

Volkswirtschaftliche Schriften

Heft 518

City Growth in Europe

By

Volker Nitsch



Duncker & Humblot · Berlin

Volker Nitsch · City Growth in Europe

Volkswirtschaftliche Schriften

Begründet von Prof. Dr. Dr. h. c. J. Broermann †

Heft 518

City Growth in Europe

By

Volker Nitsch



Duncker & Humblot · Berlin

Die Deutsche Bibliothek – CIP-Einheitsaufnahme

Nitsch, Volker:

City growth in Europe / Volker Nitsch. –

Berlin : Duncker und Humblot, 2001

(Volkswirtschaftliche Schriften ; H. 518)

Zugl.: Berlin, Humboldt-Univ., Diss., 2000

ISBN 3-428-10499-4

Alle Rechte vorbehalten

© 2001 Duncker & Humblot GmbH, Berlin


Fremddatenübernahme: Klaus-Dieter Voigt, Berlin

Druck: Werner Hildebrand, Berlin

Printed in Germany

ISSN 0505-9372

ISBN 3-428-10499-4

Gedruckt auf alterungsbeständigem (säurefreiem) Papier
entsprechend ISO 9706 

Acknowledgements

To write a dissertation while working full-time as an economist in a private bank is a daunting task. That I was nonetheless able to realize this project and even had fun in doing so is mainly the result of generous support from a number of people who have contributed in one way or another to the completion of this thesis and to whom I owe special debt.

First and foremost, I am grateful to my thesis advisors, Dalia Marin and Michael Burda. They generated in me excitement to think about regional issues in economics and helped to shape my thought in the area in important ways. Beyond their intellectual guidance, however, they provided the personal encouragement and support I needed to complete this work. Finally, I am most grateful for the perspective and understanding they offered me on this non-standard career path.

I also owe special thanks to Dietrich Beier, the former chief economist of Bankgesellschaft Berlin, who supported this project from its beginning. Although the content of this work is completely unrelated to my assignments in the bank, he continuously spent motivation by asking how the project is evolving. Also his successor as chief economist, Heinz Grimm, aided this work in many different ways: from giving me full scope in organizing my bank duties to funding several of my research activities.

While working on this dissertation, it was an interesting experience to discover that another German economist, Karsten Junius, was completing his own doctoral thesis on related topics at the Kiel Institute of World Economics. All parts of the work have been improved by his comments.

Also, this work benefitted from the discussion of seminar participants at Humboldt University, the University of Munich, and the 1996 and 1998 EEA meetings.

Lastly, but most importantly, I thank my family for their incredible support. In particular, I am indebted to my wife Coretta for being indulgent when I was working on this project at home or spending countless hours in libraries. This thesis could not have been completed without her help.

Berlin, February 2001

Volker Nitsch

Table of Contents

Chapter 1

Introduction	15
---------------------	----

Chapter 2

Some Empirics on Zipf's Law for Cities	18
---	----

2.1	Introduction	18
2.2	Theoretical Explanations	20
2.3	Evidence on Zipf's Law in Europe	21
2.3.1	Data	22
2.3.2	Basic Results	25
2.3.3	Examining Explanations for Deviations from an Exponent of 1	35
2.4	Distribution Dynamics	37
2.4.1	Kernel Density	38
2.4.2	Transition Matrices	44
2.4.3	Which Cities Grow?	57
2.5	The Austrian Experience	61
2.6	Summary	68

Chapter 3

Krugman and Livas Elizondo Revisited: Is There a Link Between Trade Policy and Urban Concentration?	70
--	----

3.1	Introduction	70
3.2	The Model	71
3.2.1	Stylized World Geography	72
3.2.2	Wage Structure	73
3.2.3	Consumer's Problem	76
3.2.4	Producer's Problem	77

3.2.5	Government's Problem.....	79
3.2.6	Equilibrium.....	79
3.3	Simulation Results.....	81
3.3.1	Replicating Krugman and Livas Elizondo (1996).....	82
3.3.2	Sensitivity Analysis.....	84
3.3.3	Allowing for Different Distances Between Domestic Locations and the ROW.....	89
3.3.4	Allowing for a Redistribution of Tariff Revenues.....	92
3.4	Conclusions.....	94

Chapter 4

Does Openness Reduce Urban Concentration? Evidence from 120 Years of European Data 96

4.1	Introduction.....	96
4.2	Potential Causes for Urban Concentration.....	98
4.2.1	Economic Development.....	98
4.2.2	Political Power.....	100
4.2.3	Transportation Infrastructure.....	100
4.3	Data.....	101
4.3.1	Data Sources.....	101
4.3.2	Alternative Measures of Urban Primacy.....	104
4.4	Results.....	109
4.4.1	Replicating Ades and Glaeser (1995).....	109
4.4.2	More Years of Data.....	119
4.4.3	More Cities.....	122
4.4.4	Other Concentration Measures.....	125
4.4.5	Full Time Period, 1870–1990.....	126
4.4.6	Changes in Urban Concentration.....	130
4.5	Conclusion.....	133

Chapter 5

Does History Matter for City Growth? The Case of Vienna 136

5.1	Introduction.....	136
5.2	The Dissolution of the Austro-Hungarian Empire.....	137
5.3	First Evidence.....	143
5.4	Probing Deeper.....	145
5.4.1	Data and Methodology.....	145

5.4.2 Is Vienna Too Large?..... 149
5.4.3 Does Vienna’s Primacy Fall Over Time?..... 153
5.5 Conclusion 158

Appendix A

Comparing Zipf Exponents for Different Sample Sizes 160

Appendix B

**Examining the Robustness of Eaton and
Eckstein’s (1997) Results** 161

Appendix C

Replicating Krugman and Livas Elizondo (1996) 169

Appendix D

Description of the Data 171

Appendix E

Construction of Openness Measure 176

References 179

Data Sources 182

Subject Index 185

List of Tables

Table 2.1a	Estimated Zipf Exponents	31
Table 2.1b	Estimated Zipf Exponents	32
Table 2.1c	Estimated Zipf Exponents	33
Table 2.1d	Estimated Zipf Exponents	34
Table 2.2a	Transition Matrices.	46
Table 2.2b	Transition Matrices.	48
Table 2.2c	Transition Matrices.	50
Table 2.2d	Transition Matrices.	52
Table 2.2e	Transition Matrices.	54
Table 2.3	Convergence, Divergence, or Parallel Growth of Cities? (Part 1). .	58
Table 2.4	Convergence, Divergence, or Parallel Growth of Cities? (Part 2). .	60
Table 2.5	Variances of Growth Rates Across Different City Sizes.	62
Table 2.6	City Growth in Austria	67
Table 4.1	Simple Correlations	107
Table 4.2	Replicating Ades and Glaeser (1995)	110
Table 4.3	Alternative Estimation Techniques and Sample Sizes	115
Table 4.4	Additional Explanatory Variables	117
Table 4.5	More Years of Data	120
Table 4.6	More Cities	123
Table 4.7	Other Concentration Measures	126
Table 4.8	Full Time Period, 1870–1990.	128
Table 4.9	Panel Estimation with Fixed Effects	129
Table 4.10	Changes in Urban Concentration, 1870–1990.	132
Table 4.11	Causality Test, 1870–1990	134
Table 5.1	The Disintegration of the Austro-Hungarian Empire.	142
Table 5.2	City Growth in Austria	144
Table 5.3	The Impact of Austro-Hungarian Disintegration on the Absolute Size of Vienna.	150
Table 5.4	The Impact of Austro-Hungarian Disintegration on the Relative Size of Vienna.	152

Table 5.5	The Impact of Austro-Hungarian Disintegration on the Urban Dominance of Vienna	154
Table 5.6	The Impact of Austro-Hungarian Disintegration on the Change in the Absolute Size of Vienna.....	156
Table 5.7	The Impact of Austro-Hungarian Disintegration on the Change in the Relative Size of Vienna	157
Table 5.8	The Impact of Austro-Hungarian Disintegration on the Change in the Urban Dominance of Vienna.....	159
Table A.1	Comparing Estimated Zipf Exponents for Different Sample Sizes .	160
Table B.1	Evidence from Growth Regressions	163
Table B.2	Comparing Mean Growth Rates.....	167
Table B.3	Correlation Coefficients.....	168
Table D.1	Main Cities	172
Table E.1	Comparing Openness Ratios from Maddison and Mitchell	176
Table E.2	Share of Trade in GDP	178

List of Figures

Figure 2.1a	Zipf Plots for Belgium and Denmark.	26
Figure 2.1b	Zipf Plots for Finland and Italy.	27
Figure 2.1c	Zipf Plots for the Netherlands and Norway	28
Figure 2.1d	Zipf Plots for Portugal and Spain	29
Figure 2.1e	Zipf Plots for Sweden and Switzerland	30
Figure 2.2	Histogram of Estimated Zipf Exponents	35
Figure 2.3a	Density Plots of Relative City Sizes for Belgium and Denmark .	39
Figure 2.3b	Density Plots of Relative City Sizes for Finland and Italy	40
Figure 2.3c	Density Plots of Relative City Sizes for the Netherlands and Norway.	41
Figure 2.3d	Density Plots of Relative City Sizes for Portugal and Spain.	42
Figure 2.3e	Density Plots of Relative City Sizes for Sweden and Switzerland.	43
Figure 2.4	Fast Growing Cities in the Madrid Region.	56
Figure 2.5	Zipf Plots for Austria, 1910.	64
Figure 2.6	Zipf Plot for Austria, 1990.	65
Figure 2.7	City Growth in Austria, 1910–90	66
Figure 3.1	Stylized World Geography	72
Figure 3.2	Wage Structure.	75
Figure 3.3	The Relationship Between Labor Force and the Wage Level Net of Commuting and Land Rents	75
Figure 3.4	The Relationship Between Labor Force and Labor Input	76
Figure 3.5	Replicating Krugman and Livas Elizondo (1996) Using Their Parameter Values	83
Figure 3.6	Replicating the Results of Krugman and Livas Elizondo (1996) .	85
Figure 3.7	Equilibrium Allocation of Labor as a Function of the Rate of Protection.	86
Figure 3.8	Real Wage Differentials Using More Plausible Parameter Values	89
Figure 3.9	Assuming Different Distances Between Domestic Locations and the Rest of the World	91
Figure 3.10	Allowing for a Redistribution of Tariff Revenues.	93

Figure 4.1	The Evolution of the Openness Ratio in Europe	97
Figure 4.2	The Evolution of the Openness Ratio and Measures of Urban Concentration	108
Figure 4.3	Share of Trade in GDP and Population in Main City, 1970–90	112
Figure 4.4	Changes in the Openness Ratio and Measures of Urban Concentration	131
Figure 5.1	Map of Austria-Hungary after 1867	140
Figure 5.2	The Evolution of the Population Size in Vienna	143
Figure 5.3	The Evolution of Urban Concentration in Austria(-Hungary)	146
Figure B.1	Alternative Ways to Explore the Relationship Between Growth Rates and Initial City Size	162

Chapter 1

Introduction

In the 1990s, there has been a broad revival of interest in economic geography, the location of economic activity in space. According to *Econlit*, the share of articles with JEL classification code R covering “urban, rural, and regional economics” in four top economics journals¹ has risen considerably over the past decade, almost doubling from an average of about 1.6% in the period from 1986 to 1988 to 2.9% ten years later. Also in the policy context, issues in urban economics have attracted greater attention. The World Bank, for instance, has recently devoted two complete chapters of its *World Development Report 1999/2000* to cities.

One of the most notable features of this “new economic geography” is a close association between theoretical and empirical work. In contrast to earlier research, theoretical studies appear to be far more strongly focused on real-world phenomena. Recent examples include the role of natural advantages in the making of major cities (e.g., Fujita and Mori [1996]), the potential impact of trade liberalization on peripheral regions (e.g., Krugman and Venables [1990]), and the evolution of hierarchical urban systems (e.g., Fujita, Krugman and Mori [1999]). Moreover, new modeling techniques also allow to address complex issues in greater detail.

At the same time, empirical work is often much more closely tied to theoretical models. Instead of purely detecting possible stylized facts, considerable efforts have been made to test for the relevance of theoretical results. Donald Davis and David Weinstein (1996, 1999), for instance, have analyzed in a series of papers the empirical importance of the home market effect, as suggested by Krugman (1980). Another example is Gordon Hanson (1998) who provides an interesting attempt to estimate a market potential function, implied by new geography models.

A major shortcoming of recent empirical work in urban economics is, however, the startling concentration on basically only two estimation strategies. Probably driven by the limited availability of data, most of the analyses are either cross-country studies which usually seek to explore a data

¹ The examined journals are the *American Economic Review*, the *Quarterly Journal of Economics*, the *Journal of Political Economy*, and the *Review of Economics and Statistics*.

set as rich as possible or the studies examine single country data and then often focus on U.S. experiences.

This thesis aims to provide a new – European – perspective. The basic idea is that a focus on European cities, apart from being interesting for itself, allows to combine the advantages of both previous approaches. In particular, there is considerable cross-country variation while, in addition, also reliable historical data is available. Therefore, it is one of the contributions of this thesis to compile a new data set of European cities which covers 13 countries and ranges from 1870 to 1990.

This data set is then applied to explore several hypotheses which have been recently proposed in the literature. In fact, as the field of urban economics is emergent and dynamic, there are a number of interesting and innovative suggestions which virtually cry out for further examination. On the theoretical side, it is often necessary to sort through which of the intriguing possibilities indicated by economic models are truly relevant or need to be elaborated further. On the empirical side, evidence is often only informative or not convincingly robust and therefore has to be investigated in far more detail, examining different contexts and applying alternative econometric methods. Inspired by the spirit of the new economic geography then and thus closely connecting theoretical and empirical aspects, three sets of issues are discussed in this thesis: the growth pattern of cities and their implications for Zipf's law, the relationship between trade openness and urban concentration, and the role of history for city growth.

Chapter 2 begins with an analysis of Zipf's law, the striking empirical regularity that the number of cities with a population larger than S tends to be proportional to $1/S$. Surprisingly, there is still no convincing explanation for this astonishingly stable pattern in the size distribution of cities, even though the empirical regularity is known for at least 80 years now. The best available answer then is a model of random growth of cities – an idea which has been recently formalized by Xavier Gabaix (1999) who shows that a scale-invariant growth process produces a final distribution that follows a power law. The analysis in chapter 2, however, raises some doubts whether there is really random growth across cities. The results rather suggest that there *is* an empirical relationship between city size and subsequent growth, but with a changing sign over time. Nonetheless, Zipf's law seems to hold for the European countries in the sample with reasonable precision.

Chapters 3 and 4 explore another interesting recent hypothesis which can be appropriately analyzed with the data at hand. In a provocative paper, Krugman and Livas Elizondo (1996) have suggested that protectionist trade policies are a major cause of large central cities. Based on anecdotal evidence from Mexico, they develop a simple theoretical model in which ex-

ternal trade liberalization promotes spatial deconcentration. As the model is basically solved through simulations, however, chapter 3 provides a detailed sensitivity analysis and allows for several extensions, showing that the theoretical results are not robust. Specifically, it is shown that, for a particular range of plausible parameter values, trade does not affect urban concentration.

Chapter 4 then turns to the empirical analysis. Looking at a long time series from 1870 to 1990, the results are not convincing. While there is indeed a negative association between openness and the size of a country's largest city in the last few decades, confirming earlier findings for this time period (e.g., Ades and Glaeser [1995]), the results become insignificant for earlier years and alternative measures of urban concentration. Thus, the empirical evidence for an association between external trade and internal geography turns out to be shaky, at best.

Chapter 5, finally, examines the impact of history on city growth. Here, it is argued that the dissolution of the Austro-Hungarian Empire in 1918 provides a natural experiment to analyze the existence of path dependence. Specifically, if history matters, one would expect that the dramatic reduction in the country's population and territory has no measurable effect on the subsequent development of the largest city, Vienna. The Austrian experience, then, is in favor of lock-in effects. While Vienna's urban dominance declines relative to other European capitals in the sample immediately after the break-up, this effect quickly runs out. Despite its overdimension, Vienna's primacy even starts to *increase* again a half century after the dissolution of the Habsburg Empire, indicating that there is a strong pattern of path dependence in city growth.

In conclusion, the three examples in this thesis nicely illustrate the variety of interesting challenges for empirical work in urban economics and the extent to which a new data set can be used to address these seemingly disparate issues. The European experience then provides a rich laboratory of real-world data which still waits to be explored.