Contents

Abstract v

Acknowledgements vii

Contents xiii

List of Figures xiii

List of Tables xv

Nomenclature xvii

1 Introduction 1
- 1.1 Motivation . . . 1
- 1.2 Modelling spatial market equilibria . . . 3
- 1.3 Thesis outline . . . 7

2 Coal lumps vs. electrons: How do Chinese bulk energy transport decisions affect the global steam coal market? 13
- 2.1 Introduction . . . 13
- 2.2 Related literature . . . 15
- 2.3 Structure of the global seaborne steam coal trade . . . 17
- 2.4 The model . . . 18
  - 2.4.1 Notation . . . 19
  - 2.4.2 Model formulation . . . 21
- 2.5 Database . . . 22
  - 2.5.1 Topology . . . 23
  - 2.5.2 Mining costs . . . 24
  - 2.5.3 Demand . . . 25
- 2.6 Scenario setup . . . 26
  - 2.6.1 Scenario 'coal-by-train' . . . 27
  - 2.6.2 Scenario 'coal-by-wire' . . . 27
  - 2.6.3 Scenario parameters . . . 29
- 2.7 Results . . . 29
  - 2.7.1 Coal supply in China . . . 30
  - 2.7.2 Long-run marginal costs of steam coal supply . . . 31
  - 2.7.3 Investment and utilisation of mines . . . 33

2.7.4 Welfare effects . . . 34
2.8 Conclusions . . . 36

3 Market structure scenarios in international steam coal trade 39
3.1 Introduction . . . 39
3.2 The seaborne steam coal trade market . . . 41
3.3 Model description . . . 42
3.4 Dataset . . . 46
3.4.1 Mining costs and export capacity . . . 46
3.4.2 Transport costs, port handling fees, and seaborne freight rates . . . 49
3.4.3 Demand data . . . 49
3.5 Simulation design . . . 51
3.6 Results . . . 53
3.6.1 Simulation results for the year 2006 . . . 53
3.6.2 Simulation results for the year 2008 . . . 55
3.6.3 Sensitivity analysis . . . 58
3.7 Discussion of 2008 results . . . 61
3.8 Conclusions . . . 62

4 Nations as strategic players in global commodity markets: Evidence from world coal trade 65
4.1 Introduction . . . 65
4.2 Steam coal market economics . . . 68
4.2.1 Market structure . . . 69
4.2.2 Implications of an export market analysis vs. an integrated analysis of export and domestic markets . . . 71
4.3 The model . . . 72
4.3.1 Model statement . . . 73
4.3.2 Model parametrisation . . . 78
4.3.3 Market structure scenarios . . . 80
4.3.4 Model validation using statistical tests . . . 80
4.4 Results . . . 82
4.4.1 Welfare effects . . . 85
4.5 Conclusions . . . 86

5 How are investment decisions in the steam coal market affected by demand uncertainty and buyer-side market power? 89
5.1 Introduction . . . 89
5.2 China's energy policy and its potential impact on global coal markets . . . 92
5.3 Methodology and model . . . 93
5.3.1 Layout of the model . . . 93
5.3.2 Risk-adjusted discount factors . . . 96
5.3.3 Model formulation . . . 97
5.4 Computational application . . . 104
5.4.1 Scenario tree definition . . . 104
5.4.2 Scenarios and outline of result discussion . . . 106
5.5 Simulation results and discussion . . . 106
5.5.1 Investments . . . 106

5.5.2 Value of Perfect Information 109
5.6 Conclusions 112

A Detailed results for chapter 2 **115**

B Detailed results for chapter 3 **121**

C Detailed results for chapter 4 **123**

D Assumptions for chapter 5 **127**

Bibliography **129**

Curriculum Vitae **140**