Italy (1960-2005) and Germany (1962-2004) come from the Comparative Subject Tables in the OECD Main Economic Indicators. Employment for France (1965-2004) is drawn from the OECD Quarterly Labor Force Survey. We accordingly obtain the series of real GDP per worker for the US and Italy (1960-2002), France (1965-2002) and Germany (1962-2002).

We follow exactly the econometric procedures as proposed by Stock and Watson (2002, 2005): (i) for preliminary comparison, the series are first transformed into quarterly growth rates; (ii) then we detrend the series in three ways: using Hodrick-Prescott filter with lambda equal 1600 and Kalman smoother, both applied to growth rates, and to complement the picture we also use Baxter and King (1999) band pass on the logs of the levels of the series; (iii) for the four cases (growth rates, HP-filtered growth rates, Kalman-smoothed growth rates and BK-passed logs of series) standard deviations are calculated by two decades; (iv) stochastic volatility with time varying autoregressive coefficients is estimated on un-dentrended quarterly growth rates and BK-passed logs of the series; (v) as both types of the series exhibit similarity, break dates are estimated on un-detrended quarterly growth rates only. See Appendix A.1.for details of filtering and econometric methods.

[2]In particular, of interest to us for the US and Europe: US - break (1983); UK - trend and break (1980); GE - neither trend nor break are significant in a nested model but break is significant in a separate test (1993), although significant moderation is clearly observed already from late 60s; FR - as in Germany but break is significant in 1968; IT - conditional variance breaks in 1980 but there is also a declining trend.

2.3 Volatility since 1960s

Figure 1 shows HP-detrended quarterly growth in real wages, productivity, real GDP and employment for the USA, Italy, France and Germany. Tables 7-10 report two-decade standard deviations relative to the full-period standard deviations for all series for the four countries (60-70s versus 80-90s).

The plot of HP-filtered quarterly growth rates points out to a decrease in volatility in the USA and Italy, and somehow mixed results for France and Germany. In Germany we observe a spike in the volatility of real wages towards the end of the 90s. Moreover, the volatility of employment both in France and Germany does not look to have decreased substantially. Numerically, comparing 1960-1979 versus 1980-2005, volatility tends to have decreased in most countries for most series, regardless of the detrending method. The result is less clear for employment in France and Germany, and wages in Germany - the latter due to the volatility spike in Germany at the end of the 90s.

In the case of real wages, standard deviations relative to the full sample standard deviations decreased more in Italy than the USA, regardless of the detrending method. In France and Germany the decrease was generally smaller than in the USA[3]. The smoothed growth rates of wages for Germany actually show a significant increase in volatility, unlike when other filtering is used. This is because the Kalman smoother removes the local mean, while the HP-filter removes very long cycles (beyond 32 quarters), and the Baxter-King pass removes both very long cycles (beyond 32 quarters) and very short cycles (under 6 quarters), where most likely the spike in volatility in Germany in the late 90s occurred. On the other hand, the volatility reduction of real GDP is clearly stronger in all welfare economies than in the USA, very much regardless of the detrending method. However, comparing to the USA, the fall in the volatility of employment is equal or smaller in Italy, while in France and Germany the volatility of employment rises in some instances: for growth rates and smoothed growth rates. Consequently, productivity (real GDP per worker) series show mixed results: decrease in volatility is rather similar between welfare economies and the USA.

Overall, while the volatility decreases mostly throughout, comparing to the USA, the welfare economies of Europe depict a stronger fall in the volatility of real GDP, and in some cases of real wages. The volatility of employment falls by less than in the USA, and the evolution of productivity is similar.

2.4 Stochastic volatility and break tests

To corroborate the evidence of volatility reduction in the the series of interest, we proceed with the method of Stock and Watson (2002, 2005). We estimate the instantaneous time-varying standard deviations, test whether lower volatility is due to changes in the conditional mean or variance of the series, and whether these changes result from a trend or a break. Finally, we estimate the break dates. See Appendix A.1., especially A.1.2. and A.1.3., for technical details.

[3]The decrease in volatility of real wages was larger in European countries throughout when manufacturing rather than economy-wide wage data was used.

The paths of the instantaneous standard deviations of growth rates and band-passed series for the four countries are plotted in Figures 2 and 3. Both are very similar but band-passed results are smoother. The volatility of real wages falls visibly in the USA, Italy and France in the 80s. The decline in Italy is by far the most pronounced. The result for German wages is blurred by a hike in volatility at the end of the 90s: volatility visibly falls starting in the 60s but then increases dramatically towards the end of the period of reference. For real GDP, the moderation is sharp in the USA, but more gradual in Italy and Germany. In France, the moderation in the volatility of GDP is weak. The fall in the volatility of employment is little marked in France and Germany, but in Italy the reduction is as strong as or stronger than in the USA, although it is more gradual. Similarly so for productivity. In Italy the reduction is similar to the USA. France seems to experience a less marked moderation. Germany's productivity distinctly breaks but the magnitude looks smaller than in the US.

Table 12 contains the tests for changes in autoregressive parameters, applied to growth rates only. With the exception of employment in France and Germany, all series show some decline in volatility. In line with literature, the decline in volatility for our series and countries is very much a decline in the conditional variance. Consistently with literature, the USA is more of a case of a break in the conditional variance, as opposed to a trend in other countries.

For the USA, the conditional variances of productivity, real GDP and employment break in 83-84, as expected. The conditional variance of real wages does not break at the significance level of 5%, however in the nested model with both a trend and a break, we observe evidence in favor of both a trend and a break in the conditional variance of real wages (early 70s). Moreover, there is a down-ward trend in the conditional variance for employment.

The series for Italy tend to have a break in the conditional variance in the late 70s and early 80s, as well as a break in the conditional mean at some point. However, with the exception of employment, trend specification for conditional variance seems more appropriate in the case of Italy.

France has a break in the conditional variance of real wages and productivity in early 80s, a break in the conditional variance of real GDP in late 60s and no volatility decline in employment. Generally, the conditional means also break in France. A trend in the conditional variance is significant for real wages only.

In the case of Germany, the conditional variance of real wages breaks in the early 90s (in the nested model with trend), and this is in spite of the observed short spike in volatility towards the end of the decade. The conditional variance of real GDP breaks in early 70s. The conditional variances of productivity and employment do not break, although there is a break in the mean of productivity. Neither trend nor break specifications hold.

2.5 Summary

There is evidence that the volatility has decreased for the series and countries of interest, with the exception of employment in France and Germany. Moreover, welfare states tend to show a stronger decrease in the volatility of real GDP and sometimes of real wages, comparing to the USA, although the decrease takes more the form of a trend rather than a break. The volatility of employment generally declines less in Europe and that of productivity shows somehow similar pattern.

3 Aggregate volatility in Ljungqvist and Sargent (1998) model

3.1 The model

Let us briefly recall the workings of Ljungqvist and Sargent (1998) economy. The value functions describing the model and the original notation can be found in Appendix A.2. A continuum of workers have geometrically distributed life spans, indexed on the unit interval. Every period, a worker faces a probability of dying. Births equal deaths. The unemployed search for jobs with endogenously chosen search intensity which is costly. Wage offers, drawn from a specified normal distribution, arrive each period with a probability being a function of the worker's search effort in the previous period. If the worker accepts the wage offer, he is paid that particular wage for the duration of the match. He can be laid off with an exogenous probability.

There is a finite number of skill levels. An unemployed worker of a given skill faces an exogenous probability that, when he enters into the next period, his skill will depreciate by one level. Otherwise, his skill will remain the same. Similarly, an employed worker faces an exogenous probability that in the next period, if he is not laid off, his skill will increase by one level. In the period following a lay-off, the skill loss probability depends on the degree of economic turbulence. Thereafter, skill transition is governed by the stochastic process as in unemployment. When there is no turbulence, a laid-off worker carries into the spell of unemployment the skill level from his last period of employment. Otherwise, his skill loss is determined according to the left half of a normal distribution, with the range from the lowest skill level to to the skill right before the lay-off. Higher turbulence is associate with a higher variance of such a distribution.

After observing his skill level at the beginning of a period, a worker decides whether to accept a wage offer, chooses his search intensity or quits his job. Quits are into the state of unemployment only. Workers maximize the expected value, conditional on current information, of after-tax income from employment and unemployment, net of the disutility of search. The analysis is focused on the effect of the welfare state on labor market incentives and skill accumulation.

In a welfare economy, laid-off workers receive unemployment compensation which depends on their last earnings. The benefit is withdrawn if a worker rejects an offer with earnings regarded by the government as suitable in the light of his past earnings. The new-born and quitters are not entitled to benefits. Incomes both from employment and unemployment are subject to a flat income tax. The government maintains a balanced budget.

The solution of the model consists of the functions giving (1) the optimal search intensity and reservation wages depending on past earnings and current skill for the unemployed eligible for unemployment benefits; (2) the optimal search intensity and reservation wages as a function of current skill only for the unemployed not eligible for unemployment compensation; and (3) the reservation wages depending only on current skill for the employed.

The steady state of the economy is defined by the above optimal polices, time-invariant employment and unemployment distributions, government policy parameters and total unemployment benefit payments that satisfy workers' optimality conditions and the government's budget constraint. Steady states are computed in an iterative procedure as a fixed point in the tax rate. For a fixed tax rate, the optimal search intensities and reservation wages, stationary employment and unemployment distributions and total unemployment compensations are calculated. A fixed point tax rate, associated with a stationary equilibrium, is defined by a balanced government budget. For all stationary equilibria, aggregate measures such as GDP, average (real) wages and average productivity are computed.

3.2 Calibration

First we follow the calibration as in Ljungqvist and Sargent (1998) but redefine the model in quarters, rather than two-week periods, to compare the moments of the predicted aggregate variables to the quarterly data. For that purpose, we introduce eleven, rather than twenty one, skill levels and redefine the probabilities of skill changes. We adjust the subjective discount factor and the probabilities of dying and being fired. As in the original paper, the low and high turbulences are defined by the variances of skill losses at lay-off equal to 0.02 and 0.04, respectively. These are the values the authors use to reproduce Gottschalk and Moffitt (1994) and Jacobson, LaLonde, and Sullivan (1993) results. Next, we perform a sensitivity analysis for different values of replacement ratio, turbulence, search cost and the variance of wage distribution. See Table 1 for details.

3.3 Steady states

To start with, we reproduce the steady state results as in Ljungqvist and Sargent (1998) for laissez-faire and welfare economies for two baseline degrees of economic turbulence — 0.02 and 0.04. The details are in Table 13. In low-turbulence scenarios, both economies have very similar steady states, so the efficiency costs pertaining to the welfare state are very low when economic conditions are stable. As turbulence rises, the welfare state exhibits significantly higher unemployment rate. The result obtains from the discouragement effect due to generous welfare provisions when unemployed, and its negative effect on search intensity and reservation wages. Moreover, higher labor taxation required to finance the

Table 1: Calibration

	Original	**Additional**
Discount factor	0.99	
Birth/death rate	0.0059	
Firing rate	0.0581	
Probability to keep current skill level when employed	0.6739	
Probability to gain one skill level when employed	0.3261	
Probability to keep current skill level when unemployed	0.3478	
Probability to lose one skill level when enemployed	0.6522	
Suitable salary as ratio of past earnings	0.7	
Exponent X in offer arrival rate ($\pi = s^X$)	0.3	
Turbulence	0.02, 0.04	0.06, 0.08, 0.1
Replacement ratio	0.7	0.5, 0.3
Ratio of SD to Mean in wage distribution	0.6	0.45, 0.3
Cost AC of search ($c = AC * s$)	0.5	1, 2, 3

growing welfare economy's needs makes work less attractive. Unemployment rate in the laissez-faire case is stable: as shown in the original article, due to a greater skill loss, workers fall into the category of unemployment that is characterized by low reservation wages.

Sensitivity The steady state of the laissez-faire economy is not affected by the degree of turbulence. However, at higher turbulence levels, unemployment and taxation rates explode in the welfare case beyond the values we wish to reproduce. On the other hand, with lower replacement ratios, the steady state of the welfare economy in turbulent times falls short of desired values. High replacement rate is therefore a crucial parameter in the model. We will hence predominantly focus on the economies with **the turbulence of 0.02 and 0.04, and the replacement rate of 0.7 for WE and 0 for LF**, as in the original article, but we will perform additional volatility tests for the economies with the replacement rates of 0.5 and 0.3, since in Martin (1996) we find that the net replacement rates do vary across countries. In particular, in France, Germany and Italy in the 90s the net replacement rates were respectively 0.79, 0.66 and 0.43 (see Table 2).

We wish to test, further, the model's predictions for different values of standard deviation to mean ratio (SDMR) in the wage offer distribution, as well as the search cost parameter (AC). The former in the original paper is 0.6, which is somehow high with respect to the empirical data on wages in the European countries. Lazear and Shaw (2009) show that the standard deviation to mean ratios for economy-wide wages in France, Germany and Italy are respectively 0.61, 0.43 and 0.35 (see Table 2)[4]. Therefore, we test the model also with alternative SDMRs of 0.45 and 0.3.

[4]Of course these are based on actual paid wages, not on offered wages whose distribution must be taken into account in the model. They are taken here as a rule of thumb indication.

Table 2: Empirical net replacement rates (RR) and standard deviation to mean ratios (SDMR)

	France	Germany	Italy
Net Replacement Rates*	0.79	0.66	0.43
SD / Mean for Wages**	0.61	0.43	0.35

*Martin (1996)

**Lazear and Shaw (2009)

Table 3: Empirical search cost data

	High replacement rates ($\simeq 0.7$) Low search intensity	**Low replacement rates ($\simeq 0.5$) High search intensity**
Search Cost / Wage***	0.4 - 0.45	0.65

***Yashiv (2000)

Table 4: Search costs generated by the model for different values of search cost parameter (AC)

	WE			
AC	**0.5**	**1**	**2**	**3**
Average Search Effort	0.98	0.96	0.85	0.67
Total Search Cost	0.49	0.96	1.71	2.00
Search Cost / Wage	**0.16**	**0.31**	**0.56**	**0.66**
Country		**France**	**Germany**	**Italy**

Comprehensive data on search costs is more difficult to ascertain. Yashiv (2000) estimates search costs using Israeli labor market data and finds that search costs are higher when replacement rates are low and search intensities high. Table 3 summarizes his findings: with a replacement rate of around 0.7 (0.5), the search costs amount to around 40% (65% respectively) of net wages. In Ljungqvist and Sargent (1998), the search cost is linear in search intensity and depends on parameter AC. Table 4 attempts to assign the values of parameter AC to individual European countries, by looking at the search cost to wage ratios generated by the model. With the highest net replacement ratio, we expect France to have the lowest search intensity and the search cost to wage ratio below 0.4. We therefore assign AC=1 to France. In the similar fashion, we assign AC=2 to Germany and AC=3 to Italy. This is of course an arbitrary exercise, and better search cost date would allow to match the model to the actual outcomes in a much more reliable fashion.

For the steady state results, see Table 14. The steady states of the laissez-faire economy are not affected by SDMR or AC since the unemployed have in general very low reservation wages. In the welfare economy, on the other hand, at a given search cost, a lower variance of wage offer distribution leads to lower unemployment rate because workers have lower incentive to wait for abnormally high wages — their reservation wages are lower. Conversely, at a given variance of wage offers, higher cost of search acts as discouragement to search effort and unemployment rate rises. We will hence focus on the original **SDMR=0.6 and AC=0.5 for LF**, as well as the combination of parameters SDMR and AC which give realistic steady states for welfare economies: **(0.6, 1), (0.45, 2), (0.3, 3) for WE** (France, Germany and Italy respectively).

3.4 Data generating process

We generate aggregate data from the model for low and high turbulence periods for laissez-faire and welfare economies. For the specified parameters, the equilibrium of the model yields a stationary probability distribution over individuals characterized by a triplet of state variables — skill level h, wage w, the earnings class y to which past earnings ($I = w\,h$) belong, and a state variable q recording the state an individual is in: employed, involuntarily unemployed (and receiving benefits in a welfare economy), or voluntarily unemployed. Moreover, the equilibrium produces transition dynamics for that distribution of individuals. Specifically, the transitions follow

$$x'(h', w', y', q') = G(\epsilon_e, \epsilon_u, \epsilon_l, h, w, y, q)\, x(h, w, y, q) + b,$$

where x and x' describe the distributions (they are the fractions of individuals in a given state this and next periods), G is the transition matrix and b is the vector of births. G depends on the Markov processes that govern the transition of skills when employed, unemployed or laid off. In a stationary equilibrium $\bar{G}$ is such that $x' = x$.

We simulate one hundred economies over eighty periods (twenty years: 60s-70s versus 80s-90s) for four cases — laissez-faire economy in low turbulence (LF T=0.02), laissez-faire economy in high turbulence (LF T=0.04), welfare economy in low turbulence (WE T=0.02) and welfare economy in high turbulence (WE T=0.04). Economies are initiated at the model-predicted equilibrium distributions. Government policies are kept at their equilibrium levels and any additional spending on unemployment compensations is financed by lump sum taxation. Using a random number generator, for laissez-faire and welfare economies, we generate one hundred of eighty-period sequences of shocks to individual skills for the employed and unemployed, ϵ_e and ϵ_u, giving us one hundred different economies for the two state types. Subsequently, using a random number generator, we produce for each laissez faire and welfare economy an eighty-period sequence of shocks to skills for the laid off in tranquil and turbulent times: in the baseline these are $\epsilon_l^{T=0.02}$ and $\epsilon_l^{T=0.04}$. Since the model predicts individual equilibrium polices, that is search intensities and reservation wages, these are used to determine the individual transition dynamics conditional on the shocks generated for each individual. Hence for the four scenarios, we obtain an eighty-period sequence for the transition matrix G which is used to calculate the aggregate variables of interest in each period. Specifically:

$$U_{Inv} = \sum_i x_i,$$

$$U_{Vol} = \sum_v x_v,$$

$$U = U_{Inv} + U_{Vol},$$
$$N = 1 - U,$$
$$GDP = \sum_I I\,x(I)\,N \qquad I = h\,w,$$
$$\bar{w} = \sum_w x(w)\,w,$$
$$p = \frac{GDP}{N}$$

are involuntary unemployment (i is an index of involuntarily unemployed), voluntary unemployment (v is an index of voluntarily unemployed), total unemployment and employment, GDP, average wage and productivity. GDP is expressed as the total of taxable earnings, with earnings being a product of a skill level and a wage.

3.5 Properties of artificial data

The data generated by the model is turned into quarterly growth rates and passed through an HP filter with lambda 1600. The graphs of quarterly growth of the variables predicted by the model with the baseline parameters are in Figures 4-7. The volatility of average wages both for laissez-faire and welfare economies falls visibly with higher turbulence (dashed lines). The result for productivity is less obvious. In fact, productivity looks more volatile, so does the GDP. Employment is again less volatile for both economies.

To shed more light on the direction and magnitude of changes, we perform a number of tests and sensitivity analysis:

- Tables 15-18 contain descriptive statistics;
- Tables 19-23 contain pooled variance tests;
- Tables 24-28 contain individual variance tests to compare LF and WE.

Baseline case Focus on the first two columns in Table 15 which show standard deviations for LF and WE with turbulence 0.02 and 0.04. As expected, the laissez-faire economy is in general more volatile than the welfare economy, but of interest to us is the direction and magnitude of change in volatility in both cases when turbulence increases. The volatility of wages and employment in both economies falls. However, the volatility of productivity and GDP rises. The bottom panel indicates how many times the standard deviation falls in each experiment. Both economies look similar in this respect. The first columns of Tables 19 and 20 show that the fall in the volatility of wages and employment, and the rise in the volatility of GDP and productivity, are significant at 1% level for both economies. The first columns of tables 24 and 25 allow to compare LF and WE with regard to the magnitude of change. In particular, the decrease in the volatility of wages and employment is stronger for the welfare economy (see in bold the numbers when volatility decrease is significant).

At this point it is fair to say that the model can potentially be consistent with the lower aggregate volatility of labor market variables — real wages and employment — at the time of higher turbulence at the micro level. It also seems that the fall in volatility is stronger for the welfare economy, which takes place since workers move less between occupational states due to the discouragement effect of the welfare state (high benefits and taxes): search effort is low and reservation wages are substantial. Hence so far the finding could be consistent with the data for real wages in the USA and Italy, but less so for France and Germany. A larger decline of volatility in employment in the model for WE matches data less well: recall that for employment in Europe the volatility decline is equal or smaller than in the USA.

Unfortunately, the volatility of GDP and productivity in the model rises, while the data show a clear decline over the last forty years. The rise in the volatility of productivity (ratio of GDP to employment) is a direct consequence of the rise in the volatility of GDP. Why do GDP fluctuations increase in the model? As defined here, GDP is the function of individual taxable earnings and employment. From the reproduction of Gottschalk and Moffit's (1994) results, Ljungqvist and Sargent (1998) show that in the model the variance of individual earnings increases with turbulence. Hence the decrease in the volatility of employment is countered by the increase in the volatility of earnings, and therefore GDP as defined by Ljungqvist and Sargent (1998) shows a rise in volatility.

One argument in defence of the model could be that the model-generated GDP data should not be compared to the actual GDP data, but some other measure of wage income in the economy. In that case, the model could be regarded as representing the labor market but not the economy as a whole. We will return to this issue in the next section. Meantime, below, I perform an additional sensitivity analysis to uncover the importance of some crucial parameters for the model's volatility predictions.

Replacement ratios The last two columns of Table 15 show descriptive statistics for the data generated when the welfare economy features replacement rates of 0.5 and 0.3. Again, when turublence increases, the volatility of wages and employment falls, while that of GDP and productivity rises. The last two columns in Table 20 indicate that these changes are very significant. Hence the value of this parameter itself is unable to reverse the model's main message.

Turbulence levels Table 15 presents the standard deviations for LF and WE when the turbulence rises up to 0.1. In the laissez-faire economy, the volatility of real wages and employment falls consistently as turbulence increases, and the contrary holds for GDP and productivity. These changes are in general very significant (Table 19), although at a higher turbulence they become less pronounced (see also Table 18).

For the welfare economy, the volatility decline in wages and employment is no longer monotonic. However, the standard deviations of GDP and productivity increase throughout when conditions become more turbulent. Focus on Table 20. Real wages become significantly less volatile only up to moderate turbulence levels. Thereafter the wage volatility no longer falls. Also at the moderate levels of turbulence, employment volatility remains unchanged or increases, which is good news for the model's ability to replicate the data on employment for the European countries where employment's volatility has not changed or increased. However, in as far as the higher levels of turbulence are not a good description of reality (in the sense that the steady state does not match well the data), this range of turbulence values is not of direct interest. On the other hand, the result for GDP and productivity remains contrary to the empirical evidence (see also Table 25). The volatility of both in general increases in the model.

Variance of offered wages The descriptive statistics for the experiments with different variances of offered wages are presented in Table 16. At first glance, SDMR does not reverse the earlier predictions (lower standard deviations for wages and employment, higher standard deviations for GDP and productivity). The volatility of wages falls by more in the welfare economy and the decrease tends to be larger the lower is SDMR. The exception is the employment of the welfare economy at low SDMR. Tables 21 and 26 confirm the results at a very significant margin. At the higher levels of turbulence in the welfare state, the volatility of employment increases when the variance of offered wages falls. Since the reservation wages are lower, the unemployed are more willing to accept job offers and more frequently move between the states of unemployment and employment. Again it is good news for the purpose of replicating date for some European countries.

Search costs Table 17 holds the result for different values of the search cost. The volatility of wages falls throughout, and more so in the welfare economy (Table 27). The magnitude of decrease is larger with larger search costs. On the other hand, GDP and productivity become more unstable. The volatility of employment actually increases for the welfare economy as search costs rise. Tables 22 and 27 establish the significance of this result. It is indeed intuitive that the volatility of employment rises when the volatility of wages falls.

Combinations of parameters Finally, Table 18 reports the standard deviations for the economies for which the combination of cost and wage variance parameters renders the steady states realistic. Again, the volatility of GDP and productivity increases. Moreover, there is a tendency for the volatility of employment to increase, also in the laissez-faire economy, when search costs are high but the variance of offered wages low. Tables 23 and 28 show the significance tests: higher search cost and a lower variance of offered wages result in significantly less volatile wages (and more so for WE) and somehow more volatile employment.

Table 5: Summary of volatility reduction in the aggregate data

	USA	France	Germany	Italy
Real Wages	↓↓	↓	↓	↓↓↓
Productivity	↓↓	↓	↓↓	↓↓
Real GDP	↓↓	↓	↓↓↓	↓↓↓
Employment	↓↓	↔	↔	↓

Table 6: Summary of volatility behavior in the model for different values of standard deviation to mean ratio (SDRM) and search cost (AC), with fixed replacement rates (RR=0 for LF and RR=0.7 for WE) and turbulence increasing from T=0.02 to T=0.04

	USA	France	Germany	Italy
(SDMR, AC)	**Baseline**	**(0.6, 1)**	**(0.45, 2)**	**(0.3, 3)**
Real Wages	↓↓	↓↓	↓↓	↓↓
Productivity	↑↑	↑↑	↑↑	↑↑
Real GDP	↑↑	↑↑	↑↑	↑↑
Employment	↓↓	↓	↑↑	↑

4 Discussion

We are attempting to match the decline in the volatility of real wages, employment, GDP and productivity in the American and European economies. We observe a tendency of the European economies to exhibit a larger moderation in the fluctuations of GDP and in some cases of wages, and somehow weaker and similar moderation in the fluctuations of employment and productivity, respectively. See Table 5 for the summary of volatility reduction in the data.

The results of the model are mixed. The model predicts the decline in the volatility of real wages and employment for both laissez-faire and welfare economies when micro-turbulence increases. The culprit are search frictions. Moreover, for the baseline parameters, the decline in the volatility of wages and employment is larger for the welfare economy, which is due to the discouragement effect that the welfare state has on unemployed searchers. The effect of turbulence on the reduction in the volatility of employment in the welfare economy is moderated as the turbulence increases, when search cost are higher and the variance of offered wages lower. This indicates that it might be possible to reconcile the date on wages and employment in the USA and Europe.

Table 6 summarizes the volatility behavior in the model for different values of parameters that approximate the economies of France, Germany and Italy. The role of parameters such as the ratio of standard deviation to mean (SDMR) for wages and search cost (AC) are not important for the volatility results in the laissez-faire economy. The volatility of real wages and employment falls throughout regardless of the parameter values. The parameters are however important for the results obtained for the welfare economies. The table shows that the model fails to match the data exactly. The direction of change for real wages is correct, although the magnitudes are too large for France and Germany, and too weak for Italy. One issue merits a comment. Do recall that the value of the replacement ratio in the model is set at 0.7 for the welfare case. This value is too high for Italy, however, with lower replacement rates the model is not able to reproduce the actual steady state. Possibly, a simulation with a lower replacement rate, close to that of Italy's 0.4, would improve the volatility result but it would not be able to match the levels of variables.

In the case of employment, the outcome is more problematic, as both the direction of change and the magnitudes are somehow off track for the three welfare economies. However, in the baseline case the fall in the volatility of employment in the model is larger for the welfare case, which is inconsistent with the aggregate data. Ceteris paribus, as the variance of offered wages decreases and search costs rise, we have found that the reduction in the volatility of employment is moderated. With the mix of parameters to reflect the three countries, the result is improved for France (the moderation of volatility is smaller), but the volatility overshoots for Germany and Italy (volatility actually rises). Unfortunately, the data on search costs, and to a lesser extent on wages in Europe, cannot be seen as exhaustive, and therefore precludes the final verdict at this point.

However, pessimistically, the model predicts an increase in the volatility of GDP, and hence of productivity, which is counterfactual. Because the variance of individual earnings increases with turbulence, the measure of GDP as defined in the model becomes more volatile. One possible solution would be to compare the model-generated GDP with a different measure of wage income. For this purpose, we perform an empirical analysis for additional series which could be better suited to be matched by the model. Instead of GDP, we use the data for total compensations of employees in the economy when such data is available for the required period: for the USA and France, coming from the OECD National Accounts Database. Then we construct the series for average real compensations (per worker) and total real compensations. These series are seasonally adjusted and treated for outliers. The results are presented in Tables 11 and 12. Regardless of the detrending method, the volatility of both total real and average real compensations falls significantly for both the USA and France, and the decline is consistently stronger in France. The conditional variances of both series for both countries exhibit breaks generally in the late 70s and early 80s. Hence using alternative data does not allow us to conclude in favor of the model.

Generating data from one of the more recent extensions of Ljungqvist and Sargent (1998) paper could possibly help reconcile the model's predictions with the volatility data since 1960, given that those new models might better represent the aggregate production function as both the supply and demand sides, as well as capital accumulation, are accounted for. Specifically, Ljungqvist and Sargent (2007a) and Ljungqvist and Sargent (2007b) have placed the original model into representative-family, matching and search-island frameworks[5]. The authors have shown that in particular the matching and search-island frameworks fare well in reproducing the facts pertaining to the evolution of the European unemployment. The representative-family setup does less well due to a very high elasticity of labor supply implicit in this model.

[5]Ljungqvist and Sargent (2004) is a published version of the model in a matching framework.

The reason why in this study we focus on Ljungqvist and Sargent (1998) paper is that the model presented here, an extension of McCall's, is a general equilibrium model in the sense that it is closed via the government's budget constraint and its equilibrium is calculated as a fixed point in the tax rate which balances the government's budget. Then we define GDP and productivity exactly as the authors do in the original article. Ljungqvist and Sargent (2007b) model placed in the matching framework is a general equilibrium model only in the sense that both searchers and vacancies are modeled — there is no capital accumulation. Considering the search-island setup with capital could be a good bet for matching the actual data, if we believe that including capital may indeed reverse the volatility prediction for GDP and productivity. However, the data generating process from the "simple" setup used here is already quite computationally heavy, as we are in a four-dimensional space. Adding another dimension would additionally complicate the exercise, hence we have decided to start with this very baseline case. A further option could be to assume that the capital stock is given, and explore the result with the diminishing returns to labor. However, it is questionable whether a positive judgement in favor of the model would be reached, were the data generated from an extended search-island version. Examples of research by Cooper, Haltiwanger, and Willis (2004) and Cooper, Haltiwanger, and Willis (2007) show that non-convex adjustment costs of employment and vacancies (hence also on the demand side) are an aspect crucial for coming close to a successful replication of aggregate volatility data. Most likely, a model with a more elaborate treatment of adjustment costs on both the supply and demand side would be needed to reproduce the Great Moderation.

5 Conclusion

In this study we have looked at the model of Ljungqvist and Sargent (1998) which imputes the persistence of long term unemployment in Europe since the 80s to the welfare state's inability to cope with more turbulent times. The authors claim that global economic conditions have been more turbulent in the 80s and the 90s, and construct a model based on search with a turbulence at micro level to reproduce the evolution of unemployment in laissez-faire and welfare economies. Stock and Watson (2002, 2005), on the other hand, document a fall in the aggregate volatility of macro series in the USA and G7 countries since the 80s. We have attempted to reconcile these two findings. Can the model of Ljungqvist and Sargent (1998) based on a micro-level turbulence be consistent with the macro data? We have looked at the aggregate date for real wages, productivity, real GDP and employment for the USA, Italy, France and Germany, and have found a decline in aggregate volatility since the 80s in all series and all countries, with the exception of employment in France and Germany. We have found that the decline in the volatility of GDP, and in some cases of real wages, has been stronger in welfare economies, while the decline in the volatility of employment has been somehow weaker. The decrease in the volatility of productivity has been similar. We have then generated macro series based on Ljungqvist and Sargent (1998) model and established what aggregate volatility it predicts for welfare and laissez-faire economies under different degrees of turbulence, and under different parameters. We have found that the model at this point fails, although has a potential to be consistent with the labor market data — wages and employment — but is not able to match broader aggregate variables such as GDP or productivity.

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A Appendix

A.1 Time Series Methods

All methods used are based on Stock and Watson (2002, 2005). For detailed discussion, see the technical appendix in Stock and Watson (2002, Appendix 1). For my data, I adapt their Gauss programmes available online (Thanks!). If Y_t are the series in levels, y_t are the series in growth rates and $\tilde{y}_t$ are the band-passed logs of the series.

A.1.1 Filters

Hodrick-Prescott filter: Given an adequately chosen, positive value of λ, there is a trend component τ_t that will minimize

$$\sum (y_t - \tau_t)^2 + \lambda \sum [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t_1})]^2.$$

For quarterly data, $\lambda = 1600$ isolates cycles shorter than 32 quarters.

Kalman smoother: This is an unobserved component model with a time-varying drift. Series are represented as the sum of a slowly evolving mean growth rate and a stationary component:

$$y_t = \mu_t + u_t \qquad \text{with} \qquad \mu_t = \mu_{t-1} + \eta_t$$

and $a(L)\, u_t = \varepsilon_t$, where L is the lag operator and ε_t and η_t are serially and mutually uncorrelated disturbances with mean zero. Kalman smoother is used to estimate the local mean μ_t and the residual. The detrended data is the residual μ_t.

Baxter and King (1999) band pass: This filter uses $K = 8$ leads and lags and a pass-band of 6 to 32 quarters (or put otherwise, frequencies between $\omega_l = \frac{2\pi}{32}$ and $\omega_h = \frac{2\pi}{6}$).

Applying moving averages, a filtered time series is expressed as:

$$y_t^* = \int_{-\pi}^{\pi} \alpha(\omega)\xi(\omega)\partial\omega,$$

where $\xi(\omega)$ are mutually orthogonal random periodic components of the series which is zero-mean and stationary, and

$$\alpha(\omega) = \sum_{h=-K}^{K} a_h e^{-i\omega h},$$

are weights attached to periodic components $\xi(\omega)$ and $\sum_{k=-K}^{K} a_k = 0$. Baxter King filter passes only frequencies in the range $\omega_l \leq \omega \leq \omega_h$.

A.1.2 Stochastic volatility model

To estimate instantaneous standard deviations, a stochastic volatility model with time varying autoregressive coefficients is used on quarterly growth rates y_t (as well as on the band-passed logs of the series $\tilde{y}_t$):

$$y_t = \alpha_{0t} + \sum_{j=1}^{p} \alpha_{jt} y_{t-j} + \epsilon_t$$

with

$$\alpha_{jt} = \alpha_{jt-1} + c\,\eta_{jt}$$

$$\epsilon_t = \sigma_t \varepsilon_t$$

$$\ln \sigma_t^2 = \ln \sigma_{t-1}^2 + \zeta_t$$

where $\varepsilon_t, \eta_{1t}, ..., \eta_{pt}$ are i.i.d. N(0,1) and ζ_t is independent of other shocks. To allow for jumps in instantaneous variance, ζ_t is drawn from a mixture of normals distribution. Parameters $\alpha_{0t}, ..., \alpha_{pt}$ and σ_t are estimated using Markov Chain Monte Carlo. Instantaneous autocovariances of y_t are computed given those estimated parameters.

A.1.3 Break tests

To date the moderation, I check for break dates for unconditional variance and conditional mean and variance of growth rates y_t by testing for changes in the coefficients of the AR model:

$$y_t = \alpha_{0t} + \sum_{j=1}^{p} \alpha_{jt} y_{t-j} + \epsilon_t$$

where

$$\alpha_{0t} + \sum_{j=1}^{p} \alpha_{jt} y_{t-j} = \begin{cases} \alpha_{0t}^1 + \sum_{j=1}^{p} \alpha_{jt}^1 y_{t-j}, t \le \kappa \\ \alpha_{0t}^2 + \sum_{j=1}^{p} \alpha_{jt}^2 y_{t-j}, t > \kappa \end{cases} \quad \text{and} \quad var(\varepsilon_t) = \begin{cases} \sigma_1^2, t \le \tau \\ \sigma_2^2, t > \tau \end{cases}$$

and κ and τ are break dates in the conditional mean and conditional variance, respectively. Tests for breaks in the unconditional variance of y_t and in the conditional mean and variance are carried out with Quandt likelihood ratio. Confidence intervals of 67% are reported when the null of no break is rejected at 5% significance level. In the final step, we test for both a break and trend in the conditional variance. For this purpose the residual is regressed both on a constant 1 and the time trend t.

A.2 Value functions

Here we recall the value functions for the model as they appear in the original paper. $V(w, h)$, $V_b(I, h)$ and $V_o(h)$ are respectively: (1) the value of being employed at wage w, while one's skill level is h; (2) the value of being unemployed and eligible for unemployment benefit, with past earnings at level I (equal to wage times skill level) and current skill level h; (3) the value of being unemployed and not eligible for unemployment benefits (i.e. the case of quits), while worker's skill level is h.

The notation is as follows. τ is the rate of wage taxation, α is the probability of dying, β is the discount factor and λ is the probability of being laid off. When employed, worker's skill level upgrades with probability μ_e. When unemployed, worker's skill level degrades with probability μ_u. In the period of lay-off, worker's skill level changes with probability μ_l. Laid off workers receive an unemployment benefit $b(I)$ which is a function of past earnings. I_g is the level of suitable earnings, determined by the government. Government terminates worker's unemployment benefit if he rejects jobs offering earnings beyond this level. Agents search with search intensity s, cost of search is $c(s)$ and job offers arrive with probability $\pi(s)$.

The optimization problem of an employed worker is presented in equation (1). The decision to remain on the job or quit amounts to comparing the income from the current job to the value of quitting $V_o(h)$. On the current job the worker enjoys an after tax wage income this period and, if he does not die, a value of employment with current wage and possibly new skill level if he is not fired, or a value of being unemployed if he is.

$$V(w,\ h) = \max_{\text{accept, reject}} \Bigg\{ (1-\tau) wh + (1-\alpha)\beta\Bigg[(1-\lambda)\sum_{h'} \mu_e(h,\ h')V(w,\ h') + \lambda \sum_{h'} \mu_l(h,\ h')V_b(wh,\ h')\Bigg],\ V_o(h)\Bigg\}, \tag{1}$$

$$\begin{aligned} V_b(I,\ h) = \max_{s} \Bigg\{ & -c(s) + (1-\tau)b(I) + (1-\alpha)\beta\sum_{h'}\mu_u(h,\ h') \\ & \times \Bigg[[1-\pi(s)]V_b(I,\ h') + \pi(s)\Bigg(\int_{w \geq I_g(I)/h'} V(w,\ h')\,dF(w) \\ & + \int_{w < I_g(I)/h'} \max_{\text{accept, reject}} \Bigg\{(1-\tau)wh' \\ & + (1-\alpha)\beta\Bigg[(1-\lambda)\sum_{h''}\mu_e(h',\ h'')V(w,\ h'') \\ & + \lambda\sum_{h''}\mu_l(h',\ h'')V_b(wh',\ h'')\Bigg],\ V_b(I,\ h')\Bigg\}dF(w)\Bigg)\Bigg]\Bigg\}, \end{aligned} \tag{2}$$

$$\begin{aligned} V_o(h) = \max_{s} \Bigg\{ & -c(s) + (1-\alpha)\beta\sum_{h'}\mu_u(h,\ h') \\ & \times \{[1-\pi(s)]V_o(h') + \pi(s)\int V(w,\ h')\,dF(w)\}\Bigg\}. \end{aligned} \tag{3}$$

The value of being unemployed and eligible for a benefit is presented in equation (2). An unemployed chooses his search intensity to maximize his expected future income less the cost of search. Worker's income this period is his unemployment benefit, net of tax. The expected income in the future, if he does not die and conditional on the evolution of his skill level while unemployed, is the value of unemployment if no offer is received and the value of employment if an offer is received and accepted. If the wage offered renders the level of future earnings lower than the government's suitable cut-off point, the worker might still accept the offer, if he expects his earnings increase in the future in such a way that they exceed the value of remaining unemployed with the current unemployment benefit.

The value of being unemployed and not eligible for a benefit is presented in equation (3). An unemployed chooses his search intensity to maximize his expected future income less the cost of search. The expected future income, if the worker does not die and conditional on the evolution of his skill level while unemployed, is the value of remaining unemployed if an offer is not received or the value of becoming employed at wage w if it is.

Figure 1: HP-filtered quarterly growth rates

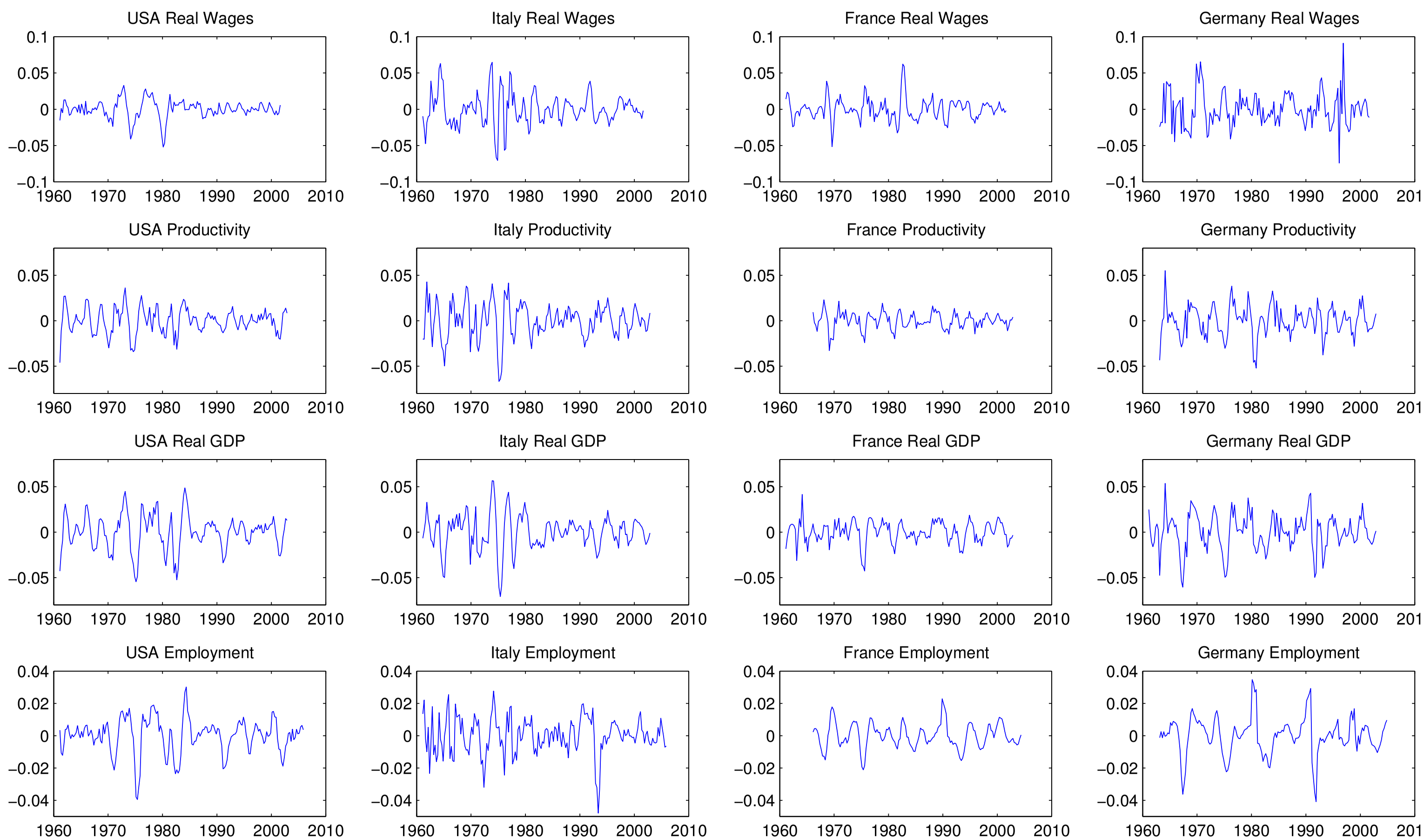

Table 7: Standard deviations of quarterly growth rates

			Relative to 1960-2005		
Series	**Country**	**1960-2005**	**1960-1979**	**1980-2005**	**Difference**
Real wages	**USA**	0.02	1.12	0.88	-0.24
	Italy	0.03	1.20	0.78	-0.42
	France	0.02	1.01	0.99	-0.02
	Germany	0.03	1.15	0.87	-0.28
Productivity	**USA**	0.02	1.25	0.73	-0.52
	Italy	0.03	1.24	0.75	-0.49
	France	0.01	1.23	0.83	-0.40
	Germany	0.02	1.08	0.94	-0.14
Real GDP	**USA**	0.02	1.09	0.92	-0.17
	Italy	0.03	1.27	0.71	-0.56
	France	0.02	1.12	0.89	-0.23
	Germany	0.02	1.14	0.87	-0.27
Employment	**USA**	0.01	1.09	0.93	-0.16
	Italy	0.01	1.01	0.99	-0.02
	France	0.01	0.97	1.02	0.05
	Germany	0.01	0.97	1.02	0.05

Table 8: Standard deviations of HP-filtered growth rates

			Relative to 1960-2005		
Series	**Country**	**1960-2005**	**1960-1979**	**1980-2005**	**Difference**
Real wages	**USA**	0.01	1.19	0.81	-0.38
	Italy	0.02	1.30	0.64	-0.66
	France	0.01	1.05	0.94	-0.11
	Germany	0.02	1.12	0.90	-0.22
Productivity	**USA**	0.01	1.24	0.76	-0.48
	Italy	0.02	1.32	0.62	-0.70
	France	0.01	1.25	0.82	-0.43
	Germany	0.02	1.08	0.94	-0.14
Real GDP	**USA**	0.02	1.07	0.90	-0.17
	Italy	0.03	1.13	0.53	-0.61
	France	0.02	0.90	0.69	-0.21
	Germany	0.02	1.05	0.79	-0.26
Employment	**USA**	0.01	1.10	0.92	-0.18
	Italy	0.01	1.14	0.89	-0.26
	France	0.01	1.13	0.92	-0.21
	Germany	0.01	0.94	1.04	0.10

Table 9: Standard deviations of smoothed growth rates

			Relative to 1960-2005		
Series	**Country**	**1960-2005**	**1960-1979**	**1980-2005**	**Difference**
Real wages	**USA**	0.01	1.14	0.86	-0.28
	Italy	0.01	1.30	0.62	-0.68
	France	0.01	1.20	0.77	-0.43
	Germany	0.05	0.40	1.30	0.90
Productivity	**USA**	0.02	1.20	0.80	-0.41
	Italy	0.02	1.19	0.81	-0.38
	France	0.00	1.22	0.83	-0.39
	Germany	0.01	1.06	0.96	-0.10
Real GDP	**USA**	0.01	1.13	0.87	-0.26
	Italy	0.01	1.31	0.63	-0.68
	France	0.01	1.23	0.56	-0.67
	Germany	0.01	1.21	0.78	-0.42
Employment	**USA**	0.02	1.21	0.79	-0.42
	Italy	0.01	1.21	0.81	-0.40
	France	0.00	0.93	1.01	0.08
	Germany	0.01	0.83	1.11	0.27

Table 10: Standard deviations of band-passed logs of series

			Relative to 1960-2005		
Series	**Country**	**1960-2005**	**1960-1979**	**1980-2005**	**Difference**
Real wages	**USA**	0.01	1.27	0.66	-0.61
	Italy	0.01	1.34	0.71	-0.63
	France	0.01	1.10	0.88	-0.22
	Germany	0.01	1.20	0.81	-0.39
Productivity	**USA**	0.01	1.23	0.74	-0.49
	Italy	0.01	1.33	0.60	-0.72
	France	0.01	1.26	0.80	-0.46
	Germany	0.01	1.14	0.86	-0.28
Real GDP	**USA**	0.01	1.12	0.89	-0.23
	Italy	0.01	1.34	0.57	-0.78
	France	0.01	1.09	0.91	-0.18
	Germany	0.01	1.21	0.78	-0.44
Employment	**USA**	0.01	1.11	0.91	-0.20
	Italy	0.01	1.04	0.97	-0.07
	France	0.01	1.12	0.93	-0.19
	Germany	0.01	1.04	0.96	-0.08

Table 11: Standard deviations for alternative data: average and total wage compensations

Series	Country	1960-2005	Relative to 1960-2005		
			1960-1979	1980-2005	Difference
Quarterly growth rates					
Average	**USA**	0.02	1.14	0.86	-0.28
Real Comp.	**France**	0.02	1.34	0.74	-0.60
Total	**USA**	0.03	1.10	0.90	-0.20
Real Comp.	**France**	0.03	1.18	0.84	-0.34
HP-filtered growth rates					
Average	**USA**	0.01	1.18	0.81	-0.37
Real Comp.	**France**	0.01	1.37	0.72	-0.64
Total	**USA**	0.02	1.22	0.75	-0.46
Real Comp.	**France**	0.01	1.24	0.78	-0.46
Smoothed growth rates					
Average	**USA**	0.02	1.15	0.84	-0.31
Real Comp.	**France**	0.01	1.31	0.75	-0.56
Total	**USA**	0.01	1.10	0.90	-0.20
Real Comp.	**France**	0.01	1.21	0.80	-0.41
Band-passed logs of series					
Average	**USA**	0.01	1.25	0.69	-0.56
Real Comp.	**France**	0.01	1.18	0.84	-0.34
Total	**USA**	0.01	1.20	0.77	-0.43
Real Comp.	**France**	0.01	1.39	0.68	-0.71

Figure 2: Estimated instantaneous standard deviations of quarterly growth rates

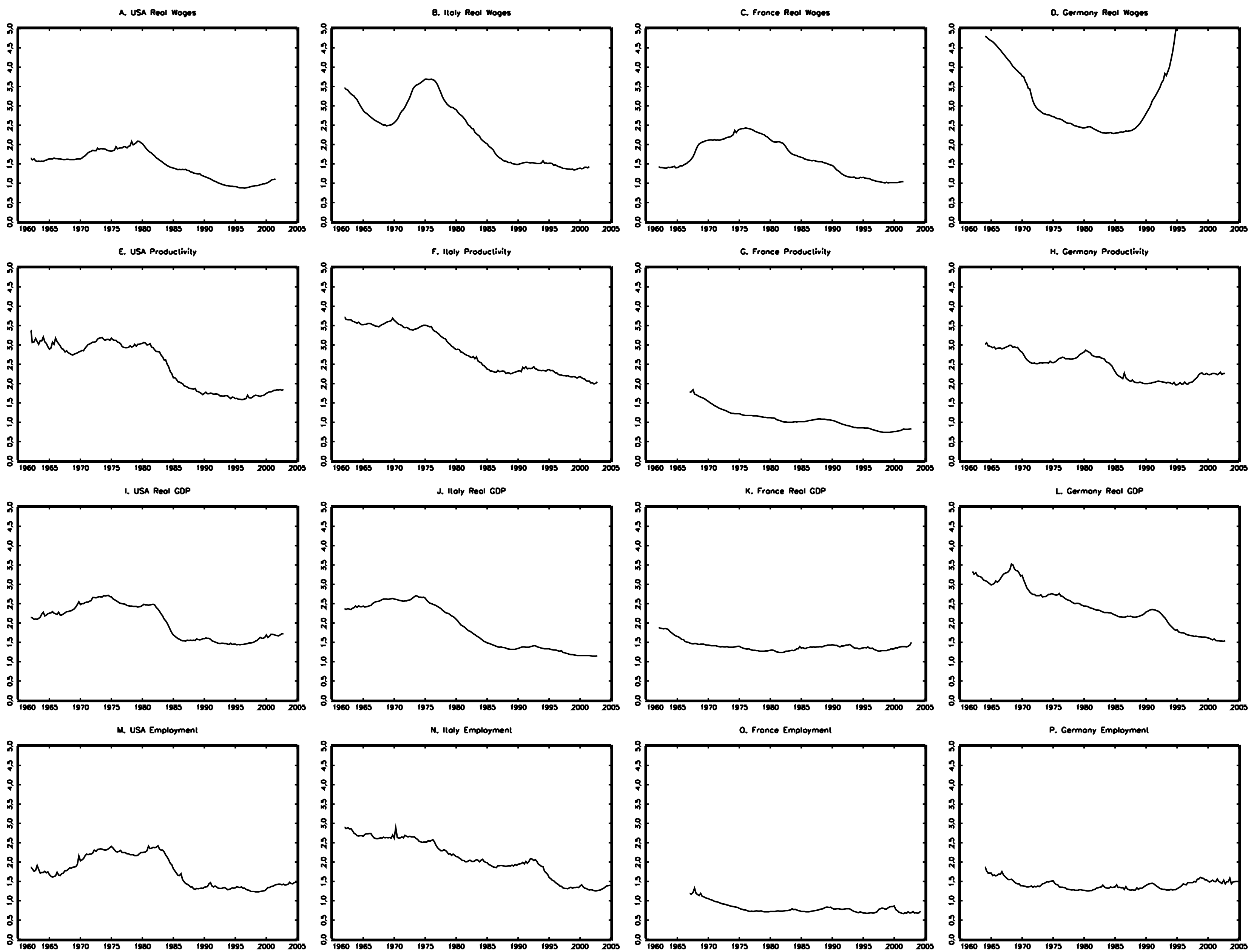

Figure 3: Estimated instantaneous standard deviations of band-passed series

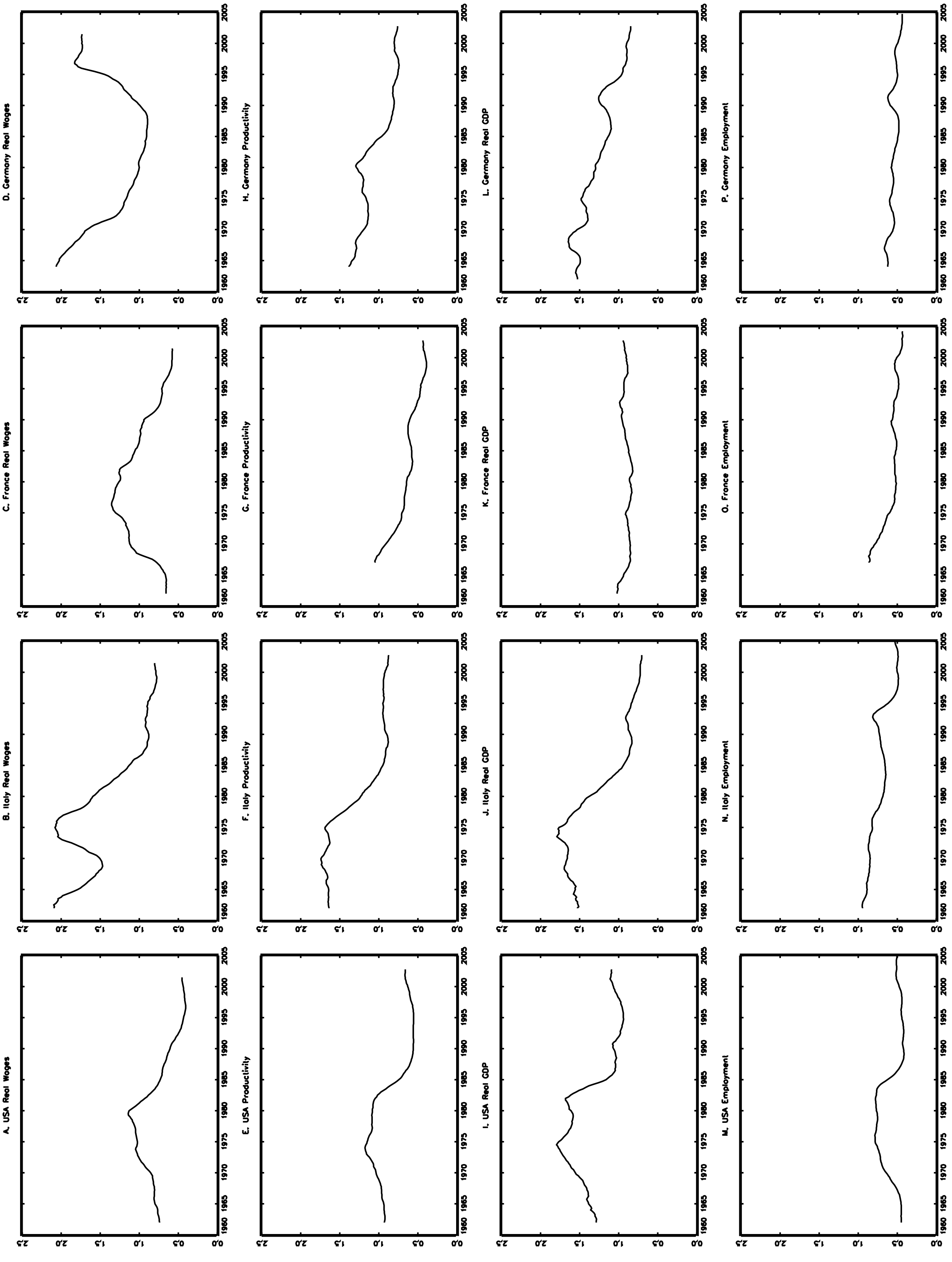

Table 12: Tests for changes in autoregressive parameters

Series	Country	Variance			Conditional Mean			Conditional Variance: Break			Conditional Variance: Trend and Break		
		p	Break Date	67% Confidence Interval	p	Break Date	67% Confidence Interval	p	Break Date	67% Confidence Interval	p Trend	p Break	Break Date
Real Wages	**USA**	0.01	1983:4	1983:1 - 1988:4	0.00	1969:1	1968:3 - 1969:3	0.05			0.00	0.00	1970:3
	Italy	0.31			0.00	1982:2	1981:4 - 1982:4	0.00	1982:1	1981:3 - 1984:1	0.00	0.01	1970:4
	France	0.24			0.00	1979:2	1978:4 - 1979:4	0.00	1982:2	1981:4 - 1985:2	0.00	0.02	1967:4
	Germany	1.00			0.00	1995:4	1995:2 - 1996:2	0.04	1971:2	1969:1 - 1973:4	0.01	0.00	1990:4
Productivity	**USA**	0.00	1981:2	1979:4 - 1984:2	0.35			0.00	1984:1	1983:3 - 1986:1	0.24	0.00	1984:1
	Italy	0.16			0.04	1973:4	1973:2 - 1974:2	0.00	1978:4	1978:2 - 1981:2	0.00	0.74	
	France	0.00	1971:3	1970:4 - 1973:1	0.00	1989:1	1988:3 - 1989:3	0.00	1980:4	1980:1 - 1983:2	0.35	0.80	
	Germany	0.30			0.01	1973:1	1972:3 - 1973:3	0.16			0.06	0.38	
Real GDP	**USA**	0.00	1984:2	1983:3 - 1987:2	0.13			0.00	1983:2	1982:4 - 1985:3	0.26	0.00	1983:2
	Italy	0.00	1977:3	1976:4 - 1979:3	0.00	1979:4	1979:2 - 1980:2	0.00	1980:1	1979:3 - 1982:4	0.00	0.22	
	France	0.67			0.00	1974:1	1973:3 - 1974:3	0.00	1968:1	1967:3 - 1969:4	0.85	0.26	
	Germany	0.63			0.03	1990:4	1990:2 - 1991:2	0.00	1970:2	1969:4 - 1972:1	0.76	0.44	
Employment	**USA**	0.00	1984:2	1980:3 - 1985:2	1.00			0.00	1984:3	1983:3 - 1987:3	0.03	0.00	1984:3
	Italy	0.13			0.02	1992:4	1992:2 - 1993:2	0.00	1977:3	1976:3 - 1980:1	0.98	0.56	
	France	1			0.54			0.33			0.18	0.43	
	Germany	0.12			0.54			0.61			0.63	0.47	
Average	**USA**	0.00	1984:2	1983:4 - 1986:1	0.00	1968:3	1968:1 - 1969:1	0.04	1981:1	1979:2 - 1985:2	0.48	0.08	
Real Comp.	**France**	0.00	1978:1	1976:4 - 1979:4	0.00	1977:1	1976:3 - 1977:3	0.00	1974:3	1974:1 - 1976:4	0.00	0.52	
Total	**USA**	0.01	1982:3	1981:3 - 1987:1	0.00	1971:2	1970:4 - 1971:4	0.33			0.10	0.02	1981:3
Real Comp.	**France**	0.02	1987:1	1984:4 - 1991:2	0.02	1968:3	1968:1 - 1969:1	0.00	1978:1	1977:2 - 1980:4	0.99	0.53	

Figure 4: Average wages for LF and WE

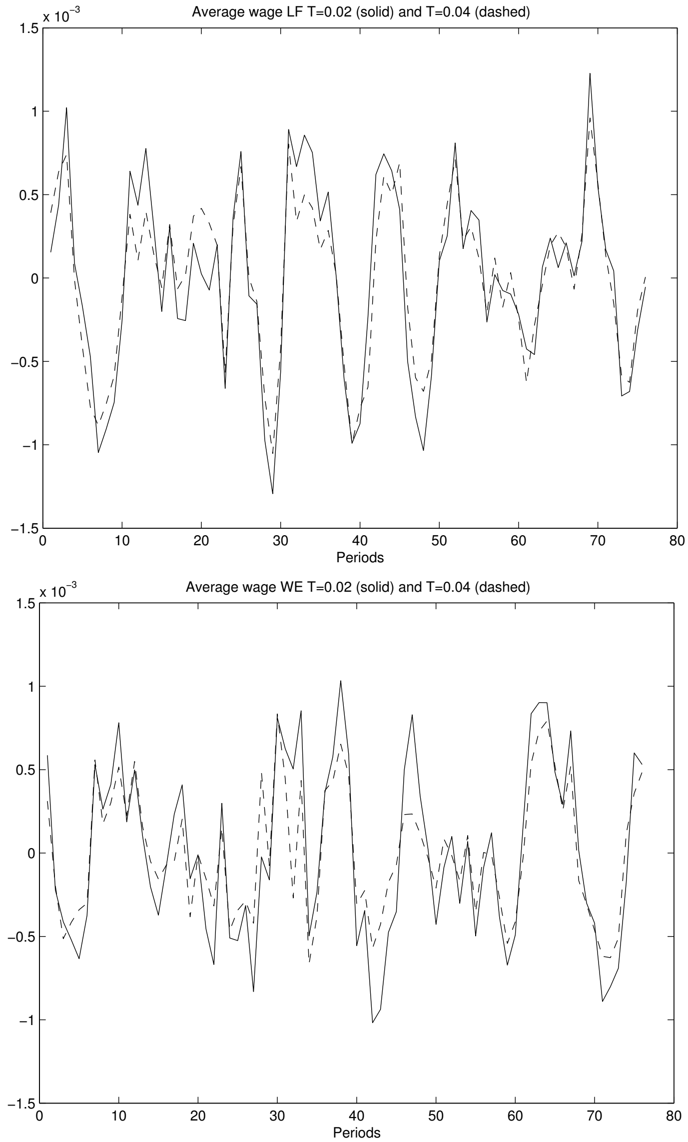

Figure 5: Productivity for LF and WE

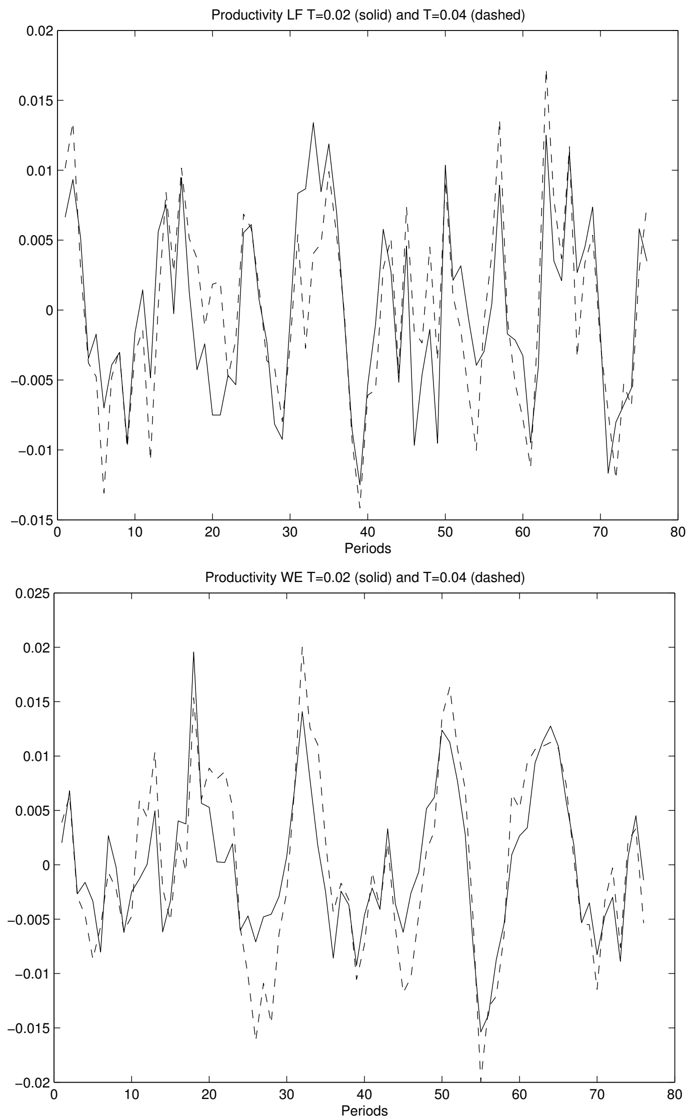

Figure 6: GDP for LF and WE

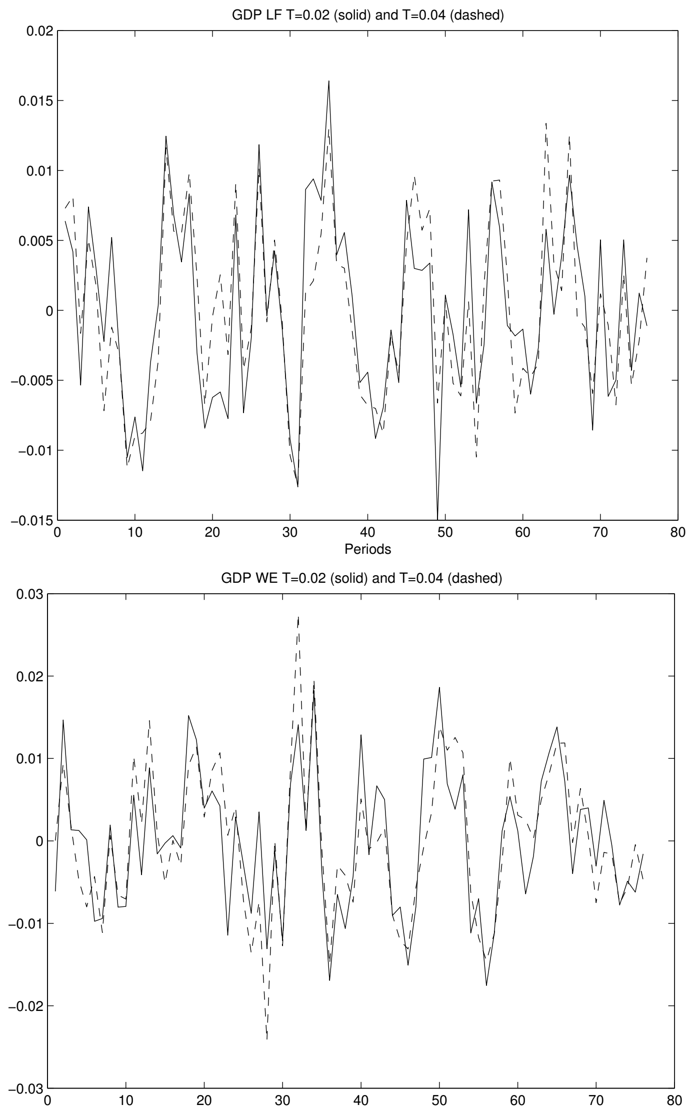

Figure 7: Employment for LF and WE

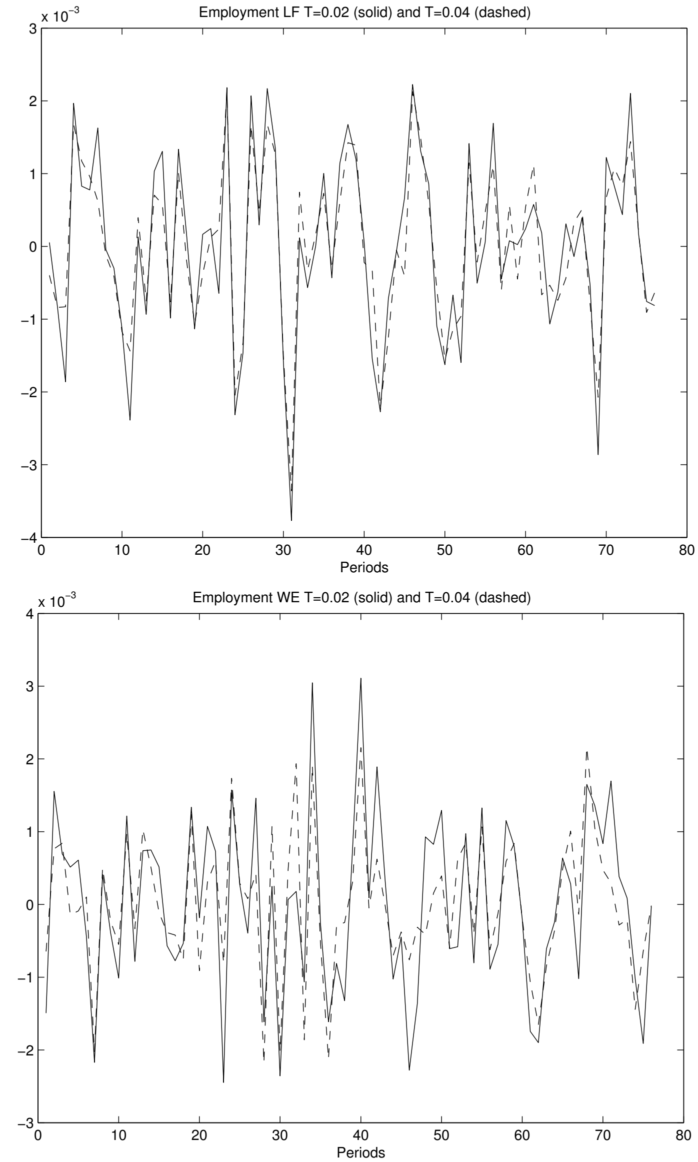

Table 13: Model steady states: with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels and replacement ratios

Replacement Ratio			**0.70**	
Economy (Bi-weekly)	**LF**	**LF**	**WE**	**WE**
Turbulence	**0.02**	**0.04**	**0.02**	**0.04**
Tax rate	0.00	0.00	0.04	0.12
Unemployment	0.06	0.06	0.07	0.15
Average duration (wks)	10.60	10.70	13.70	31.80

Replacement Ratio						**0.70**					**0.50**		**0.30**	
Economy (Quarterly)	**LF**	**LF**	**LF**	**LF**	**LF**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**
Turbulence	**0.02**	**0.04**	**0.06**	**0.08**	**0.10**	**0.02**	**0.04**	**0.06**	**0.08**	**0.10**	**0.02**	**0.04**	**0.02**	**0.04**
Tax rate	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.16	0.20	0.23	0.03	0.03	0.02	0.02
Unemployment	0.07	0.07	0.07	0.07	0.07	0.70	0.13	0.19	0.23	0.26	0.07	0.07	0.07	0.07
Average duration (wks)	12.70	12.80	12.96	13.02	13.07	14.00	26.41	40.82	52.11	60.25	13.46	13.99	13.15	13.44

Table 14: Model steady states: with replacement ratio (RR=0.7), for different parameters (cost of search AC, s.d. to mean ratio of wage distribution SDMR)

	AC	**0.50**				**1.00**				**2.00**				**3.00**			
SDMR	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**
0.60	**Turbulence**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**
	Tax rate	0.00	0.00	0.05	0.10	0.00	0.00	0.05	0.12	0.00	0.00	0.06	0.15	0.00	0.00	0.07	0.18
	Unemployment	0.07	0.07	0.07	0.13	0.07	0.07	0.07	0.14	0.07	0.07	0.09	0.18	0.07	0.07	0.10	0.21
	Average duration (wks)	12.70	12.80	14.00	26.41	12.57	12.64	14.00	29.42	12.35	12.42	16.61	38.69	12.52	12.69	20.00	47.80
SDMR	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**				
0.45	**Turbulence**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	0.02	**0.04**				
	Tax rate	0.00	0.00	0.04	0.08	0.00	0.00	0.05	0.09	0.00	0.00	0.05	0.12				
	Unemployment	0.07	0.07	0.07	0.11	0.06	0.06	0.07	0.12	0.06	0.06	0.08	0.14				
	Average duration (wks)	12.41	12.48	13.28	22.01	12.31	12.36	13.72	23.94	12.18	12.24	15.19	30.39				
SDMR	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**					**LF**	**LF**	**WE**	**WE**
0.30	**Turbulence**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**					**0.02**	**0.04**	**0.02**	**0.04**
	Tax rate	0.00	0.00	0.04	0.06	0.00	0.00	0.04	0.06					0.00	0.00	0.05	0.09
	Unemployment	0.06	0.06	0.06	0.08	0.06	0.06	0.06	0.08					0.06	0.06	0.08	0.11
	Average duration (wks)	12.10	12.13	12.55	15.86	12.07	12.08	12.58	16.62					12.34	12.47	15.63	23.67

Table 15: Descriptive statistics: with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels and replacement ratios

	Replacement Ratio						0.70					0.50		0.30	
AC=0.5	**Economy**	**LF**	**LF**	**LF**	**LF**	**LF**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**
SDMR=0.6	**Turbulence**	**0.02**	**0.04**	**0.06**	**0.08**	**0.10**	**0.02**	**0.04**	**0.06**	**0.08**	**0.10**	**0.02**	**0.04**	**0.02**	**0.04**
	Pooled standard deviations														
Real wage		0.18	0.16	0.16	0.14	0.14	0.15	0.12	0.11	0.12	0.12	0.15	0.13	0.15	0.14
Productivity		1.33	1.54	1.63	1.66	1.69	1.30	1.47	1.59	1.64	1.64	1.39	1.68	1.51	1.51
GDP		1.61	1.70	1.81	1.82	1.84	1.51	1.67	1.83	1.90	1.95	1.55	1.68	1.51	1.66
Employment		1.45	1.28	1.26	1.18	1.15	1.21	1.08	1.07	1.12	1.17	1.25	1.10	1.25	1.12
	Reported **Mean and s.e. of moment**														
Real wage		**0.18**	**0.16**	**0.15**	**0.14**	**0.14**	**0.15**	**0.12**	**0.11**	**0.13**	**0.11**	**0.15**	**0.13**	**0.15**	**0.14**
		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02
Productivity		**1.32**	**1.52**	**1.61**	**1.64**	**1.67**	**1.29**	**1.46**	**1.58**	**1.62**	**1.62**	**1.37**	**1.54**	**1.29**	**1.50**
		0.18	0.23	0.21	0.25	0.25	0.14	0.19	0.19	0.22	0.22	0.19	0.23	0.18	0.18
GDP		**1.60**	**1.69**	**1.80**	**1.80**	**1.83**	**1.50**	**1.65**	**1.81**	**1.88**	**1.93**	**1.54**	**1.67**	**1.50**	**1.65**
		0.17	0.21	0.20	0.22	0.23	0.15	0.21	0.23	0.23	0.24	0.15	0.21	0.16	0.16
Employment		**1.44**	**1.27**	**1.25**	**1.17**	**1.14**	**1.20**	**1.04**	**1.06**	**1.11**	**1.16**	**1.25**	**1.09**	**1.25**	**1.12**
		0.15	0.14	0.14	0.13	0.12	0.11	0.13	0.14	0.13	0.15	0.12	0.10	0.14	0.12
	Individual standard deviations														
Real wage	**no. sd(T=0.02)>...>sd(T=0.1)**		**92**	**60**	**67**	**67**		**94**	**63**	**51**	**49**		**87**		**84**
Productivity	**no. sd(T=0.02)>...>sd(T=0.1)**		**10**	**37**	**46**	**25**		**15**	**33**	**49**	**48**		**17**		**6**
GDP	**no. sd(T=0.02)>...>sd(T=0.1)**		**32**	**38**	**51**	**34**		**20**	**26**	**40**	**42**		**19**		**12**
Employment	**no. sd(T=0.02)>...>sd(T=0.1)**		**98**	**61**	**62**	**74**		**91**	**51**	**39**	**36**		**93**		**92**

Table 16: Descriptive statistics: with replacement ratio RR=0.7, cost of search AC=1, for different s.d. to mean ratios of wage distribution SDMR

	SDMR	**0.60**				**0.45**				**0.30**			
AC=1	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**
RR=0.7	**Turbulence**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**
	Pooled standard deviations												
Real wage		0.17	0.16	0.14	0.12	0.11	0.11	0.10	0.09	0.05	0.04	0.14	0.04
Productivity		1.33	1.54	1.31	1.48	1.32	1.53	1.30	1.48	1.31	1.52	1.30	1.49
GDP		1.51	1.68	1.46	1.70	1.34	1.55	1.35	1.63	1.24	1.47	1.27	1.57
Employment		1.30	1.20	1.10	1.07	0.91	0.86	0.83	0.88	0.41	0.36	0.38	0.57
	Reported **Mean and s.e. of moment**												
Real wage		**0.17**	**0.15**	**0.14**	**0.12**	**0.11**	**0.11**	**0.10**	**0.09**	**0.05**	**0.04**	**0.14**	**0.04**
		0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01
Productivity		**1.32**	**1.53**	**1.30**	**1.47**	**1.32**	**1.51**	**1.29**	**1.47**	**1.30**	**1.51**	**1.29**	**1.48**
		0.17	0.22	0.15	0.19	0.15	0.20	0.15	0.19	0.14	0.20	0.14	0.19
GDP		**1.50**	**1.67**	**1.46**	**1.68**	**1.33**	**1.54**	**1.34**	**1.62**	**1.23**	**1.46**	**1.26**	**1.55**
		0.15	0.18	0.15	0.22	0.14	0.19	0.14	0.22	0.15	0.19	0.15	0.21
Employment		**1.29**	**1.19**	**1.10**	**1.07**	**0.90**	**0.86**	**0.83**	**0.87**	**0.41**	**0.35**	**0.37**	**0.56**
		0.13	0.11	0.11	0.13	0.08	0.08	0.08	0.12	0.04	0.03	0.05	0.12
	Individual standard deviations												
Real wage	**no. sd(T=0.02)>sd(T=0.04)**		**84**		**90**		**80**		**86**		**93**		**100**
Productivity	**no. sd(T=0.02)>sd(T=0.04)**		**9**		**14**		**12**		**15**		**9**		**12**
GDP	**no. sd(T=0.02)>sd(T=0.04)**		**12**		**9**		**7**		**5**		**7**		**5**
Employment	**no. sd(T=0.02)>sd(T=0.04)**		**93**		**62**		**79**		**40**		**99**		**8**

Table 17: Descriptive: replacement ratio RR=0.7, s.d. to mean ratio of wage distribution SDMR=0.6, for different cost of search AC

	AC	1.00				2.00				3.00			
SDMR=0.6	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**
RR=0.7	**Turbulence**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**
	Pooled standard deviations												
Real wage		0.17	0.16	0.14	0.12	0.16	0.15	0.13	0.11	0.14	0.13	0.11	0.09
Productivity		1.33	1.54	1.31	1.48	1.34	1.53	1.32	1.49	0.34	1.53	1.33	1.51
GDP		1.51	1.68	1.46	1.70	1.44	1.62	1.36	1.66	1.36	1.56	1.32	1.64
Employment		1.30	1.20	1.10	1.07	1.12	1.05	0.90	0.96	0.95	0.88	0.73	0.79
	Reported **Mean and s.e. of moment**												
Real wage		**0.17**	**0.15**	**0.14**	**0.12**	**0.16**	**0.15**	**0.12**	**0.11**	**0.14**	**0.13**	**0.11**	**0.09**
		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Productivity		**1.32**	**1.53**	**1.30**	**1.47**	**1.33**	**1.52**	**1.31**	**1.48**	**1.32**	**1.52**	**1.32**	**1.50**
		0.17	0.22	0.15	0.19	0.15	0.20	0.15	0.19	0.18	0.20	0.18	0.19
GDP		**1.50**	**1.67**	**1.46**	**1.68**	**1.43**	**1.61**	**1.35**	**1.65**	**1.35**	**1.55**	**1.31**	**1.62**
		0.15	0.18	0.15	0.22	0.15	0.19	0.15	0.22	0.16	0.19	0.17	0.22
Employment		**1.29**	**1.19**	**1.10**	**1.07**	**1.12**	**1.04**	**0.90**	**0.95**	**0.94**	**0.88**	**0.73**	**0.78**
		0.13	0.11	0.11	0.13	0.10	0.10	0.08	0.12	0.09	0.09	0.07	0.10
	Individual standard deviations												
Real wage	**no. sd(T=0.02)>sd(T=0.04)**		**84**		**90**		**84**		**91**		**90**		**93**
Productivity	**no. sd(T=0.02)>sd(T=0.04)**		**9**		**14**		**13**		**14**		**14**		**8**
GDP	**no. sd(T=0.02)>sd(T=0.04)**		**12**		**9**		**10**		**4**		**14**		**3**
Employment	**no. sd(T=0.02)>sd(T=0.04)**		**93**		**62**		**89**		**34**		**86**		**28**

Table 18: Descriptive: with RR=0.7, for different combinations of cost of search AC and s.d. to mean ratios of wage distribution SDMR

	AC	**1.00**				**2.00**				**3.00**			
	SDMR	**0.60**				**0.45**				**0.30**			
RR=0.7	**Economy**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**	**LF**	**LF**	**WE**	**WE**
	Turbulence	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**	**0.02**	**0.04**
	Pooled standard deviations												
Real wage		0.17	0.16	0.14	0.12	0.09	0.09	0.08	0.07	0.02	0.02	0.02	0.02
Productivity		1.33	1.54	1.31	1.48	1.30	1.52	1.31	1.49	1.30	1.52	1.31	1.50
GDP		1.51	1.68	1.46	1.70	1.27	1.49	1.27	1.60	1.26	1.50	1.29	1.60
Employment		1.30	1.20	1.10	1.07	0.70	0.66	0.62	0.77	0.16	0.17	0.25	0.51
	Reported Mean and s.e. of moment												
Real wage		**0.17**	**0.15**	**0.14**	**0.12**	**0.09**	**0.09**	**0.08**	**0.07**	**0.02**	**0.02**	**0.02**	**0.02**
		0.02	0.02	0.02	0.02	0.10	0.10	0.01	0.01	0.00	0.00	0.00	0.00
Productivity		**1.32**	**1.53**	**1.30**	**1.47**	**1.29**	**1.51**	**1.30**	**1.47**	**1.30**	**1.51**	**1.31**	**1.49**
		0.17	0.22	0.15	0.19	0.18	0.18	0.15	0.19	0.14	0.20	0.15	0.19
GDP		**1.50**	**1.67**	**1.46**	**1.68**	**1.26**	**1.48**	**1.26**	**1.59**	**1.25**	**1.48**	**1.28**	**1.58**
		0.15	0.18	0.15	0.22	0.17	0.17	0.15	0.22	0.15	0.20	0.15	0.22
Employment		**1.29**	**1.19**	**1.10**	**1.07**	**0.69**	**0.66**	**0.62**	**0.76**	**0.16**	**0.17**	**0.24**	**0.48**
		0.13	0.11	0.11	0.13	0.07	0.07	0.06	0.11	0.01	0.02	0.06	0.13
	Individual standard deviations												
Real wage	**no. sd(T=0.02)>sd(T=0.04)**		**84**		**90**		**74**		**81**		**92**		**38**
Productivity	**no. sd(T=0.02)>sd(T=0.04)**		**9**		**14**		**6**		**14**		**9**		**10**
GDP	**no. sd(T=0.02)>sd(T=0.04)**		**12**		**9**		**7**		**3**		**8**		**5**
Employment	**no. sd(T=0.02)>sd(T=0.04)**		**93**		**62**		**76**		**14**		**32**		**3**

Table 19: Pooled variance tests: for LF economy, with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels

AC=0.5	Economy	LF	LF	LF	LF
SDMR=0.6	Turbulence	0.02/0.04	0.04/0.06	0.06/0.08	0.08/0.10
	Pooled F test df1=df2=7500				
Real wage					
	F	1.27	1.08	1.17	1.05
	p	0.00	0.00	0.00	0.03
		sd(0.02)>sd(0.04)***	sd(0.04)>sd(0.06)***	sd(0.06)>sd(0.08)***	sd(0.08)>sd(0.10)**
Productivity					
	F	0.75	0.89	0.97	0.96
	p	1.00	1.00	0.93	0.97
		sd(0.02)<sd(0.04)***	sd(0.04)<sd(0.06)***	sd(0.06)<sd(0.08)*	sd(0.08)<sd(0.10)**
GDP					
	F	0.90	0.89	0.99	0.97
	p	1.00	1.00	0.61	0.91
		sd(0.02)<sd(0.04)***	sd(0.04)<sd(0.06)***	sd(0.06)=sd(0.08)	sd(0.08)<sd(0.10)*
Employment					
	F	1.28	1.03	1.14	1.06
	p	0.00	0.08	0.00	0.01
		sd(0.02)>sd(0.04)***	sd(0.04)>sd(0.06)*	sd(0.06)>sd(0.08)***	sd(0.08)>sd(0.10)***

Table 20: Pooled variance tests: for WE economy, with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels and replacement ratios

	Replacement Ratio	0.70				0.50	0.30
AC=0.5	**Economy**	**WE**	**WE**	**WE**	**WE**	**WE**	**WE**
SDMR=0.6	**Turbulence**	**0.02/0.04**	**0.04/0.06**	**0.06/0.08**	**0.08/0.10**	**0.02/0.04**	**0.02/0.04**
	Pooled F test df1=df2=7500						
Real wage							
	F	1.46	1.16	0.97	1.02	1.27	1.24
	p	0.00	0.00	0.87	0.22	0.00	0.00
		sd(0.02)>sd(0.04)***	sd(0.04)>sd(0.06)***	sd(0.06)=sd(0.08)	sd(0.08)=sd(0.10)	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***
Productivity							
	F	0.78	0.85	0.95	1.00	0.80	0.75
	p	1.00	1.00	0.99	0.50	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.04)<sd(0.06)***	sd(0.06)<sd(0.08)***	sd(0.08)=sd(0.10)	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
GDP							
	F	0.82	0.83	0.93	0.95	0.85	0.83
	p	1.00	1.00	1.00	0.99	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.04)<sd(0.06)***	sd(0.06)<sd(0.08)***	sd(0.08)<sd(0.10)**	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
Employment							
	F	1.26	1.01	0.92	0.91	1.29	1.25
	p	0.00	0.33	1.00	1.00	0.00	0.00
		sd(0.02)>sd(0.04)***	sd(0.04)=sd(0.06)	sd(0.06)<sd(0.08)***	sd(0.08)<sd(0.10)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***

Table 21: Pooled variance tests: with replacement ratio RR=0.7, cost of search AC=1, for different s.d. to mean ratios of wage distribution SDMR

	SDMR	**0.60**		**0.45**		**0.30**	
AC=1	**Economy**	**LF**	**WE**	**LF**	**WE**	**LF**	**WE**
RR=0.7	**Turbulence**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Pooled F test df1=df2=7500						
Real wage							
	F	1.19	1.31	1.14	1.25	1.30	12.50
	p	0.00	0.00	0.00	0.00	0.00	0.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***
Productivity							
	F	0.74	0.78	0.75	0.77	0.74	0.76
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
GDP							
	F	0.81	0.74	0.75	0.69	0.71	0.65
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
Employment							
	F	1.18	1.05	1.10	0.89	1.31	0.43
	p	0.00	0.02	0.00	1.00	0.00	1.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)**	sd(0.02)>sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)<sd(0.04)***

Table 22: Pooled variance tests: with replacement ratio RR=0.7, s.d. to mean ratio of wage distribution SDMR=0.6, for different cost of search AC

	AC	1.00		2.00		3.00	
SDMR=0.6	**Economy**	**LF**	**WE**	**LF**	**WE**	**LF**	**WE**
RR=0.7	**Turbulence**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Pooled F test df1=df2=7500						
Real wage							
	F	1.19	1.31	1.18	1.31	1.21	1.40
	p	0.00	0.00	0.00	0.00	0.00	0.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***
Productivity							
	F	0.74	0.78	0.79	0.79	0.76	0.78
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
GDP							
	F	0.81	0.74	0.76	0.67	0.76	0.65
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
Employment							
	F	1.18	1.05	1.15	0.89	1.15	0.86
	p	0.00	0.02	0.00	1.00	0.00	1.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)**	sd(0.02)>sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)<sd(0.04)***

Table 23: Pooled variance tests: with RR=0.7, for different combinations of cost of search AC and s.d. to mean ratios of wage distribution SDMR

	AC	**1.00**		**2.00**		**3.00**	
	SDMR	**0.60**		**0.45**		**0.30**	
RR=0.7	**Economy**	**LF**	**WE**	**LF**	**WE**	**LF**	**WE**
	Turbulence	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Pooled F test df1=df2=7500						
Real wage							
	F	1.19	1.31	1.12	1.20	1.25	1.88
	p	0.00	0.00	0.00	0.00	0.00	0.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)***
Productivity							
	F	0.74	0.78	0.73	0.78	0.74	0.77
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
GDP							
	F	0.81	0.74	0.72	0.63	0.71	0.65
	p	1.00	1.00	1.00	1.00	1.00	1.00
		sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***
Employment							
	F	1.18	1.05	1.12	0.65	0.92	0.24
	p	0.00	0.02	0.00	1.00	0.99	1.00
		sd(0.02)>sd(0.04)***	sd(0.02)>sd(0.04)**	sd(0.02)>sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***	sd(0.02)<sd(0.04)***

Table 24: Individual variance tests: for LF economy, with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels

AC=0.5	**Economy**			**LF**	**LF**	**LF**	**LF**
SDMR=0.6	**Turbulence**			**0.02/0.04**	**0.04/0.06**	**0.06/0.08**	**0.08/0.10**
	Inidvidual F tests df1=df2=99						
Real wage			alpha=0.1*	0	5	5	0
		<	alpha=0.05**	0	8	7	1
			alpha=0.01***	0	5	3	0
		=		**65**	**51**	**46**	**98**
			alpha=0.1*	**16**	**11**	**11**	1
		>	alpha=0.05**	**13**	**11**	**12**	0
			alpha=0.01***	**6**	**9**	**9**	0
Productivity			alpha=0.1*	**19**	**10**	**4**	0
		<	alpha=0.05**	**19**	**15**	**6**	0
			alpha=0.01***	**11**	**15**	**13**	0
		=		**51**	**42**	**55**	**100**
			alpha=0.1*	0	2	**5**	0
		>	alpha=0.05**	0	10	**8**	0
			alpha=0.01***	0	6	**9**	0
GDP			alpha=0.1*	**6**	**9**	**6**	0
		<	alpha=0.05**	**7**	**11**	**11**	0
			alpha=0.01***	**1**	**12**	**3**	0
		=		**85**	**57**	**59**	**100**
			alpha=0.1*	1	2	**10**	0
		>	alpha=0.05**	0	5	**10**	0
			alpha=0.01***	0	4	**1**	0
Employment			alpha=0.1*	0	2	3	0
		<	alpha=0.05**	0	7	2	0
			alpha=0.01***	0	5	1	0
		=		**70**	**72**	**61**	**99**
			alpha=0.1*	**16**	**5**	**11**	1
		>	alpha=0.05**	**10**	**7**	**12**	0
			alpha=0.01***	**4**	**2**	**10**	0

Table 25: Individual: variance tests: for WE economy, with original parameters (cost of search AC=0.5, s.d. to mean ratio of wage distribution SDMR=0.6), for different turbulence levels and replacement ratios

	Replacement Ratio		0.7				0.5	0.3
AC=0.5	Economy		WE	WE	WE	WE	WE	WE
SDMR=0.6	Turbulence		0.02/0.04	0.04/0.06	0.06/0.08	0.08/0.10	0.02/0.04	0.02/0.04
	Inidvidual F tests df1=df2=99							
Real wage		alpha=0.1*	0	1	5	8	1	0
	<	alpha=0.05**	0	9	10	5	0	0
		alpha=0.01***	0	4	10	0	0	0
	=		39	46	54	73	60	64
		alpha=0.1*	17	8	8	5	13	12
	>	alpha=0.05**	17	14	6	4	16	22
		alpha=0.01***	27	18	7	5	10	2
Productivity		alpha=0.1*	14	8	6	1	15	17
	<	alpha=0.05**	19	17	11	4	18	24
		alpha=0.01***	7	10	10	5	6	9
	=		60	57	60	79	59	50
		alpha=0.1*	0	4	0	5	2	0
	>	alpha=0.05**	0	2	4	3	0	0
		alpha=0.01***	0	2	9	3	0	0
GDP		alpha=0.1*	8	9	17	8	17	12
	<	alpha=0.05**	17	15	7	2	6	8
		alpha=0.01***	5	10	9	1	4	3
	=		67	61	50	83	71	77
		alpha=0.1*	2	1	6	2	1	0
	>	alpha=0.05**	1	1	5	2	1	0
		alpha=0.01***	0	3	6	2	0	0
Employment		alpha=0.1*	1	5	6	12	0	0
	<	alpha=0.05**	0	7	7	7	0	0
		alpha=0.01***	0	7	12	1	0	0
	=		62	57	60	73	63	66
		alpha=0.1*	10	5	9	3	14	17
	>	alpha=0.05**	17	11	3	2	16	16
		alpha=0.01***	10	8	3	2	7	1

Table 26: Individual variance tests: with replacement ratio RR=0.7, cost of search AC=1, for different s.d. to mean ratios of wage distribution SDMR

	SDMR		0.6	0.45	0.3	0.6	0.45	0.3
AC=1	**Economy**		**LF**	**LF**	**LF**	**WE**	**WE**	**WE**
RR=0.7	**Turbulence**		**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Inidvidual F tests							
	df1=df2=99							
Real wage		alpha=0.1*	0	1	0	1	2	0
	<	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
	=		**82**	**85**	**59**	**57**	**61**	**0**
		alpha=0.1*	**6**	**10**	**16**	**15**	**16**	**0**
	>	alpha=0.05**	**10**	**4**	**22**	**11**	**8**	**0**
		alpha=0.01***	**2**	**0**	**3**	**16**	**13**	**100**
Productivity		alpha=0.1*	**8**	**20**	**12**	**19**	**19**	**12**
	<	alpha=0.05**	**20**	**22**	**29**	**22**	**26**	**32**
		alpha=0.01***	**17**	**10**	**13**	**4**	**4**	**6**
	=		**55**	**46**	**44**	**55**	**51**	**50**
		alpha=0.1*	0	2	2	0	0	0
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
GDP		alpha=0.1*	**15**	**21**	**8**	**20**	**12**	**7**
	<	alpha=0.05**	**15**	**24**	**29**	**20**	**31**	**27**
		alpha=0.01***	**3**	**7**	**18**	**11**	**19**	**32**
	=		**67**	**48**	**45**	**49**	**38**	**33**
		alpha=0.1*	0	0	0	0	0	1
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
Employment		alpha=0.1*	0	0	0	3	**10**	**5**
	<	alpha=0.05**	0	0	0	3	**7**	**7**
		alpha=0.01***	0	0	0	1	**8**	**67**
	=		**87**	**96**	**59**	**79**	**67**	**20**
		alpha=0.1*	**8**	**4**	**23**	**3**	7	1
	>	alpha=0.05**	**5**	**0**	**18**	**10**	1	0
		alpha=0.01***	**0**	**0**	**0**	**1**	0	0

Table 27: Individual variance tests: with replacement ratio RR=0.7, s.d. to mean ratio of wage distribution SDMR=0.6, for different cost of search AC

	AC		1	2	3	1	2	3
SDMR=0.6	**Economy**		**LF**	**LF**	**LF**	**WE**	**WE**	**WE**
RR=0.7	**Turbulence**		**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Inidvidual F tests df1=df2=99							
Real wage		alpha=0.1*	0	0	0	1	2	1
	<	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
	=		**82**	**76**	**73**	**57**	**59**	**42**
		alpha=0.1*	**6**	**17**	**15**	**15**	**13**	**17**
	>	alpha=0.05**	**10**	**7**	**11**	**11**	**16**	**21**
		alpha=0.01***	**2**	**0**	**1**	**16**	**12**	**19**
Productivity		alpha=0.1*	**8**	**18**	**14**	**19**	**16**	**19**
	<	alpha=0.05**	**20**	**22**	**20**	**22**	**22**	**22**
		alpha=0.01***	**17**	**9**	**14**	**4**	**2**	**6**
	=		**55**	**49**	**51**	**55**	**60**	**52**
		alpha=0.1*	0	2	1	0	0	1
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
GDP		alpha=0.1*	**15**	**11**	**16**	**20**	**10**	**16**
	<	alpha=0.05**	**15**	**20**	**18**	**20**	**32**	**16**
		alpha=0.01***	**3**	**3**	**12**	**11**	**25**	**36**
	=		**67**	**66**	**54**	**49**	**33**	**32**
		alpha=0.1*	0	0	0	0	0	0
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
Employment		alpha=0.1*	0	0	0	3	**9**	**7**
	<	alpha=0.05**	0	0	0	3	**8**	**12**
		alpha=0.01***	0	0	0	1	**7**	**8**
	=		**87**	**89**	**89**	**79**	**73**	**66**
		alpha=0.1*	**8**	**11**	**7**	**3**	1	3
	>	alpha=0.05**	**5**	**0**	**4**	**10**	2	3
		alpha=0.01***	**0**	**0**	**0**	**1**	0	1

Table 28: Individual variance tests: with replacement ratio RR=0.7, for different combinations of cost of search AC and s.d. to mean ratios of wage distribution SDMR

	AC		1	2	3	1	2	3
	SDMR		0.6	0.45	0.3	0.6	0.45	0.3
RR=0.7	**Economy**		**LF**	**LF**	**LF**	**WE**	**WE**	**WE**
	Turbulence		**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**	**0.02/0.04**
	Inidvidual F tests df1=df2=99							
Real wage		alpha=0.1*	0	0	0	1	1	3
	<	alpha=0.05**	0	1	0	0	1	4
		alpha=0.01***	0	0	0	0	0	4
	=		**82**	**82**	**70**	**57**	**72**	**62**
		alpha=0.1*	**6**	**11**	**15**	**15**	**6**	**10**
	>	alpha=0.05**	**10**	**6**	**15**	**11**	**17**	**10**
		alpha=0.01***	**2**	**0**	**0**	**16**	**3**	**7**
Productivity		alpha=0.1*	**8**	**15**	**12**	**19**	**15**	**15**
	<	alpha=0.05**	**20**	**30**	**29**	**22**	**24**	**28**
		alpha=0.01***	**17**	**15**	**12**	**4**	**4**	**4**
	=		**55**	**40**	**46**	**55**	**57**	**53**
		alpha=0.1*	0	0	1	0	0	0
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
GDP		alpha=0.1*	**15**	**15**	**11**	**20**	**11**	**13**
	<	alpha=0.05**	**15**	**30**	**32**	**20**	**28**	**27**
		alpha=0.01***	**3**	**15**	**17**	**11**	**34**	**30**
	=		**67**	**40**	**40**	**49**	**27**	**30**
		alpha=0.1*	0	0	0	0	0	0
	>	alpha=0.05**	0	0	0	0	0	0
		alpha=0.01***	0	0	0	0	0	0
Employment		alpha=0.1*	0	0	**14**	3	**6**	**4**
	<	alpha=0.05**	0	0	**3**	3	**22**	**4**
		alpha=0.01***	0	0	**2**	1	**34**	**85**
	=		**87**	**90**	**79**	**79**	**36**	**7**
		alpha=0.1*	**8**	**10**	2	**3**	1	0
	>	alpha=0.05**	**5**	**0**	0	**10**	1	0
		alpha=0.01***	**0**	**0**	0	**1**	0	0