UNIVERSITA' CATTOLICA DEL SACRO CUORE

Dottorato di Ricerca in
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ciclo XXI
S.S.D: SECS-P /02; SECS-P /05; SECS-P/06

A REGIONAL LABOUR MARKET MODEL FOR GERMANY - AN ANALYSIS OF MACROECONOMIC SHOCKS AND ECONOMIC POLICY VARIABLES

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to my wife and my parents

" The whole of science is nothing more
than the refinement of everyday thinking."

Albert Einstein (1879-1955)

Summary

This study deals with the reaction of labour markets to macroeconomic and economic policy shocks with reference to a number of characteristic Federal States of Germany.

The general aim of this research is to reveal structural settings of regions and to analyse the impact of economic policy measures on labour markets. The labour market model we develop could further be used as a tool for policy decisions. The proposed model builds on existing approaches such as Baussola (2007) and extends those by incorporating aspects of innovation as well as the institutional and political setting. The structure of the model, we develop, is unique in the German context, as it allows - by including aspects of innovation and the national institutional setting - for structural comparisons of regions beyond national boundaries!

The analysis builds on data from five major sources: regional accounts RA (2007) data and national accounts data SBA (2000 & 2008), annual household survey data MIK (2008), data from Research Institute of Occupation and Labour Market data IAB (2008), Regional Statistical Office data SLA (2008) and Centre for Economic Performance data NIC (2006). Further descriptive data stems from the Foundation for German Science, Grenzmann & Kladobra (2006). Together we have obtained a comprehensive data set on a NUTS 1 level with yearly data from 1975 to 2005.

Before constructing the labour market model, we deal with two aspects: First, we review the four standard approaches of macroeconomic modelling in order to decide which form fits our aim of modelling exogenous economic and policy shocks most adequately. We review, hence, the large-scale macroeconomic models, dynamic stochastic general equilibrium (DSGE) models, unrestricted vector autoregressive (VAR) models and structural cointegration VAR models. Based on their advantages and shortcomings we choose the VAR approach as being most adequate for our "shock exercise". Second, we review the theoretical background of employment and unemployment as a basis for asking the question of how we should interpret the reactions of our model variables to the simulated shocks. We extensively use the NAIRU model (Franz, 2006) to study the driving forces and mechanisms of employment and unemployment. As to our extensions to standard modelling approaches, we also discuss the role institutions play. By reviewing innovation theory, we further provide an adequate basis for the proposed labour market model.

Having a solid understanding of the form and the phenomena that are fundamental for constructing a labour market model, we look at our objects of study. We present key economic indicators of Germany and choose the three Federal States Baden-Württemberg, North Rhine-Westphalia and Schleswig-Holstein for our analysis. With their diverse economic structures and geographic locations- minimal spill over effects among others-, these three States (Laender) are good representatives of all ten Western German Laender. The descriptive exercise provides an important finding: The divergence in wealth between Baden-Württemberg and the other two Laender, North Rhine-Westphalia and Schleswig-Holstein, only slightly emanates from higher employment inputs, like higher labour force participation or a higher employment rate in Baden-Württemberg. The crucial factor for the lead of Baden-Württemberg is higher labour productivity that stems from a bigger effort in innovation especially in highly innovative industries. This finding confirms the importance of including an innovation or productivity variable in the labour market model.

In constructing the labour market model, we follow a modelling strategy that fills the gap between traditional regional models and supply-side as well as economic dynamic approaches. The model specification adopts an Error Correction Mechanism (ECM) and has the form of a simultaneous equations model; ECM captures dynamic issues while incorporating long-term relationships. This serves our goal of providing a model revealing long run relationships while also being applicable for modelling economic shocks and policy decisions. The structure of the labour market model comprises three major blocks that endogenously determine the unemployment rate: The first block, labour demand, comprises employees in industry and services disaggregated according to their degree of innovation and knowledge intensity. Labour supply constitutes the second block incorporating the participation rate and self-employment. The third block consists of identities, based on sound economic assumptions that close the model.

We estimate the relationships on the labour demand and labour supply side with different estimation approaches. The different estimation approaches confirm the robustness of our model specification. The estimated relationships reveal that value added mainly drives labour demand and that wage costs have detrimental effects on employment in all Laender. On the labour supply side, in contrast, structural variables such as migration play a pivotal role. The estimates also reveal distinct differences in structural variables between the Laender, such as difference in sectors and branches as well as the Laender's dependence on long run trends. For the

simulation, the Mincer-Zarnowitz test as well as the Wald test only finds one significant case – at the 95% level- of overconfidence and 3 cases of too timid estimations.

Following these finding, the thesis investigates the reaction of the unemployment rate, labour demand and labour supply of the Laender to macroeconomic shocks in economic policy variables. Exemplary findings are: First, increasing union coverage leads to a consistent decrease in labour demand and also to decreasing labour supply, finally resulting in a lower level of economic activity, except in Baden-Württemberg from the medium term onwards. Second, the response to an increase in active labour market policy demonstrates the pivotal role the labour supply side plays for the labour market: A shock in active labour market policy leads to a decrease in the unemployment rate. This decrease, however, results from a substantial fall in the participation rate. A lower participation rate for the economy means a decrease in economic activity!

Having analyzed the findings of these two and the other shocks, we are able to formulate specific policy recommendations for each of the three German Laender. The general interpretation of the estimation results suggests that in Baden-Württemberg and Schleswig-Holstein the industry and the services sector show high employment multipliers. German and regional policies intended to foster industry are thus especially fruitful in these Laender. In North Rhine-Westphalia by contrast, high employment multipliers stem from the services sector only. A further finding is that labour demand depends more positively on value added than negatively on wages in all Laender and West Germany.

A further finding shows that the feedback mechanisms on the labour supply side take effect only about four or five years after the shock occurred but determine the development from then onwards. This means that for evaluating the effects of policy we have to allow for considerable reaction time.

Finally, this work points to an application of the model to regions of different countries.

In conclusion, the author develops a manageable macroeconomic, dynamic labour market model that reveals structural properties of the analyzed Laender. The author further tries to provide a tool for economic policy makers at a regional, national and international level for simulating policy decisions and revealing domains of promising policy actions through detecting the structural composition of regions and their response to shocks during the course of time.

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List of Abbreviations

B	Billion
BW	Baden-Württemberg
CGE	Computable General Equilibrium
DE	Germany (West)
EC	European Community
ECM	Error Correction Mechanism
EU	European Union
GDP	Gross Domestic Product
GEM	Global Economic Model
ILO	International Labour Organization
IMF	International Monetary Fund
KIS	Knowledge Intensive Services
LD	Labour Demand
mio	Million
NACE	Statistical Classification of Economic Activities in the EC
NAIRU	Non-Accelerating Inflation Rate of Unemployment
NUTS	Nomenclature of Territorial Units for Statistics
NW	North Rhine-Westphalia
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
QUERU	Quasi Equilibrium Rate of Unemployment
R&D	Research and Development
RESID	Residual
RMSE	Root Mean Squared Error
SH	Schleswig-Holstein
SUR	Seemingly Unrelated Regression
TFP	Total Factor Productivity
TIC	Theil's Inequality Coefficient
UN	United Nations
VAR	Vector Auto Regressive
WS	Wage Supply

Introduction

When in 2000 the European member states set up the Lisbon agenda, the economic and political complexity in the EU has risen dramatically. With the accession of 12 states in 2004 and 2007, the EU now comprises 27 member states. Besides the integration of the new members, from 1999 onwards, also 12 - now 16-member states have experienced a deeper integration brought by the introduction of a single currency -the Euro. Increased integration has also led to an increased impact of national as well as European policies on a regional level. In addition to the increased integration in Europe, global trade and competition has increased within the most recent years. Consequently, the relevance of innovation has become essential for a region's competitiveness. Regional governments have gained in importance as competition between regions increased. Less competitive regions struggle with problems of high unemployment and are particularly affected by macroeconomic shocks. Macroeconomic shocks increasingly affect the regions as national boundaries and regulations diminish. The diverse effects and influences can be particularly well observed in Germany, at the centre of Europe, with federal states showing distinct differences in economic activity, sectoral composition, unemployment rates, and level of innovation as well as openness to international trade.

The complex situation requires tools for policy decision makers at regional, national and supra-national levels that are able to capture dynamic aspects and simulate policies.

Such tools should help reveal relationships between core variables and show how different regions react to the same policy or macroeconomic shock.

At the national and supra-national level large econometric models have been and are still utilized for impact analysis from central banks (Bank of Italy, 1986), government research units (Fitz Gerald, 2002) international organizations (IMF, 1998), the European Commission (Roeger & Veld, 1997), bargaining parties and many other institutions (Pesaran *et al.*, 2004). Such econometric models still widely use national specifications. Specifications for models on a sub-national level have only developed in recent years.

The focus of the present work lies at constructing a macro econometric model of the labour market for characteristic German federal states. The model helps in

understanding the diverse labour market conditions and their reactions to policy as well as economic shocks. The reactions to shock help determine whether different reaction patterns among the states exist according to their level of innovation.

The thesis comprises six chapters. We initiate **Chapter 1** with a review of macroeconomic models for economic policy analysis. After sketching the historic development over the last decades, we focus on the development in the geographical dimension of such models. Paragraph 1.3 then summarizes the four major approaches. The last two paragraphs of the first Chapter deal with empirical applications of macroeconomic models worldwide and specifically in Germany.

The **second Chapter** provides the theoretical background for the labour market model. It presents the theory of unemployment from the Classical and Keynesian models to the more recent models of the QUERU and NAIRU. We utilize the QUERU and NAIRU models as vehicles to point at major causes for unemployment such as shocks, wage rigidities, hysteresis, institutional influences or mismatches. The second part of Chapter 2 provides the theoretical background for the phenomenon of innovation and technological progress. A discussion of central thoughts in examining the relationship between innovation and the labour market constitutes the third part of Chapter 2.

Chapter 3 provides the empirical basis for understanding the economic structure and development of three characteristic German federal states. This serves as background information of our units under study. Key figures on Germany initiate the chapter. We then explain why the three chosen states are ideal for the following analysis. In the following, we decompose the most widely used measure for competitiveness and wealth GDP/head in its composites. When examining the composites we provide data on three points in time – 1975, 1991, 2005- and look at the ratios between the federal states. Besides the comparison between the federal states, we confront their values and ratios to the Western German average as a benchmark. The values and ratios provide insights in wealth, labour input- measured in hours worked and employment / unemployment as well as the participation rate, and measures of labour productivity and innovation. At the end of Chapter 3 the states' performances in the distinct measures, their sectoral structures as well as the development over time becomes clear.

Chapter 4 comprises information about the utilized datasets and variables. At the beginning, we explain why we opted for the NUTS 1 (nomenclature of territorial units for statistics) level as geographic level of analysis. Collecting data at the NUTS 1

level did not make data collection an easy task. As no comprehensive data set for all variables has existed, we have collapsed various data sets and manipulated data in order to estimate a properly detailed labour market model. A table with variable's meaning and sources completes the chapter.

Based on the modelling background of Chapter 1, the theoretical underpinnings of Chapter 2, the descriptive knowledge of Chapter 3, the knowledge about data of Chapter 4, we construct a labour market model in **Chapter 5**. We first review main existing approaches of econometric models specifically targeted at the approach we use in our model. Within the framework of the modelling strategy and philosophy, we develop the "rules" to which our specific model complies. Baussola (2007) offers a specification that suits the data well and enables us to incorporate dynamic issues important for the shock exercise in Chapter 6. Our specification follows his structure as a general guideline and extents it by incorporating policy variables differentiating between different levels of innovation and applying the same labour demand specification in industry as well as in services on a regional level. The model constitutes of a labour demand, a labour supply block and takes the goods market as exogenous. In total, the model comprises six equations and five identities. It uses an error correction representation for each of the simultaneous equations. After the model definition in part one, OLS and SUR estimation of the model constitute part two of Chapter 5. Both estimation techniques have been utilized to allow for testing the model's sensitivity to the estimation method. The choice of SUR estimation in addition to standard OLS estimation follows a positive test on dependence between the states and the finding of Barbieri (2007) that OLS and SUR estimates yield the best results in such an analysis. On the labour demand side, aggregate demand in industry and aggregate demand in services is estimated. On the labour supply side, the participation rate and self-employment are estimated. The chapter further reveals a better structural fit of the SUR opposed to the OLS estimation.

In **Chapter 6,** we present a dynamic deterministic simulation of the model based on OLS as well as SUR estimates. The fit of reproducing the endogenous variables is evaluated by Theil's inequality coefficient and the root mean square error. Only deciding upon these measures would favour OLS instead of SUR specification for the shock exercise. The visual inspection of the state's OLS residuals, the Chi^2 test and the inspection of dependencies of the endogenous variables on their lagged values, however, leads us to favour the SUR opposed to the OLS methodology for the shock exercise. Main sources of adjustment mechanisms to shocks and the

methodology are presented before carrying out the shock exercise. We model each shock once upon a time by an increase of 1% in the shock variable. The shocks comprise value added shocks, labour cost and product price shocks, innovation (productivity) shocks and three policy shocks. We follow the development of the three Western German states and the Western German average for 15 years after the shock. The chapter ends by describing observed regional reaction patterns to the modelled shocks.

Conclusions, data appendix and bibliography complete the thesis.

Acknowledgements

I am particularly grateful to my supervisors Professor Maurizio Baussola (Università Cattolica del Sacro Cuore, Piacenza) and Professor Jürgen Roth (ESB Business School, Reutlingen University) for their continuous support and for the many discussions throughout my PhD programme. It has been a remarkable experience having enjoyed an Italian as well as a German supervisor and having stayed at both sites, sometimes travelling back and forth. I hope that many more PhD students will follow our successful international "experiment".

I am also particularly grateful to Professor Niess, Professor Baumeister and Professor Seiter for their suggestions and offering me the opportunity to stay at the ESB Research Institute at Reutlingen University. I am grateful to seminar participants at the Catholic University, Reutlingen University, Hohenheim University and at the ERSA summer school 2006. I thank representatives of the IAW Tübingen, the German Statistical Office, the German National Labour Agency and the ZEW Mannheim for discussions, data and comments. The Statistical Office Baden-Württemberg helped me with many data issues and invited me for discussions- thank you very much. I also thank Professor Niebuhr (IAB Kiel) for her in-depth comments and recommendations at the ERSA conference 2007 in Paris. Special thanks also belong to participants of the Knowledge Economy Conference 2007 & 2008 at Reutlingen University as well as to Professor Pesaran at the ECOMOD Conference 2008 in Berlin for valuable suggestions.

A big thank you for great assistance –also in organizational matters- belongs to Laura Barbieri, Mario Veneziani and Carlo Migliardo. You are great!

The financial support of the Catholic University and VIMA- Verein für internationale Managementausbildung- is gratefully acknowledged.