THE IMPACT OF TWO-RATE TAXES ON CONSTRUCTION IN PENNSYLVANIA

by

Florenz Plassmann

Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Economics

Approved:

_____
T.N. Tideman, Chairman

_____ _____
R. Ashley J. Christman

_____ _____
C.Michalopoulos S.Snyder

June 24, 1997
Blacksburg, Virginia

THE IMPACT OF TWO-RATE TAXES ON CONSTRUCTION IN PENNSYLVANIA

by

Florenz Plassmann

T. Nicolaus Tideman, Chairman

Department of Economics,
Virginia Polytechnic Institute and State University

(ABSTRACT)

The evaluation of policy-relevant economic research requires an ethical foundation. Classical liberal theory provides the requisite foundation for this dissertation, which uses various econometric tools to estimate the effects of shifting some of the property tax from buildings to land in 15 cities in Pennsylvania. Economic theory predicts that such a shift will lead to higher building activity. However, this prediction has been supported little by empirical evidence so far.

The first part of the dissertation examines the effect of the land-building tax differential on the number of building permits that were issued in 219 municipalities in Pennsylvania between 1972 and 1994. For such count data a conventional analysis based on a continuous distribution leads to incorrect results; a discrete maximum likelihood analysis with a negative binomial distribution is more appropriate. Two models, a non-linear and a fixed effects model, are developed to examine the influence of the tax differential. Both models suggest that this influence is positive, albeit not statistically significant.

Application of maximum likelihood techniques is computationally cumbersome if the assumed distribution of the data cannot be written in closed form. The negative binomial distribution is the only discrete distribution with a variance that is larger than its mean that can easily be applied, although it might not be the best approximation of the true distribution of the data. The second part of the dissertation uses a Markov Chain Monte Carlo method to examine the influence of the tax differential on the number of building permits, under the assumption that building permits are generated by a Poisson process whose parameter varies lognormally. Contrary to the analysis in the first part, the tax is shown to have a strong and significantly positive impact on the number of permits.

The third part of the dissertation uses a fixed-effects weighted least squares method to estimate the effect of the tax differential on the value per building permit. The tax coefficient is not significantly different from zero. Still, the overall impact of the tax differential on the total value of construction is shown to be positive and statistically significant.

ACKNOWLEDGEMENTS:

I express my gratitude to

Edelgard and Florenz IV. Plassmann, my parents,
without whom I would never have started.

T. Nicolaus Tideman, my advisor,
without whom I would never have continued.

Vandana, my wife,
without whom I would never have finished.

TABLE OF CONTENTS:

Abstract ii

Acknowledgements iii

List of figures vii

List of tables viii

Chapter 1: Motivation

1.1 Introduction 1
1.2 Normative economics 3
1.3 Liberalism 9
1.4 Neoclassical economics and liberalism 13
1.5 Public collection of rent 16
1.6 Plan of the study 19

Chapter 2: Land Value Taxation

2.1 Introduction 22
2.2 Economic theory of land value taxation 23
2.3 Application of land value taxation 26
2.3.1 Land value taxation outside the United States 26
2.3.2 Land value taxation in the United States 29
2.3.2.1 History of land value taxation in the United States 29
2.3.2.2 History of land value taxation in Pennsylvania 31
2.3.2.3 Empirical work on land value taxation in Pennsylvania 32

Chapter 3: Estimation Techniques

3.1 The analysis of count data 40
3.2 Poisson models 42
3.3 Negative binomial models 45
3.3.1 Standard derivation and specification 45
3.3.2 Alternative derivation 48
3.3.3 Alternative specification 50
3.4 Markov Chain Monte Carlo methods 53

Chapter 4: Setup of the Analysis and Preliminary Data Examination

4.1 Introduction 58
4.2 Review of the data: The Bureau of the Census data collection 58
4.3 Municipalities used in the study 62
4.4 Construction of demographic data 65
4.5 The dependent variables 66
4.6 The independent variables 67
4.7 Data analysis with OLS and the Tobit model 69
4.8 Data analysis with the Poisson and the negative binomial model 71
4.9 Conclusion 74

Chapter 5: Analysis of 'Number of Permits' with Maximum Likelihood

5.1 Introduction 75
5.2 The relationship between the mean and the variance 75
5.3 Correction for serial correlation 77
5.4 A non-linear model 78
5.4.1 Setup of the model 78
5.4.2 Examination of nonresidential construction of whole units 81
5.4.3 Examination of residential construction of whole units 90
5.5 A fixed effects model 92
5.5.1 Setup of the model 92
5.5.2 Serial correlation 93
5.5.3 The different models and their estimates 96

Chapter 6: Analysis of 'Number of Permits' with the Gibbs Sampler

6.1 Introduction 100
6.2 Setup of the model 100
6.3 Estimation of the model 104
6.4 Results 105

Chapter 7: Analysis of 'Value per Permit'

7.1 Introduction 109
7.2 Setup of the model 109
7.3 Estimation, refinements, and results of the model 111
7.4 Conclusion 117

Chapter 8: Conclusion

8.1 Summary and evaluation of the study 118
8.2 Deficiencies of the analysis and suggestions for further research 123
8.3 Conclusion 125

Appendix A: Number of Building Permits in the Two-Rate Cities Between 1980 and 1994 127

Appendix B: Value per Permit in the Two-Rate Cities Between 1980 and 1994 131

Appendix C: Number of Months for which Data are available for the Two-Rate Cities Between 1980 and 1994 135

Appendix D: Building Permits Survey Documentation: Description of Data Items 136

Appendix E: Histograms of the Distribution of 'Number of Permits' 139

Appendix F: Alternative Distribution for the Maximum Likelihood Analysis 146

Appendix G: Full Conditional Distributions for the Gibbs Sampler 147

References 151

Vita 164

LIST OF FIGURES

Figure

2.1 Cities with two-rate taxes between 1980 and 1994 34

3.1 Relationship between the mean and the coefficient of variation 50
3.2 Monte Carlo integration 55

4.1 Distribution of population densities in 1980 64
4.2 Distribution of population change during the 1970s 64
4.3 Distribution of income in 1980 64

5.1 Relationship between the actual excess *CV* and μ 76
5.2 Relationship between Density and the first derivative of the intercept for various functional relationships 82
5.3 Relationship between Density and the first derivative of the intercept once density is included as a parabola 84
5.4 Relationship between Income and the first derivative of the intercept for various functional relationships 85
5.5 Relationship between Lagged Population Change and the first derivative of the intercept when Lagged Population Change is not included in the analysis . . . 86
5.6 Relationship between the First Lagged Residual and the first derivative of the intercept for various functional relationships 87

6.1 Graphical model for the number of building permits 102
6.2 Residential construction of whole units 106
6.3 Residential additions and alterations 106
6.4 Nonresidential construction of whole units 107
6.5 Nonresidential additions and alterations 107

7.1 Relationship between ln(buildings) and the residuals in the OLS regression 114
7.2 Relationship between ln(buildings) and the weighted residuals in the weighted least squares regression 114

E.1 Histograms of the number of permits 139

LIST OF TABLES

Table

2.1 Summary of previous OLS studies of two-rate taxes in Pennsylvania 38

4.1 The different categories in the Bureau of the Census data set 60
4.2 Estimation results of models that assume a continuous distribution 69
4.3 Estimation results of the Poisson model 71
4.4 Estimation results of overdispersion tests 72
4.5. Estimation results of the negative binomial model 73

5.1 Nonresidential construction of whole units 89
5.2 Residential construction of whole units 91
5.3 Nonresidential construction of whole units and additions and alterations 97
5.4 Residential construction of whole units and additions and alterations 98

6.1 Model specification 103
6.2 Estimation results 108

7.1 Estimation results with OLS and weighted least squares 112
7.2 Estimation results of the weighted least squares fixed effects model 116

8.1 Summary of all estimats of the tax coefficient 119
8.2 Estimated increase in Pittsburgh's construction after a 1 percentage point increase in the tax differential, and after a switch to a land-only tax 121

A.1 Number of building permits in the two-rate cities between 1980 and 1994 127
B.1 Value per building permit in the two-rate cities between 1980 and 1994 131
C.1 Number of Months reported for the two-rate cities between 1980 and 1994 135