Doctoral Thesis


Author(s):
Strecker, Nora M.

Publication Date:
2017

Permanent Link:
https://doi.org/10.3929/ethz-a-010852381

Rights / License:
In Copyright - Non-Commercial Use Permitted

A thesis submitted to attain the degree of

Doctor of Sciences of ETH Zurich

(Dr. sc. ETH Zurich)

presented by

NORA MARGOT STRECKER

Master of Arts in Economics
New York University, Graduate School of Arts and Science

born on July 29, 1986

citizen of Germany

accepted on the recommendation of

Professor Peter H. Egger, ETH Zurich, examiner
Professor Georg Wamser, University of Tübingen, co-examiner

2017
Words can hardly express the debt of gratitude I owe Professor Peter Egger for giving me the opportunity to work with him and his team at the Chair of Applied Economics: Innovation and Internationalization at ETH Zurich and to complete this dissertation. The research environment at his Chair has produced wonderful interactions, fostered great relationships with my co-authors and colleagues, and greatly advanced both my work and my research. I also gratefully acknowledge the financial support of the Swiss National Science Foundation.

I also want to thank my thesis committee, Professors Georg Wamser of the University of Tübingen and Marko Köthenbürger of ETH Zurich, for taking the time to read and comment on the dissertation presented here.

Of those who have taught me over the years, two stand out in particular. I thank Professor T. Clark Durant for supporting me during my Master’s degree at New York University. His courses and seminars allowed me to pursue wild ideas, led me to my first academic conference, and planted the idea of pursuing the even wilder idea of completing a PhD. I am also forever indebted to Marc Vincenti, who, in class and later via his wonderful letters, has continually expressed his unwavering support of me and my goals. His encouraging words were beacons in the dark times of my life, guiding me to where I am today. And for that I can never repay him.

I thank my co-authors Simon Bösenberg, Peter Egger, Sergey Nigai, Doina Radulescu, and Benedikt Rydze for their efforts on behalf of our joint work and, along with Marie Poprawe, Michaela Kesina, Katharina Erhardt, Andrea Lassmann, Federica Liberini, Michael Stimmelmayr, and the many other current and former colleagues at the Chair for Applied Economics and the Chair for Public Economics at ETH Zurich, for the numerous discussions, the exchange of ideas, and the supportive and motivating environment they’ve created.

This work has been a lengthy labor of love and for their patience I truly thank my friends, who have endured my absence at parties and lack of visits without complaint. For 17 years, Caroline Hintermann’s friendship has given me the endurance to work through difficulties and been a light in my life. For fewer but by no means less important years, Polina Minkovski has believed in me, encouraged me, and been my cheerleader. Transitioning from challenging me to think outside
the box in class to think of the big picture outside of it, Polina has been my sounding board and wide-angle lens and invaluable addition to my life and my work.

The patience and wholehearted love of my family, Annegret and Achim, Norbert and Ako, and my brother, Alexander, has been the source of great support and encouragement to pursue my goals and overcome our shared hardships. I thank them for their faith in me and my ambitions. Without them I would not be who I am or where I am today.

Nora Strecker, Zurich, November 2016
To second chances
# Contents

**Acknowledgements** i  
**Abstract** xvii  
**Zusammenfassung** xix  

## 1 Introduction  1

### 2 A Tour of Labor Income Tax in the World, 1980-2012  5

#### 2.1 Descriptive statistics  6

##### 2.1.1 Features of the tax system  7

#### 2.2 Some insights on the drivers of income-tax-system characteristics in the data  26

##### 2.2.1 Top rate and number of kinks in the statutory personal income tax schedule  28

##### 2.2.2 Total tax bill paid by an average employee and its composition  30

##### 2.2.3 Social security  32

##### 2.2.4 Untargeted family assistance  34

#### 2.3 Conclusions  35

### 2.A EATR and EMTR: Other Household Archetypes  37

### 2.B Social Security: Other Household Archetypes  43

### 2.C Progressivity: Other Household Archetypes  49

### 2.D Family Assistance Shares: Other Household Archetypes  53

## 3 Determinants of Personal Income Tax Setting  57

### 3.1 Empirical model  59

#### 3.1.1 Third-country personal income tax weighting schemes  60

### 3.2 Tax structures, rates, and overall measures  65

### 3.3 Empirical results  69

#### 3.3.1 Overall results  70
### 3.3.2 Results by country group

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.2 Results by country group</td>
<td>74</td>
</tr>
</tbody>
</table>

### 3.4 Conclusion

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4 Conclusion</td>
<td>77</td>
</tr>
</tbody>
</table>

### 3.A Sample details and co-variates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.A Sample details and co-variates</td>
<td>78</td>
</tr>
</tbody>
</table>

### 3.B Additional Results

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.B Additional Results</td>
<td>80</td>
</tr>
</tbody>
</table>

### 3.C Income distribution estimates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.C Income distribution estimates</td>
<td>87</td>
</tr>
</tbody>
</table>

### 4 Effective Labor Taxation and the International Location of Headquarters

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Effective Labor Taxation and the International Location of Headquarters</td>
<td>89</td>
</tr>
</tbody>
</table>

### 4.1 Data

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Data</td>
<td>92</td>
</tr>
</tbody>
</table>

#### 4.1.1 Data on headquarters location

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.1 Data on headquarters location</td>
<td>93</td>
</tr>
</tbody>
</table>

#### 4.1.2 Data on income taxation

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.2 Data on income taxation</td>
<td>93</td>
</tr>
</tbody>
</table>

#### 4.1.3 Data on control variables

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.3 Data on control variables</td>
<td>94</td>
</tr>
</tbody>
</table>

#### 4.1.4 Descriptive statistics

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.4 Descriptive statistics</td>
<td>95</td>
</tr>
</tbody>
</table>

### 4.2 Empirical strategy

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 Empirical strategy</td>
<td>96</td>
</tr>
</tbody>
</table>

#### 4.2.1 Conditional logit

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.1 Conditional logit</td>
<td>96</td>
</tr>
</tbody>
</table>

#### 4.2.2 Nested logit

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.2 Nested logit</td>
<td>97</td>
</tr>
</tbody>
</table>

### 4.3 Estimation results

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 Estimation results</td>
<td>100</td>
</tr>
</tbody>
</table>

#### 4.3.1 Conditional logit estimates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1 Conditional logit estimates</td>
<td>101</td>
</tr>
</tbody>
</table>

#### 4.3.2 Nested logit estimates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.2 Nested logit estimates</td>
<td>104</td>
</tr>
</tbody>
</table>

#### 4.3.3 Sensitivity analysis and further results

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.3 Sensitivity analysis and further results</td>
<td>106</td>
</tr>
</tbody>
</table>

### 4.4 Conclusion

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4 Conclusion</td>
<td>107</td>
</tr>
</tbody>
</table>

### 5 On the Distribution of Tax Effects on Headquarters Location

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 On the Distribution of Tax Effects on Headquarters Location</td>
<td>109</td>
</tr>
</tbody>
</table>

### 5.1 Econometric models of headquarters activity

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Econometric models of headquarters activity</td>
<td>110</td>
</tr>
</tbody>
</table>

#### 5.1.1 Conditional and mixed logit models for location choice

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1 Conditional and mixed logit models for location choice</td>
<td>110</td>
</tr>
</tbody>
</table>

#### 5.1.2 Random coefficients model for asset intangibility

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.2 Random coefficients model for asset intangibility</td>
<td>111</td>
</tr>
</tbody>
</table>

### 5.2 Empirical analysis

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2 Empirical analysis</td>
<td>111</td>
</tr>
</tbody>
</table>

#### 5.2.1 Data

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2.1 Data</td>
<td>111</td>
</tr>
</tbody>
</table>

#### 5.2.2 Results

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2.2 Results</td>
<td>114</td>
</tr>
</tbody>
</table>

### 6 The Taxing Deed of Globalization

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 The Taxing Deed of Globalization</td>
<td>119</td>
</tr>
</tbody>
</table>

### 6.2 Globalization, tax revenues, and personal income tax rates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2 Globalization, tax revenues, and personal income tax rates</td>
<td>121</td>
</tr>
</tbody>
</table>

#### 6.2.1 Globalization

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.1 Globalization</td>
<td>122</td>
</tr>
</tbody>
</table>

#### 6.2.2 Tax revenue composition

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.2 Tax revenue composition</td>
<td>123</td>
</tr>
</tbody>
</table>

#### 6.2.3 Corporate and personal income tax rates

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.3 Corporate and personal income tax rates</td>
<td>124</td>
</tr>
</tbody>
</table>

### 6.3 An instrument for endogenous globalization

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3 An instrument for endogenous globalization</td>
<td>125</td>
</tr>
</tbody>
</table>

### 6.4 The effect of globalization on the size and composition of tax revenues

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4 The effect of globalization on the size and composition of tax revenues</td>
<td>127</td>
</tr>
</tbody>
</table>

### 6.5 The effects of globalization on personal income taxes

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5 The effects of globalization on personal income taxes</td>
<td>130</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>6.5.1 Globalization and the relative personal income tax burden across earners</td>
<td>130</td>
</tr>
<tr>
<td>6.5.2 Globalization and the effective average personal income tax rate</td>
<td>135</td>
</tr>
<tr>
<td>6.6 Case study: Interstate migration and changes in effective taxation in the United States</td>
<td>140</td>
</tr>
<tr>
<td>6.7 Conclusions</td>
<td>143</td>
</tr>
<tr>
<td>6.A List of countries and data sources</td>
<td>145</td>
</tr>
<tr>
<td>6.A.1 List of countries</td>
<td>145</td>
</tr>
<tr>
<td>6.A.2 Data sources: International</td>
<td>145</td>
</tr>
<tr>
<td>6.A.3 Data Source: United States case study</td>
<td>148</td>
</tr>
<tr>
<td>6.B Imputation comparisons to available data</td>
<td>148</td>
</tr>
<tr>
<td>6.B.1 Imputed wages vs. Luxembourg Income Study micro-data</td>
<td>148</td>
</tr>
<tr>
<td>6.B.2 Imputed employee-borne tax revenues vs. data</td>
<td>150</td>
</tr>
<tr>
<td>6.C Non-OECD results</td>
<td>151</td>
</tr>
</tbody>
</table>

A References 155

B Sourcebook: Global Labor Income Taxation 167
List of Figures

2.1 Lowest Positive Tax Income Thresholds in 1980 and 2012 For Single Male Earners ................................................................. 9
2.2 EATR and EMTR for Average Income and Top Statutory Tax Rate For Single Male Workers .......................................................... 11
2.3 Number of Tax Brackets .................................................................................................................................................. 13
2.4 Employer-borne Social Security ........................................................................................................................................ 14
2.5 Employee-borne Social Security Contributions .................................................................................................................. 15
2.6 Total Tax Bill and Composition for Single Male Worker (Average Income) .............................................................................. 17
2.7 Point Progressivity Measure Excluding SSC ....................................................................................................................... 19
2.8 Δ ..................................................................................................................................................................................... 20
2.9 Δ and Gross Income Gini Coefficients: Single Male ................................................................................................................ 21
2.10 EATRs (+/- 1 SD) Across Time ........................................................................................................................................... 21
2.11 Assessment Structure ........................................................................................................................................................ 22
2.12 Specialized Family Tax Rules ............................................................................................................................................. 22
2.13 Tax Rate for Married, 1-earner Household with 2 Children (Average Income) ................................................................. 23
2.14 Countries with a Family Allowance System ......................................................................................................................... 24
2.15 Family Assistance Share in Total Household Income ........................................................................................................ 25
2.16 EATR in 1980 ...................................................................................................................................................................... 38
2.17 EATR in 2012 ...................................................................................................................................................................... 39
2.18 EMTR in 1980 ...................................................................................................................................................................... 41
2.19 EMTR in 2012 ...................................................................................................................................................................... 42
2.20 Employer-borne Social Security in 1980 ................................................................................................................................. 44
2.21 Employer-borne Social Security in 2012 ................................................................................................................................ 45
2.22 Employee-borne Social Security Rates in 1980 ........................................................................................................................ 47
2.23 Employee-borne Social Security Rates in 2012 ....................................................................................................................... 48
2.24 Point Progressivity in 1980 ..................................................................................................................................................... 51
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.25 Point progressivity in 2012</td>
<td>52</td>
</tr>
<tr>
<td>2.26 Assistance share in 1980 in total household income</td>
<td>54</td>
</tr>
<tr>
<td>2.27 Assistance share in 2012 in total household income</td>
<td>55</td>
</tr>
<tr>
<td>3.1 Global average corporate tax rate +/- 1SD</td>
<td>57</td>
</tr>
<tr>
<td>3.2 Weights of Germany’s immediate neighbors</td>
<td>62</td>
</tr>
<tr>
<td>3.3 Global mean +/- 1SD across PIT components</td>
<td>66</td>
</tr>
<tr>
<td>3.4 EATR &amp; EMTR and their components across income distribution</td>
<td>67</td>
</tr>
<tr>
<td>3.5 Global development of tax effect measure</td>
<td>69</td>
</tr>
<tr>
<td>3.6 Regression coefficients for EATR and EMTR components</td>
<td>72</td>
</tr>
<tr>
<td>3.7 Regression coefficients for EATR: By income group</td>
<td>75</td>
</tr>
<tr>
<td>3.8 Sample countries in 2012</td>
<td>78</td>
</tr>
<tr>
<td>3.9 Regression coefficients: Results of Model (5) for EATR, EMTR, and</td>
<td>81</td>
</tr>
<tr>
<td>their components</td>
<td></td>
</tr>
<tr>
<td>3.10 Regression coefficients for ( \alpha \tau ) components: By income group</td>
<td>84</td>
</tr>
<tr>
<td>3.11 Regression coefficients for EMTR components: By income group</td>
<td>85</td>
</tr>
<tr>
<td>3.12 Regression coefficients for ( m \tau ) components: By income group</td>
<td>86</td>
</tr>
<tr>
<td>4.1 Predicted Number of Headquarters vs. Average Labor Income Tax</td>
<td>92</td>
</tr>
<tr>
<td>4.2 Conditional Logit Choice Structure</td>
<td>97</td>
</tr>
<tr>
<td>4.3 Nested Logit Choice Structure</td>
<td>98</td>
</tr>
<tr>
<td>5.1 Headquarters’ Locations</td>
<td>114</td>
</tr>
<tr>
<td>5.2 Mixed Logit Model</td>
<td>117</td>
</tr>
<tr>
<td>5.3 Random Coefficients Model</td>
<td>118</td>
</tr>
<tr>
<td>6.1 Openness, FDI, and Migration in 65 economies over 1980-2007</td>
<td>122</td>
</tr>
<tr>
<td>6.2 Tax-revenue composition in OECD and non-OECD countries</td>
<td>124</td>
</tr>
<tr>
<td>6.3 Corporate tax rates and personal income tax rates for top-1% and</td>
<td>125</td>
</tr>
<tr>
<td>median workers in 65 economies over 1980-2007</td>
<td></td>
</tr>
<tr>
<td>6.4 Regression coefficients IV-GMM: Trade openness and percentile-specific</td>
<td>132</td>
</tr>
<tr>
<td>contributions to total employee-borne personal income tax revenues</td>
<td></td>
</tr>
<tr>
<td>6.5 Regression coefficients IV-GMM: Migration openness and percentile-specific</td>
<td>133</td>
</tr>
<tr>
<td>contributions to total employee-borne personal income tax revenues</td>
<td></td>
</tr>
<tr>
<td>6.6 Regression coefficients IV-GMM: LIS for OECD Countries</td>
<td>134</td>
</tr>
</tbody>
</table>
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Summary statistics: Lowest positive tax income thresholds in current USD</td>
<td>8</td>
</tr>
<tr>
<td>2.2</td>
<td>Summary statistics: Effective average, effective marginal, and top statutory tax rates for single men without children</td>
<td>10</td>
</tr>
<tr>
<td>2.3</td>
<td>Summary statistics: Kinks and flats</td>
<td>12</td>
</tr>
<tr>
<td>2.4</td>
<td>Summary statistics: Social security</td>
<td>13</td>
</tr>
<tr>
<td>2.5</td>
<td>Summary statistics: Tax bill composition</td>
<td>16</td>
</tr>
<tr>
<td>2.6</td>
<td>Summary statistics: Point progressivity</td>
<td>18</td>
</tr>
<tr>
<td>2.7</td>
<td>Summary statistics: Ginis and progressivity indices</td>
<td>19</td>
</tr>
<tr>
<td>2.8</td>
<td>Summary statistics: $\tau$ for married 1-earner, married household with 2 children</td>
<td>23</td>
</tr>
<tr>
<td>2.9</td>
<td>Summary statistics: Point progressivity for married, 1-earner household with 2 children</td>
<td>24</td>
</tr>
<tr>
<td>2.10</td>
<td>Summary statistics: Assistance share - married 1-earner, 2 children</td>
<td>25</td>
</tr>
<tr>
<td>2.11</td>
<td>Summary statistics: Additional regression variables</td>
<td>26</td>
</tr>
<tr>
<td>2.12</td>
<td>Additional regression variables: Description and source</td>
<td>27</td>
</tr>
<tr>
<td>2.13</td>
<td>Fixed Effects Regressions on Statutory Tax Instruments</td>
<td>29</td>
</tr>
<tr>
<td>2.14</td>
<td>Fixed Effects Regressions on (Average) Total Tax Bill and its Components</td>
<td>31</td>
</tr>
<tr>
<td>2.15</td>
<td>Fixed Effects Regressions on Employer- and Employee-borne Social Security: Binary Indicators</td>
<td>32</td>
</tr>
<tr>
<td>2.16</td>
<td>Fixed Effects Regressions on Employer- and Employee-borne Social Security: Contribution Rates</td>
<td>33</td>
</tr>
<tr>
<td>2.17</td>
<td>Fixed Effects Regressions on Family Allowance</td>
<td>35</td>
</tr>
<tr>
<td>2.18</td>
<td>Summary statistics: EATR for household types</td>
<td>37</td>
</tr>
<tr>
<td>2.19</td>
<td>Summary statistics: EMTR for household types</td>
<td>40</td>
</tr>
</tbody>
</table>
6.3 LIS Country-Year Matches .................................................. 150
6.4 Revenues, Trade and Migration - Non-OECD subgroup ............ 152
Abstract

The dissertation presented here is a collection of papers on labor income taxation around the world. The papers that make up this dissertation are based on an extensive hand-collected data set of labor income tax codes that cover 252 independent countries and semi-autonomous territories between 1980 and 2012. The second through fifth chapter go into the minute details of the tax data and how cross-country similarities shape the tax setting behavior across countries, the effect of labor taxation on the location of headquarters, and firm investment decisions, while the last chapter addresses the effect of globalization on labor income taxes around the world.

The second chapter is co-authored with Peter Egger and provides a comprehensive overview of taxation of labor income for a variety of household types, presenting a wide array of details, such as average and marginal tax rates, kinks and different boundary points of the tax schedule, and the effect on the distribution of net labor incomes. The chapter also explores the determinants of the setting of these tax instruments.

The third chapter continues the analysis of the determinants of countries’ setting of tax instruments given the differential influence of their neighbors. This chapter explores the differential effect of countries in similar versus dissimilar economic situations given political and demographic similarity, aggregate trade, and geographic distance between countries and finds a stark difference between countries in the same economic class and those outside of it, political and demographic neighbors creating positive spillovers and trading partners and geographic neighbors more likely to create negative spillovers.

The fourth chapter (co-authored with Peter Egger and Doina Radulescu) sheds light on the role of different aspects of labor taxation on the international location of headquarters. The findings suggest that both a higher progressivity of the tax system and higher (employee- and employer-born) social security contributions negatively influence a country’s attractiveness for headquarters location.

In a similar vein of analysis, Chapter 5 (co-authored with Peter Egger and Simon Bösenberg) sheds
light on the distribution of profit and personal income tax elasticities of headquarters location across firms in 68 countries between 1999 and 2012. While generally finding a negative effect of labor tax components on location choice and investment decisions, these effects are more diverse than previously considered.

The sixth and last chapter is co-authored with Peter Egger and Sergey Nigai and examines the effects of globalization on the size and composition of tax revenues, worker-specific tax burdens, and effective average labor income tax rates. The findings indicate that due to increasing mobility of firms and high-income workers, globalization led governments in OECD countries to seek tax revenues from alternative sources, specifically from employee-borne taxes paid by relatively less mobile, middle-income workers.
Zusammenfassung


Das dritte Kapitel befasst sich ebenfalls mit der Fragestellung, inwiefern Länder bei der Auswahl ihrer Instrumente zur Besteuerung durch die unterschiedlichen Gegebenheiten in ihren Nachbarländern beeinflusst werden. Die Analyse geht auf den unterschiedlichen Einfluss von Ländern in ähnlichen oder gegensätzlichen wirtschaftlichen Situationen ein, der durch die jeweilige politische und demographische Ähnlichkeit, den aggregierten Außenhandel und die geographische Distanz zwischen einem Länderpaar verstärkt oder geschwächt wird. Es zeigt sich, dass sich politische und demographische Ähnlichkeit positiv, aggregierter Außenhandel und geographischen Distanz, gemäß den Annahmen im Steuerwettbewerb, negativ auf die verschiedenen Instrumente zur Besteuerung auswirken.

Das vierte Kapitel (verfasst mit Peter Egger und Doina Radulescu) untersucht den Effekt von
verschiedenen Aspekten der Besteuerung von Arbeitseinkommen auf die internationale Standortwahl von Firmenhauptsitzen. Die Ergebnisse deuten darauf hin, dass sowohl eine höhere Progressivität des Steuersystems als auch höhere (Arbeitnehmer- und Arbeitgeber-spezifische) Sozialversicherungsbeiträge sich negativ auf die Attraktivität eines Landes auswirken.


Chapter 1

Introduction

This dissertation deals with the effects of and the effects on global labor income taxation. Long considered only at the aggregate level, labor income taxes have been rather difficult to consider in the analysis of location or investment choices or in policy diffusion. In a first step, this requires assembling a data set on precisely this information. Building on the structure provided by the OECD’s Taxing Wages publications, the data set underlying this dissertation used the information gleaned from a country’s tax laws, the amendments to these laws, as well as regulations and directives issued about the taxation of labor income to reconstruct the taxes applicable to the wages of an average worker and their household. We focus only on labor income but allow for the possibility of employment in any sector thus include sector-specific deductions. Due to lack of information and the diversity regarding the taxation of property and capital income, the data also assume that workers do not earn capital nor own property above the taxable threshold.

While there has been a recent increase in the number of publications that address labor income taxation around the globe, mainly from PriceWaterhouseCooper, Ernst & Young, and other tax consultancies, as well as by the International Monetary Fund, these data generally focus on major economies and recent years. This required hand-collection of information for more minor economies and years dating back to 1980. Tax laws and regulations had to be scoured for details and this information properly encoded. This data is unique both in the number of countries, covering 252 countries and territories, and years covered, from 1980 to 2012. Its uniqueness is further underlined by the inclusion of all applicable social security contributions payable by both the employee and employer, as well as all applicable credits, deductions, and allowances available to the “average” worker archetype and their household, including government-sponsored untargeted family allowances.
The details of this data set are relegated to the second chapter, which provides a comprehensive overview of the tax instruments collected across all 252 countries and territories between 1980 and 2012. In addition to presenting a copious amount of information on each of the included structural elements and their changes over time, the chapter also explores the effect of taxes on the distribution of net labor incomes. For this last point, we use several progressivity indices, including the post-tax Gini coefficient, which permits us to compare pre-tax and post-tax Gini coefficients on labor income for a large set of countries and years. This chapter also begins the analysis of the determinants of these tax structures and rates. Generally, the findings indicate negative spillovers from neighboring countries on the rate setting for average workers.

The third chapter continues to address the determinants of countries’ setting of tax instruments. Countries in different economic situations are ex-ante limited in the range of possible changes to their tax systems. Given this limitation, the influence of countries’ neighbors differs greatly by their relative economic position. This chapter explores the differential effect of countries in similar versus dissimilar economic situations given a country pair’s political and demographic similarity, their aggregate trade, and the geographic distance between them. The breadth of the tax data mentioned above allows the analysis to move from individual instruments, to effective average and marginal tax rates across the income distribution, to holistically analyzing the effect of neighbors’ (along the four major avenues) tax systems on a country’s own tax system. Generally, political and demographic similarity fosters positive spillovers, while aggregate trade and geographic distance tends to lead to negative spillovers.

Chapter 4 moves from the determinants of taxation to its effects on economic agents. The chapter explores the role of different aspects of labor income taxation on the international location of headquarters. Profit taxes are widely acknowledged to influence the location of firms’ headquarters and while profit taxes can be avoided in various ways, it is much harder for firms to manipulate the firm-specific labor tax base so that labor taxes may be relatively important for firm location. We construct a unique data set of effective labor tax rate in 120 countries and use data on the location of 35,206 firms to analyze the impact of labor income tax rates, the progressivity of the income tax schedule, and social security contributions on firms’ decisions where to locate their headquarters. The findings suggest that both a higher progressivity of the tax system and higher (employee- and employer-borne) social security contributions negatively influence a country’s attractiveness for headquarters. Hence, a one percentage point increase in payroll taxes, reduces the probability of a country to attract headquarters by 6.1 percent. The results remain robust in various empirical model specifications and subsets of the data.

Continuing in the same vein as Chapter 4, the fifth chapter explores the influence of labor incomes
taxation on headquarters location and investment decisions across 13,074 firms in 68 countries between 1999-2012. However, the analysis allows for a distribution of profit and personal income tax elasticities rather than a single elasticity. Although the results do suggest that the relationship between income taxes and location and investment intensity choice is negative, the results also point much higher variability in the observed elasticities than the previous literature allowed for or considered.

Reversing direction once gain, the last chapter examines the effects of globalization on income taxation, specifically the size and composition of tax revenues, worker-specific tax burdens, and effective average labor income tax rates. To identify the effect of globalization on tax outcomes, this chapter develops a novel instrument for trade and migration openness based in pure cross-border transaction costs. The increasing mobility of firms and high-income workers led to a globalization-induced shift in the source of revenues. Governments in OECD countries have increasingly sought tax revenues from alternative sources, such as employee-borne taxes paid by middle-income workers who face much higher constraints in their mobility. In 1994-2007, the workers in this middle- to low-income range experienced a globalization-related rise in their personal income tax rate of around 1.5, whereas the top 1% of workers faced a reduction of approximately 1.5 percentage points.
Chapter 2


This paper introduces a large data set covering personal labor income tax calculators for 252 countries and territories\textsuperscript{1} around the globe and their statutory tax codes at an annual basis for the years 1980-2012. The tax calculators provide data on effective average (EATRs) and effective marginal (EMTRs) tax rates in multiples of one-hundred dollars of household income for 12 broad household types. Examples of household types are single-earner married couples without children; two-earner married couples without children; single-earner and two-earner two-member households and single-parent households with one, two, or three children. These calculators allow for adjustment in the earnings status of both spouses as well as the age of each household member. They also allow for the possibility of separate and joint tax filing (where applicable) and consider households to be choosing the financially best option for their respective economic situation.

The presence of numerous instruments – the different slopes of the tax schedule in different income brackets, tax allowances, tax credits, tax deductions, the consideration of different household types, etc. – poses significant difficulties to data compilation. The legal system of each state or region must be taken into consideration – e.g., the treatment of a woman’s income, especially a married woman, may not be the same across time and countries; the availability of tax credits and allowances can vary greatly across jurisdictions; etc. Therefore, towards compiling the data, we had to delve (sometimes quite deeply) into the legal history of not only tax and social security laws but also the laws relating to welfare and marriage. As a way of comparing household types across incomes, we

\textsuperscript{1}The data set covers all autonomous and a handful of independently-taxed, semi-autonomous states. We provide details on the covered cross-sectional units below.
have calculated household taxation per household type using average worker income per country and time.

Based on the tax calculator for each household type, country/territory, and year, we may compute effective average and marginal tax rates for any hypothetical income, which will account for all relevant tax allowances, tax credits, and deductions that are available before the calculation of the income tax and include family allowances (for spouses, companions, as well as children), which generally are not income-dependent, and where they are income-dependent are generally concurrent with the year the taxable earnings were accrued. The paper describes the evolution of effective tax rates on labor income as well as various components of the tax calculators (e.g., the number of kinks in the tax schedule, the statutory top marginal rates, and the presence of social security systems, etc.) across countries and time and illustrates the potential use of the data in a number of examples.

In the main body of the paper, we focus two main household archetypes: single male workers, and single-earner households with two children. Another ten household types are relegated to the appendix for brevity’s sake.

2.1 Descriptive statistics

The purpose of this section is to provide a broad overview of key features – and their changes over time – of personal income tax codes across all 252 countries and territories in the world. There is a host of ways by which personal income tax systems can be described, and we chose to report the following elements. First of all, we collected data on the taxation and financial support of 12 working household types whereof single-male-earner-single-households without children and single-male-earner-married households with two children aged 3 and 7 years are the ones for which we provide the most detail. We provide information on all countries/territories and household types for which data are available in Appendix A. We summarize the following characteristics of tax systems for these households in 1980 and 2012: the effective average personal (labor) income tax rate; the lowest income level (in US dollars) at which tax rates become positive; the so-called point progressivity (see OECD, 2010) which is defined as the effective marginal tax rate of the average income earner minus the effective average tax rate relative to one-minus the effective average tax rate; pre-tax versus post-tax Gini coefficients on labor incomes; the level of the income tax bill for the average earner and its composition into tax contributions in a narrow sense and (employee- plus

---

2In two-earner households, we assume the second income earner to be female and earning 50% of the first income earner’s wage. But, clearly, with more nuanced information on the intra-household distribution of incomes, this assumption can be changed and the tax calculators collected in this paper can be straightforwardly applied.
employer-borne) social security contributions; the number of tax brackets (kinks) in the schedule; the assessment structure of couples imposed at the country level (separate, joint, or optional, which implies the financially best option for the household); the use of family tax rules (such as family quotients and tax incentives or disincentives for two-earner households); the level of (employer- and employee-borne) social security rates in average wages; the use of family allowances (financial support); and the share of family allowances in total household income of an average earner.

To the extent that some federally-organized countries such as Switzerland or the United States have tax codes which feature country-wide (federal) and sub-national provisions, effective and statutory income tax rates may vary within economies. In most such countries, we used the capital city to determine the location of the households at stake. Only for Australia and the United States we followed the convention of the Organization for Economic Cooperation and Development (OECD) to use New South Wales and Detroit, Michigan, respectively.

Regarding the number of cross-sectional units – countries and territories – considered, it is important that we did not change the coverage over the years. While the world’s political system permitted distinguishing 224 countries and territories in 1980, some of the countries dissolved and others formed over the course of 33 years, so that there were 248 units for the same covered land mass in 2012 as in 1980. The unique number of political entities covered here between 1980 and 2012 is 252. When considering changes in the distribution of tax instruments between 1980 and 2012, this should be borne in mind.

2.1.1 Features of the tax system

The purpose of this section is to report mainly on features of tax systems, its effective rates and its effects of the income distribution. The first few subsections are devoted to exploring tax instruments applicable to single, male, average workers without children, while in later subsections we focus on tax instruments specifically applicable to families and multi-member households.

Lowest positive tax income thresholds across countries and time

Let us define the lowest positive tax personal income threshold as the level of income where the next dollar of earnings will be taxed at a positive rate. Lowest positive tax personal income thresholds are informative about the size of zero-tax breaks (and brackets) which income tax authorities grant to households. Clearly, the relative generosity of the tax system does not only depend on this feature but also on purchasing power and the income distribution. We shed some light on these issues later on.
Table 2.1: **Summary statistics: Lowest positive tax income thresholds in current USD**

<table>
<thead>
<tr>
<th></th>
<th>1980 excl. SSC</th>
<th>1980 incl. SSC</th>
<th>2012 excl. SSC</th>
<th>2012 incl. SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5th percentile</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10th percentile</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>25th percentile</td>
<td>1</td>
<td>1</td>
<td>450</td>
<td>1</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>1,212</td>
<td>4,205</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>75th percentile</td>
<td>3,521</td>
<td>11,654</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>90th percentile</td>
<td>5,601</td>
<td>21,606</td>
<td>4,802</td>
<td></td>
</tr>
<tr>
<td>95th percentile</td>
<td>6,955</td>
<td>28,757</td>
<td>11,537</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>235,295</td>
<td>236,950</td>
<td>236,950</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2012 excl. SSC</th>
<th>2012 incl. SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3,530</td>
<td>8,694</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>17,814</td>
<td>18,008</td>
</tr>
<tr>
<td>Obs</td>
<td>179</td>
<td>218</td>
</tr>
</tbody>
</table>

Table 2.1 provides information on the distribution of lowest positive tax personal income thresholds across countries/territories in 1980 and 2012. It indicates that about 25 percent of the countries did not have a zero-tax bracket at the lower bound of the income distribution in 1980 and not much changed in that regard by 2012. This does not mean that effective tax rates in these countries will be positive at the lower end, since countries also use other instruments such as assistance payments, etc., to redistribute. The maximum income at which positive tax rates were charged across all economies that did not have a zero-flat income tax started charging positive taxes at 253,300 USD in 1980 (Suriname) and at 237,000 USD in 2012 (British Indian Ocean Territory). The average lower income bound for positive tax rates across countries rose from about 3,500 USD to about 8,700 USD over that time span. When including social security contributions (SSC), about three-quarters of all single-earner-male-single households had to contribute from the first dollar onwards in 1980 while only one-quarter had to contribute from the first dollar onwards in 2012. The average income threshold for tax plus social security contributions rose from less than 800 dollars on average in 1980 to more than 2,400 dollars across all economies in Table 2.1.

Figure 2.1 provides geographical information on the distribution of the thresholds summarized in Table 2.1. It illustrates that the thresholds tended to be higher in less developed and transition economies. Table 2.1 also includes a list of countries without an income tax, which were mainly small countries with a limited population and a low GDP. These countries were mostly located in the Caribbean, South America, and the South Pacific.

---

3Countries without an income tax are or were the following: Afghanistan (in the 1990s), Albania (before 1999), Andorra, Angola (in the 1980s), Anguilla (before 2011), Antigua, the Bahamas, Bahrain, Bermuda, Bhutan (before 1992), the British Indian Ocean Territory (before 2005), British Virgin Islands, Vietnam (before 1990), Brunei Darussalam, Cambodia (before 1994), the Cayman Islands, Cuba (before 1996), French Polynesia, Kosovo (between 1999 and 2001), Kuwait, Laos (in the 1980s), the Maldives, the Marshall Islands (before 1989), Monaco, Mongolia (before 1993), Mozambique (before 1987), Namibia (in 1986), Nauru, Norfolk Islands, North Korea, Oman, Paraguay, Pitcairn, Qatar, Saint Barths, Saint Kitt’s, Sao Tome (before 1993), the Seychelles, the Socialist Federal Republic of Yugoslavia, Somalia (after 1991), South Yemen (before reunification with the North), Swaziland (before 1983), Tokelau, Turks and Caicos Islands, the United Arab Emirates, Uruguay (before 2007), Vanuatu, Venezuela (before 1994), and lastly Yemen (before 1992).
countries both in 1980 and 2012 (e.g., in African economies and Central and Eastern Europe). This is to be expected, as thresholds are defined in absolute dollar amounts, and average income was and still is much lower in the respective countries than in the developed part of the world. However, it is interesting to see that even in some countries in South America and Asia, where average income levels are low relative to the developed countries, tax authorities do not grant big brackets to households at low incomes (see, e.g., China or Brazil). Quite apparently, it is very relevant whether social security contributions are included in this regard. Countries use this distinction to redistribute to lower-income households (charging low-income workers social security but not income taxes), doing so more in 2012 than in 1980 (see the two panels on the right relative to the ones on the left and the lower-right versus the upper-right panel in Figure 2.1).

Statutory and effective income tax rates across countries and time

Statutory and effective income tax rates are illustrative of the relevance of the tax schedule per se for an earner or household type. Table 2.2 summarizes moments of the effective average tax
rate (EATR) evaluated at an average income\(^4\) the effective marginal tax rate (EMTR)\(^5\) and top statutory income tax rates in the tax code (top)\(^6\). While the EATR and the EMTR take into consideration all possible deductions the tax payer could have taken, including but not limited to deductions of social security contributions (discussed in greater detail below), the top statutory tax rate does not.

While the block on the left-hand side of Table 2.2 is devoted to 1980, the one on the right-hand side is devoted to 2012. The table suggests that almost 50 percent of the countries charged an average worker a positive income tax, at the global median an average worker paid just 3.8% of his gross income in taxes in 1980. At most, an average worker paid 45% of his gross income in taxes in 1980, as was the case in New Caledonia. The picture changed somewhat in 2012, where less than 25% of countries did not levy a personal income tax on their average workers. The average worker in the median country/territory paid 0.8 percentage points more of his gross income in taxes in 2012 compared to 1980. The average worker paid maximum EATR of 45.0% in 1980 and only one of 36.6% in 2012. On average, an average worker’s EATR increased slightly from 7.4% to 7.8% between 1980 and 2012. Similar patterns of change as for the EATR can be observed for the EMTR. The table indicates also that top statutory tax rates were – except for flat-tax countries/territories – substantially reduced between 1980 and 2012 across the distribution of economies.

Table 2.2: Summary statistics: effective average, effective marginal, and top statutory tax rates for single men without children

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th></th>
<th>2012</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EATR</td>
<td>EMTR</td>
<td>top</td>
<td>EATR</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>11.750</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>4.417</td>
<td>10.000</td>
<td>45.000</td>
<td>4.677</td>
</tr>
<tr>
<td>75th percentile</td>
<td>11.965</td>
<td>21.500</td>
<td>60.000</td>
<td>13.154</td>
</tr>
<tr>
<td>90th percentile</td>
<td>21.149</td>
<td>32.000</td>
<td>70.000</td>
<td>20.651</td>
</tr>
<tr>
<td>95th percentile</td>
<td>25.725</td>
<td>40.000</td>
<td>70.000</td>
<td>23.848</td>
</tr>
<tr>
<td>Maximum</td>
<td>44.958</td>
<td>62.000</td>
<td>95.000</td>
<td>36.830</td>
</tr>
<tr>
<td>Mean</td>
<td>7.643</td>
<td>13.245</td>
<td>37.851</td>
<td>7.851</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>248</td>
</tr>
</tbody>
</table>

Figure 2.2 illustrates the geographical distribution of the data summarized in Table 2.2. Not surprisingly, richer countries tend to tax their average earners (as well as their top earners) at

\(^4\)This is the income tax paid in percent of total labor income for an average income earner in a country and year, assuming the earner is male, single, and without children.

\(^5\)This is the income tax paid in percent on the next dollar of income for an average income earner in a country and year, assuming the earner is male, single, and without children.

\(^6\)This is the income tax paid in percent on the next dollar earned at the top of the income tax schedule in a country and year.
Figure 2.2: EATR and EMTR for average income and top statutory tax rate for single male workers
higher rates – on average and at the margin. High effective taxes are not just a prerogative of rich countries, many countries in Africa have high effective tax rates. However, we should keep in mind that in developing and transition countries, more than developed countries, may face compliance and evasion issues, and what we display here are ex-ante (owed) payments rather than ex-post (declared) ones. In any case, most of the developed world saw their effective tax rates for average earners as well as their top-level tax rates decrease since 1980, while large swaths of Africa and Russia have been increasing their tax rates.

The number of kinks (brackets) in the tax schedule

The progressivity of a tax system can be administered in various ways. Clearly, kinks in the tax schedule generate adverse effects in behavior of individuals with an income close to a kink on the higher tax side of said kink. This change in behavior results in bunching just below such kinks (see Saez, 2010; Chetty, Friedman, Olsen, and Pistaferri, 2011; Devereux, Liu, and Lorentz, 2014; Kleven and Waseem, 2013; Landais, 2015). Larger jumps in effective tax rates at kinks of the schedule – i.e., fewer kinks for a given progressivity of the tax schedule – generate stronger behavioral incentives and distortions. Accordingly, a smoother progression for a given targeted rate of progression – e.g., through more kinks (or, conversely, no kinks at all) – may be desirable from that perspective.

Table 2.3: Summary statistics: Kinks and flats

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>50th percentile</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>(median)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75th percentile</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>90th percentile</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>95th percentile</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Maximum</td>
<td>300</td>
<td>17</td>
</tr>
<tr>
<td>Mean</td>
<td>8.353</td>
<td>3.331</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>21.088</td>
<td>2.959</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>248</td>
</tr>
</tbody>
</table>

Table 2.3 summarizes features of the distribution of the number of kinks in tax schedules across all covered countries, again for the anchor years 1980 and 2012. This table indicates that more than ten percent of the countries ran a system without any kinks in either year. Knowing that not only the number of kinks was zero in these countries/territories but also the statutory rates were constant, these cases relate to flat-tax systems. The median country (of 224) operated with seven kinks in 1980, while (among 248 countries) it did so with only four kinks in 2012. The average number of kinks declined from about nine to just more than four over the considered time span.
In 1980, Cook Island’s tax schedule contained 301 kinks, while it only had 2 kinks by 2012. The country with the maximum number of 18 kinks in its income tax schedule in 2012 was Luxembourg.

(a) 1980

(b) 2012

![Figure 2.3: Number of tax brackets](image)

Figure 2.3 illustrates the distribution of kink numbers in single-male-earner-single households’ tax schedules across countries in 1980 and 2012. The two panels suggest that substantial changes were induced through the collapse of the Soviet Union and generally on the African, Asian, as well as the North and South American continents in terms of kink numbers.

**Social security contributions (SSC)**

<table>
<thead>
<tr>
<th>Table 2.4: Summary statistics: Social security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>5th percentile</td>
</tr>
<tr>
<td>10th percentile</td>
</tr>
<tr>
<td>25th percentile</td>
</tr>
<tr>
<td>50th percentile (median)</td>
</tr>
<tr>
<td>75th percentile</td>
</tr>
<tr>
<td>90th percentile</td>
</tr>
<tr>
<td>95th percentile</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. dev.</td>
</tr>
<tr>
<td>Obs</td>
</tr>
</tbody>
</table>

With social security contributions (SSC) it is customary to distinguish between employer- and employee-borne components. SCC can contain both a savings and a tax (or insurance) component. Employer-borne SSC, ceteris paribus, represent an additional cost a firm pays for hiring another worker and providing him or her with a salary. The first two columns of Table 2.4 summarize

---

7It is the goal of the literature on tax incidence to actually determine who carries the burden – after shifting – of the contributions by employers and employees. Clearly, the answer to that differs across markets and perhaps even time periods. What we report on is the original source that the contributions are paid by and not the incidence.
moments of the employer-borne social security contributions paid for an average worker for the years 1980 and 2012. In either year, at least 25% of countries did not charge firms SSC for the average (male) worker. This may flow from several reasons: in the absence of a social security system where employers are required to contributed (as was, and largely still is, the case for large swaths of Asia and Africa and for other countries in the early years of our sample); or the rates not being charged for workers with an average (or below-average) income (as was the case in Gabon, Ireland, Israel, Kuwait, and the Solomon Islands in 1980; and Laos and Cambodia in 2012). The median employer rate of SSC for an average-income-earning single male worker has more than doubled over the time span, going from 5% to over 10% in 2012. The maximum was about half of an average worker’s gross income in 1980 in Bulgaria and Czechoslovakia, and it rose to 71.5% in 2012 in Djibouti. In the average country/territory firms paid just about 9.4% and 14.1% of SSC contributions for an average-income earner in 1980 and 2012, respectively.

SSC are rarely ever of a flat-tax type, but they can take many forms. Figure 2.4 illustrates the geographical distributions of employer-borne SSC rates for average-income earners (in the left-hand panels) as well as the form of the system (in the right-hand panels) by distinguishing between rate-regressive, capped (i.e., fixed or progressive at low incomes and de-facto regressive at high incomes), partly-capped (also de-facto regressive at high incomes), progressive, proportional, fixed (i.e., de-

---

In this and several other countries, the very high values of SSC are due to fixed-amount contributions per worker, which factor very highly relative to the incomes of low- to average-income workers.
facto regressive), and absent employer-borne SSC contributions. The figure suggests that most countries either fully or partially cap their employer-borne SSC, with progressive systems coming in third.

(a) Rate 1980

(b) Structure 1980

(c) Rate 2012

(d) Structure 2012

Figure 2.5: Employee-borne social security contributions

As a complement to the evidence above, the last two columns of Table 2.4 summarize moments of the employee-borne SSC an average worker paid between the years 1980 and 2012. In either year, at least 25% of the countries did not collect SSC from their average workers, which, as with the employer-borne SSC, can be due to these countries not implementing a social security system (e.g., large parts of Africa and Asia, and countries in the Warsaw Pact before the fall of the Iron Curtain), or due to these countries only charging SSC on workers with above-average incomes (e.g., Algeria, Burkina Faso, Gabon, Kuwait, the Netherlands Antilles, Niger, and the Solomon Islands in 1980; and Iran and Laos in 2012). At the global median, the employee SSC rate for an average worker more than doubled over the considered time span, going from 2% in 1980 to over 5% in 2012. The maximum was about 30% of an average worker’s gross income in 1980 in Bolivia and 35.2% in 2012 in the Netherlands.\(^9\) Hence, the increase in the employee-borne rate at the upper end of the distribution was much less dramatic than the 20-percentage-point increase in the highest employer-borne SSC rate for average earners. In the average economy, average-income earners paid

\(^{9}\)Very high values of social security contributions can also be due to fixed amount contributions per worker, which would factor very highly relative to the incomes of low-paid workers.
just about 4.1% and 7.1% in 1980 and 2012, respectively, which is roughly half of the employer rate charged for those earners over the same time span.

Akin to Figure 2.4, Figure 2.5 illustrates the contribution rates of average income earners (left-hand panels) as well as the structure of the employee-borne SSC system in place (two right-hand panels). According to the two panels on the left of Figures 2.4 and 2.5, rates for average earners increased for both employees and employers. As with employer-borne contributions in Figure 2.4, the majority of the countries either fully or partially cap their SSC contributions collected from employees, with progressive systems coming in third.

Composition of the tax bill

<table>
<thead>
<tr>
<th>Table 2.5: Summary statistics: Tax bill composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>5th percentile</td>
</tr>
<tr>
<td>10th percentile</td>
</tr>
<tr>
<td>25th percentile</td>
</tr>
<tr>
<td>50th percentile</td>
</tr>
<tr>
<td>(median)</td>
</tr>
<tr>
<td>75th percentile</td>
</tr>
<tr>
<td>90th percentile</td>
</tr>
<tr>
<td>95th percentile</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. dev.</td>
</tr>
<tr>
<td>Obs</td>
</tr>
</tbody>
</table>

In this section, we join the effective tax contributions from Section 2.1.1 and the employee-borne SSC from Section 2.1.1. In particular, we elaborate on two characteristics: the overall (tax-plus-SSC) tax bill for an average, single, male worker without children; and the shares of the bill attributable to taxes per se versus employee-borne SSC. For convenience, we report the tax and employee-borne SSC shares in the total tax bill separately, even though these shares always add up to 100% within a country/territory and year. Again, we report on the distribution of these characteristics across countries for 1980 and 2012, separately. Table 2.5 summarizes features of the distribution of these characteristics across countries. According to the table, the overall tax bill amounted to an effective total rate of about 16.4% for an average earner in a median country in 1980 and to 23.1% in 2012. In the average country, that rate rose from 18.2% to 23.5% over the same time span. In the average economy, the share accruing to tax contributions decreased, while the portion accruing to employee-borne SSC increased.

Figure 2.6 reports on the geographical distribution of the characteristics considered in this section.
Figure 2.6: **Total tax bill and composition for single male worker (average income)**
It illustrates that between 1980 and 2012 increases in the overall tax bill on the average, single, male workers were most pronounced in Africa, Asia, and parts of South America. Moreover, the figure suggests that this change was mainly due to an increase in employee-borne SSC rather than the income tax.

**Progressivity**

There are several approaches to measuring the progressivity of a tax system. The OECD (2010) proposes a measure of the progressivity of a country’s income tax schedule at the average wage in country \( i \) at time \( t \), \( \bar{w}_{it} \), in terms of what they call by the short hand point progressivity. This point progressivity utilizes information contained in the EMTR and EATR at the average wage according to the definition:

\[
PointProg_{it}(\bar{w}_{it}) = \frac{EMTR(\bar{w}_{it}) - EATR(\bar{w}_{it})}{1 - EATR(\bar{w}_{it})},
\]

which measures by how much the next dollar on top of the average income will be taxed relative to the average dollar earned.

Table 2.6: **Summary statistics: Point progressivity**

<table>
<thead>
<tr>
<th></th>
<th>1980 excl. SSC</th>
<th>1980 incl.SSC</th>
<th>2012 excl.SSC</th>
<th>2012 incl.SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>−0.040</td>
<td>−0.109</td>
<td>−0.140</td>
<td>−0.290</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile</td>
<td>0.029</td>
<td>0.024</td>
<td>0.051</td>
<td>0.048</td>
</tr>
<tr>
<td>(median)</td>
<td>0.114</td>
<td>0.114</td>
<td>0.127</td>
<td>0.123</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.188</td>
<td>0.203</td>
<td>0.179</td>
<td>0.187</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.227</td>
<td>0.240</td>
<td>0.235</td>
<td>0.241</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.380</td>
<td>0.430</td>
<td>0.408</td>
<td>0.361</td>
</tr>
</tbody>
</table>

Table 2.6 summarizes moments of the this point progressivity measure across all countries for the years 1980 and 2012. In either year, there were (few) countries for which the income tax schedule was regressive at the average income (see the negative numbers at the left tail of the distribution). Moreover, the tax schedule was not progressive at the point of the average income for at least two deciles of the countries, but the tax schedule was highly progressive in the right tale of the distribution. In the average country, the point progressivity at the average income increased by almost ten percent between 1980 and 2012 (bearing in mind that the number of countries increased over that time span), no matter of whether we exclude or include social security contributions.
in the calculations of $EMTR(\omega_{it})$ and $EATR(\omega_{it})$. Figure 2.7 illustrates the geography of point (a) 1980 (b) 2012

Figure 2.7: POINT PROGRESSIVITY MEASURE EXCLUDING SSC

progressivity excluding SSC by way of maps for the two considered years. It is noteworthy that those countries which featured a very low point progressivity in 1980 were also the ones that reduced it the most since the 1980s. For instance, this is true for Russia in 2012 relative to the Soviet Union in 1980 as well as for some of the South American countries. The point progressivity was highest in North America by 2012, which also had increased it dramatically since 1980. Large increases in point progressivity at the average income were also recorded in many of the African countries, while many of the South American economies reduced it over the considered time span. Given

Table 2.7: SUMMARY STATISTICS: GINIS AND PROGRESSIVITY INDICES

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th></th>
<th>2012</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Gini^{bt}$</td>
<td>$Gini^{at}$</td>
<td>$\Delta$</td>
<td>$Gini^{bt}$</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.199</td>
<td>0.154</td>
<td>-0.168</td>
<td>0.253</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.310</td>
<td>0.255</td>
<td>-0.120</td>
<td>0.332</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.342</td>
<td>0.283</td>
<td>-0.076</td>
<td>0.347</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.386</td>
<td>0.322</td>
<td>-0.075</td>
<td>0.389</td>
</tr>
<tr>
<td>50th percentile</td>
<td>0.424</td>
<td>0.377</td>
<td>-0.042</td>
<td>0.440</td>
</tr>
<tr>
<td>(median)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.474</td>
<td>0.424</td>
<td>-0.031</td>
<td>0.484</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.529</td>
<td>0.479</td>
<td>-0.040</td>
<td>0.527</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.563</td>
<td>0.528</td>
<td>-0.020</td>
<td>0.543</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.728</td>
<td>0.715</td>
<td>0.009</td>
<td>0.688</td>
</tr>
<tr>
<td>Mean</td>
<td>0.431</td>
<td>0.380</td>
<td>-0.050</td>
<td>0.438</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>0.080</td>
<td>0.082</td>
<td>0.038</td>
<td>0.071</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>248</td>
</tr>
</tbody>
</table>

the wealth in tax information, we can calculate a host of other progressivity measures that take the complete labor income tax code into consideration. An important example of such measures is the difference ($\Delta$) in the Gini coefficients for after-tax (superscript $at$) and before-tax (superscript $bt$)
bt) incomes: $\Delta = Gini^{at} - Gini^{bt}$\textsuperscript{10} With certain types of functional forms of the gross income distribution – in particular, a single-parameter Pareto or a log-normal distribution – the Gini coefficient on gross income in conjunction with information on average incomes is informative on all percentiles of the distribution. Assuming such a form, one can apply the tax calculators collected in this paper for every year to gauge the percentiles of the distribution of incomes before and after employee-borne taxes and SSC. We calculate the after-tax Gini based on the assumptions of a Pareto distribution such that a larger negative difference, $\Delta = Gini^{at} - Gini^{bt}$, indicates a bigger redistributive effect of the income tax code (without considering actual redistributions via family allowances or welfare payments). Table\textsuperscript{2.7} indicates that, both for the median and the average country in the sample, the $\Delta$ in 1980 and in 2012 were negative, suggesting that, as expected, income taxes were redistributive. However, the measure also suggest that some countries (in 1980 more so than in 2012) ran regressive income tax systems (positive values of $\Delta$). Moreover, the numbers in the table suggest that the degree of redistribution has declined for economies below the median (those who tended to redistribute more). In Figure\textsuperscript{2.9} we plot the difference in the before- and after-tax Gini coefficients, $\Delta$, against the before-tax Gini coefficient, $Gini^{bt}$. Overall no strong pattern emerges, implying that fairly equal countries are not necessarily those with strictly more redistributive tax systems. In fact, there is a slightly negative trend both in 1980 and 2012, whereby less equal societies became more redistributive (perhaps in an attempt to remedy the strong inequality in incomes) than more equal ones. While more equal societies generally are slightly less redistributive, some economies are even found to have more unequal after-tax distributions than

\textsuperscript{10}Alternatively, one could calculate the progressivity indices by Suits (1977) or Kakwani (1977). We have done so, but suppress them here for the sake of brevity. After all, $\Delta$ is a measure which most readers will find relatively easy to interpret. All three measures, the difference in after-tax and before-tax Gini coefficients for income inequality, $\Delta$, and Suits’ as well as Kakwani’s indices, illustrate the relationship between tax progressivity and the income distribution (see Formby, Seaks and Smith, 1981). The Suits index takes the distribution of gross incomes as constant, while the Kakwani index seeks to illustrate the effect of the tax system on the income distribution. In our calculations of these indices, we excluded SSC or cash support of families, and focused solely on the impact of taxes on the after-tax income distribution.
before taxes. This has in fact worsened from 1980 to 2012, with more countries producing more inequality after taxes.

Lastly, Figure 2.10 plots the global average EATR +/- one standard deviation for five multiples of the average wage (denoted $\bar{w}$) over time, providing additional insights into the development of the taxation of wages. While the EATRs for 20% to 200% of the average wage aligned quite closely, five times the average wage was taxed at significantly higher rates than even twice the average wage. This bunching was broken up over time – tax rates spaced more evenly and the bands of their respective standard errors narrowed.

Specific provisions for spouses and families and comparisons across household types

There are three possibilities for the assessment of taxation for spouses or households: one where joint assessment is mandatory, one where joint assessment is optional (so that households can
choose the option with the least financial strain), and one where household members are generally separately assessed. Clearly, with a progressive tax system households would always prefer separate and optionally-joint treatment over mandatory joint treatment.

Figure 2.11 indicates that separate accounting was dominant in 1980 and was on the rise since then up until 2012. Hence, if anything, a second earner’s (typically a spouse’s) treatment was more favorable – and fairer – in 2012 than in 1980 in the average economy on the globe. The latter also suggests that on average countries tended to eliminate disincentives for working spouses.

Some countries instituted specific tax schedules or additional deductions for married couples, which may or may not go hand in hand with mandatory joint assessment.

Therefore the separate tax schedules and additional deductions are in place to mitigate the financial burden joint assessment and reduce the disincentives to work for the lower-income party in a couple and the tax-induced disincentives towards marriage with joint filing in progressive income tax systems.

Figure 2.12 illustrates where such specific tax provisions for spouses and families had been used in 1980 and 2012, indicating that most of the changes between those years took place on the African

---

11 For example, for several years the U.S. had different tax schedules for married, separate filers and married, joint filers.
Table 2.8: Summary statistics: $\tau$ for married 1-earner, married household with 2 children

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EATR</td>
<td>EMTR</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>1.373</td>
<td>6.000</td>
</tr>
<tr>
<td>75th percentile</td>
<td>8.604</td>
<td>20.000</td>
</tr>
<tr>
<td>90th percentile</td>
<td>17.485</td>
<td>30.750</td>
</tr>
<tr>
<td>95th percentile</td>
<td>25.501</td>
<td>35.480</td>
</tr>
<tr>
<td>Maximum</td>
<td>44.215</td>
<td>60.000</td>
</tr>
<tr>
<td>Mean</td>
<td>5.805</td>
<td>11.207</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>8.683</td>
<td>13.571</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
</tr>
</tbody>
</table>

continent. Table 2.8 summarizes the moments in the distribution of the effective average and marginal tax rate for 1980 and 2012 for average-income-earning, single-earner, married households with two children across countries. The table suggests that, in the median country, tax rates for this household archetype almost doubled, increased much less so on average and even decreased at the top of the distribution over the considered time span.

(a) EATR 1980

(b) EATR 2012

(c) EMTR 1980

(d) EMTR 2012

Figure 2.13: Tax rate for married, 1-earner household with 2 children (average income)

Figure 2.13 illustrates the geographical distribution of these tax rates in 1980 and 2012. The figure suggests that EATRs for average-income, single-earner, married households with two children have
declined relative to other countries in the U.S., Australia, and South America, while they increased across Africa and Europe.

Table 2.9: Summary statistics: Point progressivity for married, 1-earner household with 2 children

<table>
<thead>
<tr>
<th></th>
<th>1980 excl. SSC</th>
<th>1980 incl. SSC</th>
<th>2012 excl. SSC</th>
<th>2012 incl. SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>−0.059</td>
<td>−0.402</td>
<td>−0.138</td>
<td>−0.250</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.006</td>
<td>0.000</td>
<td>−0.047</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>−0.025</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile</td>
<td>0.002</td>
<td>0.000</td>
<td>0.030</td>
<td>0.030</td>
</tr>
<tr>
<td>(median)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.099</td>
<td>0.094</td>
<td>0.129</td>
<td>0.134</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.184</td>
<td>0.185</td>
<td>0.168</td>
<td>0.179</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.232</td>
<td>0.250</td>
<td>0.222</td>
<td>0.233</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.396</td>
<td>0.420</td>
<td>0.420</td>
<td>0.406</td>
</tr>
</tbody>
</table>

Table 2.9 summarizes moments of the point progressivity as defined in (2.1) for married, single-earner households with two children for 1980 and 2012, excluding and including social security contributions. Consistent with the insights from the earlier results, we see that the point progressivity has risen in the median country, risen much less so in the average country and has come down at the top. In the lower tail of the distribution, the degree of point regressivity has declined quite substantially. While the previous results of this subsection are concerned with the tax rules governing families, the remainder of this section addresses monetary support of households with children and non-working spouses. We focus solely on untargeted assistance measures and exclude measures such as school subsidies or heating and nutrition assistance. Figure 2.14 suggests that the number of countries which include family allowance systems has increased substantially between 1980 and 2012, particularly in South America, Africa, and Asia. For extensive analysis of this development, see Egger, Radulescu and Strecker (2016).
Table 2.10: Summary statistics: Assistance share - married 1-earner, 2 children

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>(median)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.988</td>
<td>3.937</td>
</tr>
<tr>
<td>90th percentile</td>
<td>9.756</td>
<td>9.595</td>
</tr>
<tr>
<td>95th percentile</td>
<td>16.666</td>
<td>14.996</td>
</tr>
<tr>
<td>Maximum</td>
<td>84.434</td>
<td>88.743</td>
</tr>
<tr>
<td>Mean</td>
<td>2.945</td>
<td>3.439</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>7.957</td>
<td>9.556</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>248</td>
</tr>
</tbody>
</table>

Table 2.10 suggests that the assistance share for married, average-income, single-earner households with two children has increased quite substantially between 1980 and 2012. Yet, more than 50 percent of the countries did not grant any assistance for married, average-income, single-earner households with two children even in 2012. The financial support in total household income for single-earner families earning the average wage and having two children ranges from zero to almost 89% in 2012. Where the share is zero but a system is in place, the system on allowances is generally capped according to household income and the representative household has earned-out of the system, the allowance is only granted for children below the chosen ages in our household type, or only to families with more children than are included in our representative household. Overall, the share of assistance has decreased across the globe. This could be due to a reduction (or non-indexing) of the upper bounds for assistance or due to increasing ex-ante wages before taxation.

(a) Assistance share in 1980

(b) Assistance share in 2012

Figure 2.15: Family assistance share in total household income

Figure 2.15 documents the main reason for the increase in average assistance shares between 1980 and 2012 in Table 2.10: more countries granted any assistance and those countries which had granted one in 1980 have increased it.
2.2 Some insights on the drivers of income-tax-system characteristics in the data

Table 2.11: Summary statistics: Additional regression variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min</th>
<th>5th</th>
<th>10th</th>
<th>25th</th>
<th>Med</th>
<th>75th</th>
<th>90th</th>
<th>95th</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depend</td>
<td>13.343</td>
<td>18.517</td>
<td>21.257</td>
<td>28.197</td>
<td>51.635</td>
<td>73.895</td>
<td>84.791</td>
<td>89.121</td>
<td>108.763</td>
<td>52.177</td>
<td>24.270</td>
<td>4.537</td>
</tr>
<tr>
<td>LFPart</td>
<td>11.473</td>
<td>45.800</td>
<td>50.200</td>
<td>58.500</td>
<td>66.437</td>
<td>73.400</td>
<td>80.100</td>
<td>83.600</td>
<td>94.603</td>
<td>65.644</td>
<td>11.542</td>
<td>4.537</td>
</tr>
<tr>
<td>ln(Fort)</td>
<td>−0.117</td>
<td>0.285</td>
<td>0.378</td>
<td>0.610</td>
<td>1.071</td>
<td>1.603</td>
<td>1.834</td>
<td>1.934</td>
<td>2.222</td>
<td>1.999</td>
<td>0.546</td>
<td>4.537</td>
</tr>
<tr>
<td>TotalExp</td>
<td>18.300</td>
<td>79.599</td>
<td>88.142</td>
<td>96.967</td>
<td>102.486</td>
<td>109.307</td>
<td>118.061</td>
<td>126.893</td>
<td>333.600</td>
<td>103.988</td>
<td>20.225</td>
<td>4.537</td>
</tr>
<tr>
<td>PrimEd</td>
<td>0.000</td>
<td>5.401</td>
<td>8.097</td>
<td>15.217</td>
<td>25.936</td>
<td>38.564</td>
<td>50.279</td>
<td>57.149</td>
<td>82.219</td>
<td>27.746</td>
<td>16.044</td>
<td>4.537</td>
</tr>
<tr>
<td>TertEd</td>
<td>0.000</td>
<td>0.394</td>
<td>0.682</td>
<td>2.053</td>
<td>6.292</td>
<td>12.929</td>
<td>20.107</td>
<td>24.907</td>
<td>49.526</td>
<td>6.842</td>
<td>8.087</td>
<td>4.537</td>
</tr>
<tr>
<td>Align</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.826</td>
<td>0.379</td>
<td>4.537</td>
</tr>
<tr>
<td>Executive</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.257</td>
<td>0.437</td>
<td>4.537</td>
</tr>
<tr>
<td>Legislative</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.332</td>
<td>0.471</td>
<td>4.537</td>
</tr>
<tr>
<td>Right</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.256</td>
<td>0.436</td>
<td>4.537</td>
</tr>
<tr>
<td>Left</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>0.324</td>
<td>0.468</td>
<td>4.537</td>
</tr>
</tbody>
</table>

The list includes the origin and sources of the relevant independent variables. In the RoW category, R and B denote rates and binary indicators, respectively. For a list of sources, see Table 2.12.

The goal of this section is to provide preliminary regression analysis to shed some light on the drivers of income tax system characteristics. Since the main purpose of the paper is to introduce the database, the content of this section is mainly meant to inspire future research. In general, we do not claim to identify any causal relationship in this section, but we focus on conditional correlations by way of simple regression analysis using panel data on tax system characteristics and one-year-lagged (and, alternatively, five-year-lagged) explanatory variables. In contrast to the previous sections, we do not confine the regression analysis to just two years, 1980 and 2012, but we use all years between 1980 and 2012.

Table 2.12 introduces the covariates and their acronyms (and also the source of the data) used as explanatory variables in this section, and Table 2.11 provides summary statistics for them. The

12 This is useful to those readers, who are interested in comparing the relative importance of covariates by considering the standard deviations of the covariates to normalize the parameter point estimates reported.
### Table 2.12: Additional regression variables: Description and source

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depend</td>
<td>Dependency share, measured between 0-100% and calculated as follows: ( \text{Depend} = \frac{\text{Pop}(0-15)+\text{Population}(65+)}{\text{Population}(15-65)} )</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources.</td>
</tr>
<tr>
<td>LFPart</td>
<td>Labor participation rate in the working age population.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>Population in thousands in logs.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>Gross domestic product per capita in logs.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>ln(Fert)</td>
<td>Fertility rate measured as average number of children per woman in logs.</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources.</td>
</tr>
<tr>
<td>ln(Wage)</td>
<td>Average labor income in USD in logs.</td>
<td>ILOstat and its predecessor LABORsta.</td>
</tr>
<tr>
<td>TotalExp</td>
<td>Total national expenditure as share of GDP.</td>
<td>United Nations Statistical Office.</td>
</tr>
<tr>
<td>PrimEd</td>
<td>Share of the population with completed primary education. Data in 5-year intervals, intermittent years imputed by country-wise regression on year, year², and year³.</td>
<td>Barro and Lee (2010).</td>
</tr>
<tr>
<td>SecEd</td>
<td>Share of the population with completed secondary education. Data in 5-year intervals, intermittent years imputed by country-wise regression on year, year², and year³.</td>
<td>Barro and Lee (2010).</td>
</tr>
<tr>
<td>TertEd</td>
<td>Share of the population with completed tertiary education. Data in 5-year intervals, intermittent years imputed by country-wise regression on year, year², and year³.</td>
<td>Barro and Lee (2010).</td>
</tr>
<tr>
<td>Align</td>
<td>Binary indicator for politically aligned executive and legislative branches in government. 1 if the legislature (both chambers in the case of bicameral legislatures) and the executive are both right-wing or both left-wing.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Executive:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Binary indicator for right-wing executive branch of government.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Left</td>
<td>Binary indicator for left-wing executive branch of government.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Legislative:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Binary indicator for right-wing legislative branch of government. In case of bicameral legislature, only 1 if both chambers are right-wing majority-controlled.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Left</td>
<td>Binary indicator for left-wing legislative branch of government. In case of bicameral legislature, only 1 if both chambers are left-wing majority-controlled.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>RoW</td>
<td>Using row-sum normalized population-weighted distances for a generic country ( i ) to any country ( j ), ( W_{ij} ), we create population-distance-weighted, external, country-year-specific averages of a generic dependent variable in ( j ) and ( t ), ( \text{tax}<em>{jt} ), by computing ( \sum</em>{j \neq i} W_{ij} \text{tax}_{jt} ).</td>
<td>Population-weighted distances from CEPII.</td>
</tr>
</tbody>
</table>

This list includes the origin and sources of the relevant dependent and independent variables. For a summary statistics, see Table 2.11. The analysis includes the following countries: Afghanistan, Albania, Algeria, Argentina, Armenia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei, Bulgaria, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Congo, Costa Rica, Cote d’Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hong Kong, China, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, South Korea, Kuwait, Kyrgyz Republic, Laos, Latvia, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.
covariates capture economic characteristics (e.g., country size through population; gross per-capita income through GDP per capita – measuring also income components beyond wage income; gross wages per employee; fertility and education rates; etc.) as well as political characteristics (such as the right-wing versus left-wing orientation of the executive versus the legislative).

For the sake of brevity, we focus on the following features and organize this section as follows: (i) binary indicators such as the presence of social security system contributions payable by employers versus employees, as well as the average contribution rates payable on behalf of and by an average worker; (ii) the presence of untargeted family assistance payments and the rate of such assistance paid for married, single-earner families with two children; (iii) the top statutory tax rate as well as the number of kinks in the statutory tax schedule; and (iv) the total tax bill paid by an average employee and its composition.

In each subsection, we will present tables with the following horizontal and vertical structure. Vertically, the tables contain an upper block with the regression coefficients and standard errors, and a lower block with few characteristics of the econometric models estimated. Horizontally, we put covariate (determinant) labels in the first column and then coefficients (with standard errors underneath) for five pairs of specifications to the right of it. These five pairs of specifications use the covariates alternatively with one annual lag ($t - 1$) or five annual lags ($t - 5$). Each of these pairs of specifications uses one specification labelled (1), which is more parsimonious than the other a more inclusive version, labelled (2). We will generally refer to the parameter on $RoW$, the lagged weighted value of the dependent variable, as a spillover (or contagion) parameter. If that parameter is positive, it means that countries will adopt a certain feature of the income tax system more likely or to a larger degree if large neighboring countries did so in the years prior.

### 2.2.1 Top rate and number of kinks in the statutory personal income tax schedule

This subsection considers effects on features of countries’ statutory personal income tax codes by way of the top (marginal) tax rates and the number of kinks in the schedule (as one measure of the nature of tax progressivity). We do not claim that the number of kinks is a measure of progressivity per se; however, (except for systems with a flat tax) a larger number of kinks points to a greater smoothness of the tax progression and greater complexity of the system. Accordingly, it may be interesting to study this characteristic here and elsewhere in the future, as it may be linked to tax avoidance and effort.
Table 2.13: Fixed Effects Regressions on Statutory Tax Instruments

<table>
<thead>
<tr>
<th></th>
<th>Top Statutory Income Tax Rate</th>
<th>Number of Kinks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(t - 1)</td>
<td>(t - 5)</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Depend</td>
<td>0.102***</td>
<td>0.192***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.022)</td>
</tr>
<tr>
<td></td>
<td>0.192***</td>
<td>0.177***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>LFPart</td>
<td>0.004</td>
<td>0.001**</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td></td>
<td>0.074**</td>
<td>0.073**</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>-3.287**</td>
<td>-3.658**</td>
</tr>
<tr>
<td></td>
<td>(1.269)</td>
<td>(1.340)</td>
</tr>
<tr>
<td></td>
<td>-0.327**</td>
<td>-0.346**</td>
</tr>
<tr>
<td></td>
<td>(0.725)</td>
<td>(0.742)</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>-1.650**</td>
<td>-2.116**</td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.076)</td>
</tr>
<tr>
<td></td>
<td>-1.849**</td>
<td>-1.823</td>
</tr>
<tr>
<td>ln(Pop)X</td>
<td>0.209**</td>
<td>0.246**</td>
</tr>
<tr>
<td></td>
<td>(0.870)</td>
<td>(1.569)</td>
</tr>
<tr>
<td>ln(GDPc)X</td>
<td>-0.355**</td>
<td>-0.467**</td>
</tr>
<tr>
<td></td>
<td>(0.127)</td>
<td>(0.129)</td>
</tr>
<tr>
<td>TotalExp</td>
<td>-0.018**</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>PrimEd</td>
<td>-0.023</td>
<td>-0.078**</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>SecEd</td>
<td>-0.026</td>
<td>-0.061*</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>TertEd</td>
<td>-0.067*</td>
<td>-0.246**</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.079)</td>
</tr>
<tr>
<td>RoW</td>
<td>-112.798***</td>
<td>-112.131***</td>
</tr>
<tr>
<td>Align</td>
<td>-0.152</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.253)</td>
<td>(0.466)</td>
</tr>
<tr>
<td>Executive: Right</td>
<td>-0.319</td>
<td>-0.140</td>
</tr>
<tr>
<td></td>
<td>(0.252)</td>
<td>(0.252)</td>
</tr>
<tr>
<td>Left</td>
<td>-0.508</td>
<td>-3.280**</td>
</tr>
<tr>
<td></td>
<td>(0.628)</td>
<td>(1.112)</td>
</tr>
<tr>
<td>Legislative: Right</td>
<td>0.350</td>
<td>0.764</td>
</tr>
<tr>
<td></td>
<td>(0.519)</td>
<td>(0.936)</td>
</tr>
<tr>
<td>Left</td>
<td>0.694</td>
<td>3.908***</td>
</tr>
<tr>
<td></td>
<td>(0.615)</td>
<td>(1.098)</td>
</tr>
<tr>
<td>Constant</td>
<td>3,298.068***</td>
<td>3,288.296***</td>
</tr>
<tr>
<td></td>
<td>(28.511)</td>
<td>(29.114)</td>
</tr>
</tbody>
</table>

\(R^2\): 0.922 0.864 0.886 0.321 0.333

The dependent variable is based on a binary indicator for the data presented in Sections 2.1.1 and 2.1.1. Standard errors in parentheses. **\(p < 0.01\); **\(p < 0.05\); *\(p < 0.1\). For brevity, the year fixed effects are suppressed.

Table 2.13 suggests that the following factors are important for considering effects on top (marginal) statutory tax rates. First, there is an interesting distinction between effects of per-capita income (which is largely composed of non-wage income) and average wages: countries whose per-capita income rises tend to raise top marginal tax rates, while ones where wages rise tend to reduce them (presumably to partially accommodate the detrimental consequences of cold progression on high-income earners). This is consistent with the finding that an increase in the share of people with higher education generally leads to a reduction of top tax rates, at least in a few years time. Countries with rising dependency ratios tend to raise top tax rates (consistent with government needing to lean more heavily on fewer tax payers), while increasing fertility rates tend to reduce top tax rates (consistent with the government being able lean more heavily on future tax payers rather than current ones). Left-wing executives who gain power tend to reduce top income tax rates, while left-wing legislators tend to increase them. We find evidence of negative spillovers conditional on fixed effects and the covariates. Hence, countries tend to reduce their top marginal tax rates if their neighbors previously raised them.
Countries, whose dependency ratios rise, not only raise their top tax rates but also tend to increase the number of kinks in their system (enabling their governments to not only lean on high-income but also on medium-income earners). As with other features of taxation, countries that grow larger and richer in terms of per-capita income tend to raise the number of kinks in the tax schedule. More people with higher education generally lead to fewer kinks in the tax schedule. And, as with the other personal income tax instruments, we see negative, short-run, cross-country spillovers in the number of kinks.

2.2.2 Total tax bill paid by an average employee and its composition

We summarize the insights regarding changes in the overall level of the tax bill for an average earner in Table 2.14 as well as the respective shares contributed by personal income tax payments in a narrow sense and by social security contributions.

The table suggests that countries which grow richer (in terms of per-capita income) and larger (in terms of population) tend to be able to collect larger tax bills (enabling them inter alia to finance a more sophisticated infrastructure in terms of road or railway networks, the public health system, education, etc.). Moreover, countries whose neighbors’ personal income tax bills increase tend to face reductions in their tax bills around the globe (negative spillovers).

Similarly, we identify negative and positive effects on tax bill changes through the increasing power of left-wing legislators and executives, respectively, at least in the medium run. Apart from those effects, we see a reduction in the tax bill collected from the average income earner in the aftermath of an increase in a country’s dependency ratio, labor force participation rate, as well as increases in the educational levels in the population (an effect that is increasing in the long-run).

Tables 2.14 also suggest insights in the setting of the tax and social security shares in the total tax bill. First, countries whose labor participation rate rises tend to see an immediate and medium-run reduction in the share of the average tax bill, which is contributed by personal income tax payments in a narrow sense. In the longer run, we find a similar effect on the share of social security contributions. Second, in the medium-run, right-wing executives tend to increase the tax contribution in the total tax bill, while reducing the social security contributions. Finally, while higher total government expenditures as well as an increase in higher education tend to reduce the contributions of actual personal income tax rates to the income tax bill, if anything, they tend to have the opposite effect on the share attributable to social security contributions. This suggests that expansionary measures in government policy do not tend to be financed by direct increases in income taxation but by other measures.
Table 2.14: Fixed Effects Regressions on (Average) Total Tax Bill and its Components

<table>
<thead>
<tr>
<th>Description</th>
<th>(1)</th>
<th>(2)</th>
<th>(1)</th>
<th>(2)</th>
<th>(1)</th>
<th>(2)</th>
<th>(1)</th>
<th>(2)</th>
<th>(1)</th>
<th>(2)</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depend</td>
<td>0.001</td>
<td>-0.005</td>
<td>-0.060**</td>
<td>-0.071**</td>
<td>-0.006</td>
<td>-0.003</td>
<td>0.002</td>
<td>0.003</td>
<td>-0.025</td>
<td>-0.017</td>
<td>-0.153*</td>
<td>-0.142*</td>
</tr>
<tr>
<td>LFPart</td>
<td>-0.023**</td>
<td>-0.024**</td>
<td>-0.054**</td>
<td>-0.055**</td>
<td>-0.082**</td>
<td>-0.085**</td>
<td>-0.073</td>
<td>-0.072</td>
<td>0.014</td>
<td>0.013</td>
<td>-0.094**</td>
<td>-0.095**</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>-2.381***</td>
<td>-2.946***</td>
<td>-5.999***</td>
<td>-6.370***</td>
<td>0.293</td>
<td>0.412</td>
<td>-2.333</td>
<td>-3.987</td>
<td>0.121</td>
<td>0.278</td>
<td>8.407***</td>
<td>9.359***</td>
</tr>
<tr>
<td>ln(Pop)/X</td>
<td>0.221***</td>
<td>0.282***</td>
<td>0.492***</td>
<td>0.660***</td>
<td>-0.198</td>
<td>-0.141</td>
<td>0.018</td>
<td>0.187</td>
<td>0.259</td>
<td>0.238</td>
<td>-0.240</td>
<td>-0.319</td>
</tr>
<tr>
<td>ln(GDPc)/X</td>
<td>0.065 (0.066)</td>
<td>0.116 (0.118)</td>
<td>0.184 (0.189)</td>
<td>0.326 (0.333)</td>
<td>-0.169 (0.174)</td>
<td>0.311 (0.318)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(Fert)</td>
<td>-0.306</td>
<td>-0.451</td>
<td>-1.669</td>
<td>-1.817</td>
<td>0.472</td>
<td>0.432</td>
<td>-3.220</td>
<td>-3.096</td>
<td>-1.291</td>
<td>-1.219</td>
<td>-0.889</td>
<td>-0.704</td>
</tr>
<tr>
<td>ln(Wage)</td>
<td>-0.077</td>
<td>-0.020</td>
<td>-0.064</td>
<td>0.052</td>
<td>0.474</td>
<td>0.560*</td>
<td>0.091</td>
<td>0.218</td>
<td>-0.822***</td>
<td>-0.845***</td>
<td>-1.168***</td>
<td>-1.244***</td>
</tr>
<tr>
<td>TotalExp</td>
<td>-0.014**</td>
<td>-0.007</td>
<td>-0.038**</td>
<td>-0.069***</td>
<td>-0.005</td>
<td>0.032</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PrimEd</td>
<td>-0.014</td>
<td>0.007</td>
<td>-0.012</td>
<td>-0.064</td>
<td>-0.005</td>
<td>0.027</td>
<td>0.036</td>
<td>0.063</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SecEd</td>
<td>-0.029*</td>
<td>-0.082**</td>
<td>-0.005</td>
<td>0.046</td>
<td>0.020</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TextEd</td>
<td>-0.111***</td>
<td>-0.377***</td>
<td>-0.113</td>
<td>-0.467***</td>
<td>0.051</td>
<td>0.196</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Align</td>
<td>0.532**</td>
<td>1.127***</td>
<td>0.093</td>
<td>0.647</td>
<td>0.651</td>
<td>1.014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Executive:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>-0.010</td>
<td>-0.022</td>
<td>0.279</td>
<td>0.440</td>
<td>1.592</td>
<td>1.536</td>
<td>4.719**</td>
<td>4.510**</td>
<td>-0.658</td>
<td>-0.587</td>
<td>-3.228*</td>
<td>-3.089</td>
</tr>
<tr>
<td>Left</td>
<td>0.748</td>
<td>0.704</td>
<td>1.352</td>
<td>1.255</td>
<td>0.075</td>
<td>0.038</td>
<td>2.120</td>
<td>1.994</td>
<td>-0.815</td>
<td>-0.741</td>
<td>-3.390</td>
<td>-3.234</td>
</tr>
<tr>
<td>Legislative:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>0.341</td>
<td>0.332</td>
<td>-0.258</td>
<td>-0.256</td>
<td>0.208</td>
<td>0.197</td>
<td>-2.004</td>
<td>-2.104</td>
<td>-0.412</td>
<td>-0.427</td>
<td>1.159</td>
<td>1.192</td>
</tr>
<tr>
<td>Left</td>
<td>-0.761</td>
<td>-0.757</td>
<td>-2.030</td>
<td>-1.987*</td>
<td>0.101</td>
<td>0.088</td>
<td>-3.300</td>
<td>-3.613</td>
<td>0.518</td>
<td>0.489</td>
<td>3.595</td>
<td>3.684*</td>
</tr>
<tr>
<td>Constant</td>
<td>2.636.104***</td>
<td>2.661.466**</td>
<td>1.051.569***</td>
<td>1.022.677**</td>
<td>2.709.791***</td>
<td>2.718.899***</td>
<td>1.106.741***</td>
<td>1.110.364***</td>
<td>7.203.145***</td>
<td>7.230.136***</td>
<td>3.012.047***</td>
<td>3.005.400***</td>
</tr>
<tr>
<td>R²</td>
<td>0.821</td>
<td>0.770</td>
<td>0.490</td>
<td>0.047</td>
<td>0.489</td>
<td>0.847</td>
<td>0.402</td>
<td>0.346</td>
<td>0.879</td>
<td>0.871</td>
<td>0.420</td>
<td>0.421</td>
</tr>
<tr>
<td>Obs</td>
<td>4,394</td>
<td>4,394</td>
<td>4,382</td>
<td>4,382</td>
<td>4,394</td>
<td>4,394</td>
<td>3,822</td>
<td>3,822</td>
<td>4,394</td>
<td>4,394</td>
<td>3,822</td>
<td>3,822</td>
</tr>
<tr>
<td>Countries</td>
<td>143</td>
<td>145</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
<td>143</td>
</tr>
</tbody>
</table>

The dependent variable is based on a binary indicator for the data presented in Section 2.1. Standard errors in parentheses. *** p < 0.01; ** p < 0.05; * p < 0.1. For brevity, the year fixed effects are suppressed.
2.2.3 Social security

This subsection is devoted to identifying the covariates that are correlated with the presence of social security contributions payable by either the employer or the employee and the rates charged on or on behalf of an average worker. First, we consider a binary indicator capturing whether a country runs social security system that includes employer-borne borne contributions as well as an indicator that captures the presence of employee-borne social security contributions. Second, we consider the rates of social security contributions paid by these parties – employers versus employees for workers earning the average income. For the two binary choice social security system features, we estimate fixed-effects linear probability models. Clearly, these models do not deliver efficient estimates of the response probabilities. However, they provide sufficient information about the most important predictors of these characteristics.

Table 2.15: Fixed Effects Regressions on Employer- and Employee-borne Social Security: Binary Indicators

<table>
<thead>
<tr>
<th>Presence of employer-borne SSC</th>
<th>Presence of employer-borne SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>t = 1</td>
<td>t = 5</td>
</tr>
<tr>
<td>Depend</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) (2)</td>
</tr>
<tr>
<td>LPPart</td>
<td>(0.000) (0.000)</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>−0.016 (0.022)</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>−0.006 (0.022)</td>
</tr>
<tr>
<td>ln(Pop)x</td>
<td>0.001 (0.012)</td>
</tr>
<tr>
<td>ln(GDPc)x</td>
<td>0.001 (0.001)</td>
</tr>
<tr>
<td>ln(Pert)</td>
<td>−0.023 (0.015)</td>
</tr>
<tr>
<td>ln(Wage)</td>
<td>−0.002 (0.002)</td>
</tr>
<tr>
<td>TotalExp</td>
<td>0.000∗ (0.000)</td>
</tr>
<tr>
<td>PrimEd</td>
<td>0.000∗ (0.000)</td>
</tr>
<tr>
<td>SecEd</td>
<td>0.000 (0.000)</td>
</tr>
<tr>
<td>TaxEd</td>
<td>0.000 (0.000)</td>
</tr>
<tr>
<td>RnW</td>
<td>−116.898*** (0.855)</td>
</tr>
<tr>
<td>Align</td>
<td>0.005 (0.004)</td>
</tr>
<tr>
<td>Executive:</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>0.004 (0.009)</td>
</tr>
<tr>
<td>Left</td>
<td>−0.008 (0.011)</td>
</tr>
<tr>
<td>Legislative:</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>−0.005 (0.009)</td>
</tr>
<tr>
<td>Left</td>
<td>0.010 (0.010)</td>
</tr>
<tr>
<td>Constant</td>
<td>110.666*** (0.833)</td>
</tr>
</tbody>
</table>

| R²                            | 0.938                         | 0.925 |
| Obs                           | 4.394                         | 4.394 |
| Countries                     | 143                           | 143   |

The dependent variable is based on a binary indicator for the data presented in Section 2.1.1. Standard errors in parentheses. ** * p < 0.01; ** * p < 0.05; * p < 0.1. For brevity, the year fixed effects are suppressed.

The results for the two binary indicator social security variables are summarized in Table 2.15. This analysis suggests that big changes in social security systems occur rarely: most of the high
explanatory power of the models estimated stems from the country fixed effects. Hence, there is very little change in whether a country adopted employer-borne social security contributions since 1980, and only somewhat more so in whether a country adopted employee-borne social security contributions. The explanatory power of the models appears to be much higher with a shorter lag structure of the covariates, suggesting that, for most covariates, using a one-year time lag is preferable over using higher lags. On a year-to-year basis, cross-country spillovers appear most important among the covariates.

Table 2.16: Fixed Effects Regressions on Employer- and Employee-borne Social Security: Contribution Rates

<table>
<thead>
<tr>
<th></th>
<th>Employer-borne SSC rate</th>
<th>Employee-borne SSC rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t - 1</td>
<td>t - 5</td>
</tr>
<tr>
<td>Depend</td>
<td>-0.046*</td>
<td>-0.042</td>
</tr>
<tr>
<td>LFPart</td>
<td>-0.007</td>
<td>-0.008</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>(0.016) (0.016)</td>
<td>(0.018) (0.018)</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>(1.500) (1.582)</td>
<td>(2.089) (2.220)</td>
</tr>
<tr>
<td>ln(Pop)X</td>
<td>(0.855) (0.876)</td>
<td>(1.185) (1.196)</td>
</tr>
<tr>
<td>ln(GDPc)</td>
<td>(0.987) (0.809)</td>
<td>(0.125) (0.127)</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>(0.150) (0.152)</td>
<td>(0.183) (0.184)</td>
</tr>
<tr>
<td>TotalExp</td>
<td>-0.007</td>
<td>0.003</td>
</tr>
<tr>
<td>PrimEd</td>
<td>0.026</td>
<td>0.096**</td>
</tr>
<tr>
<td>SecEd</td>
<td>-0.022</td>
<td>-0.067**</td>
</tr>
<tr>
<td>TertEd</td>
<td>-0.017</td>
<td>0.042</td>
</tr>
<tr>
<td>RoW</td>
<td>(1.708) (1.736)</td>
<td>(2.051) (2.040)</td>
</tr>
<tr>
<td>Align</td>
<td>0.687**</td>
<td>1.145***</td>
</tr>
<tr>
<td>Executive</td>
<td>(0.299) (0.376)</td>
<td>(0.299) (0.376)</td>
</tr>
<tr>
<td>Right</td>
<td>-1.253**</td>
<td>-1.233**</td>
</tr>
<tr>
<td>Left</td>
<td>(0.621) (0.621)</td>
<td>(0.774) (0.769)</td>
</tr>
<tr>
<td>Legislative</td>
<td>0.831</td>
<td>0.445</td>
</tr>
<tr>
<td>Constant</td>
<td>958.349***</td>
<td>967.963***</td>
</tr>
<tr>
<td>R²</td>
<td>0.649</td>
<td>0.742</td>
</tr>
<tr>
<td>Obs</td>
<td>4.394</td>
<td>4.394</td>
</tr>
<tr>
<td>Countries</td>
<td>143</td>
<td>143</td>
</tr>
</tbody>
</table>

The dependent variable is based on a binary indicator for the data presented in Section 2.13. Standard errors in parentheses. *** p < 0.01; ** p < 0.05; * p < 0.1. For brevity, the year fixed effects are suppressed.

Notice that after 1980, mainly countries that were relatively distant from the OECD (whose members had already employer- and employee-borne social security contributions before 1980) adopted such social security characteristics. The coefficients suggest that country size as well as per-capita income are positively associated with a subsequent adoption of employee-borne components apart from those spillovers.\[13\] Table 2.16 summarizes the parameter estimates when using the two social

---

\[13\] This insight is based on a consideration of the marginal effects of Model (2) for employee-borne social security contributions when measuring the covariates in t - 1 in Table 2.15.
security system contribution rates for employers and employees, respectively, as dependent variables. While there is only little change in the binary social security indicators since 1980 all over the globe, there is significantly more change in the contribution rates. This can be seen from the relatively low explanatory power of models for the contribution rates relative to the explanatory power for binary social security system indicators.

The most important insights from this analysis is generally: (i) countries which grow larger and richer (in terms of per-capita income) tend to raise their social security contributions levied from both employers and employees. (ii) Countries where right-wing executives come to power tend to reduce employer-borne and to raise employee-borne social security contributions, and even where left-wing executives come to power, they tend to raise employee-borne contributions (relative to centrist governments). (ii) However, countries with new left-wing legislative majorities tend to reduce employee-borne contributions to social security systems. As with the binary indicators above, there are negative spillovers in the rates paid by both employers and employees across countries for the reasons previously mentioned.

2.2.4 Untargeted family assistance

This subsection is devoted to studying two features reflecting the presence (binary) and extent (rate) of untargeted family allowances around the globe. The first four columns in Table 2.17 present the results on the binary indicator of the presence of family assistance on the left-hand side of an econometric model, which is unity in case that a country has untargeted family allowances in place in a given year and zero otherwise. We also employ the same set of covariates.

A comparison of the explanatory power of the models in this tables with the results for the two binary social security indicators in Table 2.15 – given that the covariates do not appear to contribute much towards explaining the presence of family allowances than towards explaining the presence of social security provisions – suggests that there is only slightly more change in the global presence of family allowances than in the global presence of contributory social security systems. As with social security contributions, countries that grow in size or per-capita income are more likely to adopt family assistance provisions. If left-wing executives come to power, they tend to introduce family allowances into the welfare system, while left-wing legislative majorities tend to exclude them. For the same reasons as with social security provisions, there are negative spillovers among neighboring countries: fast-growing economies which are relatively distant from the OECD were more likely to introduce family allowances since 1980 nearer ones.
Regarding family allowance shares in household income, we may summarize the insights gained from an inspection of the estimates in the last four columns in Table 2.17. First, allowance rates are mainly raised in countries where the average wage income faster. Moreover, there is a more clear-cut divide between the effects flowing from whether right-wing versus left-wing executives versus legislators gain power. However, the qualitative insights regarding how political orientation affects family allowance rates versus the presence of family allowances are altogether quite similar.

### 2.3 Conclusions

This paper introduces a novel database which covers detailed features of income taxation systems all over the world. In fact, the database provides a previously unprecedented level of detail regarding the taxation of labor income and including social security contributions for 12 household types (delineated by the number of household members and family status), permitting the calculation of...
effective marginal and average tax rates for all household types and incomes of zero to 1 million USD in 100-USD intervals.

The database will permit future research on the details of income taxation systems and the distribution of tax rates, especially in combination with information on income distributions around the world. In particular, such research may be of particular interest to political scientists or economists studying the determinants of states and changes of income tax systems as well as their consequences on political and economic outcomes.
### 2.A EATR and EMTR: Other Household Archetypes

Table 2.18: Summary statistics: EATR for household types

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>1</td>
<td>3</td>
<td>none</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>2.371</td>
<td>1.676</td>
<td>0.411</td>
<td>2.999</td>
<td>2.033</td>
<td>1.878</td>
<td>1.380</td>
<td>2.486</td>
<td>1.773</td>
</tr>
<tr>
<td>90th percentile</td>
<td>18.913</td>
<td>18.120</td>
<td>17.000</td>
<td>19.629</td>
<td>18.927</td>
<td>18.676</td>
<td>18.359</td>
<td>18.913</td>
<td>18.049</td>
</tr>
<tr>
<td>Maximum</td>
<td>44.586</td>
<td>44.401</td>
<td>43.843</td>
<td>44.740</td>
<td>44.617</td>
<td>44.493</td>
<td>44.245</td>
<td>44.586</td>
<td>44.215</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Maximum</td>
<td>36.830</td>
<td>36.830</td>
<td>36.830</td>
<td>38.545</td>
<td>38.545</td>
<td>38.545</td>
<td>38.545</td>
<td>36.830</td>
<td>36.830</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>7.961</td>
<td>7.719</td>
<td>7.430</td>
<td>7.805</td>
<td>7.577</td>
<td>7.477</td>
<td>7.226</td>
<td>7.886</td>
<td>7.676</td>
</tr>
<tr>
<td>Obs</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
</tr>
</tbody>
</table>
(a) 1-earner married household, no children
(b) 1-earner married household, 1 child
(c) 1-earner married household, 3 children
(d) 2-earner married household, no children
(e) 2-earner married household, 1 child
(f) 2-earner married household, 2 children
(g) 2-earner married household, 3 children
(h) Single mother, 1 child
(i) Single mother, 2 children
(j) Single mother, 3 children

Figure 2.16: EATR in 1980
1. EARNER MARRIED HOUSEHOLD, NO CHILDREN
2. EARNER MARRIED HOUSEHOLD, 1 CHILD
3. EARNER MARRIED HOUSEHOLD, 3 CHILDREN
4. 2-EARNER MARRIED HOUSEHOLD, NO CHILDREN
5. 2-EARNER MARRIED HOUSEHOLD, 1 CHILD
6. 2-EARNER MARRIED HOUSEHOLD, 2 CHILDREN
7. 2-EARNER MARRIED HOUSEHOLD, 3 CHILDREN
8. SINGLE MOTHER, 1 CHILD
9. SINGLE MOTHER, 2 CHILDREN
10. SINGLE MOTHER, 3 CHILDREN

Figure 2.17: EATR in 2012
### Table 2.19: Summary statistics: EMTR for household types

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>8.000</td>
<td>6.000</td>
<td>5.125</td>
<td>8.000</td>
<td>7.827</td>
<td>6.733</td>
<td>6.000</td>
<td>9.500</td>
<td>7.000</td>
</tr>
<tr>
<td>75th percentile</td>
<td>20.000</td>
<td>20.000</td>
<td>19.371</td>
<td>20.000</td>
<td>18.733</td>
<td>18.599</td>
<td>20.000</td>
<td>20.000</td>
<td>20.000</td>
</tr>
<tr>
<td>90th percentile</td>
<td>30.750</td>
<td>30.750</td>
<td>30.000</td>
<td>30.000</td>
<td>30.000</td>
<td>30.000</td>
<td>30.000</td>
<td>32.000</td>
<td>32.000</td>
</tr>
<tr>
<td>95th percentile</td>
<td>36.000</td>
<td>35.480</td>
<td>35.314</td>
<td>40.000</td>
<td>36.104</td>
<td>35.480</td>
<td>39.160</td>
<td>36.000</td>
<td>35.314</td>
</tr>
<tr>
<td>Maximum</td>
<td>62.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
<td>60.000</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
</tbody>
</table>

**1980**

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
</tr>
<tr>
<td>90th percentile</td>
<td>30.000</td>
<td>30.000</td>
<td>30.000</td>
<td>28.276</td>
<td>28.000</td>
<td>28.000</td>
<td>28.000</td>
<td>30.000</td>
<td>30.000</td>
</tr>
<tr>
<td>95th percentile</td>
<td>32.500</td>
<td>32.500</td>
<td>32.500</td>
<td>35.000</td>
<td>33.083</td>
<td>33.083</td>
<td>33.083</td>
<td>33.330</td>
<td>33.330</td>
</tr>
<tr>
<td>Maximum</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>46.667</td>
<td>46.667</td>
<td>46.667</td>
<td>46.667</td>
<td>50.000</td>
<td>50.000</td>
</tr>
<tr>
<td>Obs</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
</tr>
</tbody>
</table>
Figure 2.18: EMTR in 1980
Figure 2.19: EMTR in 2012
### 2.B Social Security: Other Household Archetypes

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1980</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>5.000</td>
<td>5.000</td>
<td>5.000</td>
<td>5.000</td>
<td>5.110</td>
<td>5.110</td>
<td>5.110</td>
<td>5.000</td>
<td>5.000</td>
<td>5.000</td>
</tr>
<tr>
<td>95th percentile</td>
<td>38.076</td>
<td>38.076</td>
<td>38.076</td>
<td>37.300</td>
<td>37.300</td>
<td>37.300</td>
<td>37.300</td>
<td>37.300</td>
<td>37.300</td>
<td>37.300</td>
</tr>
<tr>
<td>Maximum</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
<td>50.000</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>11.854</td>
<td>11.863</td>
<td>11.862</td>
<td>11.632</td>
<td>11.639</td>
<td>11.638</td>
<td>11.638</td>
<td>11.673</td>
<td>11.672</td>
<td>11.673</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
</tbody>
</table>

|          | 2012    |         |         |         |         |         |         |             |             |             |
| Minimum        | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000       | 0.000       | 0.000       |
| 5th percentile | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000       | 0.000       | 0.000       |
| 10th percentile| 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000       | 0.000       | 0.000       |
| 90th percentile| 29.900  | 29.900  | 29.900  | 29.400  | 29.400  | 29.400  | 29.400  | 29.400      | 29.400      | 29.400      |
| 95th percentile| 36.000  | 36.000  | 36.000  | 35.283  | 35.283  | 35.283  | 35.283  | 35.283      | 36.000      | 36.000      |
| Maximum        | 71.500  | 71.500  | 71.500  | 71.500  | 71.500  | 71.500  | 71.500  | 71.500      | 71.500      | 71.500      |
| Obs            | 248     | 248     | 248     | 248     | 248     | 248     | 248     | 248         | 248         | 248         |
Figure 2.20: Employer-borne social security in 1980
Figure 2.21: Employer-borne social security in 2012
Table 2.21: Summary statistics: Employee-borne social security rates for household types

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>1</td>
<td>3</td>
<td>none</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1980</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>2.060</td>
<td>2.060</td>
<td>2.060</td>
<td>2.086</td>
<td>2.086</td>
<td>2.086</td>
<td>2.086</td>
<td>2.000</td>
<td>2.000</td>
</tr>
<tr>
<td>Maximum</td>
<td>32.623</td>
<td>32.623</td>
<td>32.623</td>
<td>30.392</td>
<td>30.392</td>
<td>30.392</td>
<td>30.392</td>
<td>30.392</td>
<td>30.000</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>5.672</td>
<td>5.676</td>
<td>5.676</td>
<td>5.392</td>
<td>5.394</td>
<td>5.394</td>
<td>5.394</td>
<td>5.394</td>
<td>5.377</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>1.600</td>
<td>1.600</td>
<td>1.600</td>
<td>1.602</td>
<td>1.602</td>
<td>1.602</td>
<td>1.602</td>
<td>1.602</td>
<td>1.600</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>5.225</td>
<td>5.225</td>
<td>5.225</td>
<td>5.000</td>
<td>5.000</td>
<td>5.000</td>
<td>5.000</td>
<td>5.225</td>
<td>5.225</td>
</tr>
<tr>
<td>90th percentile</td>
<td>17.320</td>
<td>17.320</td>
<td>17.320</td>
<td>16.500</td>
<td>16.500</td>
<td>16.500</td>
<td>16.500</td>
<td>16.500</td>
<td>17.000</td>
</tr>
<tr>
<td>Obs</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
</tr>
</tbody>
</table>
Figure 2.22: Employee-borne social security rates in 1980
(a) 1-earner married household, no children
(b) 1-earner married household, 1 child
(c) 1-earner married household, 3 children
(d) 2-earner married household, no children
(e) 2-earner married household, 1 child
(f) 2-earner married household, 2 children
(g) 2-earner married household, 3 children
(h) Single mother, 1 child
(i) Single mother, 2 children
(j) Single mother, 3 children

Figure 2.23: Employee-borne social security rates in 2012
### 2.C Progressivity: Other Household Archetypes

#### Table 2.22: Summary Statistics: Point progressivity (excl. SSC) for household types

<table>
<thead>
<tr>
<th>Excluding SSC</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Children</td>
<td>none</td>
<td>1</td>
<td>3</td>
<td>none</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>1980</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.059</td>
<td>-0.059</td>
<td>-0.059</td>
<td>-0.048</td>
<td>-0.020</td>
<td>-0.020</td>
<td>-0.027</td>
<td>-0.027</td>
<td>-0.027</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>0.011</td>
<td>0.011</td>
<td>0.000</td>
<td>0.022</td>
<td>0.016</td>
<td>0.016</td>
<td>0.007</td>
<td>0.027</td>
<td>0.011</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.099</td>
<td>0.102</td>
<td>0.098</td>
<td>0.097</td>
<td>0.097</td>
<td>0.100</td>
<td>0.093</td>
<td>0.112</td>
<td>0.102</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.189</td>
<td>0.198</td>
<td>0.188</td>
<td>0.185</td>
<td>0.178</td>
<td>0.170</td>
<td>0.170</td>
<td>0.188</td>
<td>0.188</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.235</td>
<td>0.233</td>
<td>0.225</td>
<td>0.225</td>
<td>0.225</td>
<td>0.216</td>
<td>0.213</td>
<td>0.235</td>
<td>0.242</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.380</td>
<td>0.381</td>
<td>0.424</td>
<td>0.389</td>
<td>0.395</td>
<td>0.374</td>
<td>0.394</td>
<td>0.392</td>
<td>0.396</td>
</tr>
<tr>
<td>Mean</td>
<td>0.062</td>
<td>0.062</td>
<td>0.058</td>
<td>0.060</td>
<td>0.059</td>
<td>0.057</td>
<td>0.054</td>
<td>0.066</td>
<td>0.063</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>0.086</td>
<td>0.086</td>
<td>0.086</td>
<td>0.082</td>
<td>0.081</td>
<td>0.078</td>
<td>0.077</td>
<td>0.088</td>
<td>0.088</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
<tr>
<td><strong>2012</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.140</td>
<td>-0.139</td>
<td>-0.137</td>
<td>-0.162</td>
<td>-0.162</td>
<td>-0.161</td>
<td>-0.161</td>
<td>-0.140</td>
<td>-0.139</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>0.033</td>
<td>0.033</td>
<td>0.027</td>
<td>0.038</td>
<td>0.037</td>
<td>0.038</td>
<td>0.035</td>
<td>0.043</td>
<td>0.040</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.125</td>
<td>0.124</td>
<td>0.126</td>
<td>0.113</td>
<td>0.111</td>
<td>0.114</td>
<td>0.114</td>
<td>0.132</td>
<td>0.133</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.170</td>
<td>0.173</td>
<td>0.173</td>
<td>0.165</td>
<td>0.166</td>
<td>0.165</td>
<td>0.167</td>
<td>0.173</td>
<td>0.178</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.208</td>
<td>0.220</td>
<td>0.222</td>
<td>0.214</td>
<td>0.220</td>
<td>0.220</td>
<td>0.226</td>
<td>0.220</td>
<td>0.222</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.420</td>
<td>0.420</td>
<td>0.420</td>
<td>0.329</td>
<td>0.329</td>
<td>0.329</td>
<td>0.344</td>
<td>0.420</td>
<td>0.420</td>
</tr>
<tr>
<td>Mean</td>
<td>0.064</td>
<td>0.067</td>
<td>0.066</td>
<td>0.064</td>
<td>0.064</td>
<td>0.065</td>
<td>0.065</td>
<td>0.069</td>
<td>0.071</td>
</tr>
<tr>
<td>Std. dev.</td>
<td>0.080</td>
<td>0.084</td>
<td>0.084</td>
<td>0.077</td>
<td>0.079</td>
<td>0.080</td>
<td>0.081</td>
<td>0.084</td>
<td>0.086</td>
</tr>
<tr>
<td>Obs</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
<td>248</td>
</tr>
<tr>
<td>Table 2.23: Summary statistics: Point progressivity (incl. SSC) HH types</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>No. of Children</strong></td>
<td>1-earner</td>
<td>1-earner</td>
<td>1-earner</td>
<td>2-earner</td>
<td>2-earner</td>
<td>2-earner</td>
<td>single mother</td>
<td>single mother</td>
<td>single mother</td>
</tr>
<tr>
<td>Minimum</td>
<td>−0.402</td>
<td>−0.402</td>
<td>−0.402</td>
<td>−0.284</td>
<td>−0.284</td>
<td>−0.284</td>
<td>−0.109</td>
<td>−0.109</td>
<td>−0.109</td>
</tr>
<tr>
<td>5th percentile</td>
<td>−0.009</td>
<td>−0.003</td>
<td>−0.006</td>
<td>−0.004</td>
<td>−0.002</td>
<td>−0.002</td>
<td>−0.002</td>
<td>−0.001</td>
<td>−0.003</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>0.004</td>
<td>0.004</td>
<td>0.000</td>
<td>0.020</td>
<td>0.014</td>
<td>0.012</td>
<td>0.005</td>
<td>0.014</td>
<td>0.005</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.097</td>
<td>0.097</td>
<td>0.096</td>
<td>0.103</td>
<td>0.101</td>
<td>0.101</td>
<td>0.092</td>
<td>0.105</td>
<td>0.099</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.193</td>
<td>0.192</td>
<td>0.189</td>
<td>0.177</td>
<td>0.191</td>
<td>0.170</td>
<td>0.168</td>
<td>0.206</td>
<td>0.201</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.243</td>
<td>0.262</td>
<td>0.249</td>
<td>0.236</td>
<td>0.250</td>
<td>0.229</td>
<td>0.213</td>
<td>0.258</td>
<td>0.268</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.388</td>
<td>0.405</td>
<td>0.449</td>
<td>0.408</td>
<td>0.415</td>
<td>0.393</td>
<td>0.415</td>
<td>0.439</td>
<td>0.449</td>
</tr>
<tr>
<td>Mean</td>
<td>0.059</td>
<td>0.059</td>
<td>0.054</td>
<td>0.059</td>
<td>0.058</td>
<td>0.056</td>
<td>0.053</td>
<td>0.065</td>
<td>0.061</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>0.095</td>
<td>0.095</td>
<td>0.095</td>
<td>0.089</td>
<td>0.089</td>
<td>0.085</td>
<td>0.083</td>
<td>0.093</td>
<td>0.092</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
</tbody>
</table>

**1980**

**2012**
Figure 2.24: Point progressivity in 1980
(a) 1-earner married household, no children  
(b) 1-earner married household, 1 child  
(c) 1-earner married household, 3 children  
(d) 2-earner married household, no children  
(e) 2-earner married household, 1 child  
(f) 2-earner married household, 2 children  
(g) 2-earner married household, 3 children  
(h) Single mother, 1 child  
(i) Single mother, 2 children  
(j) Single mother, 3 children

Figure 2.25: Point progressivity in 2012
## 2.D Family Assistance Shares: Other Household Archetypes

Table 2.24: Summary Statistics: Assistance Share for Household Types

<table>
<thead>
<tr>
<th>No. of Children</th>
<th>1-earner</th>
<th>1-earner</th>
<th>1-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>2-earner</th>
<th>single mother</th>
<th>single mother</th>
<th>single mother</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>1</td>
<td>3</td>
<td>none</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1980 Minimum</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>5th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>25th percentile</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>50th percentile (median)</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>75th percentile</td>
<td>0.000</td>
<td>1.260</td>
<td>0.000</td>
<td>0.000</td>
<td>0.395</td>
<td>0.608</td>
<td>0.411</td>
<td>1.109</td>
<td>1.260</td>
<td>0.000</td>
</tr>
<tr>
<td>90th percentile</td>
<td>0.000</td>
<td>3.584</td>
<td>14.286</td>
<td>0.000</td>
<td>2.418</td>
<td>6.072</td>
<td>10.000</td>
<td>5.220</td>
<td>10.736</td>
<td>14.501</td>
</tr>
<tr>
<td>95th percentile</td>
<td>0.000</td>
<td>6.498</td>
<td>23.077</td>
<td>0.000</td>
<td>4.608</td>
<td>9.037</td>
<td>13.997</td>
<td>7.114</td>
<td>18.177</td>
<td>25.396</td>
</tr>
<tr>
<td>Maximum</td>
<td>10.094</td>
<td>73.062</td>
<td>89.055</td>
<td>0.125</td>
<td>64.389</td>
<td>78.338</td>
<td>84.434</td>
<td>73.062</td>
<td>84.434</td>
<td>89.055</td>
</tr>
<tr>
<td>Mean</td>
<td>0.069</td>
<td>1.323</td>
<td>4.144</td>
<td>0.001</td>
<td>0.978</td>
<td>1.840</td>
<td>2.632</td>
<td>1.618</td>
<td>3.083</td>
<td>4.271</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>0.708</td>
<td>5.605</td>
<td>10.090</td>
<td>0.008</td>
<td>4.724</td>
<td>6.121</td>
<td>7.286</td>
<td>5.703</td>
<td>8.268</td>
<td>10.431</td>
</tr>
<tr>
<td>Obs</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
</tr>
</tbody>
</table>

2012

| Minimum | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5th percentile | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 10th percentile | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 25th percentile | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 50th percentile (median) | 0.000 | 0.926 | 5.987 | 0.000 | 0.310 | 1.619 | 3.025 | 1.551 | 3.226 | 6.178 |
| 75th percentile | 0.000 | 3.453 | 13.501 | 0.000 | 2.329 | 5.401 | 8.787 | 4.734 | 9.595 | 15.155 |
| 90th percentile | 0.000 | 6.118 | 19.951 | 0.000 | 4.155 | 8.180 | 11.789 | 7.846 | 13.302 | 20.701 |
| Maximum         | 72.435 | 84.014 | 91.313 | 63.661 | 77.796 | 84.014 | 87.512 | 72.435 | 84.014 | 88.743 |
| Mean            | 0.430 | 1.641 | 4.417 | 0.289 | 1.110 | 2.016 | 2.920 | 1.766 | 3.169 | 4.597 |
| Std.dev.        | 4.840 | 6.460 | 10.650 | 4.072 | 5.446 | 7.155 | 8.683 | 5.832 | 8.494 | 10.722 |
| Obs             | 248 | 248 | 248 | 248 | 248 | 248 | 248 | 248 | 248 | 248 |
Figure 2.26: Assistance share in 1980 in total household income
Figure 2.27: Assistance share in 2012 in total household income
Chapter 3

Determinants of Personal Income Tax Setting

With the free movement of firms, capital and high skilled labor, developed countries face diminishing ability to tax these bases sufficiently to maintain or raise revenues\footnote{On the opposite end of the spectrum, developing countries face an inability to raise revenues given their weak institutions and (usually complicated and convoluted) tax systems. Both types of countries adjust their tax systems\footnote{Whether it be through changing tax rates, structural changes in their tax schedules or the addition/removal of exemptions} in response to others. I observe significant convergence in various tax measures. In Figure 3.1, the convergence in statutory corporate tax rates between 1980 and 2012 can be illustrated in the downward trend in the global average and the narrowing the standard deviation band over time. Between developmentally similar countries, convergence in the tax system can be thought of...}

\begin{figure}[ht]
\centering
\includegraphics[width=0.5\textwidth]{figure3.1}
\caption{Global average corporate tax rate +/- 1SD}
\end{figure}

\footnote{I would like to thank conference participants and discussants at the IIPF and the KOF research seminar for their numerous comments.}
as borne out of tax competition, while a country at the opposite end of the development ladder is more likely to be setting their taxes in line with a developed nation due to learning. E.g., there is the much discussed tax competition between Germany and Switzerland; whereas a country such as Ghana might wish to learn about tax institutions from Germany.

The present work is related to several strands in the literature. First, I relate to the earlier theoretical work in tax competition, such as Bucovetsky (1991) and Kanbur and Keen (1993), who took the role of country size under consideration in implementing their baseline models of tax competition. Both believed size would impede the ability to reduce taxes in light of tax competition (and the absence of frictions), with larger countries less able to absorb tax reduction. On the other hand, Ottaviano and van Ypersele (2004) and Haufler and Wooton (1999) find market size to be beneficial in attracting firms. In their view, despite higher taxes, larger countries can win the tax competition, as they are able to provide sufficient size-induced benefits to compensate the higher tax bill. More recent works have focused on empirical trends and effects under tax competition. Razin and Sadka (1991), Devereux and Griffith (1998), and Winner (2005), Devereux, Lockwood and Redoano (2008), Rincke and Overesch (2009), among others, present evidence of strategic rate setting in corporate and capital taxation.

Empirically, labor taxes have been left largely unaddressed in the traditional tax competition literature, but have been mostly studied in the context of optimal taxation in isolation at the country-level. Onaran, Boesch and Liebrecht (2010) explore the effect of globalization on implicit tax rates on labor income across EU and EU Accession countries and find some evidence of upward pressure on labor taxes due to globalization.

The literature on policy adoption and imitation provides guidance regarding the contributing factors to the co-movement of tax systems. Most of the work on policy adoption focussed on non-tax policies (see Thun, 2004; Simmons and Elkins, 2004; Waltman, 1980; Bennett, 1991; Kumbhakar and Hjalmarsson, 1998; Estache, Gonzalez and Trujillo, 2002; Revelli and Tovmo, 2007).

In the context of taxation, residents (firms and individual) are, ceteris paribus, assumed to (re-)locate where their tax bill is lowest (see Bordignon, Cerniglia and Revelli, 2003; Allers and Elhorst, 2005; Edmark and Agren, 2008; Besley and Case, 1995; Egger, Köthenbürger and Lassmann, 2016). Besley and Case (1995) postulate that voters comparison shop jurisdictions in light of their inability to observe the behavior of elected officials. This forces U.S. state officials to not deviate too wildly from the tax settings of their neighboring states. Internationally, Egger and Strecker (2016) have compiled a enormous data set tracking changes in rates, kinks, social security contributions, etc., across time and countries. Egger, Radulescu and Strecker (2013) and Bösenberg, Egger and Strecker

3There is also evidence of strategic rate setting behavior in excise taxes (see Lockwood and Migali, 2009; Evers, De Mooij and Vollebergh, 2004).

4The tax variables I will analyze will come from this extensive data set.
(2014) use the tax code information from Egger and Strecker (2016) to obtain effective average tax rates for average workers or firms’ executives, respectively, and apply the obtained tax rates to the location choices of firms, finding a significant negative effect of labor income taxes on the attractiveness of countries. In contrast, Egger, Nigai and Strecker (2016) explore the opposite direction of countries adjusting their tax composition and, more specifically, the taxes set across the income distribution, in response to increasing international trade and migration.\footnote{This holds even for subnational taxes and subnational migration in the case of the United States, which confirms the tax competition observed in Besley and Case (1995).}

This paper offers a detailed descriptive analysis of personal income tax setting and adds some systematic econometric analysis of the convergence of different aspects of income tax systems.

### 3.1 Empirical model

I posit that a generic income tax variable, $tax_{i,t}$ in country $i$ and year $t$ is determined by contemporaneous factors with inertia. In addition to country-specific variables, other countries’ lagged income tax instruments\footnote{Competing countries are denoted $in$, while non-competing countries are denoted $out$.} also influence the current value of $tax_{i,t}$:

$$tax_{i,t} = \text{constant} + \alpha tax_{i,t-1} + \beta^{in \ast g} \sum_{j \neq i} W^{in \ast g}_{j,t-1} tax_{j,t-1} + \beta^{out \ast g} \sum_{j \neq i} W^{out \ast g}_{j,t-1} tax_{j,t-1} + \gamma X_{i,t} + \iota_t + u_{i,t}$$

(3.1)

where $tax_{i,t-1}$ is the lagged dependent variable, $\sum_{j \neq i} W^{in \ast g}_{j,t-1} tax_{j,t-1}$ is the lagged, g-type, weighted average of the same tax variable in competing countries $j = 1, ..., J$ at time $t-1$, $\sum_{j \neq i} W^{out \ast g}_{j,t-1} tax_{j,t-1}$ is the lagged, g-type, weighted average of the same tax variable in non-competing countries $j = 1, ..., J$ at time $t-1$, weighted by metric $g$, $X_{i,t}$ is a vector of additional explanatory variables, $\iota_t$ are year fixed effects, and $u_{i,t}$ is a residual. The types $in \ast g$ and $out \ast g$ of weighting schemes delineate countries $in$ or $out$ of competition for any country $i$ weighted by metric $g$.

The grouping $in$ and $out$ are based on the World Bank’s country income classification, which in turn is based on gross national income per capita. The origin of the in-group and out-group competition relationship is currently only distantly related to taxation through the tax revenue component of gross national income; however, the relationship may also be tied to competition in other forms of taxation, such as the competition over profit taxes. $in$ captures predicted competition between countries in the form of country-pair-year-dummies for country pairs located within the same income category (for example, high-high, upper middle-upper middle, etc.) in a given year $t$. $out$ captures predicted non-competition between countries in the form of country-pair-year-dummies for country
pairs in a given year $t$, where $i$ and $j$ are not in the same category, while it could be assumed that it will generally be the lower ranked learning from the higher ranked country, the reverse could also be the case. The income classification of countries varies over time, reflecting the changing positions of countries relative to country $i$ and over the sample years. Across the full sample, I consider 156 countries all present and independent for the complete 33 years in the sample, which amounts to 208,948 country-year-pairs that are in, what is assumed to be, a competitive relationship and 588,992 country-year-pairs are considered to be in a non-competitive relationship.

For robustness, I analyze the effect of the competitive and non-competitive weighted averages both over the complete sample of countries, as well as for each country classification separately.

### 3.1.1 Third-country personal income tax weighting schemes

In order to account for the specialized relationships between countries, I take into consideration the similarities and closeness between countries in four dimensions: politics, demographics, economics and geography.

For example, while considered to be competing, Germany and France have vastly different tax structures, a fact that may be accounted for given demographic or political distances. On the other hand, Chad is considered to be imitating 167 countries; however, realistically, given their political and economic ties, Chad is more likely to be imitating France than Germany. A fact confirmed by their use of family quotients to calculate individual labor taxes.

In order to align countries according to their respective distance, I create four different distance metrics $g$ based on four different categories of closeness based on an estimated similarity measure in politics or demography, and as non-estimated controls, the size of the pair’s economic relationship, measured as aggregate trade, and the geographic distance between the pair’s capitals.

The political and demographic distances are calculated as the square of the Mahalanobis distances in the respective dimensions, which for a given category $g$ is defined as:

$$M_{ij,t-1}^g = (X_{i,t-1}^g, X_{j,t-1}^g)' R^{-1} \left( X_{i,t-1}^g, X_{j,t-1}^g \right), \forall g = \{pol, dem\},$$

(3.2)

where $X_{i,t-1}^g$ and $X_{j,t-1}^g$ are vectors of different categories’ variables for country $i$, the treated country, and country $j$, the matching country, at time $t - 1$. $R^{-1}$ is inverse the variance covariance.

---

7 A depiction and list of the countries in the sample is relegated to the appendix.
matrix of the variables. Squaring $M_{ij,t-1}^g$ in (3.2) gives $D_{ij,t-1}^g$:

$$D_{ij,t-1}^g = \left(M_{ij,t-1}^g\right)^2, \forall g = \{\text{pol, dem}\}.$$  (3.3)

The last two weighting measures are based in aggregate trade and geographic distance whose construction is straightforward. In the weighting based in politics, demography and geography, a smaller distance from $i$ to $j$ should lead to greater weight of $j$ for $i$, while greater aggregate trade should imply higher weight.

Therefore, to construct $W_{ij,t-1}^\{\text{ins}g\} \forall g = \{\text{pol, dem, geo}\}$ and $W_{ij,t-1}^\{\text{outs}g\} \forall g = \{\text{pol, dem, geo}\}$, I multiply the indicator variables $in$ and $out$ with the inverted distances for calculated distance and row-sum normalize the distances between $i$ and $j$ in year $t - 1$. For $W_{ij,t-1}^\{\text{ins}eco\}$ and $W_{ij,t-1}^\{\text{outs}eco\}$, I can forgo the inversion and directly row-sum normalize the product of $D_{ij,t-1}^\text{eco}$ and $in$ and $out$, respectively.

$$W_{ij,t-1}^\{\text{ins}g\} = \frac{1}{\sum_{j \neq i} D_{ij,t-1}^\{\text{ins}g\}}, \forall g = \{\text{pol, dem, geo}\}; \quad W_{ij,t-1}^\{\text{outs}g\} = \frac{1}{\sum_{j \neq i} D_{ij,t-1}^\{\text{outs}g\}}, \forall g = \{\text{pol, dem, geo}\}$$  (3.4)

and

$$W_{ij,t-1}^\{\text{ins}eco\} = \frac{D_{ij,t-s}^\text{ins}}, \forall g = \{\text{eco}\}; \quad W_{ij,t-1}^\{\text{outs}eco\} = \frac{D_{ij,t-s}^\text{outs}}, \forall g = \{\text{eco}\}.$$  (3.5)

These four weighting types enter the estimations of (3.1), as the following:

1. $\sum_{j \neq i} W_{j,t-1}^\{\text{ins}pol\}tax_{j,t-1}$ and $\sum_{j \neq i} W_{j,t-1}^\{\text{outs}pol\}tax_{j,t-1}$ to account for political similarity between $i$ and $j$,

2. $\sum_{j \neq i} W_{j,t-1}^\{\text{ins}dem\}tax_{j,t-1}$ and $\sum_{j \neq i} W_{j,t-1}^\{\text{outs}dem\}tax_{j,t-1}$ to account for demographic similarity between $i$ and $j$,

3. $\sum_{j \neq i} W_{j,t-1}^\{\text{ins}eco\}tax_{j,t-1}$ and $\sum_{j \neq i} W_{j,t-1}^\{\text{outs}eco\}tax_{j,t-1}$ to account for the economic relationship between $i$ and $j$,

and lastly,

4. $\sum_{j \neq i} W_{j,t-1}^\{\text{ins}geo\}tax_{j,t-1}$ and $\sum_{j \neq i} W_{j,t-1}^\{\text{outs}geo\}tax_{j,t-1}$ to consider geographic proximity between $i$ and $j$.

The matching variables and a description of the outcome of each weighting type is addressed in the next few subsections.
The estimating equation is therefore

\[ \text{tax}_{i,t} = \text{constant} + \alpha \text{tax}_{i,t-1} + \beta^\text{in} \sum_{j \neq i}^{J} W_{j,t-1} \text{tax}_{j,t-1} + \beta^\text{out} \sum_{j \neq i}^{J} W_{j,t-1} \text{tax}_{j,t-1} + \gamma X_{i,t} + \iota_t + u_{i,t}, \]

\( \forall g = \{ \text{pol, dem, eco, geo} \}. \) (3.6)

I next discuss each weighting type in detail.

\[ 1980 \quad 1990 \quad 2000 \quad 2010 \]

\[ 0.01 \quad 0.02 \quad 0.03 \quad 0.04 \]

\[ 0.05 \quad 0.1 \quad 0.15 \]

\[ \text{norm. Mahalanobis distance} \]

\[ \text{norm. agg. trade} \]

Figure 3.2: Weights of Germany’s immediate neighbors

Political similarity

To take political distance into consideration in \( \sum_{j \neq i}^{J} W_{j,t-1}^{\text{inspol}} \text{tax}_{j,t-1} \) and \( \sum_{j \neq i}^{J} W_{j,t-1}^{\text{outpol}} \text{tax}_{j,t-1} \), I generate a large set of dummies for the following:

- Legal origin, colonizer and language (official and by at least 20% of the population): Certain laws will develop and remain within a legal heritage, a language or colonial relationship (i.e., Quotient Familial in France and former French colonies),
• Government structure (democracies, dictatorships, mixtures): Dictatorships and democracies face dramatically different incentives and abilities to set and/or change the tax system,

• Legislative and executive majorities (left, right): It is commonly believed that political alignment of the majority will set the direction of the laws they push, taxes included,

The information on all three broad political categories is obtained from the *Quality of Governance* data set, expanded to cover additional years and countries.

To illustrate the distribution of the distance weights, I remain in the example of Germany and track the political distance between it and its bordering states (Austria, Belgium, Switzerland, Czech Republic, Denmark, France, Luxembourg, Netherlands, and Poland) for the years in the tax sample in the first quadrant of Figure 3.2.

The Figure suggests that while the distance to Luxembourg remains fairly constant, the distance to France dropped to an all time low in the late 1990s and early 2000s. Austria is Germany’s nearest political neighbor. For the majority of countries there are several periods, where distance is constant, possibly due to matched electoral cycles and outcomes.

**Demographic similarity**

I combine a variety of country-year-specific data from the World Development and country-specific sources to create an inverse demographic Mahalanobis distance measure. Countries that have highly similar demographics, yet very little political or economic alignment, may be more likely to influence each other’s tax systems when these tax changes are beneficial given a competing or imitating country’s population structures. There are a number of tax instruments whose implementation is likely to affect demographics and, vice-versa, whose implementation is greatly driven by demographic factors (e.g., tax deductions for children and spouses, special tax schedules for married couples and single parents, can all affect the choice of couples to marry and start families.)

The Mahalanobis distance metric is based on the following factors:

• Labor force shares in industry, agriculture and services: affect the necessity of social security and lower bounds for taxation,

• Education shares: a more educated population will generally raise wages in a country, which in turn will affect both effective and statutory tax rates and social security contributions

---

9These years also saw significant cooling in the relationship between France and Germany (see Economist, 2013).
• Urbanization rate: in line with the labor force shares in industry, will affect the need to provide social security

• Labor participation and unemployment rates: a small labor force and high unemployment will shift the burden of generating tax revenues to the working population, while increasing the need for social protection contributions

• Life expectancy of women and men: again, social security for both employers and employees will be greatly affected by the requirement for retirement and pension insurance

• Fertility and Dependency ratios: social security and taxes can both affect fertility.

To illustrate the distribution of the distance weights, I stay in the example of Germany and track the demographic distance between it and its bordering states (Poland, Czech Republic, Austria, Switzerland, France, Luxembourg, Belgium, Netherlands and Denmark) for the years in the tax sample in the second quadrant of Figure 3.2. Demographic distance faces much more variation over time and across countries. Nevertheless, it is discernable that the similarities between Germany and Luxembourg decreased over time, while similarities with the Netherlands and Switzerland increased over time.

**Economic proximity**

Economic integration is an outcome of governments’ policy decisions, of which tax competition is a direct outcome. The measure of economic integration is based on aggregated bilateral trade from the World Integrated Trade Solution (WITS) database and presented in the third quadrant of Figure 3.2.

The data only capture recorded trade, thus, capturing the economic relationship between countries only imprecisely. Specifically, trade of and between former members of the Communist bloc before 1992 is only very weakly covered. However, Figure 3.2 is still able to capture the liberalization of trade in the 1990s – the economic weight of France and the Netherlands decreased as more countries opened their borders and markets (see the rapid rise of Poland’s economic weight).

---

10 Singapore is a prime example of selectively providing tax credits to educated women, to incentivize these women to not leave the workforce after childbirth.
The last weighting type is the inverse geographic distance between \( i \) and \( j \)'s capitals, used to control for the fact that neighboring states are more readily observed and a country faces a higher threat of emigration of mobile factors to neighboring/closer states, rather than very distant ones.

The geographic distance, as provided by CEPII, is taken at a specific point in time; however, I expanded the data in the time dimension, accounting for changes in location of capitals (after German reunification from Bonn to Berlin) and the emergence or demise of countries. The sharp break in the weighted geographic distances in the fourth quadrant of Figure 3.2 coincides with the reunification of East and West Germany and the subsequent relocation of the capital.

In general, it could be assumed that both the political and the demographic weighting scheme would generally foster positive correlations between \( i \)'s tax instruments and their in- and out-group averages, while the economic and geographic weighting scheme might produce a more traditionally tax competitive outcome with negative correlations between \( i \) and its in- and out-groups.

### 3.2 Tax structures, rates, and overall measures

<table>
<thead>
<tr>
<th>( t_{ax, t} )</th>
<th>Decile</th>
<th>Obs</th>
<th>Min</th>
<th>10%</th>
<th>25%</th>
<th>Med</th>
<th>75%</th>
<th>90%</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>1980 Mean</th>
<th>SD</th>
<th>2012 Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>( kinks )</td>
<td>5,148</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td>68</td>
<td>5.94</td>
<td>5.46</td>
<td></td>
<td>8.20</td>
<td>6.69</td>
<td>4.77</td>
<td>3.20</td>
</tr>
<tr>
<td>( s_t )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.20</td>
<td>0.35</td>
<td>0.47</td>
<td>0.60</td>
<td>0.95</td>
<td>0.33</td>
<td>0.20</td>
<td></td>
<td>0.38</td>
<td>0.27</td>
<td>0.28</td>
<td>0.15</td>
</tr>
<tr>
<td>( l_bound )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.19</td>
<td>0.66</td>
<td>1.60</td>
<td>42.64</td>
<td>0.67</td>
<td>2.04</td>
<td></td>
<td>0.76</td>
<td>2.54</td>
<td>0.74</td>
<td>1.48</td>
<td></td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.08</td>
<td>0.16</td>
<td>0.49</td>
<td>0.05</td>
<td>0.08</td>
<td></td>
<td>0.05</td>
<td>0.07</td>
<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
<td>0.18</td>
<td>0.49</td>
<td>0.06</td>
<td>0.08</td>
<td></td>
<td>0.05</td>
<td>0.08</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.15</td>
<td>0.24</td>
<td>0.62</td>
<td>0.10</td>
<td>0.10</td>
<td></td>
<td>0.09</td>
<td>0.09</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.03</td>
<td>0.10</td>
<td>0.21</td>
<td>0.32</td>
<td>0.42</td>
<td>0.73</td>
<td>0.22</td>
<td>0.15</td>
<td></td>
<td>0.19</td>
<td>0.16</td>
<td>0.22</td>
<td>0.13</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.15</td>
<td>0.27</td>
<td>0.60</td>
<td>0.08</td>
<td>0.11</td>
<td></td>
<td>0.07</td>
<td>0.11</td>
<td>0.09</td>
<td>0.11</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.18</td>
<td>0.30</td>
<td>0.70</td>
<td>0.10</td>
<td>0.13</td>
<td></td>
<td>0.08</td>
<td>0.11</td>
<td>0.11</td>
<td>0.12</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.10</td>
<td>0.25</td>
<td>0.40</td>
<td>0.50</td>
<td>0.90</td>
<td>0.26</td>
<td>0.19</td>
<td></td>
<td>0.24</td>
<td>0.21</td>
<td>0.24</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.21</td>
<td>0.34</td>
<td>0.65</td>
<td>0.13</td>
<td>0.13</td>
<td></td>
<td>0.11</td>
<td>0.13</td>
<td>0.14</td>
<td>0.13</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.00</td>
<td>0.04</td>
<td>0.11</td>
<td>0.25</td>
<td>0.36</td>
<td>0.75</td>
<td>0.15</td>
<td>0.14</td>
<td></td>
<td>0.12</td>
<td>0.13</td>
<td>0.16</td>
<td>0.13</td>
</tr>
<tr>
<td>( a_v )</td>
<td>5,148</td>
<td>0.00</td>
<td>0.14</td>
<td>0.30</td>
<td>0.42</td>
<td>0.54</td>
<td>0.92</td>
<td>0.29</td>
<td>0.19</td>
<td></td>
<td>0.27</td>
<td>0.22</td>
<td>0.28</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>( \Delta )</td>
<td>5,148</td>
<td>-0.24</td>
<td>-0.09</td>
<td>-0.07</td>
<td>-0.05</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.04</td>
<td>-0.05</td>
<td>0.03</td>
<td></td>
<td>-0.05</td>
<td>0.04</td>
<td>-0.04</td>
<td>0.03</td>
</tr>
</tbody>
</table>

For brevity, only rates for the bottom 10, middle 10 and top 10 percent of the wage distribution are shown.

This section presents an overview of the developments in countries’ tax system. I draw the various measures of the different countries’ tax systems from a large, self-collected data set covering 252
sovereign and autonomous countries and territories in the world. I will focus mainly on the 156 countries that were sovereign and captured for all years between 1980 and 2012, excluding former Soviet and Yugoslav constituent states and countries that emerged from lengthy occupations and sovereignty disputes (such as East Timor). An illustration of the countries included in the sample is relegated to Appendix 3.A.

\[ \text{Figure 3.3: Global mean +/- 1SD across PIT components} \]

I will consider the following aspects of personal labor income taxation, \( t_{i,t} \), with greater detailed summary statistics given in Table 3.1 and development shown in Figure 3.3:

- **kinks**, this is the number of additional rates in a progressive tax system. Flat taxes are given a 0, while the maximum is at 68 (Guatemala in the early 1980s). On average countries included 8 kinks their tax schedules in 1980 and only between 4 and 5 in 2012. The development in the average number of kinks is depicted in the first quadrant of Figure 3.3, where after a bit of stability in the early 80s, the number of kinks quickly declined over the 80s, 90s and the early 2000s, before leveling off in the last years.

- **stat\( \tau \)**, this is the top statutory income tax rate\(^{11}\) and could be considered most visible and most widely known as it is the highest rate that is common across the population of a country. This top statutory marginal tax rate decreased from an average 38\% in 1980 to 28\% in 2012 with the standard deviation experiencing a similar decline from roughly 26\% to 15 \% over the same period. The decline in both the mean and standard deviation is similar to the development in kinks and is shown in the second quadrant of Figure 3.3.

- **lbound**, this is the lower bound, below which individuals do not pay labor income taxes, relative to the average wage in a country. While the majority of countries charge income taxes starting with the first dollar earned, an average country began charging a positive income tax at 75\% of the average wage in 1980 and 73\% in 2012. In this particular case,

\(^{11}\)excludes the subnational tax rate
the development is both affected both by the change in the legal thresholds and the average wage, illustrating how, if at all, these thresholds are maintained in relation with wages in a country. The development of the relative lower bound is shown in the third block of Figure 3.3.

Figure 3.4: EATR & EMTR and their components across income distribution

The next four instruments are the components of the effective average and effective marginal tax rates measured across the different income deciles in a country. While the first three instruments provide small insights into the legal structure of countries’ tax systems, these instruments may, in fact, not affect workers in a country. Countries with tax systems that did not see a revision or revaluation of the various thresholds or rates may face significant cold progression and bracket creep, essentially pushing even median or poor workers across all thresholds into higher tax rates. On the other hand, countries with very large informal sectors and very large income disparities may see a large share of their workers below the lower bound for positive taxes or taxed at very low rates, while their top statutory rates essentially affect only a small portion of the population (such as may have been the case in Tanzania in the early 1980s when statutory tax rates reached 95%). In fact, taking all deductions into consideration, workers along the income distribution face their specific effective average and marginal tax rates, denoted EATR and EMTR respectively. The
EATR and EMTR are calculated for single, male workers, also contain the social security payable by a single, male worker and take into consideration the deductibility thereof. The development of the mean and standard deviation of the EATR and EMTR and its pure tax components are presented in Figure 3.4.

- **EATR**, this is the per-decile average labor income tax rate payable by the employee plus the employee-borne social security rate, measured for the construct of industrial, single, male workers, earning the decile-specific average wage in the economy, and sums employee-borne social security and $av\tau$ together. While the competing and non-competing countries might exert their influence on the individual components, given the vastly different rules and regulations across countries, it is possible that the in- and out-group may only be seen in the combined measure. In total, the regressive nature of social security contributions is eliminated with the 10th decile paying roughly 12% more than the 1st decile on average.

- **avτ**, this is the per-decile average labor income tax rate payable by the employee, measured for the construct of industrial, single, male workers, earning the decile-specific average wage in the economy. This includes all deductions, allowances, credits, as well as subnational and surtaxes. On average, workers in the 1st, 5th and 10th decile paid 4.8%, 5.8% and 17.6%, respectively, with little development over time; however, at the top of the income distribution, convergence has become stronger over time.

- **EMTR**, this is the per-decile marginal labor income tax rate payable by the employee plus the employee-borne marginal social security rate, measured for the construct of industrial, single, male workers, earning the decile-specific average wage in the economy, and sums $mssc_{ee}$ and $m\tau$ together. The first and fifth decile saw their total marginal tax rate increase by 3.4 and 4.4 cents on the next dollar, respectively, while the top decile faced an increase of 0.8 cents on the next dollar, with the 1st, 5th and 10th decile paying on average 13.4%, 15.4% and 29.4% each.

- **mτ**, this is the per-decile marginal labor income tax rate payable by the employee, measured for the construct of industrial, single, male workers, earning the decile-specific average wage in the economy. This accounts for all deductions, allowances, credits, as well as subnational and surtaxes. Between 1980 and 2012, marginal tax rates increased from 7.4% and 8.3% to 8.9% and 10.7% for the first and fifth decile, while decreasing from 24.5% to 24.0% for the top decile.

A more comprehensive overview of the various tax measures is presented in Egger and Strecker (2016).
While the first three instruments provide small insights into the legal structure of countries’ tax systems, these instruments may, in fact, not affect workers in a country. Countries with tax systems that did not see a revision or revaluation of the various thresholds or rates may face significant cold progression and bracket creep, essentially pushing even median or poor workers across all thresholds into higher tax rates. On the other hand, countries with very large informal sectors and very large income disparities may see a large share of their workers below the lower bound for positive taxes or taxed at very low rates, while their top statutory rates essentially affect only a very portion of the population (such as may have been the case in Tanzania in the early 1980s when statutory tax rates reached 95%). On the other hand, the effective average and marginal rates may be affected differently across the income distribution making comprehensive judgment difficult. Therefore, given both the inability of the first three tax schedule components to capture the tax system in its entirety and the diversity of effects that can be expected across the income distribution, I create a tax parameter, $\Delta^d$, that captures the difference in the before-tax and after-tax income distribution of single, male workers (in line with the assumptions for the calculation of $EATR$, $EMTR$, and its tax components. $\Delta^d$ captures the amount of redistribution that is inherent in the tax system of a country considering the income distribution and wages of a given year. The development of this difference is presented in Figure 3.5 and the last section of Table 3.1. I apply and calculate $\Delta^d$ according to the assumptions of a Pareto distribution.

![Figure 3.5: Global Development of Tax Effect Measure](image)

### 3.3 Empirical results

This section presents the results of Arellano-Bond type regressions on $kinks$, $stat\tau$, and $lbound$, the effective average and marginal tax rates, $EATR$ and $EMTR$, their components, and the overall

---

12 The exposition of the imputation of the income distribution is presented in Appendix 3.C.
measure $\Delta_{\text{pareto}}$. Section 3.3.1 presents the results for all 156 countries in the sample, while Section 3.3.2 presents for regression results by country category. The results tables contain a fifth, additional model, which includes all four weighting schemes. The regression equation then looks as follows:

$$
tax_{i,t} = \text{constant} + \alpha_{\text{tax}_{i,t-1}} + \beta_{\text{tax}_{i,t-1}} + \beta_{\text{tax}_{j,t-1}} + \beta_{\text{tax}_{j,t-1}} + \gamma_{X_{i,t}} + \iota_{t} + u_{i,t}. \tag{3.7}$$

Tables 3.5 and 3.6 in Appendix 3.A present the additional variables in $X_{i,t}$.

### 3.3.1 Overall results

Table 3.2 presents the results results for Arellano-Bond type regressions on kinks, $\text{stat}\tau$, and $\text{lbound}$.

While both the competitive and non-competitive weighted averages affect $\text{kinks}$ both in separate and joint regressions through a demographically and geographically weighted average, the economic and political in- and out-group fail to influence $i$’s tax setting for the number of kinks. Similarly, the demographically weighted in- and out-group affect both the setting of the statutory top income tax rate and the relative lower bound of positive taxes.

The results of the corresponding regressions on the components of the EATR and EMTR are presented visually in Figure 3.6. These figures plot the resulting coefficients of models (1)-(4) for the respective tax component with a 90% confidence band.

For $\text{av}_{\tau}$, a positive relationship can be discerned for the 6th decile for the political out-group average, while the median and 10th decile for both the demographically-weighted in- and out-group average are positively related to $\text{av}_{\tau}$. The economic out-group is positively related to the 10th decile of $\text{av}_{\tau}$, while the geographically-weighted in- and out-group are positively related to the lower portion of the income distribution, while the 9th decile would be negatively related to the geographic in- and out-groups.
Table 3.2: Arellano-Bond Regressions: Instrument setting through weighted in-group and out-group

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( w_i )</td>
<td>0.900***</td>
<td>0.892***</td>
<td>0.895***</td>
<td>0.874***</td>
<td>0.870***</td>
</tr>
<tr>
<td>( t )</td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>( )⁄pol</td>
<td>1.550</td>
<td>1.550</td>
<td>1.550</td>
<td>1.550</td>
<td>1.550</td>
</tr>
<tr>
<td>( )⁄eco</td>
<td>51.169***</td>
<td>51.169***</td>
<td>51.169***</td>
<td>51.169***</td>
<td>51.169***</td>
</tr>
<tr>
<td>( )⁄geo</td>
<td>147.507***</td>
<td>147.507***</td>
<td>147.507***</td>
<td>147.507***</td>
<td>147.507***</td>
</tr>
<tr>
<td>( )⁄t</td>
<td>3.017</td>
<td>3.017</td>
<td>3.017</td>
<td>3.017</td>
<td>3.017</td>
</tr>
<tr>
<td>( )⁄eco</td>
<td>3.351</td>
<td>3.351</td>
<td>3.351</td>
<td>3.351</td>
<td>3.351</td>
</tr>
<tr>
<td>( )⁄eco</td>
<td>34.553***</td>
<td>34.553***</td>
<td>34.553***</td>
<td>34.553***</td>
<td>34.553***</td>
</tr>
<tr>
<td>( )⁄geo</td>
<td>67.041***</td>
<td>67.041***</td>
<td>67.041***</td>
<td>67.041***</td>
<td>67.041***</td>
</tr>
<tr>
<td>( )⁄t</td>
<td>21,479.676</td>
<td>21,785.196</td>
<td>21,549.569</td>
<td>22,110.553</td>
<td>22,282.142</td>
</tr>
<tr>
<td>( )⁄eco</td>
<td>21,479.676</td>
<td>21,785.196</td>
<td>21,549.569</td>
<td>22,110.553</td>
<td>22,282.142</td>
</tr>
<tr>
<td>( )⁄geo</td>
<td>21,479.676</td>
<td>21,785.196</td>
<td>21,549.569</td>
<td>22,110.553</td>
<td>22,282.142</td>
</tr>
<tr>
<td>( )⁄t</td>
<td>16,665.285</td>
<td>16,812.772</td>
<td>16,628.612</td>
<td>16,605.696</td>
<td>16,813.401</td>
</tr>
<tr>
<td>( )⁄eco</td>
<td>16,665.285</td>
<td>16,812.772</td>
<td>16,628.612</td>
<td>16,605.696</td>
<td>16,813.401</td>
</tr>
<tr>
<td>( )⁄geo</td>
<td>16,665.285</td>
<td>16,812.772</td>
<td>16,628.612</td>
<td>16,605.696</td>
<td>16,813.401</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. *** \( p < 0.01; ** p < 0.05; * p < 0.1 \)  
\( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{in} \) * \( \text{pol} \) and \( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{out} \) * \( \text{pol} \). \( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{in} \) * \( \text{eco} \) and \( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{out} \) * \( \text{eco} \). \( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{in} \) * \( \text{geo} \) and \( \sum_{i=1}^{n} x_{ij,t-1} \) is abbreviated as \( \text{out} \) * \( \text{geo} \). For brevity, the year fixed effects coefficients for log population, log GDP, the vector of political variables and the vector of demographic variables (see Sections 4.1.1 and 4.1.4) for an overview are suppressed.
Figure 3.6: Regression coefficients for EATR and EMTR components
avtot has no discernable relationship to a politically-weighted external average, while the demographically-weighted in- and out-group are positively related to avtot. The relationship between the economically-weighted and geographically-weighted in- and out-group and avtot is similar to that of between economically-weighted and geographically-weighted in- and out-group and avtot.

For mτ, the 6th decile is again positively related to the politically-weighted out-group, while the 2nd, 5th, 7th, 9th and 10th are positively related to the demographically-weighted in- and out-group. For the economic weighting, the 10th decile is negatively related to the in-group. The geographically-weighted out-group is positively related to the marginal labor income tax rate. The marginal total tax rate is also positively related to portions of the politically-weighted out-group, to the demographically-weighted in- and out-group, and the geographically-weighted in and out-group, while no relationship can be detected for the economically-weighted groups. The results of joint regressions, are not substantially different from the results of separate regressions and are omitted for brevity.

### Table 3.3: Arellano-Bond Regressions: Instrument setting through weighted in-group and out-group

<table>
<thead>
<tr>
<th></th>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>p</td>
<td>p</td>
<td>p</td>
<td>p</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Δ</td>
<td>tax_{i,t−1}</td>
<td>0.791***</td>
<td>0.790***</td>
<td>0.791***</td>
<td>0.791***</td>
<td>0.792***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.109)</td>
<td>(9.039)</td>
<td>(9.099)</td>
<td>(9.100)</td>
<td>(9.122)</td>
</tr>
<tr>
<td></td>
<td>in * pol</td>
<td>6.029</td>
<td>6.037</td>
<td>6.037</td>
<td>6.037</td>
<td>6.037</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.109)</td>
<td>(9.039)</td>
<td>(9.099)</td>
<td>(9.100)</td>
<td>(9.122)</td>
</tr>
<tr>
<td></td>
<td>in * dem</td>
<td>40.616***</td>
<td>40.616***</td>
<td>40.616***</td>
<td>40.616***</td>
<td>40.616***</td>
</tr>
<tr>
<td></td>
<td>out * dem</td>
<td>128.267***</td>
<td>128.267***</td>
<td>128.267***</td>
<td>128.267***</td>
<td>128.267***</td>
</tr>
<tr>
<td></td>
<td>in * eco</td>
<td>−5.363**</td>
<td>−5.363**</td>
<td>−5.363**</td>
<td>−5.363**</td>
<td>−5.363**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.242)</td>
<td>(2.242)</td>
<td>(2.242)</td>
<td>(2.242)</td>
<td>(2.242)</td>
</tr>
<tr>
<td></td>
<td>out * eco</td>
<td>0.502</td>
<td>0.502</td>
<td>0.502</td>
<td>0.502</td>
<td>0.502</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.312)</td>
<td>(4.312)</td>
<td>(4.312)</td>
<td>(4.312)</td>
<td>(4.312)</td>
</tr>
<tr>
<td></td>
<td>in * geo</td>
<td>−15.766**</td>
<td>−15.766**</td>
<td>−15.766**</td>
<td>−15.766**</td>
<td>−15.766**</td>
</tr>
<tr>
<td></td>
<td>out * geo</td>
<td>12.019*</td>
<td>12.019*</td>
<td>12.019*</td>
<td>12.019*</td>
<td>12.019*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.225)</td>
<td>(7.225)</td>
<td>(7.225)</td>
<td>(7.225)</td>
<td>(7.225)</td>
</tr>
<tr>
<td></td>
<td>constant</td>
<td>−0.039</td>
<td>−0.034</td>
<td>−0.057</td>
<td>−0.049</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.099)</td>
<td>(0.100)</td>
<td>(0.099)</td>
<td>(0.099)</td>
<td>(0.100)</td>
</tr>
<tr>
<td>χ²</td>
<td></td>
<td>6,654.590</td>
<td>6,700.119</td>
<td>6,640.039</td>
<td>6,667.216</td>
<td>6,725.725</td>
</tr>
<tr>
<td>Obs</td>
<td>4,836</td>
<td>4,836</td>
<td>4,836</td>
<td>4,836</td>
<td>4,836</td>
<td>4,836</td>
</tr>
<tr>
<td>Countries</td>
<td>156</td>
<td>156</td>
<td>156</td>
<td>156</td>
<td>156</td>
<td>156</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. *** p < 0.01; ** p < 0.05; * p < 0.1. ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as in * pol and ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as out * pol. ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as in * dem and ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as out * dem. ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as in * eco and ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as out * eco. ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as in * geo and ∑_{j∈J} W_{j,t−1} tax_{j,t−1} is abbreviated as out * geo. For brevity, the year fixed effects, coefficients for log population, log GDP, the vector of political variables and the vector of demographic variables (see Sections 3.1.1 and 3.1.2 for an overview) are suppressed.

Given the diversity of the relationship between the differently weighted in- and out-group averages and the tax instruments and the components of the EATR and the EMTR, the results of regressions (1)-(5) on the tax measure Δpareto sums up the relationship between the tax system and in- and out-group averages, presented in Table 3.3. The demographically- and politically-weighted in-group...
and out-group are positively related to $\Delta^{pareto}$ and, as would be expected, negatively related to the economically- and geographically-weighted in-group. As neighbors or trading partners increase their level of redistribution (pushing their $\Delta^{pareto}$ lower), $i$ is likely to decrease the level of redistribution inherent in their tax system, while politically and demographically similar countries would tend to produce similarly redistributive tax systems.

### 3.3.2 Results by country group

To discern the effect across the income distribution and each country category, I repeat regressions (1)-(5) for each category. Figure 3.7 and Table 3.4 present the results the regressions on $avtot$ and $\Delta^{pareto}$. The results for the tax instruments and $avtot$, $mtau$ and $mtot$ produce similar results and are relegated to Appendix 3.B. In exploring the results, it must be noted again that the income categories are also quite dynamic, allowing for the varying influence of external countries as country $i$ rises or falls in the ranks.

Overall the results for high income countries suggest an overall decreasing relationship between both in- and out-group weighted averages with generally more positive relationships at the lower end of the income distribution than at the upper end. For upper-middle income countries no significant relationship can be detected between in- and out-group averages and the average total income tax rate. A similar pattern is repeated for lower-middle income countries. Low-income countries face a significant positive relationship with both their geographically-weighted in- and out-group.

Table 3.4 presents the results of country-category-wide regressions on $\Delta^{pareto}$. For high-income countries, the politically-weighted in-group average is positive and significant, while the geographically-weighted out-group averages are negatively and significantly related to $\Delta^{pareto}$. As in Figure 3.7, lower-middle income countries face no significant relationships between their $\Delta^{pareto}$ and weighted in- or out-group averages. While low-income countries generally face significant relationships with the demographically weighted in- and out-group, the upper-middle income countries are positively and significantly related to their politically-weighted out-group.

Thus, it would appear that the results are largely driven by the two extremes of the income categories, while the results for the overall tax measure is driven by upper-middle and low income countries.
Figure 3.7: Regression coefficients for EATR: By income group
Table 3.4: Arellano-Bond Regressions: Instrument setting through weighted in-group and out-group - By income group

<table>
<thead>
<tr>
<th>$\Delta \text{parents} \times \text{tax}_{i,t-1}$</th>
<th>Linear Income</th>
<th>High Income</th>
<th>Lower-Middle Income</th>
<th>Low Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>(5)</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td>$\text{in} \times \text{pol}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{out} \times \text{pol}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{in} \times \text{dcm}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{out} \times \text{dcm}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{in} \times \text{eco}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{out} \times \text{eco}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{in} \times \text{geo}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{out} \times \text{geo}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\chi^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. $\sum_{j \neq i} W_{j,t-1}^{\text{pol}} \text{tax}_{j,t-1}$ is abbreviated as $\text{in} \times \text{pol}$ and $\sum_{j \neq i} W_{j,t-1}^{\text{dcm}} \text{tax}_{j,t-1}$ is abbreviated as $\text{in} \times \text{dcm}$ and $\sum_{j \neq i} W_{j,t-1}^{\text{eco}} \text{tax}_{j,t-1}$ is abbreviated as $\text{out} \times \text{dcm}$. $\sum_{j \neq i} W_{j,t-1}^{\text{eco}} \text{tax}_{j,t-1}$ is abbreviated as $\text{in} \times \text{eco}$ and $\sum_{j \neq i} W_{j,t-1}^{\text{dcm}} \text{tax}_{j,t-1}$ is abbreviated as $\text{out} \times \text{eco}$. $\sum_{j \neq i} W_{j,t-1}^{\text{geo}} \text{tax}_{j,t-1}$ is abbreviated as $\text{out} \times \text{geo}$ for brevity, the year fixed effects, coefficients for log population, log GDP, the vector of political variables and the vector of demographic variables (see Sections 3.1.1 and 3.1.2 for an overview) are suppressed.
3.4 Conclusion

This paper builds on the literature of tax competition by including additional approaches to capturing tax competition (a political, a demographic, and an economic weighting structure) and two separate groups – the in- and out-group – that affect tax instrument settings differently. The literature predicts the presence of a significant relationship across various measures of the labor income tax system, an effect confirmed in several tax instruments, effective average and marginal tax rates across different tax deciles, and in a comprehensive measure of a tax system – the difference between the before- and after-tax income distribution, measured as a Gini coefficient.
3.A Sample details and co-variates

This Appendix presents an overview of the countries included in the sample and their country classification in 2012, an overview of the variable included in the $X_{i,t}$ vector and their summary statistics.

![Sample countries in 2012](image)

The sample of countries includes Afghanistan, Albania, Algeria, Andorra, Angola, Antigua and Barbuda, Argentina, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Costa Rica, Cuba, Cyprus, Democratic Republic of the Congo, Denmark, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Federated States of Micronesia, Fiji, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, Indonesia, Iran, Iraq, Ireland, Italy, Ivory Coast, Jamaica, Jordan, Kenya, Kuwait, Laos, Lebanon, Lesotho, Liberia, Libya, Liechtenstein, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mexico, Monaco, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nauru, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Korea, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Congo, Romania, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, South Africa, South Korea, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Thailand, The Bahamas, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, Uganda, United Arab Emirates, United Kingdom, United Republic of Tanzania, United States of America, Uruguay, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.
Table 3.5: ADDITIONAL regression variables: Description and source

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(GDP)</td>
<td>Gross domestic product in logs.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>Population in logs.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>DependYoung</td>
<td>Dependency share of the young, measured between 0-100% and calculated as follows: Depend = ( \frac{Pop(0-15)}{Population(15-65)} )</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources. Missing observations were interpolated via regression on a polynomial of the year variable.</td>
</tr>
<tr>
<td>DependOld</td>
<td>Dependency share of the elderly, measured between 0-100% and calculated as follows: Depend = ( \frac{Pop(65+)}{Population(15-65)} )</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources. Missing observations were interpolated via regression on a polynomial of the year variable.</td>
</tr>
<tr>
<td>LFPart</td>
<td>Labor participation rate in the working age population.</td>
<td>World Bank’s World Development Indicators. Missing observations were interpolated via regression on a polynomial of the year variable.</td>
</tr>
<tr>
<td>Fertility</td>
<td>Fertility rate measured as average number of children per woman.</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources.</td>
</tr>
<tr>
<td>Unemployment</td>
<td>Unemployment rate.</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources.</td>
</tr>
<tr>
<td>PrimEd/SecEd/TertEd</td>
<td>Share of the population with completed primary, secondary, and tertiary education. Data in 5-year intervals, intermittent years imputed by country-wise regression on year, year^2, and year^3.</td>
<td>Barro and Lee (2010). Intermittent observations were interpolated via regression on a polynomial of the year variable.</td>
</tr>
<tr>
<td>UrbanPop</td>
<td>Share of the population that lives in urban areas.</td>
<td>World Bank’s World Development Indicators, United Nations Statistical Office, and country-specific sources.</td>
</tr>
<tr>
<td>LifeExp^m/f</td>
<td>Average number of years a newborn (male or female) infant would live.</td>
<td>World Bank’s World Development Indicators, and country-specific sources. Missing observations were interpolated via regression on a polynomial of the year variable.</td>
</tr>
<tr>
<td>Federal</td>
<td>Binary indicator for federal government.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Bicameral</td>
<td>Binary indicator for bicameral, national legislature.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Align^UL/LE/UE</td>
<td>Binary indicators for politically aligned (i) upper and lower chambers of a bicameral legislature (1 if legislature is not bicameral), (ii) lower chamber and executive, and (iii) upper chamber and executive. 1 if the legislature (both chambers in the case of bicameral legislatures) and the executive are aligned are both right-wing or both left-wing.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Govt^p/r/m/r/mix</td>
<td>Binary indicators for (i) parliamentary democracies, (ii) presidential democracies, (iii) military dictatorships, (iv) royal monarchies, and (v) mixed democracies.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Polity Score</td>
<td>Indicator measuring the democracy/autocracy of a regime.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Executive:</td>
<td>Binary indicators for executive branch.</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Binary indicator for right-wing executive branch.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Left</td>
<td>Binary indicator for left-wing executive branch.</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>Binary indicator for centrist executive branch.</td>
<td></td>
</tr>
<tr>
<td>TermLimit</td>
<td>Binary indicator if office holders in executive are term-limited.</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>Indicator of the competitiveness of election for executive office, measured between 1-7.</td>
<td></td>
</tr>
<tr>
<td>Legislative:</td>
<td>Binary indicators for legislative branch.</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Binary indicator for right-wing legislative branch. In case of bicameral legislature, only 1 if both chambers are right-wing majority-controlled.</td>
<td>The Quality of Governance Database.</td>
</tr>
<tr>
<td>Left</td>
<td>Binary indicator for left-wing legislative branch. In case of bicameral legislature, only 1 if both chambers are left-wing majority-controlled.</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>Binary indicator for centrist legislative branch. In case of bicameral legislature, only 1 if both chambers are centrist majority-controlled.</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>Indicator of the competitiveness of election for legislative office, measured between 1-7.</td>
<td></td>
</tr>
<tr>
<td>τprofit</td>
<td>National profit tax rates</td>
<td>Based on Egger, P., S. Loretz, M. Pfaffermayr and H. Winner (2009), Ernst &amp; Young publications, pwc publications, and country-specific publications.</td>
</tr>
</tbody>
</table>

This list includes the origin and sources of the relevant dependent and independent variables. For a summary statistics, see Table 3.6.
Table 3.6: Summary Statistics: Additional regression variables

<table>
<thead>
<tr>
<th>$X_{i,t}$</th>
<th>Obs</th>
<th>Min</th>
<th>10%</th>
<th>25%</th>
<th>Med</th>
<th>75%</th>
<th>90%</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(GDP)</td>
<td>5,148</td>
<td>15.07</td>
<td>19.94</td>
<td>21.34</td>
<td>22.91</td>
<td>24.85</td>
<td>26.39</td>
<td>30.41</td>
<td>23.07</td>
<td>2.50</td>
</tr>
<tr>
<td>ln(Pop)</td>
<td>5,148</td>
<td>8.92</td>
<td>11.90</td>
<td>13.90</td>
<td>15.69</td>
<td>16.80</td>
<td>17.86</td>
<td>21.02</td>
<td>15.27</td>
<td>2.23</td>
</tr>
<tr>
<td>Depend$^Y_oung$</td>
<td>5,148</td>
<td>15.52</td>
<td>27.09</td>
<td>37.93</td>
<td>62.10</td>
<td>82.32</td>
<td>91.99</td>
<td>113.31</td>
<td>60.63</td>
<td>24.31</td>
</tr>
<tr>
<td>Depend$^Old$</td>
<td>5,148</td>
<td>0.81</td>
<td>5.11</td>
<td>5.87</td>
<td>7.47</td>
<td>13.08</td>
<td>21.03</td>
<td>41.23</td>
<td>10.31</td>
<td>6.48</td>
</tr>
<tr>
<td>LFPart</td>
<td>5,148</td>
<td>39.20</td>
<td>49.09</td>
<td>50.49</td>
<td>55.70</td>
<td>66.40</td>
<td>75.70</td>
<td>90.60</td>
<td>59.14</td>
<td>10.71</td>
</tr>
<tr>
<td>Fertility</td>
<td>5,148</td>
<td>0.96</td>
<td>1.59</td>
<td>2.05</td>
<td>3.31</td>
<td>5.36</td>
<td>6.54</td>
<td>9.22</td>
<td>3.76</td>
<td>1.89</td>
</tr>
<tr>
<td>Unemployment</td>
<td>5,148</td>
<td>0.00</td>
<td>2.60</td>
<td>4.30</td>
<td>6.91</td>
<td>10.90</td>
<td>17.59</td>
<td>39.30</td>
<td>8.57</td>
<td>6.18</td>
</tr>
<tr>
<td>PrimEd</td>
<td>5,148</td>
<td>0.00</td>
<td>8.53</td>
<td>16.04</td>
<td>27.62</td>
<td>42.80</td>
<td>54.71</td>
<td>87.09</td>
<td>30.30</td>
<td>17.74</td>
</tr>
<tr>
<td>SecEd</td>
<td>5,148</td>
<td>0.00</td>
<td>3.37</td>
<td>10.54</td>
<td>24.62</td>
<td>42.40</td>
<td>56.46</td>
<td>93.50</td>
<td>27.34</td>
<td>20.04</td>
</tr>
<tr>
<td>TaxEd</td>
<td>5,148</td>
<td>0.00</td>
<td>0.58</td>
<td>1.75</td>
<td>5.49</td>
<td>12.01</td>
<td>20.00</td>
<td>45.76</td>
<td>8.06</td>
<td>8.03</td>
</tr>
<tr>
<td>UrbanPop</td>
<td>5,148</td>
<td>4.34</td>
<td>19.57</td>
<td>30.10</td>
<td>49.80</td>
<td>72.93</td>
<td>85.84</td>
<td>109.00</td>
<td>51.55</td>
<td>24.76</td>
</tr>
<tr>
<td>LifeExp$^{n}$</td>
<td>5,148</td>
<td>25.12</td>
<td>48.50</td>
<td>56.57</td>
<td>66.21</td>
<td>71.42</td>
<td>75.24</td>
<td>85.87</td>
<td>63.73</td>
<td>9.92</td>
</tr>
<tr>
<td>LifeExp$^{f}$</td>
<td>5,148</td>
<td>30.49</td>
<td>50.99</td>
<td>59.70</td>
<td>71.45</td>
<td>76.91</td>
<td>80.73</td>
<td>111.60</td>
<td>68.18</td>
<td>11.18</td>
</tr>
</tbody>
</table>

Federal: 5,148 0 0 0 0 0 1 1 0.14 0.35
Bicameral: 5,148 0 0 0 0 0 1 1 0.35 0.48
Align$^{UL}$: 5,148 0 1 1 1 1 1 1 0.93 0.25
Align$^{LE}$: 5,148 0 0 0 0 0 0 0 0.86 0.34
Govt$: 5,148 0 0 0 0 0 0 0 0.90 0.30
Govt$^F$: 5,148 0 0 0 0 0 0 0 0.25 0.44
Govt$^m$: 5,148 0 0 0 0 0 0 0 0.18 0.38
Govt$^{mix}$: 5,148 0 0 0 0 0 0 0 0.08 0.27
Policy Score: 5,148 $-10$ $-7$ $-6$ 4 9 10 10 1.92 7.16

Executive:
Right: 5,148 0 0 0 0 0 0 1 1 0.23 0.42
Left: 5,148 0 0 0 0 0 0 1 0.31 0.46
Center: 5,148 0 0 0 0 0 0 0 0.09 0.29
TermLimit: 5,148 0 0 1 1 1 1 1 0.76 0.43
competition: 5,148 1 2 3 7 7 7 7 5.43 2.12

Legislative:
Right: 5,148 0 0 0 0 0 0 1 1 0.22 0.42
Left: 5,148 0 0 0 0 0 0 1 1 0.31 0.46
Center: 5,148 0 0 0 0 0 0 1 0.09 0.29
competition: 5,148 1 2 4 7 7 7 7 5.67 2.02

For a list of sources, see Table 3.5.

3.B Additional Results

Figure 3.9 presents the overall results of model (5) for $EATR$, $EMTR$, and its tax components. Table 3.7 and 3.8 presents the results of group-wise regressions on the components of the tax schedule, $kinks$, $stat\tau$, and $lbound$. Figures 3.10 to 3.12 presents the results of group-wise regressions on $EATR$, $EMTR$, and its tax components.
Figure 3.9: Regression coefficients: Results of Model (5) for EATR, EMTR, and their components
Table 3.7: Arellano-Bond Regressions: Instrument setting through weighted in-group and out-group - High and Upper-Middle Income

<table>
<thead>
<tr>
<th>Variable</th>
<th>High Income</th>
<th>Upper-Middle Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{tax}_{i,t} )</td>
<td>( \text{tax}_{i,t-1} )</td>
<td></td>
</tr>
<tr>
<td>( \text{kindex} )</td>
<td>0.673***</td>
<td>0.636***</td>
</tr>
<tr>
<td>( \text{in} )</td>
<td>0.650***</td>
<td>0.626***</td>
</tr>
<tr>
<td>( \text{out} )</td>
<td>0.581***</td>
<td>0.587***</td>
</tr>
<tr>
<td>( \text{in} \times \text{pol} )</td>
<td>(0.030)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>( \text{out} \times \text{pol} )</td>
<td>(0.030)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>( \text{in} \times \text{dem} )</td>
<td>(20.251)</td>
<td>(23.603)</td>
</tr>
<tr>
<td>( \text{out} \times \text{dem} )</td>
<td>−5.935</td>
<td>9.640</td>
</tr>
<tr>
<td>( \text{in} \times \text{eco} )</td>
<td>20.296</td>
<td>−0.491</td>
</tr>
<tr>
<td>( \text{out} \times \text{eco} )</td>
<td>(19.311)</td>
<td>(20.666)</td>
</tr>
<tr>
<td>( \text{in} \times \text{geo} )</td>
<td>13.172*</td>
<td>−8.060</td>
</tr>
<tr>
<td>( \text{out} \times \text{geo} )</td>
<td>−3.529</td>
<td>1.502</td>
</tr>
<tr>
<td>( \chi^2 )</td>
<td>3.0 ( \times 10^6 )</td>
<td>7.053</td>
</tr>
</tbody>
</table>

\( \text{tax}_{i,t-1} \) | 0.644*** | 0.648*** |
| \( \text{in} \times \text{pol} \) | (0.033) | (0.033) |
| \( \text{out} \times \text{pol} \) | (0.033) | (0.033) |
| \( \text{in} \times \text{dem} \) | (14.008) | (14.170) |
| \( \text{out} \times \text{dem} \) | 2.768 | 2.134 |
| \( \chi^2 \) | 3.252 | 7.230 |

\( \text{bound} \) | 0.656*** | 0.657*** |
| \( \text{in} \times \text{pol} \) | (0.026) | (0.025) |
| \( \text{out} \times \text{pol} \) | (0.026) | (0.025) |
| \( \text{in} \times \text{dem} \) | (10.725) | (11.001) |
| \( \text{out} \times \text{dem} \) | 8.519 | 9.267 |
| \( \chi^2 \) | 1.160 \times 10^6 | 1.670 \times 10^6 |

Standard errors in parentheses. *** p < 0.01; ** p < 0.05; * p < 0.1. \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{in} \times \text{pol} \) and \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{out} \times \text{pol} \). \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{in} \times \text{dem} \) and \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{out} \times \text{dem} \). \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{in} \times \text{geo} \) and \( \sum_{j=1}^{\text{J}} \text{W}_{j,t-1} \text{tax}_{j,t-1} \) is abbreviated as \( \text{out} \times \text{geo} \). For brevity, the year fixed effects, coefficients for log population, log GDP, the vector of political variables and the vector of demographic variables (see Sections 3.1.1 and 3.1.2 for an overview) are suppressed.
Table 3.8: Arellano-Bond Regressions: Instrument setting through weighted in-group and out-group - Lower-Middle and Low Income

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lower-Middle Income</th>
<th>Low Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>$\kappa_{X_{i,t}}$</td>
<td>0.825***</td>
<td>0.814***</td>
</tr>
<tr>
<td>in * pol</td>
<td>(0.021)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>out * dem</td>
<td>(67.594)</td>
<td>193.332***</td>
</tr>
<tr>
<td>in * eco</td>
<td>9.722**</td>
<td>5.607</td>
</tr>
<tr>
<td>out * eco</td>
<td>(8.850)</td>
<td>(8.709)</td>
</tr>
<tr>
<td>in * geo</td>
<td>62.403***</td>
<td>65.342***</td>
</tr>
<tr>
<td>constant</td>
<td>(46.930)</td>
<td>1.485</td>
</tr>
<tr>
<td>stat</td>
<td>$\kappa_{X_{i,t-1}}$</td>
<td>0.658***</td>
</tr>
<tr>
<td>in * pol</td>
<td>(0.030)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>out * pol</td>
<td>5.650</td>
<td>5.608</td>
</tr>
<tr>
<td>out * dem</td>
<td>(9.840)</td>
<td>(9.595)</td>
</tr>
<tr>
<td>in * eco</td>
<td>55.391***</td>
<td>57.684***</td>
</tr>
<tr>
<td>constant</td>
<td>131.663***</td>
<td>136.362***</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>(45.205)</td>
<td>(46.636)</td>
</tr>
<tr>
<td>bound</td>
<td>$\kappa_{X_{i,t-1}}$</td>
<td>0.630***</td>
</tr>
<tr>
<td>in * pol</td>
<td>(0.020)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>out * pol</td>
<td>15.356</td>
<td>8.279</td>
</tr>
<tr>
<td>out * dem</td>
<td>42.380</td>
<td>38.922</td>
</tr>
<tr>
<td>in * eco</td>
<td>-1.678</td>
<td>1.191</td>
</tr>
<tr>
<td>out * eco</td>
<td>(25.833)</td>
<td>(30.117)</td>
</tr>
<tr>
<td>constant</td>
<td>-24.229</td>
<td>33.380</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>(56.710)</td>
<td>(59.436)</td>
</tr>
<tr>
<td>Obs</td>
<td>1,491</td>
<td>1,491</td>
</tr>
<tr>
<td>Countries</td>
<td>86</td>
<td>86</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as in * pol and $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as out * pol. $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as in * dem and $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as out * dem. $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as in * eco and $\sum_{i=1}^{N} \sum_{j=1}^{M} W_{i,j}^{pol} \kappa_{X_{i,t-1}}$ is abbreviated as out * eco. For brevity, the year fixed effects, coefficients for log population, log GDP, the vector of political variables and the vector of demographic variables (see Sections 2.1.4 and 3.1.2 for an overview) are suppressed.
Figure 3.10: Regression coefficients for avτ components: By income group
Figure 3.11: Regression coefficients for EMTR components: By income group
Figure 3.12: Regression coefficients for $m\tau$ components: By income group
3.C Income distribution estimates

For the decile-specific analysis, I need decile-specific measures of nominal labor income for the panel of countries. Unfortunately, as micro-data sources only cover a handful of countries for a bare minimum number of years, I estimate the wage income distribution using the Gini coefficient and the average wage. I assume that wages are Pareto distributed.\[13\]

I follow the wage calibration applied in Egger, Nigai and Strecker (2016), using data on two moments: the gross wage Gini coefficient, $Gini_{it}$, and the average gross wage, $\bar{w}_{it}$.\[14\]

With the single shape parameter Pareto distribution, the shape ($\phi_{it}$) and the scale parameter ($w_{it}$) can be identified from the following two moment conditions:

$$\bar{w}_{it} = \frac{\phi_{it}}{\phi_{it} - 1} w_{it}; \quad Gini_{it} = \frac{1}{2\phi_{it} - 1}.$$ \[3.8\]

Once calibrated, I can calculate an average income within each of the hundred percentiles per country and year. Average labor income levels are obtained/calculated from the International Labor Organization’s LABORSTA database, its successor, the ILOstat database, and, for a number of countries, domestic statistical sources. The data on gross wage Gini coefficients are from the ILOstat database. Where specific years or countries were not available, gross wage Gini coefficients are imputed via linear regressions from gross income Gini coefficients (Standardized World Income Inequality Database and country-specific sources), the average wage, the distribution of education levels in the population (Barro and Lee, 2010), and total capital stock as predictors.

Following Griliches (1980), I use the perpetual inventory method for calculating country-specific capital stocks. The capital stock of country $i$ in year $t$ is

$$K_{it} = K_{it-1} (1 - \delta) + I_{it},$$ \[3.9\]

where $I_{it}$ is real investment (gross fixed capital formation) in country $i$ and year $t$ and $\delta$ denotes the depreciation rate, which is assumed to be 10 percent. The capital stock $K_{i0}$ in the first period of the sample is computed as $K_{i0} = \frac{I_{i0}}{(\bar{g}_{i} + \delta)}$, where $\bar{g}_{i}$ represents the average annual investment growth rate over the whole time span and $I_{i0}$ denotes investment in the first year where data are available.

\[13\]Egger, Nigai and Strecker (2016), in addition to a log-normal and 5%-mixture distribution, implements a Pareto distribution of labor incomes and provides evidence that such Pareto imputed incomes, along with labor force statistics, and the tax rates described above match realized tax revenues quite well.

\[14\]Pareto (1896) himself provided evidence that incomes and wealth follow Pareto-type power-laws. And more recently, Felbermayr, Hauptmann, and Schmerer (2014) and Egger, Egger, and Kreickemeier (2013), among others, are able to show the same Pareto distribution applies to worker data.
Chapter 4

Effective Labor Taxation and the International Location of Headquarters

The taxation of profits and capital as an impediment to the location (and extent) of investment received much attention in theoretical as well as empirical academic work in public finance (see, e.g., Devereux and Griffith, 1998; Devereux and Hubbard, 2003). The focus on profit taxation flows from the assumption of capital to be relatively mobile across international borders, at least in comparison to other production factors such as labor. Empirical work, however, points to three issues suggesting that an emphasis on profit taxation may be insufficient: (i) capital and skilled workers have been conjectured and found to be largely complementary in production (see Griliches, 1969; Duffy, Papageorgiou, and Perez-Sebastian, 2004); (ii) skilled workers and employees – such as managers, technicians, and researchers – are relatively mobile across international borders (see Chiswick, 1999; Liebig and Sousa-Poza, 2004; Grogger and Hanson, 2008); and (iii) the profit tax base can easily be manipulated (by transfer pricing, debt shifting, etc.) while this is much harder for the labor (or income) tax base. Hence, income taxation may be relevant for headquarters.

1This chapter is based on Egger, Radulescu, and Strecker (2013). The authors gratefully acknowledge funding from the Swiss Science Foundation through grant number 100014_131878. The authors would like to thank numerous comments by conference participants and discussants at the IIPF, ESEM, CESifo Conference on Public Sector Economics, Public Choice Societies Congress, SSES, Verein für Socialpolitik, Doctoral Meeting of the Center for Business Taxation. In particular, the authors are grateful to an anonymous reviewer for numerous helpful comments.

2There is extensive evidence in the literature on the strategies and the extent to which multinational enterprises engage in profit shifting activities (see for instance Huizinga and Laeven, 2008; Weichenrieder, 2009). This can be done for instance by manipulating transfer prices (see Hines and Rice, 1994; Clausing, 2003), by intracompany loans (see e.g., Mintz and Smart, 2004; Bttner and Wamser, 2007) or by the relocation of intangible assets to low-tax affiliates (see e.g., Dischinger and Riedel, 2011).
location to the extent that it affects the local availability of skilled workers (and their effort) and even education choice of individuals in the long run.

There is anecdotal evidence that the (re-)location of headquarters of large multinational firms in recent years has been co-determined by issues of profit and labor taxation.\textsuperscript{3} Most of the theoretical and empirical literature on the location of firms considers (employee- and employer-borne) income tax aspects only implicitly.\textsuperscript{4} If at all, previous work on firm location considered the role of profit taxation, but abstained from explicitly shedding light on income taxation issues. The paper by Egger and Radulescu (2011) is an exception. It considers the effects of labor taxation on bilateral foreign direct investment (FDI) in a cross section of 52 countries rather than headquarters location as such. Their results suggest that bilateral outward FDI is smaller the bigger the difference between host-to-parent country labor tax rates. The roles played by the net wage, the income tax rate, and, more generally, the employee’s income tax burden, as opposed to the employer’s tax burden, in determining firm locations are virtually unexplored.\textsuperscript{5}

We argue that a higher employer-borne income tax burden on high-skilled labor directly reduces a firm’s profits, as they represent a direct cost for the firm unless the tax burden can be fully passed on to employees. A higher employee-borne income tax burden exercises a negative effect on

\textsuperscript{3}E.g., this was mentioned with regard to the relocation of the European headquarters of Procter and Gamble, McDonalds, and Kraft, from London to Switzerland (see Handelsblatt, 2009).

\textsuperscript{4}See Baldwin, Forslid, Martin, Ottaviano, and Robert-Nicoud (2003) for economic theory and Rathelot and Sillard (2008) for empirical analysis on the location of mobile firms in general; Markusen (2002) for economic theory and Strauss-Kahn and Vives (2009) for empirical analysis on the location of headquarters of multinational firms; Barba Navaretti and Venables (2006) for economic theory and Head and Mayer (2004) as well as Becker, Ekholm, Jckle, and Muendler (2005) for empirical analysis on the location of production units of multinational firms. Defever (2006) focuses on the co-location of non-European firms’ value chain in the European Union for the period 1997-2002 and finds that the location of service activities depends in particular on functional aspects and that headquarters location does not seem to attract any other part of a firm’s value chain. Bel and Fageda (2008) employ firm-level and international flights data on major urban areas in 25 European Union member countries. Their findings indicate that, among others, the proximity to large markets and the supply of direct international flights influence the headquarters location choice positively. Davis and Henderson (2008) use panel data on auxiliary establishments of firms in the United States and show that a higher number of local service input providers and the scale of other headquarters activities nearby stimulates the agglomeration of headquarters. Strauss-Kahn and Vives (2009) investigate the location of headquarters for the United States over the years 1996 to 2001 and find that factors such as low average wages, low corporate tax rates, and the agglomeration of other headquarters in the same sector influence the relocation of headquarters positively.

\textsuperscript{5}As said before, this may be problematic especially, with an interplay of capital-skill complementarity at the headquarters level, the relative mobility of skilled workers, and the relative difficulty of avoiding labor taxes (relative to profit taxes).
managerial effort (see Egger and Radulescu, 2011) and, hence, indirectly reduces a firm’s profits. Headquarters services intensively use high-skilled labor, in particular (see Carr, Markusen, and Maskus, 2001; Markusen, 2002). High-skilled workers perform more complex tasks where outcomes may be more risky and effort less observable than for more standardized low-skill-intensive activities. This suggests that the effort of high-skilled individuals may be more sensitive with respect to labor taxation than that of low-skilled workers. In addition, since high-skilled individuals tend to be more mobile across borders than low-skilled workers, labor taxation and the progressivity of a tax system will have a stronger negative effect on the availability of these individuals. Hence, the level of social security contributions and the level of income tax rates, as well as their progressivity should be important for a country’s attractiveness as headquarters’ location. The relationship between the number of headquarters and the labor income tax for an individual earning the average wage is depicted in Figure 1. Accordingly, the figure shows that the predicted number of headquarters ceteris paribus declines with a higher labor income tax. The present paper assesses these previously mentioned hypotheses in the following way.

We construct a unique panel data set on average and marginal effective labor income taxes (including employee- and employer-borne social security contributions, tax credits, and tax allowances and deductions) for 120 economies. We exploit the cross-sectional dimension of this data set by considering all location decisions or relocating and new (first) location. We match this data set onto the universe of corresponding cross-sectional data on 37,502 firms from Compustat. This leads to a common data set of 79 countries and 35,206 firms, which can be used for the empirical analysis. Alternatively, we exploit information on new (first) locations and on relocations.

\( ^6 \)In economic theory, a salient prediction states that the effective economic incidence of a tax is independent of the statutory incidence of taxes. In our context, this implies that placing an income tax of the same amount on employees versus employers will have identical effects on the real economy, unless there are other distortions which cause asymmetric effects. This principle is referred to as “Invariance of Incidence Proposition (IIP)”, and, for labor taxation, it inter alia requires perfectly competitive labor markets (OECD, 1990). In the presence of adjustment costs or imperfect labor markets, moving from taxing income at the employer to taxing it at the employee may not be neutral. The labor market institutions and conditions have thus an important influence on the effect of different labor taxes. In reality, nominal contractual wages are characterized by a downward rigidity and prices (and real wages) are sticky (OECD, 1990; Goerke, 2000). At least in the short run, switching from employee to employer based income taxes increases wage costs to employers and, unless the firm can charge higher prices or pass the costs on to the employee, will face a decline in profits (Rutkowski and Walewski, 2007, Daveri and Tabellini 2000). In case of a “real wage resistance”, a shift in personal income taxes or social security contributions induces a change in wage costs and taxes are (mainly or partly) borne by the firm, depending on the elasticity of labor supply. Daveri and Tabellini (2000) used data for continental European countries to provide some evidence of wage resistance and found that a 10 percentage point increase in the tax wedge raises real labor costs by 5 percent. Kugler and Kugler (2009) used a panel of manufacturing plants from Colombia over the 1980s and 1990s and showed that wages fell only by 1.4 to 2.3 percent in response to a 10-percent rise in payroll taxes due to downward wage rigidities and an elastic labor supply in the Colombian labor market. Furthermore, as pointed out by Alesina and Perotti (1994), changes in the tax burden that induce a change in real labor costs can change domestic production costs vis-à-vis those of foreign competitors and, hence, indirectly influence labor demand. Thus, an increase in employer social security contributions can diminish a country’s international competitiveness acting like a real exchange rate appreciation (Arpaia and Carone, 2004). All of the just-mentioned arguments suggest a stronger effect of payroll taxes relative to labor income taxes on the location of firms.
The empirical results suggest that – conditional on other factors of influence such as profit taxes – the probability of a country to be chosen as the headquarters location depends negatively on the average level and progressivity of a country’s income tax rate, as well as on the extent of social security contributions paid by firms and employees, respectively. The results are most pronounced for employer-borne payroll taxes among all components of effective labor income taxes. On average, for new (first or re-) locations a one percentage point increase in a country’s labor income tax rate reduces the probability of it to attract the headquarters of the average firm by 6.1 percent versus 6.8 percent for a one percentage point increase in employer social security contributions.

The remainder of the paper is structured as follows. In the next section, we present the data, in particular, on effective labor income tax rates. Section 3 introduces the econometric approach used for the empirical analysis – conditional logit and nested logit models. Section 4 summarizes the empirical results and the results of a series of robustness checks, and Section 5 concludes.

4.1 Data

In general, we use averaged data for explanatory variables for the period 2005-2009 or for 1992-2009, when considering new (first) and relocations. The dependent variable is a binary location choice indicator, which denotes either the location state as of 2009, for 35,206 companies, the relocations between 1992 and 2009 for 610 companies, or the first location as well as relocation decisions for 4,335 firms.
4.1.1 Data on headquarters location

Information on the location of firms’ headquarters is available from Compustat. That data set provides the residence country of the headquarters (as opposed to the country of incorporation) of global firms, covered by stock indices. For each company, this allows us to determine the $J$-nomial variable $Loc$ and the binary variable $Loc_{ij}$, where the latter is unity whenever, for firm $i$ with $i = 1, \ldots, I$, $Loc = j$ with $j = 1, \ldots, J$ in 2009. Similarly, we can determine relocations between 1992 and 2009. Following the direction of Pastor and Veronesi (2003), Fama and French (2004), or Chun, Kim, Morck, and Yeung (2008), we obtain our sample of first locating firms, by matching the date of the initial public offering of our firms to the time in which they first appear in our data set. If the IPO date occurred in the same (or later) year, we consider it a first locating firm.

4.1.2 Data on income taxation

One contribution of this paper is the construction of a unique panel data set on effective labor income taxes for 120 countries annually for the years 1992-2009. We follow the methodology of the “Taxing Wages” approach used by the OECD, discussed by Heady (2004) and described in Egger and Radulescu (2011), to compute marginal and average effective tax rates plus the social security contributions for an individual earning the average wage or five times the average wage of an economy. Beyond social security contributions, we account for detailed provisions of the respective national tax codes such as personal tax allowances, tax credits, standard deductions, other country-specific formulae and local (subnational) taxes. This data set allows us to consider the importance of the progressivity of a country’s income tax schedule beyond the one of average tax rates. The latter appears of particular importance when considering the role of income taxation for high-skilled (and hence, high-income) earners, as opposed to average workers and employees.

This comprehensive data set on income taxation was assembled from numerous sources such as individual countries’ tax law, publications from international organizations, and data from international accounting firms. Among the most important sources, beyond individual countries’ sources, we should mention the OECD Taxing Wages data sets for several years, PricewaterhouseCoopers’ Individual Taxes: Worldwide Summaries for various years, PKF International’s Worldwide Tax Guide, the Social Security Observatory’s Social Security Programs Throughout the World for social

---

7 This information is only available for the North American data set.
8 Notice that, with relocations or new locations, exploiting a short time period may be problematic for reasons of few events, especially, if the focus is on headquarters and large firms.
9 Peter, Buttrick, and Duncan (2010) compute the tax liability for pre-tax incomes equivalent to one, two, three and four times a country’s GDP per capita. However, we assume gross wages to be better reflective of the actual income tax base. Also, Peter, Buttrick, and Duncan (2010) do not account for social security contributions and other provisions which we consider as important for inference of the effective tax burden on labor.
security legislation, and the International Labor Organization’s LABORSTA database for data on annual gross wages.

Based on the aforementioned data sources, we define the following variables capturing aspects of the income taxation of country \( j \): \( \text{LabTax}_j \) denotes the labor income tax burden on an individual earning the average wage; \( \text{Prog}500_j \) indicates the progression of a country’s tax schedule defined as the log of one minus the difference between the marginal taxes of an individual earning five times the average wage and the marginal tax of an individual earning the average wage; \( \text{EmployeeSocSec}_j \) and \( \text{EmployerSocSec}_j \) represent employee- and employer-borne social security contributions, respectively. \( \text{LabTax}500_j \) indicates the labor income tax burden for an individual earning five times of the average wage.\(^{10}\)

To compute the above and the corresponding marginal income tax rates, we used information on average gross wages per employee in U.S. dollars, \( \text{Wage}_j \), from the United Nations’ labor statistics database, LABORSTA. For consistency’s sake, we used annual sectoral wages by level of employment to create an average annual wage where possible.

### 4.1.3 Data on control variables

Several control variables for headquarters location beyond income tax variables were based on source data from the World Bank’s World Development Indicators 2010 and the United Nations’ Statistics Division. In particular, we used the following variables and data in all regressions: statutory corporate tax rates across potential locations (\( \text{CorpTax}_j \)) as a fraction of unity, measuring the intensity of profit taxation; gross domestic product in U.S. dollars as a measure of \( j \)’s market size (\( \text{GDP}_j \)); a country’s capital stock in U.S. dollars (\( \text{CapStock}_j \)) as a measure of capital abundance (given market size)\(^{11}\) and on average wages per employee in U.S. dollars (\( \text{Wage}_j \)) as a measure of wage costs in \( j \) net of labor taxes. While data on the latter variable come from the United Nations’ LABORSTA database, the ones underlying \( \text{CorpTax}_j \), \( \text{GDP}_j \), and \( \text{CapStock}_j \) are from

\(^{10}\)A considerable number of countries have labor income, social security, and corporate income tax rates of zero.

\(^{11}\)We follow Griliches (1980) to use the perpetual inventory method for calculating country-specific capital stocks. The capital stock of country \( j \) in year \( t \) is

\[
K_{jt} = K_{jt-1}(1 - \delta) + I_{jt},
\]

where \( I_{jt} \) is real investment (gross fixed capital formation in constant U.S. dollars of the year 2000) in country \( j \) and year \( t \) and \( \delta \) denotes the depreciation rate, which we assume to be 10 percent. The capital stock \( K_{j0} \) in the first period of the sample is computed as

\[
K_{j0} = \frac{I_{j0}}{\bar{g}_j + \delta},
\]

where \( \bar{g}_j \) represents the average annual investment growth rate over the whole time span and \( I_{j0} \) denotes investment in the first year where data are available. We then calculate the average value of \( K_{jt} \) for the relevant time span (2005-2009 or 1992-2009).
the World Bank’s World Development Indicators. Moreover, in some regressions we use the share of the population with tertiary education in country \( j \) (\( TertEdu_j \)) based on data from Lutz, Goujon, and Sanderson (2007) to measure skill abundance\(^{12}\) and the number of flights to and from country \( j \) as a measure of infrastructure abundance to construct the following variables (\( Flights_j \)) from World Development Indicators. To include a measure of the institutional strength of a country, we employ a (\( LegalRights_j \)), which is unity if the country’s legal rights index, as reported in the World Development Indicators, is above the world-wide median\(^{13}\). All remaining variables are used in a log-transformed way. In particular, all income and profit tax measures are log-transformed after subtracting the respective fraction from unity (since some of those measures are zero). Hence, the respective variables measure a country’s attractiveness in (income and profit) tax terms. All level variables enter the regressions simply in a log-transformed way, except for \( TertEdu_j \) which is the log of the tertiary education share plus unity.

### 4.1.4 Descriptive statistics

Table 1 provides summary statistics of the data for 79 countries and 35,206 firms for which all the necessary information is available and which can subsequently be used for the empirical analysis.

**Table 4.1: Summary Statistics for Stock of Firms: 2005-2009**

<table>
<thead>
<tr>
<th></th>
<th>Mean (1)</th>
<th>Stddev (2)</th>
<th>Median (3)</th>
<th>Max (4)</th>
<th>Min (5)</th>
<th>Nb-obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>LabTax</td>
<td>0.103</td>
<td>0.071</td>
<td>0.108</td>
<td>0.363</td>
<td>0.000</td>
<td>35,206</td>
</tr>
<tr>
<td>Prog500</td>
<td>0.155</td>
<td>0.071</td>
<td>0.143</td>
<td>0.432</td>
<td>0.000</td>
<td>35,206</td>
</tr>
<tr>
<td>EmployerSocSec</td>
<td>0.110</td>
<td>0.065</td>
<td>0.095</td>
<td>0.372</td>
<td>0.000</td>
<td>35,206</td>
</tr>
<tr>
<td>EmployeeSocSec</td>
<td>0.075</td>
<td>0.048</td>
<td>0.071</td>
<td>0.300</td>
<td>0.000</td>
<td>35,206</td>
</tr>
<tr>
<td>CorpTax</td>
<td>0.324</td>
<td>0.067</td>
<td>0.331</td>
<td>0.411</td>
<td>0.000</td>
<td>35,206</td>
</tr>
<tr>
<td>GDP, mn. US$</td>
<td>3,884,000</td>
<td>4,688,000</td>
<td>2,470,000</td>
<td>13,720,000</td>
<td>3,418</td>
<td>35,206</td>
</tr>
<tr>
<td>CapStock, mn. US$</td>
<td>5,283,000</td>
<td>5,862,000</td>
<td>2,640,000</td>
<td>16,410,000</td>
<td>8,060</td>
<td>35,206</td>
</tr>
<tr>
<td>TertEdu</td>
<td>0.589</td>
<td>0.131</td>
<td>0.588</td>
<td>0.858</td>
<td>0.167</td>
<td>35,206</td>
</tr>
<tr>
<td>Wage</td>
<td>34,386</td>
<td>18,103</td>
<td>40,135</td>
<td>66,851</td>
<td>20</td>
<td>35,206</td>
</tr>
</tbody>
</table>

Table 1 suggests that the mean of the labor tax burden on an individual earning the average wage is 10.3 percent and the maximum is 36.3 percent for the average country and year between 2005 and 2009. The average rate of progressivity is 15.5 percent and has a maximum value of 43.2 percent in that period. The average values of employer-borne and employee-borne social security contributions amount to 11 percent and 7.5 percent, respectively, with maximum values of 37.2 percent and 30 percent, respectively. Table 1 also reports summary statistics on corporate taxes, which range from a minimum value of 0 percent to a maximum of 41.1 percent with an average

---

\(^{12}\)We argue that strong progressivity of the income tax system may distort the education decision of individuals. To that end, the tertiary education measure may reflect in part an income tax effect. However, income taxation should also induce an impact on effort beyond education.

\(^{13}\)The worldwide median for the WDI’s Strength of Legal Rights Index is 6 out of a possible 10.
Table 4.2: Summary Statistics for Relocating & First Locating Firms: 1992-2009

<table>
<thead>
<tr>
<th></th>
<th>Mean (1)</th>
<th>Stddev (2)</th>
<th>Median (3)</th>
<th>Max (4)</th>
<th>Min (5)</th>
<th>Nb-obs (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LabTax</td>
<td>0.148</td>
<td>0.053</td>
<td>0.170</td>
<td>0.400</td>
<td>0.000</td>
<td>4,335</td>
</tr>
<tr>
<td>Prog500</td>
<td>0.104</td>
<td>0.044</td>
<td>0.092</td>
<td>0.365</td>
<td>0.000</td>
<td>4,335</td>
</tr>
<tr>
<td>EmployerSocSec</td>
<td>0.094</td>
<td>0.045</td>
<td>0.079</td>
<td>0.282</td>
<td>0.000</td>
<td>4,335</td>
</tr>
<tr>
<td>EmployeeSocSec</td>
<td>0.072</td>
<td>0.026</td>
<td>0.070</td>
<td>0.258</td>
<td>0.000</td>
<td>4,335</td>
</tr>
<tr>
<td>CorpTax</td>
<td>0.377</td>
<td>0.052</td>
<td>0.393</td>
<td>0.456</td>
<td>0.000</td>
<td>4,335</td>
</tr>
<tr>
<td>GDP, mn. US$</td>
<td>7,582,000</td>
<td>3,979,000</td>
<td>10,150,000</td>
<td>10,150,000</td>
<td>5,016</td>
<td>4,335</td>
</tr>
<tr>
<td>CapStock, mn. US$</td>
<td>9,061,000</td>
<td>4,420,000</td>
<td>11,750,000</td>
<td>11,750,000</td>
<td>6,281</td>
<td>4,335</td>
</tr>
<tr>
<td>TertEdu</td>
<td>0.679</td>
<td>0.089</td>
<td>0.725</td>
<td>0.868</td>
<td>0.233</td>
<td>4,335</td>
</tr>
<tr>
<td>Wage</td>
<td>35,630</td>
<td>10,760</td>
<td>40,020</td>
<td>70,343</td>
<td>635</td>
<td>4,335</td>
</tr>
</tbody>
</table>

Value of 32.4 percent. The lowest average annual wage income amounts to 20 U.S. dollars recorded in Zimbabwe and the highest one to 66,851 U.S. dollars recorded in Switzerland.

In Table 2 we present the same summary statistics but this time for a smaller sample of 50 countries and 4,335 firms including only the relocated and first locating firms. The mean for the labor tax burden for an individual earning the average wage amounts to 14.8 percent, with a maximum of 40 percent for the average country between 1992 and 2009. Progressivity amounts to slightly more than 10 percent, with a maximum of 36.5 percent. Social security contributions remained roughly on par with the sample for 2005-2009. Corporate taxes now range from 0 percent to 45.6 percent with an average of 37.7 percent.

4.2 Empirical strategy

This section introduces the empirical specifications used to identify whether and to which extent labor taxes, social security contributions, and the progressivity of a tax system ceteris paribus play a role in a firm’s decision about where to locate its headquarters.

4.2.1 Conditional logit

To estimate location choice behavior, one model is the conditional logit model (McFadden, 1974), as illustrated in Figure 4.2. This model is suitable to address the question of how a country’s characteristics, such as the effective taxes on labor income, affect a country’s likelihood of being chosen as a firm’s headquarters location.

As explained in Section 4.1.1, we denote the binary dependent variable by \( Loc_{ij} \). It is unity if firm \( i = 1, \ldots, I \) has its headquarters in country \( j = 1, \ldots, J \) in 2009 and zero otherwise. Alternatively, it is unity if firm \( i \) relocates or locates for the first time its headquarters in \( j \) between 1992 and 2009.
and zero otherwise. To determine the probability that country $j$ is chosen as the location of firm $i$’s headquarters, we first define the deterministic net return that would be derived from locating in country $j$ as

$$V_{ij} = V(Loc_{ij} = 1|x_j) = \beta x'_j,$$

(4.3)

where $x_j$ denotes a vector of alternative-specific variables facing the headquarters of firm $i$ in country $j$, such as $LabTax_j$, $Prog500_j$, $EmployeeSocSec_j$, $EmployerSocSec_j$, $CorpTax_j$, $GDP_j$, $CapStock_j$, $Wage_j$, $TertEdu_j$, $Flights_j$, and $LegalRights_j$.

The conditional probability of headquarters location for firm $i$ in country $j$ is first estimated using the following conditional logit regression model

$$Pr(Loc_{ij} = 1|x_j) = \frac{e^{V_{ij}}}{\sum_{l=1}^{J} e^{V_{il}}} = \frac{e^{\beta x'_j}}{\sum_{l=1}^{J} e^{\beta x'_l}}, \forall l = 1, \ldots, J: j \neq l.$$  

(4.4)

As is well known, $\beta$ can be estimated consistently if the following assumptions hold: first, error terms associated with the stochastic version of (4.3) must be identically and independently distributed and, second, the independence of irrelevant alternatives (IIA) criterion must be met. If the IIA assumption is violated, including some previously omitted location could alter the probability at which similar countries are chosen. For example, exclusion of Canada from the list of alternative countries could increase the probability that firms locate in the United States. Similarly, Germany and France could have correlated error terms, both being in Europe. Such correlation is ruled out under IIA; therefore, the conditional logit model runs the risk to produce biased estimates of the effects of taxes on the location decision.

4.2.2 Nested logit

To overcome the potential bias of the conditional logit model following from a violation of the IIA assumption, we employ the nested logit model as an alternative econometric approach, because it relaxes the IIA criterion by employing a hierarchical choice structure. In the nested logit model, we

---

Notice that the conditional logit model is also dubbed the conditional fixed effect logit model as it captures by construction all characteristics that are invariant across locations and specific to the individual or firm making location choices (see Allison, 2009; Greene, 2002). Since a firm’s main industry is a (fairly) time-invariant characteristic, the approach implicitly also controls for product characteristics. However, this is not the case with regional-specific effects which vary across nests of locations $j$. The latter may be accounted for in a nested logit model using, e.g., continental clustering.
group countries by per-capita income (low, middle-low, middle-high, and high) following the World Bank’s categorization with the first two groups combined into one so as to achieve a more even distribution of countries into nests. The decision to locate in country \( j \) is split into first the choice of the nest of countries \( j \) belongs in, \( N(j) \), which is determined by nest-specific characteristics that do not vary within the nest, and, subsequently, the choice among the countries within the nest, as illustrated in Figure 4.3.

The deterministic net return of firm \( i \) from locating its headquarters in country \( j \) is then specified as

\[
V_{ij} = V(Loc_{ij} = 1|x_j, w_n) = \beta x_j' + \delta_n w_n',
\]

(4.5)

where \( x_j \) is a vector of alternative-specific variables firm \( i \) faces in country \( j \), and \( w_n \) denotes a vector of nest-specific variables determining the choice of nest \( N(j) \).

The probability of locating in country \( j \) can be split into the product of the conditional probability of locating in country \( j \) if it belongs in nest \( N(j) \) – term (a) – and the probability of \( j \) being in nest \( N(j) \) – term (b):

\[
Pr(Loc_{ij} = 1|x_j) = Pr(Loc_{ij} = 1|x_j \in N(j)) \times Pr(j \in N(j))
\]

(4.6)

15Of the 79 countries in our sample, 37 fall into the high-income category, 25 into the middle-high income class, 17 middle-low to low-income countries. The exact definition is as follows. High-income countries: Austria, Australia, the Bahamas, Bahrain, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hong Kong, Hungary, Ireland, Italy, Japan, Luxembourg, Malta, the Netherlands, Norway, New Zealand, Poland, Portugal, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, and the United States. Middle-to-high-income countries: Argentina, Bulgaria, Brazil, Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Jordan, Kazakhstan, Lithuania, Latvia, Mexico, Mauritius, Malaysia, Namibia, Panama, Peru, Romania, Russia, South Africa, Thailand, and Turkey. Low-income countries: Bangladesh, Bolivia, Cote d’Ivoire, Egypt, Ghana, India, Indonesia, Kenya, Morocco, Pakistan, Paraguay, the Philippines, Sri Lanka, Ukraine, Vietnam, Zambia and Zimbabwe. From here on, we will refer to the middle-to-high-income category as the middle-income category.

16In the generalized version, we set up the nested logit model such that the alternative-specific variables have a non-alternative-specific coefficient, while the nest-specific variables have nest-specific coefficients. We do this since alternative-specific variables will have an equal influence on firms, while the other variables are indeed nest-specific.
Starting with term (a), we can describe the conditional probability of belonging in nest $N(j)$ as

$$
Pr(Loc_{ij} = 1 | x_j \in N(j)) = \frac{\frac{v_{ij}}{e^{\tau_{N(j)}}}}{\sum_{l \in N(j)} e^{IV_{N(j)}}}, \forall j \neq l \in N(j) \tag{4.7}
$$

where

$$
IV_{N(j)} = \ln \sum_{l \in N(j)} e^{\tau_{N(j)}}. \tag{4.8}
$$

The random net return maximization model adopted here imposes the least restrictions on the structure of the nested logit model and allows us to compare countries even across nests rather than only within a nest. In that model, the dissimilarity parameter, $\tau_{N(j)}$, is a measure of the uniqueness of the country-alternatives within nest $N(j)$ and is defined as

$$
\tau_{N(j)} = \sqrt{1 - \rho_{N(j)}}, \tag{4.9}
$$

where $\rho_{N(j)}$ denotes the correlation coefficient among the error terms within nest $N(j)$. If the correlation among countries within a nest is positive, then $\tau_{N(j)}$ will be within the unit interval.$^{17}$

Term (b) in equation (4.6) represents the conditional probability of choosing country $j$ in nest $N(j)$ and can be expressed as

$$
Pr(j \in N(j)) = \frac{e^{\tau_{N(j)}IV_{N(j)}}}{\sum_{k \in N(k)} e^{\tau_{N(k)}IV_{N(k)}}}, \forall N(j) \neq N(k) \tag{4.10}
$$

By multiplying the two probabilities defined in equations (4.7) and (4.10), we obtain the probability of choosing country $j$ as the headquarters location:

$$
Pr(Loc_{ij} = 1 | x_j) = \frac{\frac{v_{ij}}{e^{\tau_{N(j)}}}}{\sum_{l \in N(j)} e^{\tau_{N(j)}}} \times \frac{e^{\tau_{N(j)}IV_{N(j)}}}{\sum_{k \in N(k)} e^{\tau_{N(k)}IV_{N(k)}}}, \forall j \neq l \in N(j), N(j) \neq N(k). \tag{4.11}
$$

By obtaining estimates for the $V_{ij}$ in the nested logit model, we can evaluate the probability of choosing country $j$ as a location of headquarters as well as semi-elasticities of tax parameters.

---

$^{17}$It is possible that the correlation of countries within a nest is negative, resulting in a $|\tau_{N(j)}| > 1$. 
4.3 Estimation results

We hypothesize ceteris paribus a negative effect of our variables of interest – namely the ones involving $\text{LabTax}_j$, $\text{Prog500}_j$, $\text{EmployeeSocSec}_j$, and $\text{EmployerSocSec}_j$ – on a country’s attractiveness as a potential headquarters location. Higher labor income taxes, higher employee-borne social security contributions and a more progressive tax system exert a negative effect on effort of high-income earners, such as managers and engineers, whereas higher employer-borne social security contributions represent higher direct labor costs for firms such that all four variables negatively affect expected profits, directly or indirectly. The effects of these variables of interest are estimated conditionally on a number of aforementioned control variables involving $\text{CorpTax}_j$, $\text{GDP}_j$, $\text{CapStock}_j$, $\text{Wage}_j$, $\text{TertEdu}_j$, $\text{LegalRights}_j$, and $\text{Flights}_j$, and three interaction terms, $\text{Wage}_j \times \text{TertEdu}_j$, $\text{CapStock}_j \times \text{GDP}_j$, and $\text{Wage}_j \times \text{GDP}_j$. These control variables account for determinants of headquarters location choice beyond labor taxes.

We rationalize the effects of these additional controls in the following way. Higher corporate taxes, $\text{CorpTax}_j$, and higher average gross wages, $\text{Wage}_j$, should reduce a country’s attractiveness as a potential location for headquarters since they both reduce profits ceteris paribus. In line with previous theoretical research, we expect that a higher $\text{GDP}_j$, as a measure of market size, positively influences the inclination of firms to locate in a particular country, the same goes for a bigger capital stock $\text{CapStock}_j$, which, given country size, is a proxy for the availability of capital in a country. Finally, a more educated population, $\text{TertEdu}_j$, greater institutional quality, $\text{LegalRights}_j$, as well as a better traffic and airport infrastructure, $\text{Flights}_j$, for a given country size, should also increase a country’s attractiveness as a potential host for headquarters at given country size. The interaction terms $\text{Wage}_j \times \text{TertEdu}_j$, $\text{Wage}_j \times \text{GDP}_j$, and $\text{CapStock}_j \times \text{GDP}_j$ control for a possibly lesser importance of wage costs in skill-abundant and large markets on the one hand and of market size and capital-abundance (as a measure of development) on the other hand. Since $\text{LabTax}_j$, $\text{Prog500}_j$, $\text{EmployeeSocSec}_j$, $\text{EmployerSocSec}_j$, and $\text{CorpTax}_j$ are used in log-transformed variables, the log of one minus the respective variable in our regressions, positive coefficients for the first five dependent variables reported in Tables 3, 4 and 6 actually reflect a negative impact of the underlying tax components on location choice, as seen by the negative semi-elasticities.

\footnote{Given that the conditional logit model implicitly controls for company specific effects such as productivity, wage cost differences reflect production costs rather than productivity levels, such that we can safely assume a negative effect on profits.}
4.3.1 Conditional logit estimates

Table 3 presents the regression results for three alternative conditional logit specifications. The three specifications differ with respect to the control variables included. The coefficients of the main variables of interest, namely the ones involving \( \text{LabTax}_j \), \( \text{Prog500}_j \), \( \text{EmployeeSocSec}_j \), and \( \text{EmployerSocSec}_j \), are positive (i.e., the impact of the underlying tax instruments is negative) and highly significant in Models (1) and (2), while \( \text{LabTax}_j \) and \( \text{CorpTax}_j \) are not significantly different from zero in Model (3).

Table 4.3: CONDITIONAL LOGIT RESULTS FOR COUNTRY CHOICE

<table>
<thead>
<tr>
<th></th>
<th>Model (1)</th>
<th>Model (2)</th>
<th>Model (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln(1 - \text{LabTax}) )</td>
<td>1.730***</td>
<td>1.523***</td>
<td>0.263</td>
</tr>
<tr>
<td></td>
<td>0.109</td>
<td>0.153</td>
<td>0.167</td>
</tr>
<tr>
<td>( \ln(1 - \text{Prog500}) )</td>
<td>0.598***</td>
<td>0.806***</td>
<td>1.205***</td>
</tr>
<tr>
<td></td>
<td>0.089</td>
<td>0.098</td>
<td>0.103</td>
</tr>
<tr>
<td>( \ln(1 - \text{EmployerSocSec}) )</td>
<td>5.202***</td>
<td>4.862***</td>
<td>5.116***</td>
</tr>
<tr>
<td></td>
<td>0.077</td>
<td>0.097</td>
<td>0.099</td>
</tr>
<tr>
<td>( \ln(1 - \text{EmployeeSocSec}) )</td>
<td>1.943***</td>
<td>2.027***</td>
<td>–0.159</td>
</tr>
<tr>
<td></td>
<td>0.143</td>
<td>0.150</td>
<td>0.170</td>
</tr>
<tr>
<td>( \ln(1 - \text{CorpTax}) )</td>
<td>1.413***</td>
<td>0.740***</td>
<td>0.927***</td>
</tr>
<tr>
<td></td>
<td>0.076</td>
<td>0.124</td>
<td>0.125</td>
</tr>
<tr>
<td>( \ln(\text{GDP}) )</td>
<td>1.211***</td>
<td>1.465***</td>
<td>1.195***</td>
</tr>
<tr>
<td></td>
<td>0.066</td>
<td>0.081</td>
<td>0.082</td>
</tr>
<tr>
<td>( \ln(\text{CapStock}) )</td>
<td>2.948***</td>
<td>2.486***</td>
<td>3.984***</td>
</tr>
<tr>
<td></td>
<td>0.080</td>
<td>0.092</td>
<td>0.116</td>
</tr>
<tr>
<td>( \ln(\text{Wage}) )</td>
<td>–0.004</td>
<td>0.148</td>
<td>–0.464***</td>
</tr>
<tr>
<td></td>
<td>0.127</td>
<td>0.138</td>
<td>0.141</td>
</tr>
<tr>
<td>( \ln(\text{TertEdu}) )</td>
<td>3.418***</td>
<td>5.296***</td>
<td>0.225</td>
</tr>
<tr>
<td></td>
<td>0.215</td>
<td>0.021</td>
<td>0.022</td>
</tr>
<tr>
<td>( \ln(\text{LegalRights}) )</td>
<td>0.591***</td>
<td>0.751***</td>
<td>0.304***</td>
</tr>
<tr>
<td></td>
<td>0.021</td>
<td>0.014</td>
<td>0.014</td>
</tr>
<tr>
<td>( \ln(\text{Flights}) )</td>
<td>–0.385***</td>
<td>–0.604***</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>0.022</td>
<td>0.024</td>
<td>0.024</td>
</tr>
<tr>
<td>( \ln(\text{Wage} \times \text{TertEdu}) )</td>
<td>–0.062***</td>
<td>–0.055***</td>
<td>–0.084***</td>
</tr>
<tr>
<td></td>
<td>0.005</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td>( \ln(\text{CapStock} \times \text{GDP}) )</td>
<td>0.009*</td>
<td>0.010*</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>( \ln(\text{Wage} \times \text{GDP}) )</td>
<td>0.009</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>Cases</td>
<td>35,840</td>
<td>35,206</td>
<td>34,392</td>
</tr>
<tr>
<td>LR</td>
<td>90,832.95***</td>
<td>79,903.83***</td>
<td>77,758.29***</td>
</tr>
<tr>
<td>Pseudo – R²</td>
<td>0.276</td>
<td>0.260</td>
<td>0.265</td>
</tr>
</tbody>
</table>

Notes: Choice of country using the conditional logit model. Standard errors are reported beneath the coefficients. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

Headquarters location choice obviously depends on other factors beyond labor taxes. Capital abundance and market size display a positive effect on the decision to locate in a particular country, as expected. In Models (2) and (3), we also account for the influence of the population with tertiary education. The coefficient of interest is positive and highly significant. Moreover, a better airport infrastructure, as captured by the number of international flights, increases the probability of choosing a particular host country. The interaction terms of wages with \( \text{GDP}_j \) and \( \text{TertEdu}_j \)
are significantly different from zero while the main effect of wages is not. Many of the estimated parameters are significant at one percent. We consider Model (2) as a reasonably parsimonious benchmark specification and consider modifications of it in what follows.

One particular concern with the results in Table 3 might be that there is enormous heterogeneity about the timing of location choice in the sample of firms at hand. In other words, it would be desirable to focus on new locations in comparison to all locations. We pursue such an approach in two ways. First, we consider relocations of headquarters in the time window 1992-2009. A relocation is identified by a firm identifier and a change in the country of location (domicile) of a headquarters. In the data, there are 610 relocations between 1992 and 2009. Alternatively, we may consider new locations in general, defined as relocations and first locations (through new incorporations). We do so by considering first locations and relocations between 1992 and 2009 in the data. Altogether, this obtains 4,335 new locations (first locations plus relocations). The corresponding parameter estimates are summarized in Table 4.

Table 4.4: Baseline Regression Results: Conditional Logit Model

<table>
<thead>
<tr>
<th>Stock of Firms</th>
<th>Relocating Firms</th>
<th>Relocating &amp; New Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln(1 - \text{LabTax}) )</td>
<td>1.523***</td>
<td>7.793***</td>
</tr>
<tr>
<td>0.153</td>
<td>1.426</td>
<td>0.771</td>
</tr>
<tr>
<td>( \ln(1 - \text{Prog500}) )</td>
<td>0.800***</td>
<td>6.209***</td>
</tr>
<tr>
<td>0.098</td>
<td>1.180</td>
<td>0.575</td>
</tr>
<tr>
<td>( \ln(1 - \text{EmployerSocSec}) )</td>
<td>4.862***</td>
<td>11.306***</td>
</tr>
<tr>
<td>0.097</td>
<td>1.415</td>
<td>0.724</td>
</tr>
<tr>
<td>( \ln(1 - \text{EmployeeSocSec}) )</td>
<td>2.027***</td>
<td>-3.454*</td>
</tr>
<tr>
<td>0.150</td>
<td>1.895</td>
<td>1.047</td>
</tr>
<tr>
<td>( \ln(1 - \text{CorpTax}) )</td>
<td>0.740***</td>
<td>2.031**</td>
</tr>
<tr>
<td>0.124</td>
<td>0.856</td>
<td>0.542</td>
</tr>
<tr>
<td>( \ln(\text{GDP}) )</td>
<td>1.465***</td>
<td>9.177***</td>
</tr>
<tr>
<td>0.081</td>
<td>1.114</td>
<td>0.492</td>
</tr>
<tr>
<td>( \ln(\text{CapStock}) )</td>
<td>2.486***</td>
<td>-2.054***</td>
</tr>
<tr>
<td>0.092</td>
<td>0.711</td>
<td>0.390</td>
</tr>
<tr>
<td>( \ln(\text{Wage}) )</td>
<td>0.148</td>
<td>11.750***</td>
</tr>
<tr>
<td>0.138</td>
<td>1.600</td>
<td>0.877</td>
</tr>
<tr>
<td>( \ln(\text{TertEdu}) )</td>
<td>3.418***</td>
<td>55.079***</td>
</tr>
<tr>
<td>0.215</td>
<td>7.094</td>
<td>3.627</td>
</tr>
<tr>
<td>( \text{LegalRights} )</td>
<td>0.591***</td>
<td>1.396***</td>
</tr>
<tr>
<td>0.021</td>
<td>0.263</td>
<td>0.136</td>
</tr>
<tr>
<td>( \ln(\text{Wage} \times \text{TertEdu}) )</td>
<td>-0.385***</td>
<td>-4.967***</td>
</tr>
<tr>
<td>0.022</td>
<td>0.706</td>
<td>0.361</td>
</tr>
<tr>
<td>( \ln(\text{CapStock} \times \text{GDP}) )</td>
<td>-0.055***</td>
<td>-0.045*</td>
</tr>
<tr>
<td>0.003</td>
<td>0.026</td>
<td>0.013</td>
</tr>
<tr>
<td>( \ln(\text{Wage} \times \text{GDP}) )</td>
<td>0.010*</td>
<td>-0.369***</td>
</tr>
<tr>
<td>0.005</td>
<td>0.054</td>
<td>0.031</td>
</tr>
</tbody>
</table>

**Notes:** Representation of conditional logit results for the baseline Model (2) in Table 3. Standard errors are reported beneath the coefficients. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

For convenience, Table 4 repeats the estimates for Model (2) from Table 3 in the first column.
The parameters suggest that the results qualitatively support the conclusions drawn from Table 3, except for employee-borne social security contributions. However, we should be aware of the drastically smaller number of observations when considering location changes relative to the stock of locations in Table 3.

Since the models in Tables 3 and 4 are nonlinear, we can not infer anything from the coefficient estimates about the relative importance of tax instruments in affecting location choice within and across the estimated models. To assess the relative importance of the variables of interest, we calculate semi-elasticities by raising one tax instrument’s level by one percentage point (i.e., by 0.01) and assessing the change in the average probability of a country being chosen as the location in response to the rise per tax instrument. The semi-elasticities corresponding to the models in Table 4 (which includes the benchmark Model (2) from Table 3) are summarized in Table 5.

<table>
<thead>
<tr>
<th></th>
<th>LabTax</th>
<th>Prog500</th>
<th>EmployerSocSec</th>
<th>EmployeeSocSec</th>
<th>CorpTax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock of Firms</td>
<td>-0.017</td>
<td>-0.009</td>
<td>-0.055</td>
<td>-0.022</td>
<td>-0.010</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Relocating Firms</td>
<td>-0.082</td>
<td>-0.068</td>
<td>-0.122</td>
<td>0.038</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Relocating &amp; New Firms</td>
<td>-0.061</td>
<td>-0.064</td>
<td>-0.068</td>
<td>0.023</td>
<td>-0.030</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>**</td>
<td>***</td>
</tr>
</tbody>
</table>

Notes: The average semi-elasticities refer to Table 4. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

One-hundred times an entry in Table 5 indicates the percentage change in the average country’s probability of being chosen as a headquarters location in response to a one-percentage point increase in a respective tax instrument at a time. The results suggest that a one-percentage point increase in the employer-borne social security contributions exhibits the relatively biggest effect among the instruments considered. In most specifications, this is followed by the wage tax rate. The relatively lowest results are recorded for corporate income taxes. We argue that this result can be ascribed to the possibility of corporate profit shifting to low tax locations. In comparison, the income tax base (wage bill) cannot be as easily manipulated as the profit tax base, which leads to relatively bigger effects of labor income taxes and social security contributions on the location choice than of profit taxes.

To calculate the semi-elasticity of a log-transformed tax variable \( t \), we raise \( t \) by one percentage point, i.e., by 0.01. In the model, this changes \( \ln(1-t) \) to \( \ln(1-t-0.01) \). Then, evaluated at the average, we consider the change in the probability of the average country to be chosen as a headquarters location in percent.
4.3.2 Nested logit estimates

For the reasons explained in Section 4.2.2, it may be worthwhile to consider a nested logit model as an alternative econometric approach towards headquarters location choice. Table 6 reports the results for a nested logit model based on the specification of Model (2) in Table 3 and using different nesting approaches. We use the *nest-averaged* log of GDP per capita for each nest as the *nest-specific* variable, $w_n$, in terms of equation (4.5). As in the conditional logit specification, the coefficients on the main variables of interest, namely $\text{LabTax}_j$, $\text{Prog500}_j$, $\text{EmployeeSocSec}_j$, and $\text{EmployerSocSec}_j$ are all positive and highly significant in the model with income nesting.

Table 4.6: Baseline Regression Results: Nested Logit Models

<table>
<thead>
<tr>
<th></th>
<th>Income Nested</th>
<th>Region Nested</th>
<th>Distance Nested</th>
<th>Distance Nested (Alternative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln(1 - \text{LabTax})$</td>
<td>3.849***</td>
<td>1.913***</td>
<td>1.039***</td>
<td>0.862***</td>
</tr>
<tr>
<td>$\ln(1 - \text{Prog500})$</td>
<td>0.770</td>
<td>0.322</td>
<td>0.250</td>
<td>0.194</td>
</tr>
<tr>
<td>ln($\text{EmployeeSocSec}$)</td>
<td>2.368***</td>
<td>1.056***</td>
<td>0.614***</td>
<td>0.581***</td>
</tr>
<tr>
<td>ln($\text{EmployerSocSec}$)</td>
<td>0.477</td>
<td>0.179</td>
<td>0.144</td>
<td>0.124</td>
</tr>
<tr>
<td>ln($\text{CorpTax}$)</td>
<td>6.461***</td>
<td>3.916***</td>
<td>4.074***</td>
<td>2.776***</td>
</tr>
<tr>
<td>$\ln(\text{GDP})$</td>
<td>1.245</td>
<td>0.569</td>
<td>0.571</td>
<td>0.505</td>
</tr>
<tr>
<td>ln($\text{CapStock}$)</td>
<td>1.687***</td>
<td>1.473***</td>
<td>2.149***</td>
<td>1.211***</td>
</tr>
<tr>
<td>ln($\text{Wage}$)</td>
<td>0.383</td>
<td>0.256</td>
<td>0.336</td>
<td>0.243</td>
</tr>
<tr>
<td>ln($\text{TertEdu}$)</td>
<td>0.781***</td>
<td>0.064</td>
<td>0.884***</td>
<td>0.657***</td>
</tr>
<tr>
<td>$\ln(\text{GDP})$</td>
<td>0.229</td>
<td>0.147</td>
<td>0.202</td>
<td>0.156</td>
</tr>
<tr>
<td>ln($\text{CorpTax}$)</td>
<td>0.229</td>
<td>1.805***</td>
<td>1.484***</td>
<td>0.843***</td>
</tr>
<tr>
<td>ln($\text{Wage}$)</td>
<td>0.144</td>
<td>0.275</td>
<td>0.223</td>
<td>0.166</td>
</tr>
<tr>
<td>ln($\text{CapStack}$)</td>
<td>4.221***</td>
<td>1.365***</td>
<td>1.092***</td>
<td>1.262***</td>
</tr>
<tr>
<td>ln($\text{TertEdu}$)</td>
<td>0.820</td>
<td>0.230</td>
<td>0.190</td>
<td>0.240</td>
</tr>
<tr>
<td>ln($\text{CorpTax}$)</td>
<td>-3.379***</td>
<td>0.897***</td>
<td>0.996***</td>
<td>0.520***</td>
</tr>
<tr>
<td>ln($\text{Wage}$)</td>
<td>0.701</td>
<td>0.200</td>
<td>0.200</td>
<td>0.135</td>
</tr>
<tr>
<td>ln($\text{TertEdu}$)</td>
<td>4.571***</td>
<td>2.042***</td>
<td>0.892***</td>
<td>1.141***</td>
</tr>
<tr>
<td>ln($\text{CorpTax}$)</td>
<td>0.917</td>
<td>0.378</td>
<td>0.283</td>
<td>0.267</td>
</tr>
<tr>
<td>LegalRights$_{dummy}$</td>
<td>0.709***</td>
<td>0.504***</td>
<td>0.859***</td>
<td>0.424***</td>
</tr>
<tr>
<td>ln($\text{CorpTax}$)</td>
<td>0.139</td>
<td>0.075</td>
<td>0.120</td>
<td>0.078</td>
</tr>
<tr>
<td>ln($\text{Wage}$)</td>
<td>-0.477***</td>
<td>-0.222***</td>
<td>-0.150***</td>
<td>-0.143***</td>
</tr>
<tr>
<td>ln($\text{TertEdu}$)</td>
<td>0.096</td>
<td>0.040</td>
<td>0.033</td>
<td>0.031</td>
</tr>
<tr>
<td>ln($\text{CorpStack} \times \text{GDP}$)</td>
<td>-0.086*</td>
<td>-0.037*</td>
<td>-0.024*</td>
<td>-0.024*</td>
</tr>
<tr>
<td>ln($\text{Wage} \times \text{TertEdu}$)</td>
<td>0.017</td>
<td>0.006</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td>ln($\text{CorpStack} \times \text{GDP}$)</td>
<td>0.137***</td>
<td>-0.029***</td>
<td>-0.034***</td>
<td>-0.018***</td>
</tr>
<tr>
<td>ln($\text{Wage} \times \text{GDP}$)</td>
<td>0.028</td>
<td>0.007</td>
<td>0.007</td>
<td>0.005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Cases</th>
<th>Cases</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Likelihood</td>
<td>-113,308.44</td>
<td>-112,375.74</td>
<td>-112,785.34</td>
<td>113,071.27</td>
</tr>
<tr>
<td>LR Test for IIA</td>
<td>269.42***</td>
<td>640.80***</td>
<td>281.92***</td>
<td>81.402***</td>
</tr>
<tr>
<td>IIA Passed?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes: Representation of nested logit results for baseline Model (2) as in Table 3. Standard errors are reported beneath the coefficients. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

As alternatives to income nesting, we employ three different types of nesting based on geographical variables. In the second column of Table 6, we group countries into continental groups: the Americas (comprised of countries in North America, Latin America, and the Caribbean), Europe (comprised of European countries, including Russia), and the Rest of the World (comprising all remaining
countries in Africa, Asia, and Oceania). As before, the coefficients on all main variables of interest are positive and highly significant, while the corporate tax variable is insignificant.\footnote{These results are in line with Strauss-Kahn and Vives (2009) who also find low elasticities for the corporate tax. In their study, corporate tax levels are insignificant in a region-nested model but have a significant impact on the headquarters location choice in a population-nested model. In their population-nested specifications, a one percentage point rise in the corporate tax rate reduces the probability of a state as a headquarters location by 2.25 percent. As Strauss-Kahn and Vives (2009) also note, these lower elasticities compared to other studies can also be explained by the fact that these studies focus on manufacturing firms which creates an upward bias in the corporate tax effect whereas Strauss-Kahn and Vives (2009) and we use data on headquarters in all economic sectors.}

As two further alternatives to income nesting, we group countries according to their average distance to the rest of the world in two ways. The first distance-based nesting summarized in the third column of Table 6 groups countries with an average distance of less than 7,000km into the category *Near*, an average distance to the rest of the world between 7,000km and 9,000km into the category *Middle*, and all remaining countries into the category *Far*. The second distance-based nesting summarized in the fourth column of Table 6 (denoted *Alternative*), draws those boundaries at 8,000km and 10,000km, respectively.\footnote{The average distance to the rest of the world ranges from a little more than 6,500km for Bulgaria to over 13,000km for New Zealand.}

Also with distance-based nesting, the coefficients of the variables of interest, namely the ones involving $\text{LabTax}_j$, $\text{Prog500}_j$, $\text{EmployerSocSec}_j$, and $\text{EmployeeSocSec}_j$, are positive and highly significant.

Table 4.7: Baseline Semi-Elasticities - Nested logit

<table>
<thead>
<tr>
<th></th>
<th>LabTax</th>
<th>Prog500</th>
<th>EmployerSocSec</th>
<th>EmployeeSocSec</th>
<th>CorpTax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>-0.036</td>
<td>-0.023</td>
<td>-0.064</td>
<td>-0.016</td>
<td>-0.009</td>
</tr>
<tr>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td><strong>Income Nested</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>High – Income</em></td>
<td>-0.028</td>
<td>-0.018</td>
<td>-0.049</td>
<td>-0.012</td>
<td>-0.007</td>
</tr>
<tr>
<td><em>Middle – Income</em></td>
<td>-0.044</td>
<td>-0.029</td>
<td>-0.080</td>
<td>-0.020</td>
<td>-0.012</td>
</tr>
<tr>
<td><em>Low – Income</em></td>
<td>-0.044</td>
<td>-0.027</td>
<td>-0.072</td>
<td>-0.018</td>
<td>-0.012</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>-0.022</td>
<td>-0.012</td>
<td>-0.046</td>
<td>-0.016</td>
<td>-0.001</td>
</tr>
<tr>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td><strong>Region Nested</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Americas</em></td>
<td>-0.020</td>
<td>-0.012</td>
<td>-0.046</td>
<td>-0.016</td>
<td>-0.001</td>
</tr>
<tr>
<td><em>Europe</em></td>
<td>-0.026</td>
<td>-0.015</td>
<td>-0.057</td>
<td>-0.020</td>
<td>-0.001</td>
</tr>
<tr>
<td><em>ROW</em></td>
<td>-0.018</td>
<td>-0.010</td>
<td>-0.036</td>
<td>-0.013</td>
<td>-0.001</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>-0.011</td>
<td>-0.007</td>
<td>-0.045</td>
<td>-0.022</td>
<td>-0.012</td>
</tr>
<tr>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td><strong>Distance Nested</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Near</em></td>
<td>-0.013</td>
<td>-0.008</td>
<td>-0.053</td>
<td>-0.025</td>
<td>-0.013</td>
</tr>
<tr>
<td><em>Middle</em></td>
<td>-0.011</td>
<td>-0.007</td>
<td>-0.041</td>
<td>-0.021</td>
<td>-0.012</td>
</tr>
<tr>
<td><em>Far</em></td>
<td>-0.009</td>
<td>-0.006</td>
<td>-0.038</td>
<td>-0.019</td>
<td>-0.010</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>-0.011</td>
<td>-0.010</td>
<td>-0.047</td>
<td>-0.019</td>
<td>-0.013</td>
</tr>
<tr>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td><strong>Distance Nested (Alternative)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Near</em></td>
<td>-0.016</td>
<td>-0.011</td>
<td>-0.055</td>
<td>-0.022</td>
<td>-0.015</td>
</tr>
<tr>
<td><em>Middle</em></td>
<td>-0.011</td>
<td>-0.008</td>
<td>-0.035</td>
<td>-0.014</td>
<td>-0.011</td>
</tr>
<tr>
<td><em>Far</em></td>
<td>-0.012</td>
<td>-0.008</td>
<td>-0.038</td>
<td>-0.017</td>
<td>-0.012</td>
</tr>
</tbody>
</table>

Notes: The average semi-elasticities refer to Table 6. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

Table 7 summarizes the semi-elasticities of location choice with respect to tax instruments corresponding to the parameter estimates in Table 6. The magnitudes of those semi-elasticities are generally comparable to the ones based on the conditional logit models in Table 5.
4.3.3 Sensitivity analysis and further results

In the sensitivity analysis, we focus on conditional logit models since they are comparable regarding the semi-elasticities and much less demanding in terms of likelihood optimization. Since the semi-elasticities are more meaningful than mere parameter estimates, we focus on a presentation of those.

We summarize the sensitivity analysis in Table 8. The table is organized horizontally in three blocks and vertically in two blocks. Horizontally, we distinguish between samples of all firms 35,206 firms in 2005-2009 and their location choice independent of the time (Stock of Firms; far left), of all 610 firms relocating between 1992 and 2009 (Relocating Firms; in the center), and of all 4,335 first-locating or relocating firms between 1992 and 2009 (Relocating & New Firms; far right).

Vertically, we report on three robustness checks using subsamples in the upper part of the table and on the use of one alternative tax instrument in the last row of Table 8. In two robustness checks presented in the first two lines of Table 8, we restrict the sample to high-skilled and low-skilled intensive firms, respectively. Such firms are identified by a ratio of expenditures on research and development and sales which is higher than the median and low-skilled intensive firms by a ratio which is at most as high as the median. In a third experiment, we focus on a sample which excludes holding companies. The Compustat North American database – which is a sub-set of the data used here – includes data on so-called American Depositary Receipt (ADR) companies which are basically U.S. holding companies. We are able to use this information to exclude these companies.

In the fourth row of Table 8, which represents an experiment involving an alternative tax instrument, we replace the tax progressivity measure, $Prog_{500_j}$, by the labor tax rate on five times the average wage in a country, $LabTax_{500_j}$. The findings suggest that the qualitative insights from earlier tables are unchanged. In particular, employer-borne social security contributions are relatively important among the considered instruments, and several labor tax instruments exhibit higher semi-elasticities as corporate taxes do for headquarters location. The tax rate for five times the average wage, $LabTax_{500_j}$, exhibits a significant negative impact on top of the income tax rate for the average wage. This is consistent with the results involving tax progressivity in Model (2) of Table 3.
Table 4.8: Conditional Logit Semi-Elasticities: Sensitivity Experiments

<table>
<thead>
<tr>
<th>Conditional Logit: Stock of Firms</th>
<th>Conditional Logit: Relocating Firms</th>
<th>Conditional Logit: Relocating &amp; New Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Tax 500</td>
<td>Lab Tax 500</td>
<td>Lab Tax 500</td>
</tr>
<tr>
<td>Prog Tax 500</td>
<td>Prog Tax 500</td>
<td>Prog Tax 500</td>
</tr>
<tr>
<td>SocSec ER</td>
<td>SocSec EE</td>
<td>SocSec EE</td>
</tr>
<tr>
<td>Corp Tax</td>
<td>Corp Tax</td>
<td>Corp Tax</td>
</tr>
<tr>
<td>Lab Tax 500</td>
<td>Lab Tax 500</td>
<td>Lab Tax 500</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

Subsamples of the data

<table>
<thead>
<tr>
<th>High Skilled</th>
<th>Low Skilled</th>
<th>No Holding Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Tax</td>
<td>Lab Tax</td>
<td>Lab Tax</td>
</tr>
<tr>
<td>Prog Tax</td>
<td>Prog Tax</td>
<td>Prog Tax</td>
</tr>
<tr>
<td>SocSec ER</td>
<td>SocSec EE</td>
<td>SocSec EE</td>
</tr>
<tr>
<td>Corp Tax</td>
<td>Corp Tax</td>
<td>Corp Tax</td>
</tr>
<tr>
<td>Lab Tax</td>
<td>Lab Tax</td>
<td>Lab Tax</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

Alternative tax instrument

Notes: Subsamples of the data include: Firms operating in high-skilled (as measured by sector-averaged R&D-to-Sales ratio greater than the world-wide median); firms operating in low-skilled sectors (sectors with below-median R&D-to-Sales ratios); non-holding companies. The alternative tax instrument replaces Progressivity, Prog500, with the labor income tax rate for five times the average wage, LabTax500. The symbols ***, **, and * denote statistical significance at 1, 5, and 10 percent, respectively.

4.4 Conclusion

This paper provides evidence on the impact of different components of effective labor taxes on the international location decision of firms’ headquarters using data on 35,026 firms’ headquarters and 79 countries. We compile a unique data set on effective labor income taxes comprising besides labor taxes also both employee-borne and employer-borne social security contributions as well as further country specific regulations. We merge these tax data with data from Compustat that provide information on the location of firms’ headquarters and data from WDI on country specific characteristics. The richness of our tax data and the large number of firm headquarters observations as well as the econometric specifications employed allow a more precise identification of the impact of effective labor taxes on firms headquarters’ location than aggregate data would.

Overall, our findings suggest that the progressivity of a country’s tax schedule, the social security contributions levied and the level of the labor income tax affect the conditional probability of firms’ headquarters location choice. The results are most pronounced for employer-borne payroll taxes. Hence, a one percentage point increase in a country’s labor income tax leads – on average – to a reduction in the probability of a country as a potential location for headquarters by 1.7 percent in the whole stock of firms and by 6.1 percent for relocating and new firms, and 8.2 for relocating firms only. For employer social security contributions the results are even larger and a
one percentage point increase reduces the probability of headquarters’ location by 5.5 percent in the whole sample of firms, by 6.8 percent when we consider only relocating and new firms, and by 12.2 percent if we focus on relocating firms only. The results prove robust in various empirical model specifications (such as using alternative nesting structures) and subsets of the data (i.e., focusing on firms operating in high or low skilled sectors only).
Chapter 5

On the Distribution of Tax Effects on Headquarters Location

The modern theory of multinational firms emphasizes the role of local costs of and returns to knowledge-capital for the location of headquarters and their activity (see Carr et al., 2001; Markusen, 2002; Markusen and Maskus, 2002). Apart from the availability of capital in a broad sense, the costs of operating a headquarters (managerial and labor costs, taxes), market size, proximity to the most important markets, and the extent of potential knowledge creation and the accumulation of intangible assets (see Dischinger and Riedel, 2011) are key determinants thereof.

This paper focuses on the role of taxation for headquarters location and relative intangible asset accumulation. It differs from earlier work on the matter in three important regards. First, given average factor costs and productivity per firm, it considers detailed information about the effective income and thereby taxation of the chief executive officer (CEO) and information on the average worker and effective profit taxation in the sector and country in which headquarters operate. Second, it focuses on differential effects of effective personal income versus effective profit taxation on outcomes (headquarters location and asset intangibility). Third, the paper alludes to the distribution of tax effects by allowing behavioral parameters to be generally firm-specific. The latter permits quantifying the variability of tax effects over the whole support region of income and profit tax variables in the data. This is accomplished in a data-set of 13,074 firms regarding the asset intangibility and location decisions across 68 countries.

---

1This chapter is based on Bösenberg, Egger and Strecker (2014). The authors gratefully acknowledge funding from the Swiss Science Foundation through grant number 100014_131878.

2In firms with multiple chief officers (COO, CFO, etc.), we generate an “average chief officer” to utilize in our calculations.
We summarize the econometric models employed in the next section. Section 3 summarizes the data and provides a condensed presentation of the regression results.

5.1 Econometric models of headquarters activity

5.1.1 Conditional and mixed logit models for location choice

We model headquarters location choice by conditional and mixed logit models. The latter dissipate three main limitations of standard logit models, since they: allow for random behavioral variation; permit unrestricted substitution patterns across locations; and, lastly, accommodate correlation in unobserved factors over time. Mixed logits thereby approximate any possible random profit model to firms’ location choice to any degree of accuracy (see McFadden and Train, 2000).

Suppose a firm $i$’s random profit function about locating in country $n$, in a generic year, depends on industry-country-specific variables $\tau_{in}$ (wages/ productivity, profit taxes, personal income taxes, etc.) and control variables $x_{in}$ (e.g., market size, production costs, delivery costs, etc.) and can be written as

$$\pi_{in} = \tau_{in}\alpha_i + x_{in}\beta_i + \varepsilon_{in}, \quad (5.1)$$

whereby both the unobservables in $\varepsilon_{in}$ and the observables in $(\tau_{in}, x_{in})$ potentially induce firm-specific effects. While the firm may know $\alpha_i$ and $\beta_i$ ex-ante, the researcher does not. The probability of location, conditional on $(\alpha_i, \beta_i)$, is

$$\ell_{in}(\alpha_i, \beta_i) \equiv \begin{cases} \ell_{in}(m = n|\alpha, \beta) = \frac{\exp(\tau_{in}\alpha + x_{in}\beta)}{\sum_{m=1}^{N} \exp(\tau_{im}\alpha + x_{im}\beta)}, & \text{in CL} \\ \ell_{in}(m = n|\alpha_i, \beta_i) = \frac{\exp(\tau_{in}\alpha_i + x_{in}\beta_i)}{\sum_{m=1}^{N} \exp(\tau_{im}\alpha_i + x_{im}\beta_i)}, & \text{in MXL,} \end{cases} \quad (5.2)$$

where $m, n = 1, ..., N$ denote possible countries of location. The unconditional choice probability involves an integral over the conditional probabilities and is defined as (see McFadden and Train, 2000):

$$p_{in}(\alpha_i, \beta_i) \equiv \begin{cases} \int_{(\alpha, \beta)} \frac{\exp(\tau_{in}\alpha + x_{in}\beta)}{\sum_{m=1}^{N} \exp(\tau_{im}\alpha + x_{im}\beta)} f(\alpha, \beta) d(\alpha, \beta) \\ \int_{(\alpha_i, \beta_i)} \frac{\exp(\tau_{in}\alpha_i + x_{in}\beta_i)}{\sum_{m=1}^{N} \exp(\tau_{im}\alpha_i + x_{im}\beta_i)} f(\alpha_i, \beta_i) d(\alpha_i, \beta_i), \end{cases} \quad (5.3)$$

with $f(\cdot)$ denoting the (not necessarily) continuous density about the unknown parameters as its arguments.

Since mixed logits do not assume independence of a given choice from irrelevant alternatives nor
a restrictive, mechanical substitution pattern as conditional logits, it is useful to quantify the local semi-elasticity of the probability of locating in, say, \( n \) versus \( o \) with respect to, e.g., the \( k \)th attribute in \( \tau_{io} \) as

\[
r_{ino}(m = n, \Delta \tau_{io}^k, \tau_{in}, x_{in}) = \begin{cases} 
- \int (\alpha, \beta) \frac{\alpha^k \ell_{io}(\alpha, \beta) \ell_{in}(\alpha, \beta)}{p_{in}(\alpha, \beta)} f(\alpha, \beta) d(\alpha, \beta) \\
- \int (\alpha, \beta) \frac{\alpha^k \ell_{io}(\alpha_i, \beta_i) \ell_{in}(\alpha_i, \beta_i)}{p_{in}(\alpha_i, \beta_i)} f(\alpha_i, \beta_i) d(\alpha_i, \beta_i).
\end{cases}
\]  

(5.4)

5.1.2 Random coefficients model for asset intangibility

Given headquarters location, the intensity of headquarters service generation through knowledge-capital is a second activity of interest. We measure knowledge-capital as the share of intangible assets in total assets in a generic year and specify it as

\[
Intangibles_{in} = \tau_{in} \alpha + x_{in} \beta + \tau_{in} \alpha_i + \varepsilon_{in}.
\]  

(5.5)

As with location choice, the parameter heterogeneity about the impact of \( \tau_{in} \) emerges due to a firm-specific random component, \( \alpha_i \). Hence, a one-percentage-point increase in \( \tau_{k,in} \) raises \( Intangibles_{in} \) by 0.01(\( \alpha_k + \alpha_{k,i} \)).

5.2 Empirical analysis

In this section, we take the above models to data.

5.2.1 Data

All variables involved – their acronyms, description, and sources – are described in Table 5.1 and their summary statistics are provided in Table 5.2. An illustration of the cross-country distribution of headquarters covered is presented in Figure 5.1.

**Dependent variables:** The (conditional and mixed) logits analyze the location decisions of 13,074 firms in 68 countries between 1999 and 2012. Parameter heterogeneity is modeled as in (5.1). The random coefficients model determines \( Intangibles_{in} \) for 10,882 firms in 65 countries within the same time span (some data are lost due to missing information on assets), accordingly modeled as in (5.5).

**Independent variables:** Vector \( \tau_{in} \) contains five industry-country-specific elements: four effective
Table 5.1: VARIABLE DESCRIPTION

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$l_{in}$</td>
<td>Location of headquarters of 13,174 large, listed firms in an array of 68 country between the years 1999 and 2012.</td>
<td>Provided by Compustat (North American and Global databases).</td>
</tr>
<tr>
<td>$\text{CapStock}_n$</td>
<td>Capital stock. Using $i_{nt}$ to denote gross capital formation in country $n$ and year $t$ and $d$ to denote the depreciation rate, capital stocks in any year $t$ are defined as $k_{nt} = k_{nt-1}(1-d) + i_{nt}$. We compute capital stocks for any given year using the initial capital stock, $k_{n0}$ (which equals $i_{n0}/(g_n + d)$, where $g_n$ is the average yearly country-level rate of investment) and $d$ is the depreciation rate (in this case $d = 0.1$).</td>
<td>Gross fixed capital formation from World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>$\text{GDPPC}_n$</td>
<td>Gross domestic product per capita.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>$\text{PopDensity}_n$</td>
<td>Population density.</td>
<td>World Bank’s World Development Indicators.</td>
</tr>
<tr>
<td>$\text{productivity}_n$</td>
<td>Industry-country-specific average productivity per worker.</td>
<td>From ILOstat and its predecessor.</td>
</tr>
<tr>
<td>$\text{tax}_{\text{CEO},n}$</td>
<td>Industry-country averaged effective average executive income tax. We apply a country’s tax code to an executive’s composite income derived from cash salary, bonus payments, dividends received and stock options that are taxable in a particular year, including the social security and payroll contributions due and the sector specific deductions that accrue for said income.</td>
<td>Executives’ compensation provided by BoardEx. For tax information see Egger, Radulescu and Strecker (2013).</td>
</tr>
<tr>
<td>$\text{tax}_{\text{Payroll},n}$</td>
<td>Industry-country averaged effective average employer-borne payroll taxes. We apply a country’s tax code to the industry-country-specific average gross wage $wage_{in}$ and retain the portion payable by an employer.</td>
<td>For tax information see Egger, Radulescu and Strecker (2013).</td>
</tr>
<tr>
<td>$\text{prog}_{\text{CEO},n}$</td>
<td>Progression between industry-country averaged executive marginal income tax and marginal tax for the average worker (who earns $wage_{in}$ in the firm’s industry (includes employee-born payroll and social security taxes).</td>
<td>BoardEx and Egger, Radulescu and Strecker (2013).</td>
</tr>
<tr>
<td>$\text{tax}_{\text{Profit},n}$</td>
<td>Industry-country averaged effective average profit tax rate. Calculation based on Devereux and Griffith (1998) and Egger et al. (2009), using nine depreciable assets: buildings ($\delta^b$), machinery ($\delta^m$), computers ($\delta^c$), office equipment ($\delta^{oe}$), motor vehicles ($\delta^{mv}$), planes ($\delta^v$), intangibles ($\delta^{int}$) and software ($\delta^{sm}$). We calculate the net present value (NPV) of depreciation allowances as $A = A^b(\delta^b) + A^m(\delta^m, \delta^c, \delta^{oe}, \delta^{mv}, \delta^v, \delta^{int}, \delta^{sm}) + A^{int}(\delta^{int}, \delta^{sm})$. For sensible NPVs for machinery and intangibles, we weigh the depreciable assets under machinery and inventory, where $A^m = \delta^m(x) + \delta^{m}(x) + \delta^{m}(x) + \delta^{m}(x) + \delta^{m}(x) + \delta^{m}(x)$ and $A^{int} = \delta^{int}(x) + \delta^{int}(x)$, with $\sum x = 1$ for $A^m$ and $A^{int}$ separately. Firm level variation enters into our calculus by decomposing firms total assets into tangible fixed assets, intangible assets and stocks of current assets, before applying industry-specific weights for the asset composition across sectors to account for heterogenous composition of the capital stock.</td>
<td>Tax information from tax guides by Ernest and Young, International Bureau of Fiscal Documentation, OECD, PriceWaterhouse Coopers, and Egger et al. (2009). Firm-specific level of assets and asset composition from Compustat.</td>
</tr>
<tr>
<td>$\text{Intangibles}_n$</td>
<td>Share of intangible assets in total assets.</td>
<td>Compustat.</td>
</tr>
</tbody>
</table>

Notes: This list includes the origin and sources of the relevant dependent and independent variables.
<table>
<thead>
<tr>
<th>Conditional &amp; mixed logit models</th>
<th>Mean (1)</th>
<th>Stddev (2)</th>
<th>Median (3)</th>
<th>Max (4)</th>
<th>Min (5)</th>
<th>Nb-firms (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPPC$_n$ (USD)</td>
<td>39,841.06</td>
<td>11,391.02</td>
<td>42,516.39</td>
<td>114,210.82</td>
<td>721.459</td>
<td>13,074</td>
</tr>
<tr>
<td>CapStock$_n$ (mn. USD)</td>
<td>9,532.00</td>
<td>7,458.00</td>
<td>12,440.00</td>
<td>19,540.00</td>
<td>3,896</td>
<td>13,074</td>
</tr>
<tr>
<td>PopDensity$_n$</td>
<td>178.375</td>
<td>742.397</td>
<td>33.536</td>
<td>19,885.107</td>
<td>0.407</td>
<td>13,074</td>
</tr>
<tr>
<td>tax$_{CEO,in}$</td>
<td>0.107</td>
<td>0.074</td>
<td>0.094</td>
<td>0.585</td>
<td>0.000</td>
<td>13,074</td>
</tr>
<tr>
<td>tax$_{Payroll,in}$</td>
<td>0.106</td>
<td>0.050</td>
<td>0.091</td>
<td>0.469</td>
<td>0.000</td>
<td>13,074</td>
</tr>
<tr>
<td>progrCEO$_{in}$</td>
<td>-0.195</td>
<td>0.093</td>
<td>-0.209</td>
<td>0.470</td>
<td>-0.726</td>
<td>13,074</td>
</tr>
<tr>
<td>tax$_{Profit,in}$</td>
<td>0.311</td>
<td>0.043</td>
<td>0.327</td>
<td>0.522</td>
<td>0.000</td>
<td>13,074</td>
</tr>
<tr>
<td>productivity$_{in}$ (USD)</td>
<td>48,133.71</td>
<td>15,532.854</td>
<td>49,385.164</td>
<td>131,969.31</td>
<td>548.479</td>
<td>13,074</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Random coefficients model</th>
<th>Mean (1)</th>
<th>Stddev (2)</th>
<th>Median (3)</th>
<th>Max (4)</th>
<th>Min (5)</th>
<th>Nb-firms (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intangibles$_{in}$</td>
<td>0.188</td>
<td>0.202</td>
<td>0.111</td>
<td>1.000</td>
<td>0.000</td>
<td>10,882</td>
</tr>
<tr>
<td>GDPPC$_n$ (USD)</td>
<td>39,506.638</td>
<td>11,751.991</td>
<td>41,458.933</td>
<td>114,210.82</td>
<td>721.459</td>
<td>10,882</td>
</tr>
<tr>
<td>CapStock$_n$ (mn. USD)</td>
<td>9,204.00</td>
<td>7,421.00</td>
<td>9,941.00</td>
<td>3,896.00</td>
<td>0.000</td>
<td>10,882</td>
</tr>
<tr>
<td>PopDensity$_n$</td>
<td>190.983</td>
<td>775.335</td>
<td>33.536</td>
<td>19,885.107</td>
<td>2.527</td>
<td>10,882</td>
</tr>
<tr>
<td>tax$_{CEO,in}$</td>
<td>0.109</td>
<td>0.074</td>
<td>0.096</td>
<td>0.585</td>
<td>0.000</td>
<td>10,882</td>
</tr>
<tr>
<td>tax$_{Payroll,in}$</td>
<td>0.110</td>
<td>0.053</td>
<td>0.091</td>
<td>0.469</td>
<td>0.000</td>
<td>10,882</td>
</tr>
<tr>
<td>progrCEO$_{in}$</td>
<td>-0.190</td>
<td>0.093</td>
<td>-0.202</td>
<td>0.407</td>
<td>-0.726</td>
<td>10,882</td>
</tr>
<tr>
<td>tax$_{Profit,in}$</td>
<td>0.311</td>
<td>0.044</td>
<td>0.326</td>
<td>0.532</td>
<td>0.000</td>
<td>10,882</td>
</tr>
<tr>
<td>productivity$_{in}$ (USD)</td>
<td>46,895.439</td>
<td>15,105.853</td>
<td>49,020.008</td>
<td>131,969.31</td>
<td>548.749</td>
<td>10,882</td>
</tr>
</tbody>
</table>

Notes: This list includes the summary statistics for the variables employed in all three econometric models. All level variables are in terms of current U.S. Dollars, while CapStock is in terms of millions of current U.S. Dollars. The remaining variables are rates or based on rates between 0 and 1.

tax instruments (personal income tax rate of the CEO$^3$, progression of the marginal tax rate between the average worker and the executive; payroll tax rate of the average worker; corporate profit tax rate$^4$, and (log) wage rates, productivity$_{in}$. Tax variables are transformed as ln(1 – tax) to avoid dropping countries that do not use a particular tax instrument$^5$ and productivity$_{in}$ serves as a proxy for the productivity level in an industry relative to the country average (we expect a positive average parameter on this variable). We control for three further determinants of location choice and asset intangibility of headquarters in vector $x_n$: GDPPC$_n$ (proxying the cost of living and of factors in logs) for which we expect a negative impact; CapStock$_n$ in logs (reflecting the availability of capital in $n$) for which we expect a positive impact; PopDensity$_n$ (capturing net effects of market thickness and crowdedness) for which we do not have a clear-cut hypothesis.

$^3$This should matter if, at a given net income, the CEO is able to pass at least some of her personal tax burden onto the firm.

$^4$Once controlling for the tax rate of the CEO, it is equivalent of whether one controls for the progression between the average worker and the CEO’s tax rate or the level of the average worker’s personal income tax rate. We do not control for payroll taxes of the CEO, since they are of minor importance given the high salaries of CEOs (see Egger et al., 2013).

$^5$A positive coefficient on ln(1 – tax) indicates a negative effect of tax on the dependent variable.
5.2.2 Results

The results of the location choice models as well as the random coefficients model for asset intangibility are summarized in Table 5.3.

Location choice

As expected, transformed tax instruments in $\tau_{in}$ are positively related to location choice (representing a negative relationship) in both the conditional and the mixed logit models. Further, $productivity_{in}$ (representing the industry-country-specific productivity level), is positively related to the likelihood of locating in $n$, while average factor costs and costs of living ($GDPPC_{in}$) are negatively related to this likelihood, and so is $PopDensity$. $CapStock_n$ is positively related to the probability of firm $i$ locating in $n$. These findings pertain to average coefficients.

We visualize the variability of firms’ coefficients $\alpha_i$ with the level of each specific element in $\tau_{in}$ in the upper half of Figure 5.2 by scatter plots. The higher is $n$’s average tax rate in $i$’s industry, the lower $\alpha_i$ tends to be, i.e., the lower is the likelihood of locating in $n$. The lower part of Figure 5.2 illustrates the effect of a 1-percentage-point increase in $\tau_{in}$ ceteris paribus across all industries on the likelihood to locate in $n$ in the average year in the mixed logit. While the local semi-elasticities in the conditional logit are country-specific by design (and suppressed for space constraints), they...
### Table 5.3: Baseline Regressions

<table>
<thead>
<tr>
<th></th>
<th>Conditional Logit:</th>
<th></th>
<th>Mixed Logit:</th>
<th></th>
<th>Random Coefficients:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\ell_{in}$</td>
<td>$\ell_{in}$</td>
<td>$\ell_{in}$</td>
<td>$\ell_{in}$</td>
<td>$\ell_{in}$</td>
<td>$\ell_{in}$</td>
</tr>
<tr>
<td>ln(CapStock$_{in}$)</td>
<td>(1) 1.290***</td>
<td>(1) 1.197***</td>
<td>(1) 1.264***</td>
<td>(1) 1.271***</td>
<td>(2) −0.271***</td>
<td>(2) −0.258***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.008)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>ln(GDP$_{PC.in}$)</td>
<td>−0.902***</td>
<td>−1.036***</td>
<td>−1.036***</td>
<td>−0.909***</td>
<td>0.404***</td>
<td>0.404***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.011)</td>
<td>(0.038)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>ln(PopDensity$_{in}$)</td>
<td>−0.103***</td>
<td>−0.099***</td>
<td>−0.099***</td>
<td>−0.137***</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(1-tax$_{CEO, in}$)</td>
<td>3.674***</td>
<td>5.397***</td>
<td>8.746***</td>
<td>8.737***</td>
<td>1.866***</td>
<td>2.026***</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.119)</td>
<td>(0.324)</td>
<td>(0.332)</td>
<td>(0.148)</td>
<td>(0.149)</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>6.305***</td>
<td>−3.298</td>
<td>5.371***</td>
<td>5.359***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.216)</td>
<td>(2.384)</td>
<td>(1.16)</td>
<td>(0.116)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(1-tax$_{Payroll, in}$)</td>
<td>4.382***</td>
<td>3.939***</td>
<td>6.764***</td>
<td>6.848***</td>
<td>0.777***</td>
<td>0.538***</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.070)</td>
<td>(0.296)</td>
<td>(0.340)</td>
<td>(0.225)</td>
<td>(0.224)</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>15.786***</td>
<td>16.446***</td>
<td>4.155***</td>
<td>4.119***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.288)</td>
<td>(0.381)</td>
<td>(0.262)</td>
<td>(0.260)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(1-Prog$_{CEO, in}$)</td>
<td>4.011***</td>
<td>2.820***</td>
<td>2.036***</td>
<td>1.138***</td>
<td>−1.126***</td>
<td>−1.619***</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.075)</td>
<td>(0.235)</td>
<td>(0.232)</td>
<td>(0.172)</td>
<td>(0.177)</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>10.668***</td>
<td>10.391***</td>
<td>4.271***</td>
<td>4.308***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.401)</td>
<td>(0.349)</td>
<td>(0.131)</td>
<td>(0.131)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(1-tax$_{Profit, in}$)</td>
<td>5.680***</td>
<td>5.862***</td>
<td>1.105***</td>
<td>1.473***</td>
<td>−2.482***</td>
<td>−2.606***</td>
</tr>
<tr>
<td></td>
<td>(0.069)</td>
<td>(0.069)</td>
<td>(0.217)</td>
<td>(0.224)</td>
<td>(0.166)</td>
<td>(0.169)</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>9.229***</td>
<td>9.199***</td>
<td>2.316***</td>
<td>2.176***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.215)</td>
<td>(0.214)</td>
<td>(0.098)</td>
<td>(0.104)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln(productivity$_{in}$)</td>
<td>0.726***</td>
<td>1.622***</td>
<td>3.196***</td>
<td>3.991***</td>
<td>0.441***</td>
<td>0.082**</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.022)</td>
<td>(0.072)</td>
<td>(0.079)</td>
<td>(0.019)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>−2.841***</td>
<td>2.739***</td>
<td>0.126***</td>
<td>0.127***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.050)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.dev. residual$_{i}$</td>
<td>0.698***</td>
<td>0.698***</td>
<td>0.698***</td>
<td>0.698***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations 5,250,114
No. of firms 13,074
Log likelihood −174,586.93
Wald test model $\chi^2$ 222,462.45***

Notes: Robust standard errors are reported beneath the coefficients. The symbols ****, ***, and * denote statistical significance at 1, 5, and 10 percent, respectively. Reported below the regression coefficients for variables in the τ vector are the standard deviations and their significance of the firm-specific $alpha_i$ coefficients in the mixed logit and random coefficients models.
are firm-(country-)specific in Figure 5.2 (referred to as local semi-\( \eta_i \), there). The mixed logit reveals a huge variability about the negative relationship between higher tax rates and tax elasticities.

### Asset intangibility

In the random coefficients model for asset intangibility, \( tax_{CEO,in} \), \( tax_{Payroll,in} \), and \( productivity_{in} \) have the same sign and significance level as in the logit models in Table 5.3. The coefficient on \( tax_{Profit,in} \) would indicate a positive relationship with \( Intangibles_{in} \), this is plausible because as the profit tax rate increases, the more a firm is drawn towards assets that are deductible. R&D tax incentives, in the form of deductions or credits, make intangible asset investments particularly attractive. \( PopDensity_n \) and \( CapStock_n \) are negatively and \( GDPPC_n \) is positively related to \( Intangibles_{in} \).

The upper half of Figure 5.3 illustrates that taxes affect individual firms’ asset intangibility very heterogeneously. Certain industries are more attractive for firms with a high asset intangibility or R&D than others, even within countries. The response to a 1-percentage point increase in any tax instrument in \( \tau_m \) in a generic year is centered around zero but eventually reaches nontrivial magnitudes for profit tax rates and tax rates on CEOs and their relative progressivity.

---

\(^6\)28 of 31 major economies have implemented such R&D incentives over the sample period, covering nearly 91.4 percent of the observations.
Figure 5.2: Mixed Logit Model

Note: Representation of the relationship between the respective tax rate and firm-specific $\alpha$-coefficient, as well as the local semi-elasticity, $\eta$, in the mixed logit model (specification 2). Vertical lines represent the average tax rate or productivity level, respectively.
Figure 5.3: Random Coefficients Model

Note: Representation of the relationship between the respective tax rate and firm-specific $\alpha_i$-coefficient, as well as the local semi-elasticity, $\eta_i$, obtained in the random coefficients model (specification 2). Vertical lines represent the average tax rate or productivity level, respectively.
Chapter 6

The Taxing Deed of Globalization

Over the past decades, global integration of the world economy has risen dramatically – as has inequality across and within countries. That globalization may be a source of inequality is widely accepted by economists, but the exact channels of causation are still debated. We explore one of them: the influence of globalization on inequality through changes in personal income taxation systems around the globe. Using the largest existing database on income tax calculators, collected by the authors, this paper identifies the existence of a causal effect exerted by globalization, measured as goods trade and migration, on country-level tax outcomes and quantifies its magnitude.

Economies became increasingly integrated in the post-World-War-II era, which was characterized by falling barriers to cross-border flows of goods and production factors. While the consequences of vanishing barriers to trade and migration are complex, we focus on the effect of globalization on the behavior of tax authorities around the globe. On the one hand, measures of globalization are correlated with higher expenditures on public goods (see Rodrik, 1998; Epifani and Gancia, 2009). On the other hand, raising the mobility of some factors – such as capital (see Persson and Tabellini, 1993; Devereux, Griffith, and Klemm, 2002; Devereux, Lockwood, and Redoano, 2008) or skilled and/or high-income workers (see Kleven, Landais, Saez, and Schultz, 2014) – in conjunction with liberalization of cross-border business transactions limits the opportunities of

1This chapter is based on Egger, Nigai and Strecker (2016). The authors would like to thank conference participants and discussants at the CESifo Conference on Public Sector Economics, IIPF, Royal Economic Society, European Trade Study Group, 8th FIW-Research Conference “International Economics”, FIW-Workshop “Trade, Migration and Labor Market Outcomes”, Villars Research Workshop on International Trade, and seminars at Yale University, the European Commission, Technical University Dresden, University of Lucerne, and the University of Bayreuth for their numerous comments. In particular, the authors are grateful to Josef Falkinger, Richard Baldwin, and Marcelo Olarreaga for helpful advice.

2Leading explanations for the positive correlation between public spending and globalization include workers’ increased demand for additional insurance against external shocks (Rodrik, 1998) and terms-of-trade externalities (Epifani and Gancia, 2009). For the link between globalization and the size of government spending, also see Cameron (1978) and Alesina and Wacziarg (1998).
tax authorities to diversify the tax burden. Hence, governments rely increasingly on fewer and relatively immobile tax bases to fulfill a growing demand for public goods. These tax bases are essentially three: (i) property and wealth, (ii) sales and consumption, and (iii) the personal income of relatively immobile workers.

This paper assesses the effects of globalization on the relative size of these tax bases and specifically focuses on worker-specific tax burdens and effective average labor income tax rates across the individual income distribution in an economy.

To identify the effect that globalization exerts on tax outcomes, we develop a novel instrument for trade and migration openness – pure cross-border transaction costs – based on insights from new quantitative trade and migration general-equilibrium models. We combine this instrument with data on taxation, specifically, data on personal income taxation, to derive several insights.

First, globalization made governments seek tax revenues from sources other than firm-borne taxes, which is consistent with economic theory suggesting a decreasing taxation of mobile and increasing taxation of immobile tax bases. Globalization increased the share of tax revenues that are collected via employee-borne taxes. Second, relative tax burdens on the broad middle class relative to the very-high-income and lowest-income earners have increased, particularly in the industrialized part of the world. Third, this last change was induced inter alia through modifications of countries’ income tax laws, which provided for a relatively more aggressive taxation of the middle class relative to the extremes of the income distribution. We find that middle-income earners faced a rise in their personal income tax rate of around 1.5 percentage points due to the rise in globalization between 1994 and 2007 alone. In the same time period, the top 1% of workers faced a globalization-induced reduction in their effective income tax rates of approximately 1.5 percentage points. These changes are confirmed in data sets on aggregate income distributions across countries, in microdata across countries from the Luxembourg Income Study (LIS), and, using interstate worker mobility in the United States, in microdata at the sub-national level.

Our findings are consistent with the literature on optimal non-linear taxation in closed (Saez, 2001) and open (Simula and Trannoy, 2010; Piketty and Saez, 2013; Lehmann, Simula, and Trannoy, 2014).

---

3The literature on cross-border tax competition primarily documents a convergence of corporate income and consumption tax rates (see Devereux, Griffith, and Klemm, 2002; Onaran, Boesch, and Liebrecht, 2012), as well as of effective tax rates on labor income (see Onaran, Boesch, and Liebrecht, 2010).

4For the link between globalization and tax design, see Ganghof and Eccleston (2004) and Hines and Summers (2009).

5While revenues from personal income taxation are the most important source for developed countries, they are less important than value-added taxes in less developed economies.
This paper documents the global dimension of the causal impact of globalization on income tax systems, specifically, the personal income tax schedules over the last quarter of a century. In pursuit of this line of research, the present paper compiled the biggest existing data set on personal income tax calculators, covering 252 economies and territories around the globe at an annual level between the years 1980 and 2012 for 12 household archetypes (distinguished by the types of allowances and deductions granted across all the existing systems). Many of the results are well aligned with the current public debate on globalization-induced inequality; however, thus far this debate has lacked the exact documentation of the phenomenon that the present paper generates.

The remainder of the paper is organized as follows: In the next section, we provide a few stylized facts on the link between globalization, the relative size and composition of tax revenues, and firm-borne versus individual-borne tax rates. In Section 6.3, we develop an instrument for globalization that is consistent with recent quantitative trade and migration models and elaborate on the theoretical causal link between openness and income inequality. In Section 6.4, we document the causal link between globalization and the size and composition of tax revenues for OECD and non-OECD countries and over the years 1980-2007. Section 6.5 is devoted to investigating the effect of globalization on worker-specific tax burdens and effective average tax rates. Section 6.6 illustrates the robustness of the findings and provides supporting evidence based on the link between state-to-state migration and state-level tax characteristics in the United States. The last section concludes.

6.2 Globalization, tax revenues, and personal income tax rates

The purpose of this section is to document stylized facts about the changes of what we refer to as globalization, of the composition of tax revenues across major bases, and of personal income tax rates across countries and years. The description of the sources and the generation of the data that are used throughout the paper are relegated to the Appendix. This paper’s research agenda limits the scope of the analysis to 65 countries between 1980 and 2007 due to the need for additional data in our regressions such as income inequality and education.

---

6Saez (2001) examined optimal taxation with immobile labor whereas Simula and Trannoy (2010) and Lehmann, Simula, and Trannoy (2014) extended the analysis to consider migration in a canonical optimal taxation setting along the lines of Mirrlees (1971) and Diamond (1998). Earlier empirical work on the link between migration and personal income taxes exists for individual countries and location decisions of workers within countries (see Kirchgaessner and Pommerehne, 1996; Wagner, 2000; Schmidheiny, 2006). This literature documents a higher income tax sensitivity of more skilled (higher earning) and younger individuals than on average.

7See Egger and Strecker (2016) for more information on the data set.

8While we compiled data on income tax calculators for 252 countries and territories for the period 1980-2012, the limiting factor to the analysis here are the additional regressors.
6.2.1 Globalization

It is well documented in the literature that trade grew substantially in all major regions of the world over the last decades, and that the liberalization of discriminatory and non-discriminatory trade policy measures is partly responsible for this pattern (see Baier and Bergstrand, 2001; Egger and Nigai, 2015). Important policy changes fostering this development were the GATT (General Agreement on Tariffs and Trade) and WTO (World Trade Organization) rounds, as well as the formation of what Baldwin (2006) called the “spaghetti bowl” of preferential trade agreements. At the same time, labor migration increased substantially and, in some OECD countries, became a major force to counteract plummeting fertility rates. In this context, it should be mentioned that the mobility of high-skilled workers – through migration – as well as international trade – through international, within-firm production process fragmentation – is fundamentally linked to the activity of multinational firms. Hence, the two measures of globalization should be expected to be highly correlated with multinational activity and each other.

Figure 6.1: Openness, FDI, and Migration in 65 economies over 1980-2007

Figure 6.1 illustrates the evolution of average imports (in percent of GDP), average inward FDI stocks (in percent of GDP), and average immigration stock (per capita) among the 65 biggest
economies in the world. The figure suggests that, between 1980 and 2007, normalized imports, inward FDI stocks, and immigrant stocks rose by more than 16%, 272%, and 37%, respectively. Lower barriers to goods trade, capital mobility, and worker migration are generally associated with higher government spending for a variety of reasons, also illustrated in Figure 6.1, where tax revenues as a share of GDP increased by 16%. Rodrik (1997, 1998) argues that globalization exposes domestic workers to external shocks, which increases their demand for social insurance and the provision of public goods. This is consistent with trade liberalization being a source of higher inequality as suggested by Goldberg and Pavcnik (2004, 2007). However, Epifani and Gancia (2009) point to the terms-of-trade effect, whereby open economies may raise public spending partly at the expense of foreign economies.

6.2.2 Tax revenue composition

Countries differ in terms of the composition of tax revenues. This composition may be influenced by globalization as well as other factors (e.g., see Hines and Summers, 2009) but there are systematic differences between OECD and non-OECD countries in the period between 1980 and 2007. While both country groups collect roughly one quarter of their total tax revenues from firm-borne taxes, they differ substantially in the relative importance of other sources.

We shed more light on the differences in the average composition of tax revenues in Figure 6.2. For the present purpose and to some extent for reasons of data availability, we distinguish between four sources of tax revenues: firm-based taxes (corporate taxes and employer-borne labor taxes, such as payroll and employer-borne social security contributions); personal income taxes on employees (including their social security contributions); taxes on goods and services following the International

---

9While FDI rose most dramatically, its measurement is less precise than trade or immigration. This is due to differences in the definition of FDI across countries and differences in the thresholds imposed for accounting purposes imposed by the OECD or the UNCTAD FDI/TNC Database.

10Trade economists have put forth a number of theoretical explanations for the positive link between openness and inequality: (i) positive sorting of more productive workers to exporting firms (see Helpman, Itskohki, and Redding, 2010; Burstein and Vogel, 2012; Harrigan and Reshef, 2013 among others), (ii) firm heterogeneity and a high profitability of exporters combined with wage bargaining (see Egger and Kreickemeier, 2009; Amiti and Davis, 2011; Egger, Egger, and Kreickemeier, 2013), (iii) offshoring of certain skill-specific stages of production (see Feenstra and Hanson, 1996, 1999, 2004; Zhu and Trefler, 2005), and finally (iv), capital-skill complementarity and associated skill-premia (see Parro, 2014). For an empirical example, Autor, Dorn, Hanson, and Song (2014) use individual-level U.S. data and find that a higher exposure to imports from China has had a larger adverse effect on the demand for low-skilled workers relative to that of high-skilled workers, which suggests that globalization imposes heterogeneous costs on workers by skill and employment status. Autor, Dorn, and Hanson (2015), using local U.S. labor market data, find that rising import competition, depending on industry characteristics, may lead to wage polarization and/or rising unemployment.
Monetary Fund’s (IMF) definition\textsuperscript{11} and a remainder category, which contains all other sources of tax revenue. The figure suggests that the share of revenues collected from employee-borne income taxation is the most important source in the OECD group over the sample period, followed by taxes on goods and firm-based taxes. In contrast, non-OECD countries rely least heavily on employee-based taxes and most heavily on goods taxes. For these reasons, we devote much of our discussion in the main text to OECD member countries but provide all the results for non-OECD economies in the Appendix.

![Figure 6.2: Tax-revenue composition in OECD and non-OECD countries](image)

6.2.3 Corporate and personal income tax rates

Earlier evidence suggests that capital and high-mobility workers respond sensitively to lower tax rates, while low-mobility workers are less responsive. This is consistent with Figure [6.3] which summarizes the evolvement of the average corporate tax rate, the average top-1% personal income tax rate, and the average median-income tax rate in our sample between 1980 and 2007.\textsuperscript{12} The figure suggests that tax rates levied on relatively mobile bases – corporate profits and high incomes – have declined, while taxes on the median personal income have, on average, increased in the recent past. Hence, the relative stability of personal income tax revenues over the same time span conceals the relatively strong changes in the structure of effective personal income tax rates. The

\textsuperscript{11}According to the IMF’s Government Finance Statistics: goods and services taxes include taxes levied on the production, extraction, sale, transfer, leasing, and delivery of goods and services, but exclude taxes on imports, exports, and other cross-border transactions.

\textsuperscript{12}Personal income tax rates in this context include the worker-specific labor income tax rate and the employee-borne social security contributions. The computation of effective personal income tax rates requires information on the distribution of personal gross incomes within countries over time and on the personal income tax code per country and year. Details on both types of data are relegated to the Appendix.
fact that the reductions in both corporate profit and top personal income tax rates are concurrent with an increase in the median personal income tax rate suggests that the average economy reduced the burden on mobile capital and high-income individuals at the expense of median-income earners. While evidence on this fact is interesting in itself, this paper is concerned with documenting the causal role of globalization in this process. This process, however, is not straightforward, as both trade and migration are affected by taxes on firms and workers. To circumvent this problem we develop an instrument for globalization using the insights from structural models of cross-border flows of goods and workers.

![Graph showing corporate and top-1% income tax rates, median income tax rate, and corporate tax rates over time from 1980 to 2007.](image)

Figure 6.3: Corporate tax rates and personal income tax rates for top-1% and median workers in 65 economies over 1980-2007

### 6.3 An instrument for endogenous globalization

Identifying the effect of globalization on tax revenues and personal income tax schedules is challenging, because the production of goods depends on (gross-of-tax) factor returns, the consumption of goods depends on (net-of-tax) disposable income, and the location of factors (capital and workers) depends on expected net factor returns and the provision of public goods (which are themselves a function of tax revenue). Hence, an analysis of the effect of globalization on tax revenues and tax rates needs to guard against this intricate endogeneity problem.

This paper utilizes insights from recent structural general equilibrium models of trade (see Eaton and Kortum, 2002; Anderson and van Wincoop, 2003; Arkolakis, Costinot, and Rodriguez-
Let us use $\pi_{n,ijt}$, with $n = \{\text{trade, mig}\}$ to denote the expenditure share at time of importer country $i$ on goods from $j$ in the case of trade and the share of natives from $j$ that have chosen to migrate to $i$ in the case of migration, respectively. Then, for a set of $N$ countries we can specify bilateral trade and migration shares as:

$$\pi_{n,ijt} = \frac{c_{n,jt} \beta_{n,ijt}}{\sum_k c_{n,kt} \beta_{n,ikt}},$$

(6.1)

where $c_{n,jt}$ is proportional to country $j$’s supply potential and $\beta_{n,ijt}$ captures the influence of frictions to or preferences against acquiring goods or receiving migrants in country $i$ from $j$ at time $t$. With trade, $c_{n,jt}$ may be influenced by production costs and (gross-of-tax) factor income, while with migration it is a function of potential migrants’ (net-of-tax) reservation wages in $j$, both being influenced by taxation. We follow Head and Ries (2001) in circumventing the problem by normalizing $\pi_{n,ijt}$ as:

$$\frac{\pi_{n,ijt}}{\pi_{n,iit}} = \frac{c_{n,jt} \beta_{n,ijt}}{c_{n,it} \beta_{n,iit}},$$

(6.2)

and, following Eaton and Kortum (2002), Anderson and van Wincoop (2003) and many others, assume domestic trade costs to be zero for all $i$ and $t$, whereby $\beta_{n,iit} = 1$. We then obtain:

$$\beta_{n,ijt} \beta_{n,jit} = \frac{\pi_{n,ijt} \pi_{n,jit}}{\pi_{n,iit} \pi_{n,jjt}}.$$

(6.3)

With $\beta_{n,ijt} \beta_{n,jit}$ at hand, we can compute average costs of (inward and outward) trade or migration, which are denoted by $\beta_{n,it} = \sum_{j \neq i} \beta_{n,ijt} \beta_{n,jit}$. These costs are correlated with trade and migration, but they do not depend on gross- or net-of-tax factor incomes in exporting or importing countries, according to modern quantitative work in international economics.

Let us use $\pi_{n,it}$ to denote country-level average openness to trade (measured as the average of exports and imports to total absorption) and migration (measured as the average of immigrant and emigrant stock to native population). Moreover, let $\lambda^n_t$ and $\mu^n_i$ denote time and country fixed effects, respectively. We can then formulate a stochastic model of trade/immigrant openness that will serve as the first stage as:

$$\ln(\pi_{n,it}) = \text{constant}^n + \Gamma^n_t Z_{it} + \lambda^n_t + \mu^n_i + \delta \ln(\beta_{n,it}) + \upsilon_{n,it},$$

(6.4)

where $\text{constant}^n$ is an intercept, $Z_{it}$ is the matrix of additional controls and $\upsilon_{n,it}$ is a residual term. Using the data on trade and migration from the sources described in the Appendix, this regression
obtains a coefficient estimate of $\hat{\delta} = 0.114$ with a standard error of 0.005 when considering trade and $\hat{\delta} = 0.447$ with a standard error of 0.008 when using migration. Both instruments have strong partial F-statistics of 433 and 2,785 for trade and migration, respectively.

6.4 The effect of globalization on the size and composition of tax revenues

The question of how globalization affects the overall level of tax revenues (relative to GDP) is closely related to the analysis of Rodrik (1997, 1998) and Epifani and Gancia (2009), who identified a positive relationship between government spending and openness. However, our analysis is different from theirs in two significant ways. First, we are interested not only in the size of overall tax revenue but also its composition. Second, we rely on the structural instrument of globalization as outlined in Section 6.3. We start identifying the effect of globalization on tax revenues and their composition by letting $R_r$, where $r = \{\text{total}, \text{firm}, \text{employee}, \text{goods}, \text{other}\}$, be the government tax revenues of type $r$ denoting total tax revenues, revenues from firm-borne taxes, employee-borne taxes, sales, and value-added-type taxes on goods and services, and other tax revenues, respectively. We also denote the two proposed measures of globalization as $\pi_{n,it}$ for $n = \{\text{trade, mig}\}$. Then, we specify the following linear regression model:

$$100 \times \frac{R_r^i}{GDP_{it}} = \text{const}^r_n + \psi^r_n \ln(\pi_{n,it}) + \Gamma^r_n Z_{it} + \lambda^r_{n,t} + \mu^r_{n,i} + u^r_{n,it}, \quad (6.5)$$

where $Z_{it}$ is a vector of controls, $u_{n,it}$ is the disturbance term, the scalars $\text{const}^r_n$ and $\gamma^r_n$ and the vector $\Gamma^r_n$ are regression parameters, and $\lambda^r_{n,t}$ and $\mu^r_{n,i}$ are fixed time and country effects, respectively. The vector $Z_{it}$ includes the following nine control variables: (i) three regressors for the share of population with primary, secondary, and tertiary education, (ii) three binary indicator variables for democracy and either left- or right-wing majorities in the legislature, (iii) log population, log real GDP per capita, and the interaction term of the two. We employ two different specifications of equation (6.5): (1) OLS where $\ln(\pi_{n,it})$ is treated as exogenous, and (2) instrumental-variable (IV) generalized method of moments where $\ln(\pi_{n,it})$ is treated as endogenous and we instrument $\ln(\pi_{n,it})$ with the derived instrument $\ln(\beta_{n,it})$ from Section 6.3. Among the two types of models, the IV estimator is the preferred one, since it avoids the endogeneity bias of the two openness measures by instrumenting and conditioning on observable determinants of government size. Owed to their correlation, we use the two measures of globalization in separate regressions, but the results are robust to including both of them at the same time.

\[14\] All data sources are reported in the Appendix.
The regression results, summarized in Table 6.1, are consistent with the literature in indicating that openness is generally associated with larger government size relative to GDP. The coefficient is larger in the IV model with openness being instrumented in comparison to OLS, where it is not. Hansen-Sargan-C-tests confirm that the OLS estimates are subject to the aforementioned endogeneity bias. E.g., in the case of total revenues, the $\chi^2$-test statistic is equal to 4.87 and is significant at 5%. Next to the results on total tax revenues in Table 6.1, we report the ones for the same models estimated on the remaining four tax revenue categories in $r$. These suggest that globalization has had important compositional effects on government revenues. Specifically, it raised the relative size of employee-borne tax revenues and ones on goods transactions, and reduced the relative size of the residual (other) tax revenues. The effect on the share of firm-borne tax revenues cannot be estimated precisely. The effects of trade and migration on the composition of tax revenues generally have the same sign and qualitatively differ only with regard to the statistical precision at which they are estimated.

Naturally, the effect of openness on the size and composition of government revenues may differ across different time periods and country groups. To explore this issue, we divide the sample into four subcategories along country and time dimensions. First, following Rodrik (1998), we consider the OECD and non-OECD country groups separately (see the Appendix for definitions). This split is motivated by the fact that these two groups differ significantly in a range of underlying fundamentals, such as the levels of the social protection of workers and the quality of institutions, which may not be entirely captured by the control variables. According to Figure 6.2, these two country groups also differ significantly in the composition of their tax revenues. Second, we consider two different sub-periods, namely 1980-1993 and 1994-2007. Doing so naturally divides the sample into two equally-sized subsamples, while allowing the coefficients of interest to differ between them. The differences in the coefficients on the globalization variables around the early 1990s could be rooted in the deep liberalization steps of migration and trade policy that became effective around this time. Specifically, the Maastricht Treaty, which allowed European Union

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Trade</th>
<th>Mig</th>
<th>Coef.</th>
<th>Trade</th>
<th>Mig</th>
<th>Coef.</th>
<th>Trade</th>
<th>Mig</th>
<th>Coef.</th>
<th>Trade</th>
<th>Mig</th>
<th>Coef.</th>
<th>Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\psi}_n$</td>
<td>1.560</td>
<td>0.150</td>
<td>0.388</td>
<td>0.599</td>
<td>0.703</td>
<td>−0.082</td>
<td>0.333</td>
<td>0.162</td>
<td>0.433</td>
<td>−0.728</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.951</td>
<td>0.951</td>
<td>0.890</td>
<td>0.899</td>
<td>0.954</td>
<td>0.954</td>
<td>0.859</td>
<td>0.859</td>
<td>0.610</td>
<td>0.612</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>2.441</td>
<td>1.013</td>
<td>−0.104</td>
<td>0.151</td>
<td>1.370</td>
<td>−0.124</td>
<td>1.947</td>
<td>1.118</td>
<td>−1.237</td>
<td>−0.658</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\psi}_n$</td>
<td>(0.575)</td>
<td>(0.423)</td>
<td>(0.407)</td>
<td>(0.272)</td>
<td>(0.216)</td>
<td>(0.303)</td>
<td>(0.399)</td>
<td>(0.242)</td>
<td>(0.473)</td>
<td>(0.236)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.951</td>
<td>0.950</td>
<td>0.889</td>
<td>0.899</td>
<td>0.954</td>
<td>0.954</td>
<td>0.852</td>
<td>0.856</td>
<td>0.594</td>
<td>0.612</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obs</td>
<td>1,575</td>
<td>1,575</td>
<td>1,389</td>
<td>1,389</td>
<td>1,393</td>
<td>1,393</td>
<td>1,534</td>
<td>1,534</td>
<td>1,374</td>
<td>1,374</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses are robust to an unknown form of heteroskedasticity and autocorrelation. For brevity, the constant, time and country fixed effects and coefficients for education shares, democracy, left-and right-wing governments, log population, log real GDP per capita and the interaction between log population and log real GDP per capita are suppressed.
nationals free movement within the EU, started in 1992; the Schengen Agreement, which reduced border barriers between EU members, came into force in 1995; the North Atlantic Free Trade Agreement, which led to a tremendous increase in trade between Canada, Mexico, and the United States, became effective in 1994. All these events suggest that examining the effect of openness on taxation across these two time periods separately could be fruitful.

Table 6.2: Revenues, Trade and Migration - Subgroups

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs</td>
<td>Coef.</td>
<td>R²</td>
<td>Obs</td>
<td>Coef.</td>
<td>R²</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS</td>
<td>353</td>
<td>0.353</td>
<td>330</td>
<td>330</td>
<td>330</td>
<td>330</td>
</tr>
<tr>
<td>IV</td>
<td>364</td>
<td>0.364</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
</tbody>
</table>

We utilize the associated results to quantify the effect of openness on the share of different tax revenue components across the two country groups and time periods and report the results for OECD countries in Table 6.2 whereas results for non-OECD countries are available in the Appendix. As we are left with two subsamples, the table consists of two panels, where the upper and lower panels pertain to the OECD-country sample in 1980-1993 and 1994-2007, respectively.

The results in the upper panel of Table 6.2 suggest that in the early (pre-liberalization) period the effect of globalization on the relative size of total tax revenues could not be precisely estimated for OECD countries. During this time, OECD countries responded to trade by raising additional revenues from taxes on firms, employees, and goods. On the other hand, higher migration was associated with lower firm-borne tax revenues and taxes on goods. Only migration seems to have stimulated revenues from taxes on goods and to have reduced taxes in the other category. By way of contrast, we find very strong effects of globalization on the total revenue-to-GDP ratio for OECD countries in the later (post-liberalization) period. The results in the lower panel of Table

---

15 For a quantitative discussion of the effect of NAFTA see Caliendo and Parro (2014).
16 Formal structural break tests on a country by country basis also suggest that the hypothesis of no structural break is rejected at 5% and that the estimated break year is 1994 on average.
suggest that trade openness, in particular, raised the relative magnitude of revenues collected from taxes on employees and goods transactions. For reasons that will be discussed in the next section, the effect of migration openness cannot be precisely estimated.

Overall, the results in Table 6.2 suggest two important insights. First, the effect of openness on the relative size of tax revenues became more pronounced during the more recent time period for OECD countries. This increase, however, was not compensated by increased taxes paid by firms but rather by employees. A signature feature of income tax systems in most countries, particularly developed ones, is their progressivity, whereby the tax burden more than proportionately rises with income. Hence, the question at hand is whether the change in the relative magnitude of tax revenues collected from employees was due to inflation due to greater globalization-induced productivity growth for (low- and middle-) income earners in the progressive part of the tax schedule versus (high-income) earners in the non-progressive part, or due to a change in the tax schedule itself. The assessment of this question will be the subject of the next section, which will unveil the key insights of this paper.

6.5 The effects of globalization on personal income taxes

Measuring the effects of globalization – through trade and migration openness – in personal income taxes across as many countries and years as possible is at the heart of the present paper. For this, we focus on two personal income tax measures: the share of the relative tax burden borne by workers across different percentiles of the income distribution and effective personal income tax rates across those percentiles. The former reflects an outcome of both effective tax rates and gross income levels, while the latter focuses on effective tax rates only.

6.5.1 Globalization and the relative personal income tax burden across earners

For the respective analysis per earner type, we need to calculate personal income tax burdens for all percentiles of the income distribution for each country-year observation in our sample. This requires detailed information on the distribution of gross incomes and the country-year-specific tax calculators. Some countries are included in the Luxembourg Income Study, so that representative micro-level data on the personal income distribution are available. However, these data do not cover 65 countries over 28 years. Therefore, we must make use of otherwise available data on Gini coefficients and average wages, which can be obtained for the 65 economies of interest between

---

17 This phenomenon is called cold progression, whereby a constant tax schedule leads to higher average effective personal income tax rates through inflation-driven cross-market increases in nominal wages.
1980-2012 (see the Appendix for details). These measures permit portraying the distribution across centiles only upon adopting assumptions regarding the shape of the distribution. The Gini coefficient and the average wage are sufficient statistics for backing out all moments of the distribution with single-parameter-Pareto- or log-normally-distributed wages. We test and are able to confirm the validity of these necessary assumptions, having compared LIS microdata-based wage percentiles with imputed wage percentiles assuming Pareto versus log-normal distributions. We feed the obtained country-year-specific average percentile wages into the tax calculator for that country and year to obtain the country-year-percentile-specific effective average tax rate. This analysis results in two measures of interest: the nominal wage paid to an average worker in percentile \( p \), country \( i \), and year \( t \), \( w_{it}^p \), and the associated effective employee-borne tax rate, which includes labor income taxes, and employee-borne social security contributions, \( \tau_{it}^p \). Based on these measures, we compute the percentage contributed by each percentile relative to total employee-born tax revenue under the aforementioned assumptions, \( 100 \times \frac{\tau_{it}^p w_{it}^p}{\sum_k \tau_{it}^k w_{it}^k} \), and determine the associated impact of globalization thereon by:

\[
100 \times \frac{\tau_{it}^p w_{it}^p}{\sum_k \tau_{it}^k w_{it}^k} = \text{const}_n^p + \gamma_n^p \ln(\pi_{n,it}) + \Gamma_n^p Z_{it} + \chi_{n,t}^p + \mu_{n,i}^p + u_{n,it},
\]

for \( p = \{1, ..., 100\} \) and \( n = \{\text{trade, mig}\} \). As before, we conduct the analysis separately for the OECD and non-OECD country groups and for the time periods 1980-1993 and 2004-2007. For the sake of brevity, we focus on IV regression results and on the parameter \( \gamma_n^p \), and suppress the results for the non-OECD countries in this and the subsequent subsections and relegate them to the Appendix.

We summarize the findings by way of figures, since there are 100 (percentile-specific) regression coefficients for each sub-sample. In each figure, we report the estimates obtained for the contribution to total employee-borne tax revenue obtained under the Pareto and the log-normal parameterization, and we display point estimates along with 90% confidence bands. The estimated percentile-specific coefficients \( \gamma_n^p \) are displayed in Figures 6.4 and 6.5 for trade openness and migration openness, respectively. Each figure is organized horizontally in two panels, 1980-1993 on the left and 1994-2007 on the right.

---

18 We describe the imputation procedure in detail in the Appendix.
19 Here, we focus on single male earners. The effective tax rate depends on the marital and family status of a worker, the employment status of co-habiting partners and spouses, etc., in many countries. To that effect, the tax calculators cover 12 household types. However, not even the micro data in the Luxembourg Income Study are sufficiently detailed or the data sets sufficiently large to permit calculating proper weights for each household type. We therefore have to make the additional assumption on household type. This study does not want to address individual behavioral responses to changes in income prospects or structural tax changes. Rather, we implicitly hold behavior constant and assess how income prospects and particularly the tax calculator itself are affected by globalization. For this purpose, it is sufficient to consider effects for the single male earner archetype.
Figure 6.4: Regression coefficients IV-GMM: Trade openness and percentile-specific contributions to total employee-borne personal income tax revenues

Figure 6.4 provides the following insights. In the first half of the covered time span, OECD countries collected more-than-proportionately higher personal income tax revenues from earners with higher, relative to earners with lower, incomes in response to greater trade openness, independent of how wages are imputed (Pareto or log-normally). The relationship was relatively flat and insignificantly different from zero for the lower half of the wage distribution. However, OECD countries leaned more heavily on above-median-income earners in response to greater trade openness. Under the Pareto assumption for wages, the respective coefficient $\hat{\gamma}_{\text{trade}}$ (with standard errors in parenthesis) is 0.21 (0.06), 0.49 (0.11), and 4.15 (1.95) for the 75th, 90th, and 100th percentile, respectively. This pattern is consistent with two large strands of existing work. First, the recent trade literature predicts that lowering cross-border barriers to goods transactions raises the inequality of workers by benefiting highly-productive workers and workers in highly-productive firms relatively more (see Egger and Kreickemeier, 2009; Helpman, Itskhoki, and Redding, 2010; Nigai, 2015). If globalization shifted the wage schedule progressively, we expect to see the pattern of the left panel of Figure 6.4. Second, with limited cross-border mobility of labor, the optimal taxation literature (most exemplary, Saez, 2001) suggests that an increase in real income inequality should be countered by increasing taxes on the high-earning and redistributing across percentiles. Hence, greater globalization-induced progression of the wage distribution should be accompanied with greater progression of the income tax schedule. Again, this is consistent with Figure 6.4.

However, this pattern is lost entirely in the recent period 1994-2007, as illustrated in the right
Again, the results of the Pareto and log-normal wage imputations are very similar. In contrast to the earlier period, the later period suggests an inverse-U-shaped locus for the relationship between the relative personal income tax burden and wage percentiles in response to globalization. Clearly, this stark change in the relationship between the early and the later period cannot possibly be explained by a differential impact of globalization on the wages behind the percentiles, but must be related to a change in effective tax rates. In the later half, we observe what we will refer to as the hollowing-out of the middle class: trade openness raised the tax burden on earners at the center of the wage distribution but not at the left and the right tails. The results suggest that the top decile of the income distribution in fact benefited from trade openness relative to other income groups, while the lowest quintile of the income distribution was not affected in relative terms. The coefficients (with standard errors in parentheses) that correspond to the 75th, 90th and 100th percentiles under the assumptions of a Pareto distribution of wages are 0.20 (0.07), -0.06 (0.13), and -8.98 (3.20), respectively. These results are consistent with models in the optimal taxation literature, which assume high-income earners to also be highly mobile (see Simula and Trannoy, 2010; Lehmann, Simula, and Trannoy, 2014).

Figure 6.5: Regression coefficients IV-GMM: Migration openness and percentile-specific contributions to total employee-borne personal income tax revenues

Figure 6.5 summarizes the corresponding results for the migration-based measure of openness. The figure suggests that the responses to migration-openness-induced changes in personal income tax burdens are qualitatively similar at the center of the distribution to those of trade-openness-

---

20Recall that this change could have two roots: a change in the nominal wage schedule at a given tax schedule and a change in the tax schedule.
induced changes. There are some differences in the tails. For instance, migration openness appears to have reduced effective tax burdens at the lower end of the income distribution between 1980-1993, increased them at incomes above the median, but produced no statistically significant response at the very top of the distribution (100th percentile). In the more recent period, the figure suggests that migration openness led to higher relative tax burdens for incomes below the median and to a lower relative tax burden for incomes above the median. The effect on top incomes is again not precisely estimated.\textsuperscript{21} However, the similarity in the qualitative shapes of the patterns between Figures 6.4 and 6.5 indicates the presence of a fundamental qualitative change in underlying tax policies.

We compare the above results based on imputed wages to relative tax burdens calculated from LIS microdata for the countries and years where such data are available. However, comparable and representative microdata are only available for 77 matching OECD country-year observations in the later half of the time span.\textsuperscript{22} The purpose of using these data is to show that the results in Subsection 6.5.1 are consistent with the available microdata and are not an artifact of imputation. Moreover, these data may speak to the relative superiority of assuming Pareto- versus log-normally-distributed earnings.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Fig66.png}
\caption{Regression coefficients IV-GMM: LIS for OECD Countries}
\end{figure}

For convenience, we repeat the above analysis using the limited LIS data in Figure 6.6, where the

\textsuperscript{21}We attribute this to two shortcomings of the migration data: First, data on migration (whether stocks or flows) are generally sparse and missing for a large number of countries. To obtain a complete data set, we combine available data on stocks and flows across different sources, which may be subject to a high degree of imprecision. We describe the imputation procedure in detail in the Appendix. Second, the measure encompasses all types of migration (of high and low-skilled workers; politically and economically driven; etc.) which muddles the effect.

\textsuperscript{22}The coverage of matching non-OECD countries is virtually nonexistent and only 61 OECD country-year matches can be made in the first half.
left and right panels present the effect of trade and migration openness measures on the relative tax burdens, respectively. Naturally, due to the small sample size, the estimated coefficients of openness based on LIS data are significantly more noisy than when using the imputed data. Further, LIS caps reported incomes, such that the top quantile(s) are likely underestimated. We do not view this as a problem since in that case we would underestimate (rather than overestimate) the effect of trade and migration openness on the tax burden for the very top quantile(s)\footnote{For some country-year observations, the samples are too small to impute 100 percentiles entirely. In those cases, we linearly impute the internal missing percentiles and the lower bound, i.e., \( w_{s,t}^{p-1} \) when top percentiles are missing.} However, the general shape and magnitude of the results are consistent with previous effects. This suggests that the earlier results do not hinge upon the parametric assumptions on the shape of the income distribution and are in fact supported by available microdata.

6.5.2 Globalization and the effective average personal income tax rate

In this subsection, we investigate the extent to which changes in the labor tax burden were due to changes in effective tax rates versus wage changes. Here, we repeat the analysis of the previous subsection but now use the average effective tax rate of each percentile \( p \) as the dependent variable:

\[
100 \times \tau_{it}^p = const_n^p + \xi_n^p \ln(\pi_{n,it}) + \Gamma_n^p Z_{it} + \lambda_{n,t}^p + \mu_{n,i}^p + u_{n,it}^p, \tag{6.7}
\]

for \( p = \{1, ..., 100\} \) and \( n = \{\text{trade}, \text{mig}\} \). As before, we focus on IV-regression results on the

Figure 6.7: Regression coefficients IV-GMM: Trade openness and percentile-specific effective average tax rates
parameter $\xi^p$, relegate results for non-OECD countries to the Appendix, and use figures to illustrate the findings.

Figure 6.7 summarizes estimates of $\hat{\gamma}_p$ based on (6.7) when using instrumented trade openness as the measure of globalization, while Figure 6.8 does so when using instrumented migration openness instead. Figure 6.7 suggests that the trade-openness-induced changes in the progression of effective average tax rates across wage percentiles in both sub-periods feature a similar shape to the one of the tax burden in the previous subsection, only the confidence bounds are somewhat wider. Likewise, Figure 6.8 suggests that the migration-openness-induced changes in the progression of effective average tax rates across wage percentiles in both sub-periods are qualitatively similar to the ones of the tax burden in the previous subsection; however, the relationship is less pronounced. Both figures indicate a fundamental change in the effect of globalization on effective average personal income tax rates in the OECD, which is consistent with the fundamental change of the impact on the tax burden in the previous subsection.

![Figure 6.7: OECD: 1980-1993](image1)

![Figure 6.8: OECD: 1994-2007](image2)

Figure 6.7: Regression coefficients IV-GMM: Migration openness and percentile-specific effective average tax rates

Figure 6.8: Regression coefficients IV-GMM: Migration openness and percentile-specific effective average tax rates

In Figures 6.7 and 6.8, we identify changes in the effective average tax rates in response to higher openness with a certain amount of accuracy. However, it is also essential to study the cumulative magnitude of this response. We utilize the estimated coefficients and the observed data on openness to calculate the cumulative magnitude of the effects for the 100 different population groups in an average OECD country across the two periods. To calculate the effect of globalization exerted on the effective labor income tax rates in 1980-1993 and 1994-2007, we multiply the average change...
in (log) openness observed in the OECD group on the estimated (if different from zero at 10% significance level) coefficient in each period, respectively. For the cumulative effect between 1980 and 2007 we add the effects for the two periods. We plot the results for trade and migration in Figure 6.9.

The magnitude of both period-specific effects and the total effect using trade openness is quite large. The poor (between the 1st and 20th percentile) experienced an increase in effective tax rates of around two percentage points in 1980-1993 but remained unaffected by the second wave of globalization. Workers in the lower-middle- and middle-income group experienced a similar increase in taxes (around 2 percentage points) in each period which amounted to roughly 4 percentage points in total. Workers located above the median but below the 70th percentile faced a slightly larger increase in tax rates with the total effect being between 4 and 5 percentage points. Period-specific effects start diverging significantly for people above the 70th percentile in the income distribution.

While in 1980-1993 the effect was progressive and higher percentiles saw their tax rates rising by relatively more such that labor tax rates were raised by around 6 percentage points for the top earners versus only 2.5 for workers in the 70th percentile, in 1994-2007 the effect was regressive. In the later half of our sample period, the tax rate for the top earning decreased by more than 2 percentage points whereas it increased by more than 2 percentage points for workers in the middle and the upper-middle class as a consequence of globalization. These results are of significant magnitude compared to the conventional estimates to the gains from trade of moving from autarky to the observed, concurrent level of openness (see Arkolakis, Costinot, and Rodriguez-Clare, 2012).
Therefore, the net effects of globalization for a household or earner depend substantively on the personal income tax redistribution scheme a government implements.

In a progressive tax system, a general increase in the level of all wages would not preserve relative effective tax rates across different percentiles. Therefore, it is interesting to isolate pure policy (tax schedule) responses to globalization. As mentioned before, the relative tax burden and effective average tax rates are driven by changes in average wages, changes in the dispersion of wages, and changes in the tax schedule (i.e., tax policy in a narrow sense). Here, we are interested in fleshing out actual tax policy (i.e., tax schedule) changes. For this, note that the labor income of percentile $p$ in country $i$ in year $t$ depends linearly on the average wage in country $i$ in year $t$, $\overline{w}_{it}$, and a distribution parameter, $s_{it}^p$, such that $w_{it}^p = \overline{w}_{it} s_{it}^p$. Let us use the function $f_{it}(\cdot)$ to denote the tax code (or tax calculator) in country $i$ and year $t$. Then, the effective average tax rate of percentile $p$ may be defined as:

$$\tau_{it}^p \equiv f_{it}(\overline{w}_{it} s_{it}^p).$$

(6.8)

Naturally, globalization may affect average wages, $\overline{w}_{it}$, as well as wage inequality, $s_{it}^p$, a fact that is well supported by economic theory (see Feenstra and Hanson, 1996; Egger and Kreickemeier, 2009; Amiti and Davis, 2011) as well as by empirical evidence (see Goldberg and Pavcnik, 2004, 2007). However, it is less clear-cut whether globalization affects the tax calculator directly. To isolate changes in $f_{it}(\cdot)$, we produce counterfactual average wages and distribution parameters that are free of the effect of globalization. To this end, we first estimate the effect of globalization on average wages and percentile-specific distribution parameters using the following two regressions:

$$\ln(\overline{w}_{it}) = \text{const}_w + \xi_w \ln(\pi_{n,it}) + \Gamma_w Z_{it} + \lambda_{n,t}^{\overline{w}} + \mu_{n,i}^{\overline{w}} + u_{n,it}$$

(6.9)

$$\ln(s_{it}^p) = \text{const}_s^p + \xi_s^{p} \ln(\pi_{n,it}) + \Gamma_s^{s,p} Z_{it} + \lambda_{n,t}^{s,p} + \mu_{n,i}^{s,p} + u_{s,p_{it}},$$

for $n = \{\text{trade}, \text{mig}\}$ and $p = \{1, \ldots, 100\}$. Having estimated parameters on the openness variables, we produce percentile-specific counterfactual effective tax rates for each country and year under the assumption that globalization had no effect on $\overline{w}_{it}$ and $s_{it}^p$ as:

$$\tilde{\tau}_{it}^p = f_{it} \left( e^{\ln(\overline{w}_{it}) - \text{const}_w^{\overline{w}}} \ln(\pi_{n,it}) - \ln(\pi_{n,i1980}) \right) e^{\ln(s_{it}^p) - \text{const}_s^p} \ln(\pi_{n,it}) - \ln(\pi_{n,i1980}) \right).$$

(6.10)

We re-run the regressions in (6.7) using these counterfactual effective average tax rates. We denote the estimated coefficient as $\tilde{\gamma}_n^{f(\cdot),p}$ and plot them in Figures 6.10 and 6.11.

First, when we use changes in tax calculators isolated from the effects of globalization on the level of wages and their dispersion, the analysis obtains results that are nearly identical to those in Figures...
6.7 and 6.8 across both time periods. This is reassuring as we can conclude that our results mainly rest on estimating government response, i.e., changes in the tax code, rather than on mechanical effects such as the cold progression. Quantitatively, the pattern is less pronounced for the first 99 percentiles and more pronounced for the top percentile.

Figure 6.10: Regression coefficients IV-GMM: Isolated policy-response $f_{it}(\cdot)$ and Trade

Figure 6.11: Regression coefficients IV-GMM: Isolated policy-response $f_{it}(\cdot)$ and Migration
Overall, these findings suggest that the effects of globalization on effective personal income tax rates are *mainly* (rather than *also*) driven by changes in the tax calculator.

### 6.6 Case study: Interstate migration and changes in effective taxation in the United States

Our results based on international data indicate that factor flows have heterogeneous effects on workers in terms of three tax outcomes: the relative tax burden, the effective average labor income tax rate, and the labor income tax calculator. We found that especially governments in developed countries reduced average taxes for high-income earners in response to trade and migration openness, while increasing them for earners in the middle and lower parts of the wage distribution to retain labor tax revenues. In this section, we examine whether similar mechanisms are observed at a sub-national level, using the example of the United States. This exercise will prove to be useful in two important respects. First, it will illustrate to which extent the main insights from the cross-country analysis are confirmed in sub-national data. Second, it will serve as an important validation based on much more complete microdata than the available internationally LIS microdata.

The taxation system of the United States provides an interesting case study, since goods trade is largely and migration is completely free within the country, and various levels of government influence the various levels of income taxes on individuals (and firms) within jurisdictions – federal, state, and in some cases local, sub-state levels. We use the variation across state income tax schedules to examine whether the mobility of high-skilled workers drives intra-national labor tax competition, akin to what we observed internationally.

One important feature of this case study is the high quality of the data involved. These data have several ingredients. First, we employ microdata from the Annual Social and Economic (ASEC) Supplement to the Current Population Survey (CPS) provided by the Integrated Public Use Microdata Series (IPUMS). These data include taxable income of each individual surveyed, as well as their paid federal and state-level taxes. Based on these data, we generate fifty taxable income quantiles and calculate the relative income tax burden and the effective average income tax rate for the state and federal level. Second, we complement these tax burdens with state-to-state migration flows provided by the Internal Revenue Service (IRS). The IRS records the location of each tax filer every year\(^{24}\), which we then use to compute overall state-to-state flows. We use the relative tax burden and the effective income tax rates for single individuals with positive income (to match

\(^{24}\)Specifically, the IRS provides the total taxable income, the total number of returns and the total number of exemptions filed within states by the state in which they were filed in the year prior.)
our international archetype as closely as possible) and measure migration flows in terms of the number of tax returns. We generate the instrument for interstate migration in the same way as before, using normalized state-to-state flows to compute relative mobility cost by state \( s \) for year \( t \). We are only able to address migration openness, as interstate trade is assessed differently from international trade and assessed on a decennial basis only. We employ data on fifty states for eight years (2000-2007) which gives us 400 observations in comparable years to Section 6.5 and avoids the years of the Economic and Financial Crisis in 2008 and its years of recovery.

We start our analysis with analyzing the impact of mobility on the relative tax burden in each of the fifty states for different workers:

\[
100 \times \frac{\tau^q_{st} w^q_{st}}{\sum_k \tau^q_{st} w^q_{st}} = \text{const}^q_{mig} + \gamma^q_{mig} \ln(\pi_{mig,st}) + \Gamma^q_{mig,t} Z_{st} + \lambda^q_{mig,s} + \mu^q_{mig,s} + \nu^q_{mig,st},
\]

for \( q = \{1, ..., 50\} \), where we include the matching state \( s \) (as opposed to country \( i \)) controls in vector \( Z_{st} \). We report the data sources in the Appendix. There are minor differences to the approach in Section 6.5. First, we produce fifty rather than hundred quantiles based on taxable income to ensure that we calculate as many quantiles as possible while maintaining a high level of disaggregation. Hence, each \( q \) captures two percentiles of state \( s \)’s population. Second, we are unable to differentiate between taxes on labor versus other forms of personal income, \( w_{pt} \) therefore denotes total taxable income. Finally, as before with LIS data, due to the anonymity requirement, IPUMS caps reported incomes, such that we are likely underestimating taxable income for the very top quantile(s) in some states/years. We do not view this as a problem since in that case we would underestimate (rather than overestimate) the effect of migration on tax outcomes for the very top quantile.

We report the results for the relative tax burden in the left panel of Figure 6.12, where for the ease of exposition we again plot the estimated coefficients against quantiles \( q \) along with 90% confidence bands. In qualitative terms, the shape of the estimated response curve is strikingly similar to what we saw in Section 6.5 for the OECD countries in the 1994-2007 period. The middle and upper-middle classes experienced an increase in their relative tax burden in response to higher interstate mobility, whereas earners in the top six percentiles experienced significant decreases in their relative tax burden. The estimated coefficients suggest that a one-percent increase in interstate earner mobility (into and out of) a state leads to a 0.15-percentage-point decline in the relative tax burden of the top-income percentile. This is in line with our findings on top incomes in the right panel of Figure 6.5.

\footnote{For some states/years, the state-year samples are too small to produce the top quantile(s). In those cases, we impute missing observations by taking the lower bound, i.e., \( w_{st}^{q-1} \).}
Next, we examine the effect of interstate migration openness on the effective average state-level income tax rate by running the following regression:

$$100 \times \tau^q_{st} = \text{const}^q_{mig} + \xi^q_{mig} \ln(\pi^q_{mig, st}) + \Gamma^q_{mig} Z_{st} + \lambda^q_{mig,t} + \mu^q_{mig,s} + u^q_{mig, st},$$

(6.12)

for $q = \{1, ..., 50\}$ and where $\tau^q_{st}$ is the average effective tax rate applied by state $s$ in year $t$ to quantile $q$. We report the results in the right panel of Figure 6.12. Here, taxes decreased in response to rising migration openness for the top six percentiles, while the rest of the distribution remained unchanged. This suggests that state-level governments do engage in tax competition for mobile top-earners and lower the income tax rates accordingly. The estimates imply that, on average, a one-percent increase in interstate migration openness reduced the effective average state-level personal income tax rate by roughly 0.07 percentage points – a non-negligible increase given the overall size of state taxes.

Even though state governments set their own state-level income taxes, each individual is subject to the federal income taxation as well, irrespective of their resident state. Hence, the federal government of the United States superimposes an additional tax layer which cannot be avoided by relocating within the country. This would suggest that the impact of interstate mobility on the overall tax burden and tax rates is less pronounced relative to state-level component. To assess this hypothesis, we calculate the total relative tax burden and the total effective average tax rate (state plus federal personal income taxes) for each quantile of the income distribution and rerun the regressions in (6.11) and (6.12). The results are reported in Figure 6.13.
The left panel of Figure 6.13 portrays the estimated effect of state-to-state migration on the overall tax burden of individuals in each state and suggests that higher interstate mobility does not have a significant impact on the overall personal income tax burden apart from the two highest income percentiles of the population. The coefficients are largely insignificant and become negative only at the very right tail of the income distribution. The same applies to the effective average federal-plus-state-level personal income tax rate shown in the right panel of Figure 6.13. This panel illustrates that the top two percentiles of the income distribution enjoyed lower tax rates due to higher mobility, while others experienced no significant effects. Figure 6.13 suggests that the federal tax layer functions as a tax policy coordination device in labor taxation, which mitigates or dampens the effect of increasing mobility on state tax policy.

Figure 6.13: Regression coefficients IV-GMM: State-to-state migration and quantile-specific total personal income tax outcomes

6.7 Conclusions

This paper estimates the impact of globalization on tax revenues and its compositions across different country groups, time periods, and population segments. To this end, we have developed a novel instrument based on modern quantitative trade and migration theory. We apply this instrument in unique data set on relative personal income tax burdens and effective average income tax rates in the 65 biggest economies between 1980-2007.

We establish a new set of results based on the link between globalization and various tax outcomes. First, we find that globalization increased pressure on governments in OECD countries to raise
additional tax revenues. These were raised mainly via increased labor income taxes. Second, we find that, while between 1980-1993, the response to globalization involved increasing the progressivity of the relative tax burden and the average effective labor income tax schedule, between 1994-2007 increased globalization led to increases in the tax rates and tax burdens on the middle and the upper-middle classes and to reductions for the top earners. We argue that this was partly due to high-skilled/high-income workers’ cross-border migration and partly due to intensifying tax competition between governments for the same workers. We also identify the same mechanism in a within-country setting looking at state-level personal income taxation in the United States. There, we also find that increasing migration openness led to lower tax burdens and lower tax rates for the top income percentiles.

Our results are significant in several other dimensions. First, we suggest that competition to attract and retain high-skilled workers may have a non-trivial impact on the effective income tax schedule, which has to be taken into consideration as immobile residents are likely to bear the additional burden of such tax competition. Second, we provide an additional link between globalization and rising income inequality, which directly relates to governments’ policy responses rather than pure market forces. Quantifying the effect of globalization-induced policy responses on inequality in a general equilibrium framework may be fruitful for a quantification of the overall effect and we leave this for future research.
6.A  List of countries and data sources

6.A.1  List of countries

OECD: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United States. Non-OECD: Argentina, Bangladesh, Barbados, Bolivia, Cameroon, Chile, China, Colombia, Costa Rica, Cyprus, Ecuador, Fiji, Ghana, Guatemala, Honduras, India, Indonesia, Israel, Jamaica, Jordan, Kenya, Kuwait, Malaysia, Malta, Mauritius, Morocco, Nepal, Pakistan, Peru, Philippines, Senegal, Singapore, South Africa, Sri Lanka, Thailand, Trinidad, Tunisia, Uruguay, Venezuela.

6.A.2  Data sources: International

In this section, we describe data sources of the variables used in the analysis. For the ease of introduction, we categorize them in four main groups: (i) tax revenues, (ii) wages, (iii) tax rates, and (iv) control variables.

(i) Tax revenues

The components of interest are total tax revenue, \( total_{it} \), firm-borne tax revenue, \( firm_{it} \), employee-borne tax revenue, \( employee_{it} \), revenue from taxes on goods and services, \( goods_{it} \), and all other taxes, \( other_{it} \). We combine data from the IMF’s Government Finance Statistics and the OECD’s Tax Statistics to collect the respective variables. Since the two databases have different definitions of taxes that fall under the goods category, we use the IMF’s definition (taxes levied on the production, extraction, sale, transfer, leasing, and delivery of goods and services) as our benchmark and harmonize the OECD data by excluding the taxes on imports, exports, and cross-border transactions. In addition, for some country/year combinations separate data on employer- and employee-borne social security contributions are not available. We use our own estimates based on country-specific tax codes to predict the employer and employee shares of total social security contributions and apply these to the data on the latter.

(ii) Gross wages

For the analysis, we need percentile-specific measures of nominal labor income for a panel of countries. Unfortunately, micro-data sources only cover a handful of countries for a bare minimum
number of years. To overcome these limitations, we parameterize wage income distributions using the moments observed in the data and produce country-year-percentile specific gross wages. We employ two alternative assumptions about the underlying income distribution – Pareto and log-normal. Although it would theoretically be possible to use a mixture distribution where the left tail is modelled as log-normally and the right tail as Pareto distributed, this mixture requires information on at least three moments of the distribution, which are unavailable for the majority of countries used in this study. Therefore, in order to calibrate the parameters of the distributions, we use data on two moments: the gross wage Gini coefficient, $Gini_{it}$, and the average gross wage, $\bar{w}_{it}$.

With the single shape parameter Pareto distribution, the shape ($\phi_{it}$) and the scale parameter ($w_{it}$) can be identified from the following two moment conditions:

$$\bar{w}_{it} = \frac{\phi_{it}}{\phi_{it} - 1} w_{it}; \quad Gini_{it} = \frac{1}{2\phi_{it} - 1}. \quad (6.12)$$

In the case of the log-normal distribution with location parameter ($\mu_{it}$) and scale ($\varphi_{it}$), the two moment conditions are:

$$\bar{w}_{it} = \exp\left(\mu_{it} + \frac{\sigma_{it}^2}{2}\right); \quad Gini_{it} = 2\Phi\left(\frac{\varphi_{it}}{\sqrt{2}}\right) - 1, \quad (6.12)$$

where $\Phi(\cdot)$ is the cumulative distribution function for the standard normal distribution. Once we have calibrated the parameters of the income distributions, we calculate an average income within each of the hundred percentiles per country and year. Average labor income levels are obtained/calculated from the International Labor Organization’s LABORSTA database and, for a number of countries, domestic statistical sources. The data on gross wage Gini coefficients are from the ILOstat database. Where specific years or countries were not available, we imputed missing gross wage Gini coefficients via linear regressions using gross income Gini from the Standardized World Income Inequality Database (SWIID), the average wage, the distribution of education levels in the population, and total capital stock as predictors.

(iii) Tax rates

We calculate the final tax rate for each income percentile by aggregating all labor taxes, all employee-based social security contributions, and all other taxes payable on income by employees and subtracting all relevant deductions and credits for a percentile’s income level. This final

---

26That household incomes and wealth follow Pareto-type power-laws was the very insight provided by Pareto (1896) himself. Recent evidence by among others Felbermayr, Hauptmann, and Schmerer (2014) and Egger, Egger, and Kreickemeier (2013) for worker data supports this fact.
tax must include social security, as the decision to alter the structure of the income tax schedule is co-determined with the structure of the social security schedule.\textsuperscript{27} The final data set covers the years from 1980 to 2007 for 65 countries in the world. The data on income tax codes were collected by the authors and are described in greater detail in Egger and Strecker (2016).

(iv) **Endogenous control variables**

In our analysis, we employ a vector of endogenous control variables, which are the following:

(a) *Trade:* As previously stated, we associate openness with the share of imports in total consumption of manufacturing goods, which we calculate using aggregate volume of manufacturing imports and total absorption of manufacturing goods. These data are taken from the World Bank’s World Integrated Trade Solution Database. We classify manufacturing goods according to the SITC 1 classification. The domestic sales shares are calculated using data on manufacturing production from the OECD’s Structural Analysis Database and United Nations Industrial Development Organization’s Industrial Statistics Database when available. Otherwise, we predict production log-linearly using manufacturing value added.

(b) *Migration:* To compute the measure of migration openness we combine several data sets starting with the one from the World Bank’s Global Bilateral Migration Database available for 1980, 1990, and 2000. We complement these data with ones from Adsera and Pytlíková (2015). Next, we use data on migration flows when available from several sources (EUROSTAT, United Nations Global Migration Database and International Labor Organization) to compute annual migration stocks. When flow data were unavailable we assumed zero flows and kept migration stock constant relative to the previous year.

(v) **Exogenous control variables**

In our analysis, we employ a vector of exogenous control variables, which are the following:

(a) *Primary, Secondary, and Tertiary education:* The shares of the population with primary, secondary and tertiary education are based on Barro and Lee’s (2010) data on educational attainment between the years 1970 and 2000 in 5-year intervals. Intermittent observations were interpolated via regression on a polynomial of the year variable.

\textsuperscript{27} The components of social security contributions vary by country, but generally include old age pension provisions, insurance against unemployment, invalidity, sickness, accidents, as well as the necessary contributions towards family allowances, payable by employees, employers or both.
Democracy, Left-wing, and Right-wing legislative majorities: We include a democracy index as a binary indicator (as opposed to autocratic regimes), as well as binary indicator variables for left- and right-wing majorities in the legislature (center being the excluded variable) from the *The Quality of Government Basic Dataset*.

Population, real GDP per capita, interaction term: We control for country size, level of development, and the interaction between the two by including these three normalized measures in logs obtained from the World Bank’s WDI database.

### 6.A.3 Data Source: United States case study

(i) **Endogenous control variable**

In our U.S. case study, we employ a similar vector of control variables, which are the following:

(a) *Migration*: We use the number of migrated tax returns (inflows and outflows) from the IRS’s *U.S. Population Migration Data* for the years 2000-2007.

(ii) **Exogenous control variables**

In our U.S. case study, we employ a similar vector of control variables, which are the following:

(a) *Primary, Secondary, and Tertiary education*: The shares of the population with primary, secondary and tertiary education are based on the *U.S. Census Current Population Survey’s* data on educational attainment between the years 1990 and 2010, where missing observations were interpolated via regression on a polynomial of the year variable.

(b) *Democracy, Left-wing, and Right-wing legislative majorities*: We include concurrent binary indicators for left- and right-wing majorities of the state legislature from the *National Conference on State Legislatures’s* timelines of state partisan composition.

(c) *Population, real GDP per capita, interaction term*: We control for state size, level of development and the interaction by including these three normalized measures obtained from the *Bureau of Economic Analysis* database on Regional Economic Accounts.

### 6.B Imputation comparisons to available data

6.B.1 Imputed wages vs. Luxembourg Income Study micro-data
The best available cross-country source of micro-data on personal incomes is the Luxembourg Income Study (LIS), which are based on income surveys administered nationally and gathered and disseminated by the LIS Cross-National Data Center in Luxembourg. However, LIS data cover only 138 country-year observations that match our 65 countries between 1980 and 2007. Those matches are neither consecutive within-country nor available for a reasonable cross-section of countries in a given year.

To check the soundness of the imputed wage distributions based on Ginis and average wages, we compare the predictions with the available LIS data. We calculate percentile wages for single adult males with employment income based on their reported labor incomes and present the LIS and imputed percentile incomes for the year 2007 in Figure 6.14. It is apparent that the imputed percentiles match the data very well. Further, we report the country-year-specific correlation coefficients between the imputed and observed percentile wages in Table 6.3 which suggest that the imputed incomes match higher moments of the micro-data well.
Table 6.3: LIS Country-Year Matches

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS</td>
<td>Log-normal</td>
<td>0.987</td>
<td>0.981</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.910</td>
<td>0.916</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUT</td>
<td>Log-normal</td>
<td>0.981</td>
<td>0.986</td>
<td>0.854</td>
<td>0.977</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.870</td>
<td>0.884</td>
<td>0.980</td>
<td>0.945</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEL</td>
<td>Log-normal</td>
<td>0.971</td>
<td>0.982</td>
<td>0.782</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.904</td>
<td>0.920</td>
<td>0.963</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAN</td>
<td>Log-normal</td>
<td>0.992</td>
<td>0.999</td>
<td>0.989</td>
<td>0.974</td>
<td>0.970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.848</td>
<td>0.890</td>
<td>0.900</td>
<td>0.912</td>
<td>0.941</td>
<td>0.948</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEU</td>
<td>Log-normal</td>
<td>0.990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.852</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DNK</td>
<td>Log-normal</td>
<td>0.988</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.895</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESP</td>
<td>Log-normal</td>
<td>0.799</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.920</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIN</td>
<td>Log-normal</td>
<td>0.994</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.879</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRA</td>
<td>Log-normal</td>
<td>0.956</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.963</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBR</td>
<td>Log-normal</td>
<td>0.963</td>
<td>0.997</td>
<td>0.927</td>
<td>0.932</td>
<td>0.950</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.951</td>
<td>0.832</td>
<td>0.973</td>
<td>0.982</td>
<td>0.969</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRC</td>
<td>Log-normal</td>
<td>0.981</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.875</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUN</td>
<td>Log-normal</td>
<td>0.989</td>
<td>0.943</td>
<td>0.913</td>
<td>0.977</td>
<td>0.908</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.875</td>
<td>0.964</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRL</td>
<td>Log-normal</td>
<td>0.973</td>
<td>0.969</td>
<td>0.969</td>
<td>0.857</td>
<td>0.989</td>
<td>0.986</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.792</td>
<td>0.789</td>
<td>0.906</td>
<td>0.981</td>
<td>0.915</td>
<td>0.922</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITA</td>
<td>Log-normal</td>
<td>0.975</td>
<td></td>
<td>0.937</td>
<td>0.948</td>
<td>0.855</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.863</td>
<td></td>
<td>0.966</td>
<td>0.960</td>
<td>0.988</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEX</td>
<td>Log-normal</td>
<td>0.935</td>
<td>0.988</td>
<td>0.847</td>
<td>0.947</td>
<td>0.903</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.979</td>
<td>0.917</td>
<td>0.998</td>
<td>0.976</td>
<td>0.993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NLD</td>
<td>Log-normal</td>
<td>0.981</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.816</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOR</td>
<td>Log-normal</td>
<td>0.980</td>
<td></td>
<td></td>
<td>0.966</td>
<td>0.951</td>
<td>0.959</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.885</td>
<td></td>
<td></td>
<td>0.942</td>
<td>0.957</td>
<td>0.962</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWE</td>
<td>Log-normal</td>
<td>0.976</td>
<td></td>
<td></td>
<td>0.933</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.837</td>
<td></td>
<td></td>
<td>0.953</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Log-normal</td>
<td>0.960</td>
<td>0.903</td>
<td>0.884</td>
<td>0.925</td>
<td>0.951</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pareto</td>
<td>0.964</td>
<td>0.987</td>
<td>0.987</td>
<td>0.982</td>
<td>0.972</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Missing percentiles in the LIS data were linearly interpolated. We are able to match 138 country-year-pairs, with 77 observations entering regressions in Figure 6.6.

6.B.2 Imputed employee-borne tax revenues vs. data

To check whether the estimates square well with other out-of-sample data, we compare the observed size of total employee-borne revenues with the implied employee-borne tax revenues based on the imputed data. As we have percentile-specific income data, as well as their respective tax rates (discussed below), we can calculate total employee-borne tax revenues as:

\[
P_{it}^{employee} = \frac{lforce_{it}}{100} \times \sum_k \tau_k w_{it}^k,
\]

where \(lforce_{it}\) is total labor force in country \(i\) at time \(t\) obtained from the World Bank’s World Development Indicators, with missing years interpolated using a polynomial regression on time.

We compare the imputed and the actual data on employee-borne tax revenues in Figure 6.15.
While the predicted values of total labor tax revenues compare well with the data, the fit is better for OECD than for non-OECD countries. This can be explained by imperfect measurement of the active labor force and/or problems with tax collection in those countries. The overall correlation coefficients between the predicted and actual values (in logs) of $R_{it}^{employee}$ is 0.986 for the whole sample of tax revenues.

### 6.C Non-OECD results

In this appendix, we provide results for non-OECD countries that mirror those presented in the main text for OECD members. As we have mentioned, non-OECD countries rely on employee-based taxes to a much lesser extent; hence, the results that we obtain for this group are generally much less pronounced.

We start with running the following regression:

$$100 \times \frac{R_{it}^r}{GDP_{it}} = const_n^r + \psi_n^r \ln(\pi_{n,it}) + Z_{it} \Gamma_n^r + \lambda_{n,t}^r + \mu_{n,i}^r + u_{n,it}^r,$$

where $Z_{it}$ is a vector of controls, $u_{n,it}$ is the disturbance term, the scalars $const_n^r, \gamma_n^r$, and the vector $\Gamma_n^r$ are regression parameters, and $\lambda_{n,t}^r$ and $\mu_{n,i}^r$ are fixed time and country effects, respectively. We report the results in Table 6.4.

The upper panel provides results for the non-OECD group in the 1980-1993 and the lower panel in the 1994-2007 periods. In the former period, we do not observe significant changes in the composition of the tax revenues due to openness. However, the results suggest that in the latter period, governments in non-OECD countries responded to higher openness by reducing the relative size of revenues raised with employer-based social security contributions and taxes in the other
The figures suggest that in 1980-1993 trade openness did not lead to lower burdens for the top category. Hence, non-OECD countries did not respond to globalization by raising the relative size of tax revenue to GDP but rather by changing the composition thereof via lower revenues from firm-based and other taxes.

Table 6.4: Revenues, Trade and Migration - Non-OECD Subgroup

<table>
<thead>
<tr>
<th>Year</th>
<th>Coef</th>
<th>Firm Employee</th>
<th>Goods</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\psi_n$</td>
<td>0.272</td>
<td>-0.470</td>
<td>0.907</td>
<td>3.540</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.907</td>
<td>0.907</td>
<td>0.853</td>
<td>0.862</td>
</tr>
<tr>
<td>IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\psi_n$</td>
<td>0.892</td>
<td>-3.761</td>
<td>0.372</td>
<td>1.155</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.906</td>
<td>0.906</td>
<td>0.849</td>
<td>0.855</td>
</tr>
<tr>
<td>Obs</td>
<td>385</td>
<td>385</td>
<td>312</td>
<td>312</td>
</tr>
</tbody>
</table>

1994-2007

<table>
<thead>
<tr>
<th>Year</th>
<th>Coef</th>
<th>Firm Employee</th>
<th>Goods</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\psi_n$</td>
<td>0.670</td>
<td>1.314</td>
<td>0.694</td>
<td>0.152</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.935</td>
<td>0.936</td>
<td>0.869</td>
<td>0.867</td>
</tr>
<tr>
<td>IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\psi_n$</td>
<td>1.406</td>
<td>-0.691</td>
<td>0.412</td>
<td>0.294</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.934</td>
<td>0.932</td>
<td>0.868</td>
<td>0.867</td>
</tr>
<tr>
<td>Obs</td>
<td>473</td>
<td>473</td>
<td>397</td>
<td>397</td>
</tr>
</tbody>
</table>

Next, we report the effect of globalization on the relative tax burdens in Figures 6.16.

The figures suggest that in 1980-1993 trade openness did not lead to lower burdens for the top
earners in the non-OECD economies, which is different from the results for OECD countries. In terms of the other time periods and measures of globalization, results are qualitatively similar to the ones in the main text. For example, migration openness had a larger effect on workers in the right tail of the earnings distribution in 1980-1993, whereas they enjoyed lower tax burdens due to globalization in 1994-2007.

Finally, we report the effects of globalization on the average effective tax rates across different workers in non-OECD countries in Figure 6.17. When we measure globalization using trade openness, we cannot detect any significant effects, though qualitatively the results look similar to those for OECD countries. The same generally holds when considering migration: in 1980-1994 workers in the right tail of the wage distribution faced higher tax rates but enjoyed relatively lower rates in 1995-2007 due to globalization.

Figure 6.17: Regression Coefficients IV-GMM: Trade and Percentile-specific Tax Rates
Appendix A

References


Arpaia, A. and G. Carone (2004), Do Labour Taxes (and their Composition) Affect Wages in the


Bösenberg, S., Egger, P. and N. Strecker (2014), On the Distribution of Tax Effects on Headquar-

Büttner, T. and G. Wamser (2007), Intercompany Loans and Profit Shifting Evidence from


Chetty, R., J. Friedman, T. Olsen and L. Pistaferri (2011), Adjustment Costs, Firm Responses, and


Devereux, M., B. Lockwood and M. Redoano (2008), Do countries compete over corporate tax rates?, *Journal of Public Economics*, 92(5-6), 1210-1235.


Feenstra, R. and K. Hanson (2004), Global Production Sharing and Rising Inequality: A Survey of


International Monetary Fund, *Staff Country Reports*, International Monetary Fund, 1980-2010.


Liebig, T. and A. Sousa-Poza (2004), Migration, Self-Selection and Income Inequality: An International Analysis, Kyklos, 57(1), 125-145.


Luxembourg Income Study Database (LIS), www.lisdatacenter.org (multiple countries; data run in July 2015), Luxembourg: LIS.


Appendix B

Sourcebook: Global Labor Income Taxation

**Afghanistan**


**Aland Islands**


**Albania**


**Algeria**


**American Samoa**


**Andorra**


**Angola**

**Anguilla**


**Antigua and Barbuda**


**Argentina**


**Armenia**


IMF Staff Team (2005), Republic of Armenia: First Review under the Three-Year Arrangement under the Poverty Reduction and Growth Facility, *IMF Country Report* 05/422.


**Aruba**


Departamento di Impuesto (2014), *Aangifte Inkomstenbelasting* (Several Years), Oranjestad: Departamento di Impuesto, Web. 7-Oct-2014


IMF Staff Team (2003), Kingdom of the Netherlands-Aruba: Statistical Appendix, *IMF Country Report* 03/43.

IMF Staff Team (2005), Kingdom of the Netherlands-Aruba: Selected Issues and Statistical Appendix, *IMF Country Report* 05/203.


Minister van Financien (2005), *Tabel Inkomstenbelasting 2005*, Oranjestad: Minister van Financien.


Minister van Financien (2010), *Tabel Inkomstenbelasting 2010*, Oranjestad: Minister van Financien.


Minister van Financien (2012), *Tabel Inkomstenbelasting 2012*, Oranjestad: Minister van Financien.


**Australia**


**Austria**


**Azerbaijan**


**Bahamas, The**


**Bahrain**


**Bangladesh**


**Barbados**


**Belarus**


**Belgium**


**Belize**

IMF Staff Team (2000), Belize: Statistical Appendix, *IMF Country Report* 00/75.


**Benin**


**Bermuda**


**Bhutan**


**Bolivia, Plurinational State of**


IMF Staff Team (1999), Bolivia: Statistical Appendix, *IMF Country Report 00/38*.


IMF Staff Team (2003), Bolivia: Selected Issues and Statistical Appendix, *IMF Country Report 03/258*.


181


Plurinational Legislative Assembly (2014), *Asignacion Familiar*, La Paz: DrLeyes, Web. 6-Oct-2014


**Bosnia and Herzegovina**

IMF Staff Team (2000), Bosnia and Herzegovina: Selected Issues and Statistical Appendix, *IMF Country Report* 00/77.


**Botswana**


**Brazil**


Mourao, L. and A. Macedo de Jesus (2011), Bolsa Familia (Family Grant) Programme: An Analysis of Brazilian Income Transfer Programme, *Field Actions Science Reports, Special Issue* 3.


World Bank (1990), Brazil: An Agenda for Tax Reform, *World Bank Report* 8147-BR.

**British Indian Ocean Territory**


**Brunei Darussalam**


**Bulgaria**


IMF Staff Team (2000), Bulgaria: Staff Report for the 1999 Article IV Consultation and Third Review under the Extended Arrangement, *IMF Country Report* 00/53.


**Burkina Faso**


IMF Staff Team (2000), Burkina Faso: Staff Report for the 2000 Article IV Consultation and First Review under the Poverty Reduction and Growth Facility, *IMF Country Report* 00/86.


**Burundi**


Ministere de la Sante Publique et de la Lutte Contre le SIDA (2014), Etude sur le Financement de la Sante au Burundi Rapport de Synthese, Bujumbura: Ministere de la Sante Publique et de la Lutte Contre le SIDA.

**Cabo Verde**


**Cambodia**


190


**Cameroon**


IMF Staff Team (2005), *Memorandum Structural Adjustment Credit*, IMF Country Report 05/165.


**Canada**


**Cayman Islands**


**Central African Republic**


**Chad**


**Chile**


**China, People’s Republic of**

Christmas Island
(see Australia)

Cocos Islands
(see Australia)

Colombia
IMF Staff Team (1999), Colombia: Statistical Appendix, *IMF Country Report* 00/12.


**Comoros**


**Congo, Democratic Republic of**


IMF Staff Team (2003), Democratic Republic of the Congo: Selected Issues and Statistical Appendix, *IMF Country Report* 03/175.


**Congo, Republic of**


**Cook Islands**


198


**Costa Rica**


Asamblea Legislativa (1976), *Amendment 5909*, San Jose: Costa Rican Legal Information System.


Division de Fiscalizacion Operativa y Evaluativa (2005), Impuesto Sobre Utilidades: Estudio Estadistico de la Base y la Evasion, San Jose: Division de Fiscalizacion Operativa y Evaluativa.


**Côte d’Ivoire**


**Croatia**


**Cuba**


**Cyprus**


IMF Staff Team (2003), Cyprus: Selected Issues and Statistical Appendix, *IMF Country Report 03/31*.

IMF Staff Team (2005), Cyprus: Selected Issues and Statistical Appendix, *IMF Country Report 05/106*.


Inland Revenue Department (2014), *Direct Taxation*, Nicosia: Inland Revenue Department, Web. 5-Sep-2014

Inland Revenue Department (2014), *Self-Assessment Individual*, Nicosia: Inland Revenue Department, Web. 5-Sep-2014

Inland Revenue Department (2014), *Tax Rates*, Nicosia: Inland Revenue Department, Web. 5-Sep-2014

**Czech Republic**


Foerster, M. and I. Gyoergy Toth (2000), Trends in Child Poverty and Social Transfers in the


Vecernik, J. (2001), Earnings Disparities in the Czech Republic: Evidence From the Past Decade and a Cross-National Comparison, Finance a Uver, 52(9), 450-471.


**Czechoslovakia**


Haas, J. and J. Ditrich (2011), Sub-Central Governments’ Additional Taxes in the Czechoslovak Republic During the Great Depression Era, West Bohemian Historical Review, 2, 223-247.


National Assembly of the Czechoslovak Republic (1953), Law About the Monetary Reform 1953, Prague: National Assembly of the Czechoslovak Republic.


World Bank (1990), Czechoslovakia: Transition to a Market Economy, World Bank Report 8847-CZ.

**Denmark**


Ministeriet for Born, Ligestilling, Integration Og Sociale Forhold (1991), Dsk 19985: Datasammenskrivning Af Lov Om Bornetilskud Og Forskudsvis Udbetaling Af Bornebidrag, Kobenhaven: Rets Information, Web. 28-Oct-2014

Ministeriet for Born, Ligestilling, Integration Og Sociale Forhold (1991), Lbk 254: Bekendtgørelse Af Lov Om Bornetilskud Og Forskudsvis Udbetaling Af Bornebidrag, Kobenhaven: Rets Information, Web. 28-Oct-2014

Skatteministeriet (2002), Skatteberegningssreglerne for Personer-for Ug Nu, Kobenhaven: Skatteministeriet.

**Djibouti**


Presidence de la Republique (2014), Journal Officiel de la Republique de Djibouti, Djibouti: Presidence de la Republique, Web. 4-Sep-2014

Presidence de la Republique (2014), Impots-Directs ITS, Djibouti: Ministere des Finances, Web. 4-Sep-2014


**Dominica**


IMF Staff Team (1999), Dominica: Staff Report for the 1999 Article IV Consultation, *IMF Country Report* 00/16.


**Dominican Republic**


**Ecuador**


Servicio de Rentas Internas (1999), *Boletín* 41 de 1999, Quito: Servicio de Rentas Internas.


Servicio de Rentas Internas (2011), *Ley Orgánica de Regimen Tributario Interno* (as amended), Quito: Servicio de Rentas Internas.


**Egypt**


**El Salvador**


Republica de el Salvador (1952), *Diario Oficial* 155(87), San Salvador: Imprenta Nacional.
Republica de el Salvador (1953), *Diario Oficial* 159(82), San Salvador: Imprenta Nacional.
Republica de el Salvador (1966), *Diario Oficial* 211(91), San Salvador: Imprenta Nacional.
Republica de el Salvador (1968), *Diario Oficial* 219(64), San Salvador: Imprenta Nacional.
Republica de el Salvador (1968), *Diario Oficial* 221(236), San Salvador: Imprenta Nacional.
Republica de el Salvador (1979), *Diario Oficial* 262(14), San Salvador: Imprenta Nacional.


**Equatorial Guinea**


**Eritrea**


Estonia


Ethiopia


**Falkland Islands**


**Faroe Islands**


**Fiji**


Finland


217


**France**


218


**French Guiana**

(see France)


**French Polynesia**


**Gabon**


IMF Staff Team (2005), Gabon: Selected Issues and Statistical Appendix, *IMF Country Report 05/147*.


219


**Gambia, The**


**Georgia**


IMF Staff Team (2000), Georgia: Recent Economic Developments and Selected Issues, *IMF Country Report* 00/68.


**German Democratic Republic**


Staatsrates der Deutschen Demokratischen Republik (1965), *Familiengesetzbuch der Deutschen Demokratischen Republik* (as amended), Berlin: Staatsrates der Deutschen Demokratischen Republik, Web. 2-Sep-2014


**Germany**


**Ghana**

222


IMF Staff Team (1999), Ghana: Selected Issues, *IMF Country Report* 00/2.


**Gibraltar**


**Greece**


**Greenland**


**Grenada**


**Guadeloupe**

(see France)

**Guam**

(see United States)


**Guatemala**


228


Decano de la Prensa Centroamericana (1990), *Diario de Centro America*, 58(1990), Guatemala: Republica de Guatemala.

Decano de la Prensa Centroamericana (1990), *Diario de Centro America*, 75(1990), Guatemala: Republica de Guatemala.


**Guernsey**


Guernsey Legal Resources (2014), *Summary of Allowances and Budget Schedule by Year*, St. Peter Port: Guernsey Legal Resources, Web. 28-Aug-2014


**Guinea**


IMF Staff Team (1999), Guinea: Statistical Appendix, *IMF Country Report 00/13*.

IMF Staff Team (2002), Guinea: Statistical Appendix, *IMF Country Report 02/100*.


**Guinea-Bissau**


236


**Guyana**


238


**Haiti**


**Honduras**


Decano de la Prensa Hondurena (1965), *La Gaceta: Diario Oficial de la Republica de Honduras*, 18190, Tegucigalpa: Republica de Honduras.


Decano de la Prensa Hondurena (1990), *La Gaceta: Diario Oficial de la Republica de Honduras*, 26683, Tegucigalpa: Republica de Honduras.


Decano de la Prensa Hondurena (1999), *La Gaceta: Diario Oficial de la Republica de Honduras*, 28989, Tegucigalpa: Republica de Honduras.


Secretaria de Hacienda y Credito Publico (2004), Ley de Impuesto Sobre Ventas, *Base de Datos de Tributacion del CIAT*.


**Hong Kong**


Inland Revenue Department (2014), *Allowances*, Hong Kong: Inland Revenue Department, Web. 9-Oct-2014

Inland Revenue Department (2014), *Salaries Tax/Personal Assessment: Allowances, Deductions and Tax Rate Table*, Hong Kong: Inland Revenue Department.

Lap, C., Tung, L. and Y. Hin (2012), *Income Inequality in Hong Kong*, Hong Kong: Hong Kong Statistical Society.


242
Legislative Committee on Finance (2009), *Annual Adjustment of Payment Rates under the Comprehensive Social Security Assistance Scheme and the Social Security Allowance Scheme*, Hong Kong: Legislative Committee.

Legislative Committee on Finance (2012), *Annual Adjustment of Payment Rates under the Comprehensive Social Security Assistance Scheme and the Social Security Allowance Scheme*, Hong Kong: Legislative Committee.


Legislative Committee Panel on Welfare Services (2014), *Panel on Welfare Services (Papers)*, Hong Kong: Legislative Committee.

Littlewood, M. (2010), *Taxation Without Representation: the History of Hong Kong’s Troublingly Successful Tax System*, Hong Kong: Hong Kong University Press.


Social Welfare Department (2008), *Comprehensive Social Security Assistance Scheme: Standard Rate*, Hong Kong: Census and Statistics Department.

Social Welfare Department (2009), *Comprehensive Social Security Assistance Scheme: Standard Rate*, Hong Kong: Census and Statistics Department.

Social Welfare Department (2010), *Comprehensive Social Security Assistance Scheme: Standard Rate*, Hong Kong: Census and Statistics Department.


**Hungary**


**Iceland**


**India**


IMF Staff Team (1999), India: Recent Economic Developments, *IMF Country Report* 98/120.


244

**Indonesia**


IMF Staff Team (2005),  *Indonesia: Selected Issues*,  *IMF Country Report 05/327*.


**Iran, Islamic Republic of**


IMF Staff Team (2000),  *Islamic Republic of Iran: Recent Economic Developments*,  *IMF Country Report 00/120*.


**Iraq**


**Ireland**


246


247


248


249


250

**Isle of Man**

Income Tax Division (1990), *Practice Note* 29/90, Douglas: Treasury.
Income Tax Division (1990), *Practice Note* 29/90, Douglas: Treasury.
Income Tax Division (2003), *Practice Note* 95/03, Douglas: Treasury.
Income Tax Division (2005), *Practice Note* 111/05, Douglas: Treasury.
Income Tax Division (2012), *Practice Note* 171/12, Douglas: Treasury.

253


255


Israel


**Italy**


**Jamaica**


Japan


Jersey


Jersey Citizens Advice Bureau (2010), Social Security Contribution Credits During Unemployment Small Income Exception (9.8.0.L2), St. Helier: Jersey Citizens Advice Bureau.

Jersey Law (1956), Family Allowances (Rate of Allowance) (Jersey) Act, 1956, R&O 3763, St. Helier: States Greffe.

Jersey Law (1957), Family Allowances (Rate of Allowance) (Jersey) Act, 1956, R&O 3763, St. Helier: States Greffe.


Jersey Law (1975), Family Allowances (General Provisions) (Amendment 3) (Jersey) Order 1975, R&O 6146, St. Helier: States Greffe.

Jersey Law (1975), Family Allowances (Jersey) Regulations 1975, R&O 6130, St. Helier: States Greffe.


Jersey Law (1975), Social Security (General Benefit) (Jersey) Order 1975, R&O 6149, St. Helier: States Greffe.


Jersey Law (1976), Family Allowances (Jersey) Regulations 1976, R&O 6271, St. Helier: States Greffe.


Jersey Law (1979), Family Allowances (Jersey) Regulations 1979, R&O 6643, St. Helier: States Greffe.


Jersey Law (1990), Family Allowances (Amendment) (Jersey) Regulations 1990, R&O 8133, St. Helier: States Greffe.


Jersey Law (1990), Family Allowances (Jersey) Regulations 1990, R&O 8033, St. Helier: States Greffe.


270


272


275


**Jordan**


Kazakhstan


Kenya


**Kiribati**


Korea, Democratic People’s Republic of


Korea, Republic of


282


**Kosovo**


Deloitte Touche Tohmatsu (2010), *Kosovo Tax Highlights*, Tirana: Deloitte CE.


**Kuwait**


**Kyrgyzstan**


Karalaeva, E. (2010), Local Tax Reform in the Kyrgyz Republic, Conference Proceedings: *18th NispaCEE Annual Conference*


UNICEF Kyrgyzstan (2008), *Effectiveness of Benefits to Families and Children in the Kyrgyz Republic*, Bishkek: UNICEF.


**Lao People’s Democratic Republic**


284
IMF Staff Team (2000), Lao People’s Democratic Republic: Recent Economic Developments, *IMF Country Report* 00/03.


**Latvia**


Council of Ministers (1990), on Amendments to the Latvian Republic 1990th on 12th December the Law “on Personal Income Tax” 1/2, *Latvijas Vestnesis*.

Council of Ministers (1990), on Amendments to the Latvian Republic 1990th on 12th December the Law “on Personal Income Tax” 2/2, *Latvijas Vestnesis*.


Council of Ministers (1991), for Pensioners the Minimum Subsistence Allowance and the Amount of the Increase, Decision 136, \textit{Latvijas Vestnesis}.

Council of Ministers (1991), for Premiums Due to the Movements in Commodity Prices and An Increase in Tariffs, Decision 418, \textit{Latvijas Vestnesis}.


Council of Ministers (1992), on Changes in the Minimum Wage and Benefits and the Size of the Scholarship, Decision 188, \textit{Latvijas Vestnesis}.


Lebanon


Central Administration of Statistics (2009), Lebanses Income & Wages, Beirut: Central Administration of Statistics.


Saidi, N. (2003), Lebanon: Monetary Policy, Dollarization & the Exchange Rate, Beirut: Banque du Liban.


Lesotho


**Liberia**


**Libya**


El-Firjani, E. and S. Faraj (2014), An Empirical Investigation into the Motives for the Adoption of International Accounting Standards within Developing Countries: the Case of Libya, Conference Proceedings: *British Accounting & Finance Association Annual Conference*.


IMF Staff Team (2005), Socialist People’s Libyan Arab Jamahiriya: Statistical Appendix, *IMF Country Report 05/78*.


IMF Staff Team (2008), Socialist People’s Libyan Arab Jamahiriya: Statistical Appendix, *IMF Country Report 08/301*.

**Liechtenstein**


**Lithuania**


**Luxembourg**


**Macao**


Governo de Macau (1990), Lei 4/90, *Boletim Oficial de Macau*, 23(1990), Macau: Governo de Macau.


Governo de Macau (1996), Boletim Oficial de Macau, 28(1996), Macau: Governo de Macau.

Macedonia, Former Yugoslav Republic of


IMF Staff Team (2000), Former Yugoslav Republic of Macedonia: Recent Economic Developments, IMF Country Report 00/72.


Madagascar


Andrianarison, F. (1998), Une Introduction a la Fiscalite Malgache: Reformes Apres Reformes-le Taux de Pression Reste Constant, Projet Madio: Appui a la Reflexion Macro-Economique 9735E.


IMF Staff Team (2000), Madagascar: Recent Economic Developments and Selected Issues, IMF Country Report 00/92.


Malawi


**Malaysia**


Inland Revenue Board of Malaysia (2012), *B7 Personal Reliefs*, Kuala Lumpur: Inland Revenue Board of Malaysia.


Maldives


Mali


Malta
300


House of Representatives (2014), Income Tax Act, Ch. 132 (as amended), Laws of Malta, Valletta: House of Representatives.

House of Representatives (2014), Social Security Act, Ch. 318 (as amended), Laws of Malta, Valletta: House of Representatives.


the Malta Institute of Accountants (2008), Taxation (Malta), Paper F6 (MLA), Examination Materials, Association of Chartered Certified Accountants.

Marshall Islands


Martinique
(see France)

Mauritania


Cherif, M. (2009), Reforme de la Fiscalite des Entreprises en Mauritanie, Nouakchott: Centre Mauritanian d’Analyse de Politiques.


IMF Staff Team (2003), Islamic Republic of Mauritania: Statistical Appendix, IMF Country Report 03/16.


KPMG (2011), Mauritania Fiscal Guide 2011, Dakar: KPMG.


Republique Islamique de Mauritanie (1990), *Journal Officiel*, 744(1990), Nouakchott: Republique Islamique de Mauritanie.


**Mauritius**


Supreme Court Online Library System (2014), \textit{Statistics Archive}, Port Louis: Supreme Court Online Library System, Web. 28-May-2014


World Bank (1982), Report and Recommendation on a Proposed Loan (Sixth Line of Credit) to the Development Bank of Mauritius with the Guarantee of Mauritius, *World Bank Report* P-3312-MAS.


**Mayotte**

(see France)


**Mexico**


**Micronesia, Federated States of**


**Moldova, Republic of**


Ernst & Young (2005), *Doing Business in Moldova*, Chisinau: Ernst & Young.

Ernst & Young (2008), *Doing Business in Moldova*, Chisinau: Ernst & Young.


**Monaco**


314


Mongolia


**Montenegro**


**Montserrat**


**Morocco**


Imprimerie Officielle (2009), Bulletin Officiel, 5732, Rabat: Imprimerie Officielle.


Mozambique


Myanmar


KPMG (2013), Myanmar Tax Profile, Singapore: KPMG Asia Pacific Tax Centre.


State Law and Order Restoration Council (1989), Amendment to the Income Tax Law, Naypyidaw: Ministry of Finance.

State Law and Order Restoration Council (1990), The Commercial Tax Law, Naypyidaw: Ministry of Finance.


Namibia


**Nauru**


**Nepal**


**Netherlands Antilles (Bonaire, Sint Eustache, Saba, Curacao, Sint Maarten)**


IMF Staff Team (2001), Kingdom of the Netherlands-Netherlands Antilles: Recent Developments, Selected Issues and Statistics Appendix, *IMF Country Report* 01/73.


327


**New Caledonia**


**New Zealand**


**Nicaragua**


Centro Interamericano de Administraciones Tributarias (2005), Descripcion General de Los Impuestos Aplicados en Nicaragua, *Base de Datos de Tributacion del CIAT*.


Niger


IMF Staff Team (2009), Niger: Selected Issues and Statistical Appendix, IMF Country Report 09/70.


Nigeria


**Niue**


**Norfolk Island**

Minister for Infrastructure and Regional Development (2014), Statement on Norfolk Island, Kingston: Norfolk Island Legislative Assembly.


Norfolk Island Legislative Assembly (2013), Hansard-10 April 2013, Kingston: Norfolk Island Legislative Assembly.

**Northern Cyprus**


**Northern Mariana Islands**


**Pakistan**


Central Board of Revenue (1999), *Circular* 18 of 1999, Universal Self-Assessment Scheme (USAs) for the Assessment Year 1999-2000, Islamabad: Revenue Division.


Central Board of Revenue (2005), *Islamabad: Revenue Division*, Islamabad: Revenue Division.


IMF Staff Team (2001), Pakistan: Selected Issues and Statistical Appendix, *IMF Country Reports* 01/11.


**Palau**


**Palestine, State of**


**Panama**


Asamblea Nacional (1992), *Código Fiscal de la Republica* (as amended), Panama City: Asamblea Nacional.


Asamblea Nacional (2010), *Código Fiscal de la Republica* (as amended), Panama City: Asamblea Nacional.


Asamblea Nacional (2014), *Código Fiscal de la Republica* (as amended), Panama City: Asamblea Nacional.

338


IMF Staff Team (2000), Panama: Selected Issues and Statistical Appendix, *IMF Country Report* 00/44.


Justia Panama (2014), *Ley de Panama-Federales*, Panama City: Justia Panama, Web. 19-Sep-2013


**Papua New Guinea**


**Paraguay**


**Peru**


**Philippines, The**


President of the Philippines (1954), *Republic Act* 1161, An Act to Create a Social Security System Providing Sickness, Unemployment, Retirement, Disability and Death Benefits for Employees, Manila: President of the Philippines.

President of the Philippines (1960), *Republic Act* 2658, An Act to Amend Certain Sections of Republic Act 1161, Manila: President of the Philippines.


President of the Philippines (1969), *Republic Act* 6111, An Act Establishing the Philippine Medical Care Plan and Creating the Philippine Medical Care Commission, Manila: President of the Philippines.

President of the Philippines (1972), *Presidential Decree* 24, Amending Certain Sections of Republic Act 1161, Manila: President of the Philippines.

President of the Philippines (1973), *Presidential Decree* 323, Amending Section 21 and Section 51 of the National Internal Revenue Code, Manila: President of the Philippines.

President of the Philippines (1977), *Presidential Decree* 1158-A, Amending Certain Sections of the National Internal Revenue Code of 1939, Manila: President of the Philippines.

President of the Philippines (1978), *Presidential Decree* 1519, Revising the Philippine Medical Care Act of 1969, Manila: President of the Philippines.

President of the Philippines (1981), *Presidential Decree* 1773, Amending Certain Sections of the National Internal Revenue Code, Manila: President of the Philippines.

President of the Philippines (1981), *Presidential Decree* 1806, Amending Section 12 of Presidential Decree 1636, Manila: President of the Philippines.


President of the Philippines (1986), *Executive Order* 37, Further Amending Certain Provisions of the National Internal Revenue Code, as amended, Manila: President of the Philippines.

President of the Philippines (1987), *Executive Order* 273, Adopting a Value-Added Tax, Amending for This Purpose Certain Provisions of the National Internal Revenue Code, and for Other Purposes, Manila: President of the Philippines.

President of the Philippines (1989), *Executive Order* 365, Increasing Benefits and Monthly Contributions under the Philippine Medical Care Plan and Providing for a Health Financial Assistance Program, Manila: President of the Philippines.

Pitcairn


Poland


**Portugal**


PorData (2012), *National Minimum Wage in Portugal*, Lisbon: PorData, Web. 21-Nov-2014

PorData (2012), *Valores Mensais de Algumas Prestacoes Familiares da Seguranca Social*, Lisbon: PorData.

PorData (2014), *Despesa da Seguranca Social: Subsidios a Infancia e a Familia*, Por Tipo, Lisbon: PorData.


**Puerto Rico**


Burgos Andujar, N., Marrero, W. and E. Medina Irizarry (1993), Impacto de las Firmas Manufac-
tureras 936 Sobra la Economia de Puerto Rico: una Analisis usand la Tecnica de Insumo-
Producto, Junta de Planificacion de Puerto Rico 936.

de Investigaciones Comerciales e Iniciativas Academicas de la Facultad de Administracion de
Empresas, Forum Empresarial, 3(2), 3-36.

Camara de Representantes (2009), P. de la C. 2148, San Juan: Camara de Representantes.

Comision de Hacienda (2005), Informe Positivo Sobre el P. de la C. 1445, San Juan: Camara de
Representantes.

Comision de Hacienda (2007), Informe Positivo Sobre el P. de la C. 3341, San Juan: Senado de
Puerto Rico.

Comision de Hacienda (2010), Informe Positivo Sobre el P. de la C. 3029, San Juan: Senado de
Puerto Rico.

Comision de Hacienda (2011), Informe Positivo Sobre el P. de la C. 3070, San Juan: Senado de
Puerto Rico.

Comision Economica para America Latina y el Caribe (2004), Globalizacion y Desarrollo: De-
safios de Puerto Rico Frente Al Siglo XXI, Comision Economica para America Latina y
el Caribe 646.

Departamento de Estado (2014), Registro de Reglamentos, San Juan: Departamento de Estado,
Web. 5-May-2014

Departamento de Hacienda (2014), Income Tax Forms for Individuals, San Juan: Departamento
de Hacienda, Web. 28-Apr-2014

Department of the Treasury (1957), Amendment 2937 to Income Tax Act, San Juan: Department
of the Treasury.

Department of the Treasury (1957), Amendment 3566 to Income Tax Act, San Juan: Department
of the Treasury.

Department of the Treasury (1997), Amendment 5718 to Income Tax Act, San Juan: Department
of the Treasury.

Department of the Treasury (1997), Amendment 5718 to Income Tax Act, San Juan: Department
of the Treasury.

Department of the Treasury (1998), Individual Income Tax Return 1998 (Long Form & Instruc-
tions), San Juan: Department of the Treasury.

Department of the Treasury (1999), Individual Income Tax Return 1999 (Long Form & Instruc-
tions), San Juan: Department of the Treasury.

Department of the Treasury (2000), Individual Income Tax Return 2000 (Long Form & Instruc-
tions), San Juan: Department of the Treasury.

Department of the Treasury (2001), Individual Income Tax Return 2001 (Long Form & Instruc-
tions), San Juan: Department of the Treasury.

Department of the Treasury (2003), *Individual Income Tax Return* 2003 (Long Form & Instructions), San Juan: Department of the Treasury.


Department of the Treasury (2005), *Individual Income Tax Return* 2005 (Long Form & Instructions), San Juan: Department of the Treasury.


Department of the Treasury (2008), *Codigo de Rentas Internas de Puerto Rico de 1998* (as amended), San Juan: Department of the Treasury.

Department of the Treasury (2008), *Individual Income Tax Return* 2008 (Long Form & Instructions), San Juan: Department of the Treasury.

Department of the Treasury (2009), *Individual Income Tax Return* 2009 (Long Form & Instructions), San Juan: Department of the Treasury.

Department of the Treasury (2010), *Individual Income Tax Return* 2010 (Long Form & Instructions), San Juan: Department of the Treasury.


Department of the Treasury (2012), *Individual Income Tax Return* 2012 (Long Form & Instructions), San Juan: Department of the Treasury.


Gutierrez, E. (1996), *La Economia de la Dependencia, la Polarizacion y la Marginacion Social: una Alternativa*, San Juan: Club de Roma, Capitulo de Puerto Rico.


Reunion
(see France)

Romania


IMF Staff Team (2001), Romania: Selected Issues and Statistical Appendix, IMF Country Report 01/16.


Legislatia Romaneasca (2004), Law 416/2001 (as amended), Bucharest: Legislature Romania.
Legislatia Romaneasca (2005), Law 61/1993 (as amended), Bucharest: Legislature Romania.
Legislatia Romaneasca (2008), Law 61/1993 (as amended), Bucharest: Legislature Romania.


Russia


**Rwanda**


World Bank (1968), The Economy of Rwanda, *World Bank Report* AF-78A.


**Saint Barthelemy**


**Saint Helena, Ascension and Tristan da Cunha**


**Saint Kitts and Nevis**


**Saint Lucia**


Law Revision Commissioner (2005), National Development Corporation Act, Ch.15.24 (Revised), in *Laws of St. Lucia*, Castries: Law Revision Commissioner.


**Saint Martin**


**Saint Pierre et Miquelon**


**Saint Vincent and the Grenadines**


IMF Staff Team (2007), St. Vincent and the Grenadines: 2006 Article IV Consultation-Staff Report; Staff Statement; and Public Information Notice on the Executive Board Discussion, *IMF Country Report* 07/367.

IMF Staff Team (2009), St. Vincent and the Grenadines: 2007 Article IV Consultation-Staff Report; Staff Supplement and Statement; Public Information Notice on the Executive Board Discussion; and Statement By the Executive Director for St. Vincent and the Grenadines, *IMF Country Report* 09/118.


InvestSVG (2012), St. Vincent & the Grenadines (SVG), Kingstown: Invest SVG.


**Samoa**


San Marino


Sao Tome and Principe


Saudi Arabia


Senegal


IMF Staff Team (2001), Senegal: Selected Issues, *IMF Country Report* 01/188.


IMF Staff Team (2008), Senegal: Selected Issues, *IMF Country Report* 08/221.

**Serbia**


**Seychelles**


IMF Staff Team (2000), Seychelles: Recent Economic Developments, *IMF Country Report* 00/162.


**Sierra Leone**

IMF Staff Team (1997), Sierra Leone: Recent Economic Developments, *IMF Country Report 97/47*.


IMF Staff Team (2009), Sierra Leone: Selected Issues and Statistical Appendix, *IMF Country Report 09/12*.


KPMG (2010), *Sierra Leone Fiscal Guide 2010*, Freetown: KPMG.


**Singapore**

356


Central Provident Fund Board (1999), *CPF Contribution Rates From 1-Jan-1999*, all Age Groups, Singapore: Central Provident Fund Board.


Central Provident Fund Board (2001), *CPF Contribution Rates From 1-Jan-2001*, all Age Groups, Singapore: Central Provident Fund Board.


Central Provident Fund Board (2005), *CPF Contribution Rates From 1-Jan-2005*, all Age Groups, Singapore: Central Provident Fund Board.

Central Provident Fund Board (2005), *CPF Contribution Rates From 1-Jan-2006*, all Age Groups, Singapore: Central Provident Fund Board.


Central Provident Fund Board (2010), *CPF Contribution Rates From 1-Sep-2010*, all Age Groups, Singapore: Central Provident Fund Board.


Central Provident Fund Board (2012), *CPF Contribution Rates From 1-Sep-2012*, all Age Groups, Singapore: Central Provident Fund Board.


**Slovakia**


**Slovenia**


National Council (2005), Law on Personal Income Tax (consolidated Version), *Official Gazette of RS, 70(2005).*

**Solomon Islands**


IMF Staff Team (2005), Solomon Islands: Selected Issues and Statistical Appendix, *IMF Country Report 05/364.*


Internal Revenue Department (2011), *Changes to the Personal Exemption Threshold,* Hoinara: Internal Revenue Department.


The Association of Southeast Asian Nations (2011), *ASEAN Community in Figures ACIF 2011*, Jakarta: ASEAN Secretariat.

**Somalia**


**South Africa**


Government of South Africa (2008), 385 of 2008: Amendment: to Amend the Social Assistance Act 2004 (Act 13 of 2004), So As to Provide for Qualifications for Disability Grants; to Provide for Older Persons' Grant Qualification Age for Men; and to Provide for Matters Connected Therewith., Staatskoerant 30891.


Government of South Africa (2008), 411 of 2008: Clarification Regarding the Regulations Made By the Minister of Social Development., Staatskoerant 30965.


IMF Staff Team (2000), South Africa: Selected Issues, *IMF Country Report* 00/42.


South Sudan


**Soviet Union**


**Spain**


Lopez Laborda, J. and A. Zarate Marco (1999), Afecta el IRPF a la Decision de Contraer Matrimonio?, FEDEA Studies on the Spanish Economy 49.


Sri Lanka

Department of the Commissioner (2014), Samurdhi Relief Program, Sri Jayawardeneepura Kotte: Department of the Commissioner, Web. 9-Jun-2014


IMF Staff Team (2001), Sri Lanka: Recent Economic Developments, IMF Country Report 01/70.


**Sudan**


**Svalbard and Jan Mayen**

Paris Conference (1920), Treaty between Norway, The United States of America, Denmark, France, Italy, Japan, the Netherlands, Great Britain and Ireland and the British overseas Dominions and Sweden concerning Spitsbergen signed in Paris 9th February 1920, Longyearbyen: Governor of Svalbard.


**Suriname**


Nationale Assemblee (2001), Wet van 3 Juni 2002, Houdende Instelling van Het “Instituut Voor de Bevordering van Investeringen in Suriname” (Wet Investsur), *Staatsblad van de Republiek Suriname*.

**Swaziland**


**Sweden**


**Switzerland**


376
Bundesamt für Sozialversicherungen (2011), Securite Social, Application de la 5ieme Revision de l’AI, Bern: Bundesamt für Sozialversicherungen.


Eidgenössische Steuerverwaltung (1973), Bundesgesetz über die Erhöhung der Warenumsatzsteuer und der Wehrsteuer und den Ausgleich der Folgen der Kalten Progression, 21 March 1973, Bundesrecht, Systematische Rechtssammlung.


Eidgenössische Steuerverwaltung (1982), Botschaft zu einem Bundesgesetz über den Ausgleich der Folgen der Kalten Progression bei der Direkten Bundessteuer, Bundesrecht, Systematische Rechtssammlung, Bern: Eidgenössische Steuerverwaltung.


Eidgenoessische Steuerverwaltung (2010), *Daten aus der Geschichte der Bundessteuern*, Bern: Schweizerische Steuerkonferenz SSK.


Eidgenoessische Steuerverwaltung (2013), *Kurzer Ueberblick ueber die Einkommenssteuer Natuerlicher Personen*, Stand 1-Sep-2013, Bern: Schweizerische Steuerkonferenz SSK.


**Syrian Arab Republic**


**Taiwan, Province of China**


**Tajikistan**


IMF Staff Team (2003), Republic of Tajikistan: Selected Issues and Statistical Appendix, *IMF Country Report* 03/5.


Republic of Tajikistan (2010), Tax Code of the Republic of Tajikistan (as amended), Dushnabe: Republic of Tajikistan.


**Tanzania, United Republic of**


IMF Staff Team (2003), Tanzania: Selected Issues and Statistical Appendix, IMF Country Report 03/2.


**Thailand**


**Timor-Leste**


**Togo**


Tokelau


Tonga


Trinidad & Tobago


National Insurance Board of Trinidad and Tobago (2006), *Earnings Classes and Contributions From 1972-2006*, Port of Spain: National Insurance Board of Trinidad and Tobago.

National Insurance Board of Trinidad and Tobago (2010), *Contribution Rate Schedule Payable From January 4, 2010*, Port of Spain: National Insurance Board of Trinidad and Tobago.

National Insurance Board of Trinidad and Tobago (2012), *Earning Classes and Contributions 2008-2012*, Port of Spain: National Insurance Board of Trinidad and Tobago.
National Insurance Board of Trinidad and Tobago (2014), *Contribution Earning Classes, Rates and Benefit Rates*, Port of Spain: National Insurance Board of Trinidad and Tobago.

**Tunisia**


**Turkey**


**Turkmenistan**


**Turks and Caicos Islands**


**Tuvalu**


**Uganda** 17-Mar-2014


**Ukraine**


386
United Arab Emirates


United Kingdom


United States


Tax Credits for Working Families (2014), States with EITCs, *Tax Credits for Working Families*, Bethesda: Hatcher Group, Web. 4-Dec-2014


**Uruguay**


IMF Staff Team (2001), Uruguay: Recent Economic Developments, *IMF Country Report 01/47*.}

388

**Vanuatu**

**Venezuela, Bolivarian Republic of**

**Viet Nam**

**Virgin Islands, British**

**Virgin Islands, U.S.**


Wallis & Futuna


Western Sahara


Yemen (also Yemen, Arab Republic)


Yemen, Democratic Republic of


Yugoslavia


Zambia


Zimbabwe


International


Barrientos, A., Nino-Zarazua, M. and M. Maitrot (2010), Social Assistance in Developing Countries Database, V. 5.0, Brooks World Poverty Institute, the University of Manchester.


392


Education Policy and Data Center (2016), EPDC Database, Web. 3-Feb-2016.


Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Austria, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.
Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Belgium, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Denmark, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Finland, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.


Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Germany, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Greece, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Ireland, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Italy, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Luxembourg, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Portugal, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Spain, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), Sweden, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), The Netherlands, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), United Kingdom, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

Enterprise and Industry, Small and Medium-Sized Enterprises (2002), USA, in *Employee Stock Options in the EU and the USA*, Brussels: Commission of the European Communities.

EPSU (2009), *Minimum Wages in Eastern Europe Outside the EU*, Brussels: European Federation of Public Service Unions.


401


402


NORA MARGOT STRECKER
ETH Zurich
KOF Swiss Economic Institute
LEE G129
Leonhardstrasse 21
8092 Zurich
Switzerland
Phone: +41 44 632 93 80
Email: strecker@kof.ethz.ch

Date of Birth: July 29, 1986
Citizenship: German
Place of Birth: Berlin-Lichtenberg, Germany

Research Interests
Labor Taxation, Public Economics, Public Finance

Education
Fall 2016 Ph.D. in Economics, ETH Zurich, Zurich, Switzerland.

09.2009-05.2010 M.A. Economics, New York University, Graduate School of Arts and Science, New York, NY, USA.
  • Major: Economics (Economic Policy, Public Economics)
  • Master Thesis: Home Bias in Investment: Analysis of the G7 Countries in the 2000s

09.2005-07.2009 B.A. Economics, (cum laude), New York University, College of Arts and Science, New York, NY, USA.
  • Major: Economics: Policy Track
  • Minor: French Literature

Work Experience
02.2007-07.2010 Administrative Assistant, New York University School of Law, Center for Labor and Employment Law, New York, NY, USA.

07.2008-07.2010 Editor (In-House), New York University School of Law, NYU Labor & Employment Law, New York, NY, USA.

07.2008-07.2010 Administrative Assistant, Dwight D. Opperman Institute of Judicial Administration, New York University School of Law, New York, NY, USA.

01.2010-05.2010 Grader: Ethics and Economics, Prof. M. Rizzo, New York University College of Arts and Science, Department of Economics, New York, NY, USA.

08.2008-10.2008 Research Assistant, Prof. S. Estreicher, New York University School of Law, New York, NY, USA.

Articles

with Simon Bösenberg and Peter Egger (2014), 'On the Distribution of Tax Effects on Head-
quarters Location’, *Economics Letters*, 124(2), 308-311.

**Working Papers**


**Awards**

- 2009 Founder’s Day Award
- 2006-2008 Dean’s List, New York University
- 2005 California Scholarship Foundation Award

**Memberships**

- 2016 Member of the Academic Jury for the St. Gallen Wings of Excellence Award at the 46th St. Gallen Symposium (St. Gallen, Switzerland)
- since July 2015 Member of the International Institute of Public Finance

**Languages**

- German (native), English (native), French (proficient)