The Relationship Between Entrepreneurship, Labour Market Institutions and Economic Performance

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AR(1)	autocorrelation of order 1
CIS	Eurostat Community Innovation Survey
COMPENDIA	Comparative Entrepreneurship Data for International Analysis (by EIM)
EBD	European Business Demography (database)
EIM	EIM Business and Policy Research
EIP	Entrepreneurship Indicators Project (by OECD and Eurostat)
EPL	employment protection legislation
EPO	European Patent Office
EU-15	Old EU member states (as prior 2004)
EU-27	All EU member states (as of January 2010)
FE	fixed effects
FESE	Flash Eurobarometer Survey on Entrepreneurship
FGLS	feasible generalized least squares
FOC	first order condition
GDP	gross domestic product
GE	general equilibrium
GEM	Global Entrepreneurship Monitor
GLS	generalized least squares
IBE	International Benchmark of Entrepreneurs (by EIM)
ICT	information and communication technology
JPO	Japan Patent Office
LMR	labour market regulation
MC	marginal cost
NACE	Statistical Classification of Economic Activities in the European Community
NMS-10	Countries becoming full EU member states in 2004
NMS-12	Countries becoming full EU member states in 2004 or 2007
OECD	Organization for Economic Co-operation and Development
OLS	ordinary least squares
PCSEs	panel corrected standard errors
PMR	product market regulation
R&D	research and development
RE	random effects
SME(s)	small and medium enterprise(s)
SPR	SME Performance Review (by European Commission)
TOT	terms of trade
TSCS	time series cross-section (data)
USPTO	United States Patent and Trademark Office
WBGES	World Bank Group Entrepreneurship Survey

1 INTRODUCTION

1.1 Field of research and aims of the monograph

In the not so distant past (at least until the 1980s), the conventional wisdom was that small businesses are inefficient relative to large ones and cannot afford investments into research and development (R&D). Chandler (1990), Langlois (1987), and Schumpeter (1942 [1976]) in his late period of research believed that *entrepreneurship* had been losing its battle with large businesses and that it was to fade away. However, entrepreneurship is today recognized as an important source of new ideas and economic growth. An early idea of Schumpeter (1911 [2002])[1] that entrepreneurial product innovations distort the market equilibrium (by the process of creative destruction) and boost economic growth is back to life. Several empirical studies[2] confirm that entrepreneurship creates jobs, increases productivity and drives economic growth in developed economies. Formation of strategies for stimulating entrepreneurship ranks high on supranational,[3] national and local government agendas. However, probably partly due to the unclear definition of entrepreneurship and problems with its measurement, evidence on the link between entrepreneurship and economic performance is not robust enough. The idea that entrepreneurship is the driving force bringing new products and new businesses to the marketplace and promoting economic growth is one of the cores of the monograph.

Strategies for boosting entrepreneurial innovations include measures related to labour and product markets. Labour market and product market regulations are often viewed as being hostile to innovative entrepreneurship. High wages, high taxes, high entry cost, and strict technical standards raise costs, distort incentives, and therefore present barriers to entrepreneurship.

Significant variation in *labour market institutions* across countries has motivated economists to investigate theoretically and empirically the impact of labour market institutions on entrepreneurship and economic performance. They (Checchi and Lucifora 2002; ECFIN 2004, 18–19; Baker *et al.* 2004; Bassanini and Duval 2006; Eichhorst, Feil and Braun 2008)

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[1] In *The Theory of Economic Development*, Schumpeter (1911 [2002]) exposes an innovative entrepreneur as an engine of economic development. In his later work, *Capitalism, Socialism and Democracy*, Schumpeter (1942) describes how large businesses outperform relatively small entrepreneurs in innovative activities.

[2] These studies mostly employ data on self-employment or business ownership (*e.g.* Thurik *et al.* 2008, Carree *et al.* 2007 and 2002, van Stel and Carree 2004, and Blanchflower 2000) and data for indices from Global Entrepreneurship Monitor (*e.g.* Thurik 2008 and van Stel *et al.* 2005).

[3] See, for example, European Commission's (2003) *Green Paper on Entrepreneurship*, which recognizes the importance of entrepreneurship for economic performance and suggests actions for promoting entrepreneurship.

in general suggest that unemployment is positively related to the generosity of unemployment benefits, to tax burden on labour income, and to the rate of union coverage. On the other hand, unemployment is negatively associated with expenditures on active labour market policies and with a degree of coordination in wage bargaining. The roles of employment protection legislation and trade union density (*i.e.* the rate of union membership) are less certain. Some evidence about the link between labour market institutions and economic growth is provided by Nickell and Layard (1999), Wyplosz (2000) and IMF (2003). While several studies investigate the effect of labour market institutions on entrepreneurship as measured by self-employment or business ownership rate (*e.g.* Ilmakunnas and Kanniainen 2001, Kanniainen and Vesala 2005, Robson 2003, Parker and Robson 2004), there is a limited body of literature relating labour market institutions to the innovative aspect of entrepreneurship.

On one hand, there are studies relating entrepreneurship to economic performance. On the other hand, a range of studies suggests a significant impact of labour market institutions on entrepreneurship and economic performance. The channels through which labour market regulations affects macroeconomic performance have received less attention. The monograph focuses on one of these mechanisms – it examines the role of entrepreneurship as a channel of transmission of the effect of labour market regulation on macroeconomic performance. The type of entrepreneurship we focus on is innovative or Schumpeterian entrepreneurship that is related to new goods and businesses creation. A similar reasoning of entrepreneurship and its impact on economic performance (especially output growth) can also be found, for example, in Schmitz (1989), Grossman and Helpman (1991), Aghion and Howitt (1992), and more recently in Acs *et al.* (2005) and Braunerhjelm *et al.* (2010). However, these studies leave the role of labour market institutions aside.

The main aim of the monograph is to disentangle the association between entrepreneurship and economic performance and to investigate the impact of chosen labour market institutions on the two. We aim to show theoretically and empirically how chosen labour market institutions affect entrepreneurship and economic performance. Hereby, entrepreneurship represents a channel through which labour market institutions affect macroeconomic performance.

The monograph consists of six sections. The purpose of section 2 that follows the introduction is to provide an overview of theories of entrepreneurship and highlight its multidimensional nature. Awareness of the latter is important for any attempt to model entrepreneurship, to measure the amount of entrepreneurship and, at the latest, to analyse its relationship with other variables. Since different dimensions of entrepreneurship might differently respond to labour market institutions and other factors, and can play different roles in the economy, we separately review the literature on the determinants and economic importance of two main dimensions of entrepreneurship (Knightian related to managing and uncertainty bearing, and Schumpeterian related to innovativity). The purpose of section 3 is to summarize the findings

of main studies investigating the importance of labour market institutions for the real economy. Within this section, special attention is devoted to a description of mechanisms though which labour market institutions affect the occupational choice between entrepreneurship and paid (wage) employment. The purpose of section 4 is to build a theoretical general equilibrium (GE) model[4] describing a closed entrepreneurial economy with endogenous growth. By incorporating occupational choice between wage employment and self-employment, we attempt to show how Schumpeterian entrepreneurship acts as a channel through which labour market institutions (union bargaining power, unemployment benefits, and tax rate on labour income) affect the rest of the economy. Schumpeterian entrepreneurship is therefore on one hand endogenous to the system, and on the other hand influences other parts of the economy and economic growth. The purpose of section 5 is empirical testing of the qualitative predictions of the theoretical model using *time-series cross-section data* (henceforth TSCS data)[5] for the chosen set of developed countries. Section 6 concludes.

1.2 Research problem statement

Since entrepreneurship is a multifaceted concept that extends beyond economics, it can be highlighted from the aspects of different scientific disciplines and can be analysed in different context. While some theorists are tempted to work with general definitions, most of economists today adopt a model-oriented definition and develop a concept in line with their theoretical or empirical models. The results of theoretical and empirical studies related to entrepreneurship might therefore not describe exactly the same phenomenon and relationships. For these reasons, we organize studies investigating the determinants of entrepreneurship and its impact on economic performance along chosen benchmark concepts of entrepreneurship and summarize their conclusions.

Due to the multidimensional nature of entrepreneurship, it is appropriate to set limits to investigated dimensions or aspects of the phenomenon and start the analysis by defining the adopted concept of entrepreneurship. Due to a lack of evidence regarding the role of Schumpeterian entrepreneurship in the economy and the impact of labour market institutions

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[4] A GE model is a systematic theoretical model that describes equilibrium in all markets simultaneously. It is used to analyse relationships among markets and the overall impact of policy changes on different markets.

[5] We distinguish TSCS data from typical panel data. Contrary to panel data, TSCS data have relatively long sequences of data over time (T), but relatively few subjects (N). Both typical panel data ($N>T$) and time-series cross-section data ($T>N$) have two dimensions: the cross-sectional dimension that reflects information on differences between subjects, and the time dimension that reflects the changes within subjects over time. We can use similar techniques to analyse both types of data, but should pay a special attention to time processes when using time-series cross-section data (see also Beck and Katz 2004).

on this type of entrepreneurship, our theoretical model and its empirical verification focus on the concept that is closest to Schumpeter's (1911 [2002]) view on the entrepreneur. More specifically, we define entrepreneurs as persons who create new product varieties using the existing knowledge and their entrepreneurial abilities and bring them to the marketplace. The theoretical model we develop presumes that new product varieties that are successfully brought to the marketplace by entrepreneurs result in new business creation. New products and businesses are therefore the output of entrepreneurial processes. This interpretation allows us to proxy entrepreneurship by the creation of new businesses or, in relative terms, by the business birth or entry rates. The empirical part, which tests the hypotheses and the implications of the theoretical model, measures entrepreneurship by the business entry rate. The latter indicator appears to be a natural candidate for entrepreneurship as incorporated in the theoretical model.

Labour market institutions may affect economic performance directly through the labour market and indirectly through entrepreneurship (*i.e.* the supply of entrepreneurial effort that is also likely to be influenced by the institutional setup). Having been influenced by labour market institutions, entrepreneurship might partly transmit these effects onto economic performance (in particular output growth). We therefore investigate how the Schumpeterian entrepreneurship responds to variation in labour market institutions and other determinants that shape the economic environment and how it influences economic performance, taking into account the relevant institutions. Moreover, we try to find out whether Schumpeterian entrepreneurship serves as a channel through which labour market rigidities affect economic performance in terms of output (per capita) growth and what are the directions of these impacts.

Labour market institutions, which are the subject of analysis, are the bargaining power of trade unions and tax-benefit institutions related to the labour market (unemployment benefit replacement rate and tax rate on labour income).

1.3 Research statement and hypotheses

The research statement reads that labour market institutions (more particularly, trade union bargaining power, unemployment benefits, and tax rate on labour income) affect Schumpeterian entrepreneurship (in the form of business creation) and economic performance. Entrepreneurship serves as one of the channels through which labour market rigidities hurt economic performance in terms of output (per capita) growth.

The hypotheses, which are in the spirit of the research statement but more precise, read:

- Hypothesis 1: The bargaining power of trade unions negatively affects entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.

- Hypothesis 2: The generosity of unemployment benefits negatively affects entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.
- Hypothesis 3: Tax burden on labour income negatively affects entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.
- Hypothesis 4: Entrepreneurship as measured by the chosen indicator of business creation positively affects economic growth as measured by the growth of GDP per capita.
- Hypothesis 5: Analysed labour market institutions (bargaining power of trade unions, unemployment benefits, and tax burden on labour) exert also a direct negative impact on economic growth as measured by the growth of GDP per capita.

The first four hypotheses are tested theoretically in section 4 and empirically in section 5. The fifth hypothesis is tested only empirically in order to keep the theoretical model concise and tractable. In the theoretical part, labour market institutions are presented by specific parameters in the model. In the empirical part, the bargaining power of trade unions is measured by union density and the presence of legal extension of collective bargaining outcomes. The unemployment benefit is measured by the unemployment benefit replacement rate, and tax burden on labour income is measured by the tax wedge for an average-wage worker without children.

1.4 Methodological framework and data

In this subsection, we first separately and in the itemized order present the methodological approach and tools for:

- the two mainly theoretical sections (*i.e.* section 2 and section 3);
- the theoretical model (*i.e.* section 4);
- the empirical model (*i.e.* section 5).
- Then we present the data for key variables that are employed in different sections of the monograph.

In section 2 of the monograph, we first review the concepts and theories of entrepreneurship. This part of the second section rests on *a review of the existing theoretical literature*. We then prepare an overview of indicators of entrepreneurship and corresponding international databases and classify them according to the benchmark concepts of entrepreneurship. For this purpose, we *review the existing theoretical and empirical literature* and check the databases of established institutes and international organizations. We also perform a *statistical analysis* of entrepreneurship indicators, which includes the correlation analysis and tests of concordance of country rankings with respect to indicators attached to the same concept of entrepreneurship. On the basis of *a survey of the theoretical and empirical literature*, we describe the impact of labour market institutions on entrepreneurship and

economic performance and evidence of the impact of entrepreneurship on economic performance. Based on *a review of the empirical and theoretical literature* we in section 3 provide some empirical and theoretical motivation to study labour market institutions. Based on descriptive statistics we also provide related stylized facts.

Section 4 introduces *a theoretical GE model of* a closed economy with endogenous economic growth. The model serves as an analytical framework composed of a set of assumptions from which we derive conclusions on the causal-relationships between included variables. The GE model demonstrates how (innovative) entrepreneurs, as the bearers of business dynamics and technological progress, transmit the effects of chosen types of labour market regulation on the level of employment and aggregate output growth. Its main purpose is not to provide an integral analysis of the determinants of employment and economic growth, but rather to theoretically establish the link between chosen labour market institutions, the creative destruction of businesses, and macroeconomic performance. As argued by Aghion and Howitt (2004, 1), endogenous growth models are not solely a tool for understanding the macroeconomic structure of growth, but also a framework for understanding different microeconomic issues related to institutions, policies and incentives that may affect economic growth. Economic modelling engages the use of *mathematical static and dynamic optimization methods*. Based on economic theory and empirical motivation, we develop a set of equilibrium equations. Since they are not easily solved and analysed theoretically, we employ *the numerical solution methods* to solve the system of non-linear equations. In our case, the technical computing software Matlab is exploited for this purpose. The model is then parameterised (*i.e.* some of the parameters are set to values suggested by empirical literature and stylized facts for chosen OECD[6] countries) and calibrated to match data for the old (*i.e.* pre-2004) member states of the European Union (EU), henceforth referred to as the EU-15. Finally, we explore the (qualitative) predictions of the model about the effect of labour market institutions on business dynamics and the impact of the latter on aggregate output growth. We simulate the steady states obtained under different combinations of parameters and derive *comparative static properties* of the model. In our case, this means that we analyse how variables of interest change as we allow one or more labour market parameters to change. Simulations of changes in labour market parameters are performed in Matlab. In interpretation we focus on the direction rather than the size of the impacts of parameter changes.

Section 5 is *empirical*. In this section, we estimate a *regression model* derived on the grounds of the theoretical model and previous empirical literature. In estimation of the model, we follow a two-step approach elaborated in Cincera and Galgau (2005) and Loayza, Oviedo and Servén (2005). In the first step, we regress business entry rate on indicators of chosen labour market institutions and carefully selected control variables. In the second step, we estimate the

[6] OECD – Organisation for Economic Co-operation and Development.

relationship between the indicator of economic growth and (lagged) business entry rate together with selected controls. Potential problems with endogeneity are addressed by employing the Granger (1969) causality test and lowered by using a lagged version of critical independent variables and, alternatively, by using proxy variables that are less exposed to endogeneity. The model is estimated on TSCS data, which we distinguish from typical panel data due to the more pronounced time-series dimension and smaller cross-sectional dimension. Models estimated on this type of data usually deviate from the assumptions of the standard linear regression model stating that (Beck and Katz 2004): i) the variance in the error term is constant across units and over time (the assumption of homoskedasticity); ii) the errors are serially uncorrelated (the assumption of the absence of autocorrelation); and iii) the behaviour of individual units does not depend on the behaviour of other units (the assumption of cross sectional independence). The use of TSCS data often leads to problems with *heteroskedasticity* in the error term (both across units and across time) and *autocorrelation* (*i.e.* serially correlated errors). The next potential trap is *cross-sectional or between group dependence*, which means that the behaviour of individual units depends on the behaviour of other units (*e.g.* units/countries respond to common shocks or common unobserved factors in a similar manner). In the regression analysis, we first test for the stationarity of main variables in the model and then also for the presence of each of the above-mentioned violations. If it appears to be necessary, we undertake the appropriate statistical procedures to deal with each violation of the assumptions underlying the classical linear regression analysis (Wooldridge 2002a, 82–93).

In the monograph, we use annual country-level data for the level of entrepreneurship, labour market institutions, economic performance and other variables coming from various sources. In section 3, we present the situation on the labour market in the EU member states and some other OECD countries (the United, States, Canada, Australia, Japan, and New Zealand) in the period 1980-2007 (for employment rate and its growth) or in the period 1980–2009 (for the unemployment rate). Data come from OECD (2009a) and OECD (2010g). Section 4, which is mainly theoretical, employs data for parameterization and calibration of parameters. For this purpose, we use data for EU-15 and, separately, for the Unites States for the period 1995–2007. Data come from different sources (OECD 2007, 2010a, 2010b, EIM 2010c, TEDI 2010, and different empirical studies). Lastly, in section 5, a range of variables from different sources enters the regression analysis. For estimation of the business entry equation, we employ data for nine EU countries and the United States for the period 1995–2007. For the estimation of the growth equation, we use data for the same set of countries for the period 1995–2008. The set of countries, however, shrinks in the case of inclusion of certain variables into the set of explanatory variables. The main data sources for this section are: EIM (2010c), TEDI (2010), Visser (2009), World Bank Group (2008), OECD (2010a, 2010c, 2010d, 2010f), and Heston, Summers and Aten (2009).

1.5 Limitations and assumptions related to analysis of indicators of entrepreneurship

Economic literature suggests that entrepreneurship is a multidimensional phenomenon and can be investigated from different aspects. After reviewing and summarizing the theories and concepts of entrepreneurship in section 2, we downsize the dimensions of entrepreneurship to: i) managing and uncertainty bearing (aspects exposed by Knight 1921), ii) innovativity (best captured by Schumpeter's (1911 [2002]) early concept of entrepreneurship), and iii) alertness to opportunities (exposed by Kirzner 1973). When trying to match commonly used empirical indicators of entrepreneurship with concepts of entrepreneurship, we limit our attention to the so-called Knightian, Schumpeterian, and Kirznerian entrepreneurship. Leaving several aspects of entrepreneurship aside (in particular sociological and psychological) enables us to measure and quantify the scope of the phenomenon and to search for a systematic relationship between the chosen sets of indicators.

The theoretical GE model with steady-state growth developed in section 4 is built on the grounds of previous theoretical literature (in particular Helpman and Krugman 1991 and Aghion and Howitt 1992) and modified and extended in different directions. The model's framework embeds several limiting assumptions, most of which are taken over from related literature: i) the economy consists of only two sectors (innovative sector and intermediate good sector) plus an additional final good sector; ii) labour and intermediate goods are the only factors of production; iii) individuals, businesses and trade unions are utility-maximizing agents; iv) agents are perfectly informed; v) stochastic elements are absent from the economy, etc. Most of the assumptions are accepted in order to keep the model simple and tractable. Moreover, we assume that the creation of new product varieties is tightly related to new business creation. While this assumption is very restrictive, it is close to the spirit of Schumpeter's (1911 [2002], 66) early view on the features and the role of the entrepreneur. The model can be further developed to take into account also innovation activities of incumbent businesses and to reconcile qualitative prediction and empirical evidence that competition is good for growth, as suggested by Aghion and Howitt (2004, 19). Another limitation of the model is that it embeds only the quality-ladder mechanism (*i.e.* new product varieties of better quality replace the obsolete product varieties), while it assumes away the expanding-variety mechanism (*i.e.* innovations increase the total number of product varieties). In line with some empirical studies (Funke and Ruhwedel 2001, to name but one), the expanding product variety significantly contributes to economic growth. Still, we ignore this mechanism to be able to demonstrate the role of creative destruction of products and businesses in the economy and their determinants in a relatively simple manner. Lastly, the theoretical model considers the impact of entrepreneurship in the form of business creation on economic growth and not also the other way around. It therefore highlights only one side of the story, since the relationship is often believed to be mutual.

The first group of limitations of the empirical analysis is related to the quality of data used. To proxy Schumpeterian entrepreneurship in the form of business creation, we employ the entry rate data from EIM (2010c). Data sets for enterprise birth rates provided by Eurostat (2010) and OECD (2010e), which reflect the creation of genuinely new enterprises and are more in line with the dimension of entrepreneurship incorporated in the theoretical model, suffer from short time series and many missing values in the panel. Another problematic issue is that of measuring the bargaining power of trade unions. We assess that the trade union density that is often employed in this regard might not be a proper measure, and combine this indicator with the dummy variables for the existence of extension procedures. The TSCS data for the number of strikes by trade unions, which could also help to identify trade union power, are not available. The second group of limitations is methodological. Firstly, the theoretical model presents the economy in equilibrium and thus reflects stable or long-term relationships between variables. Long-term relationships shall be estimated by employing data that cover a time span of sufficient length and by using variable averages over a certain number (*e.g.* five) of years and then examine the relationship between the averages. The data available do not enable such an approach; the number of countries included is relatively small (10) and the observed time period spans 13 years (or less for certain variables). We try to control for short-term oscillations of dependent variables by controlling for shocks in terms of trade. Secondly, when estimating the economic growth equation, we are dealing with potential problems of endogeneity. Granger's (1969) test of causality between the business entry rate and the growth rate of GDP per capita would have been more reliable in case of longer time-series for the included countries. Additionally, one could also use the instrumental variable approach, where we face problems with finding a convincing instrument for the business entry rate.[7]

Extending the theoretical model for additional sectors and testing its implications using industry-level data could provide a more in-depth analysis of the relationship between labour market institutions, business entry, and economic performance. The main limitation in this regard is indeed data availability. We take this extension as a challenge for further research.

[7] We did an exercise by performing an instrumental variable (or two stage least squares) approach by employing the World Bank's (2010) indicator of obstacles for starting a business as an instrument for business entry rate. The statistical tests did not support this indicator as a powerful instrument.

2 ENTREPRENEURSHIP – THE CONCEPT, DETERMINANTS AND ECONOMIC ROLE

Researchers define entrepreneurship using the premises of their own disciplines. In the monograph, we restrict our focus to the field of economics and leave other behavioural sciences (*e.g.* psychology, and sociology) aside. We circumvent also academic management literature, where entrepreneurship is often associated with personal, psychological characteristics of the entrepreneur, such as boldness, daring, imagination, creativity, communication and leadership skills (Klein and Cook 2006, 345). We recognize that the personal characteristics of entrepreneurs are important in exercising their role in the economy, but rather focus on entrepreneurship from the perspective of micro- and macroeconomics. An interested reader may refer to Filion (1998), who summarizes characteristics often attributed to entrepreneurs.

Since various definitions of entrepreneurship are in use, let us first review the concepts and theories of entrepreneurship and then describe the aspect of entrepreneurship that is subject to theoretical and empirical investigation in the monograph. Afterwards, we present possible measures of entrepreneurship and relate them to the theoretical concepts. Lastly, we provide a brief review of studies that investigate: i) determinants of entrepreneurship and ii) economic relevance of entrepreneurship.

2.1 Concepts and theories of entrepreneurship in economics

Despite the widely recognized importance of what is generally considered as *entrepreneurship*, no uniform, coherent and broadly accepted definition of this concept has been developed so far. Casson (2003, 19) distinguishes two main approaches to defining entrepreneurship. The first approach focuses on activities and functions of entrepreneurs in society. This approach is concerned with what an entrepreneur does and is called the functional approach. The second approach, referred to as the indicative approach, provides a description of features by which entrepreneurs may be recognized (*e.g.* their legal status, contractual relations with other parties, or their position in society). The two approaches can be brought closer together by specifying a set of observable characteristics, which enable entrepreneurs to carry out their function and activities most efficiently (Casson 2003, 20). The latter approach has been in the focus of several empirical studies investigating the relationship between observable personal characteristics and the level of entrepreneurial activity. Micro- and macroeconomists, however, mostly adopt the functional approach.

In the monograph, we take the functional approach to defining entrepreneurship. Before describing the concept of entrepreneurship utilized in the monograph, we provide a concise overview of the most known concepts and theories of entrepreneurship. In order to shed some light on the evolution of theories in relation to socio-economic changes over time, the overview is chronological.

2.1.1 Early views on entrepreneurship

The first known academic usage of the term *entrepreneurship* was by economist Richard Cantillon in the early 1730s (Cannan 1964, 286; Filion 1998; Casson 2003, 19). Cantillon's (1755) treatise on economic theory includes over 110 references to the word *entrepreneur*[8] (Rothbard 1995, 362; Hülsmann 2001, 693). According to their divergent functions in a market economy, Cantillon (1755, 71) makes a distinction between workers and entrepreneurs (as the two dependent classes), and politicians and land owners[9] (as the two independent classes). Unlike workers, who are persons hired to execute different tasks for fixed wages, entrepreneurs make decisions on the allocation of resources for uncertain income. Cantillon (1755, 69) uses the term entrepreneur in a variety of ways and clearly distinguishes between entrepreneurs who provide capital versus those who rely on their own labour and resources (see Hülsmann 2001, 694). Since entrepreneurs operate in a market with unstable and unknown prices and quantities, their return is uncertain. While some entrepreneurs get rich, others fail and go bankrupt. Cantillon's entrepreneur is a person who, in the pursuit of profit, allocates resources based upon market demand (for any given product line) and exercises the function of an arbitrageur in a free-market economy (De Coster 2006; Parker 2004, 39).

2.1.2 Classical and neoclassical views on entrepreneurship

The concept of entrepreneurship was reintroduced into economics (brought into the centre of production and distribution theory) by Jean-Baptiste Say in the late 18th century. Say (1803 [2001]) defines three main factors of production: human, capital and natural resources. He focuses on human resources that are further divided into scientists, entrepreneurs and workers. These groups perform different functions in society: i) the scientist's task is to create knowledge and develop theories, ii) the entrepreneur's function is to apply theory to useful purposes; and iii) the workers' role is to execute operations (Barreto 1989, 9–10). According to Say's classification, the entrepreneur is mainly a manager, whose function is to combine and coordinate (organise) factors of production with an aim to satisfy consumer demand. Entrepreneurs are at the centre of the production processes. They collect and process the relevant information and make decisions about the production processes. Say's entrepreneur earns residual income, which includes a return to capital personally supplied and a reward for

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[8] The word entrepreneur comes from the French verb *entreprendre*, which can be translated as »to undertake« a business venture, for example (Cannan 1964, 286). In the spirit of his time, Cantillon's entrepreneurs were persons who bought and traded mostly agricultural products at an uncertain price, thus bearing the direct financial risk. Besides the retailing merchant, also the farmer was an entrepreneur in his own right, since his/her result depends naturally upon unforeseen circumstances (De Coster 2006).

[9] According to Cantillon (1755, 72-75) land-owners have natural independence, whereas capital-owners are independent only so far as this capital goes (see also Hülsmann 2001, 694). Land-owners earn rents, while entrepreneurs own capital and earn uncertain profits.

his talent and managing skills. Say's entrepreneur is a risk-bearing manager who has good judgement and the experience to assess business opportunities (Barreto 1989, 10–11). Say (1803 [2001]) defines the entrepreneur/undertaker as one of the factors of production, while profit was viewed as income accruing to the capitalist. In his late issues of the same work, profit was transferred to the entrepreneur (Parker 2004, 40). Summing up, the functions of Say's entrepreneur include coordination (the key role), decision-making and risk bearing. Say advocated (1803 [2001]) that entrepreneurs play a key role in the production process (moving resources out of less productive areas and into areas that are more productive) and are, together with accumulation of capital, essential to economic development. Say recognizes entry cost, random events (shocks), and requisite qualities as limiting factors of entrepreneurship supply, since they affect the entrepreneur's returns (Barreto 1989, 14). He also believes that state regulation and taxation present threats to prosperity (Sechrest 2009; Say 1803 [2001], 60).

John Stuart Mill (1848) further popularized the academic usage of the word *entrepreneur*. Mill (1848) uses the term »entrepreneur« to refer to a person who assumes both the risk and the management of business. Unlike Cantillon (1755), Mill (1848) distinguishes the entrepreneur from other business owners such as shareholders of a corporation, who bear financial risk but do not actively participate in the management of the business (Sobel 2008).

In the second half of the 19th century, Alfred Marshall (1890) published his celebrated work *The Principles of Economics*. He does not explicitly use the term entrepreneur in this work (however he does use the term undertaker several times) but rather speaks about businessmen. His concept of businessmen, however, mainly upgrades the concepts of undertakers or entrepreneurs as developed by Say (1803 [2001]) and Mill (1848). Marshall (1890, book IV, chapter 12) sees modern businessmen as a body of employers specialized in directing production. Businessmen/entrepreneurs bring together the capital and the labour required for the work, arrange a general plan, superintend its minor details and undertake its risks. Thus, the entrepreneur is mainly a manager, employer and a risk-bearer – so far similar to the entrepreneur established by Say (1803 [2001]). Several authors (e.g. Iversen, Jørgensen and Malchow-Møller 2008, 4) assure us that it was Marshall who first added an innovative function to the entrepreneurs. In relation to his views on competition, Marshall (1890, book IV, chapter 12) describes the process of permanent change in the market environment and the life cycle of businesses. This change is driven by the entrepreneur, who continuously seeks opportunities to make profit through minimising the operating costs. Businesses (mostly older and bigger) that use old solutions to entrepreneurial problems tend to decay and are replaced by new businesses created by entrepreneurs who undertake creative moves.[10] Summing up,

[10] In such a dynamic framework, increasing returns to employed resources do not necessarily lead to monopoly and can be compatible with competitive market structure.

the Marshallian entrepreneur is a manager, an employer, a risk bearer and an innovator, who seeks opportunities to minimize costs and is able to adapt quickly to changes. Even though Marshall put more emphasis on the routine activities of management and superintendence than on the innovative activity of the entrepreneur (as argued by Casson 2003, 19), he can be given the credit for laying the foundations for Schumpeter's (1911 [2002], 1942 [1976])) theory of *creative destruction*.

2.1.3 Theories of the early 20th century (Schumpeter and Knight)

In the first half of the 20th century, Joseph A. Schumpeter and Frank H. Knight developed comprehensive theories of entrepreneurship. Due to some separating lines between the theories, we may talk about the Schumpeterian and the Knightian entrepreneur(ship).

Schumpeter's theory of entrepreneurship and his view on the role of entrepreneurs in the economy has been evolving over time. It was first outlined in *Theory of Economic Development* published in 1911. Concisely and somewhat simplified, the entrepreneur as established by Schumpeter (1911), sometimes referred to as *Schumpeterian entrepreneur*, is essentially a person who perceives business opportunities and uses the existing knowledge to innovate (*i.e.* to carry out new combinations). However, most of their time entrepreneurs manage businesses, *i.e.* buy and sell resources and products, lead personnel, take decisions regarding different affairs, execute strategic decisions (Schumpeter 1911 [2002], 77). According to Schumpeter (*ibid.*), the entrepreneur may or may not be a capitalist. Not all businesspersons or managers are entrepreneurs, but only those who exercise the innovating function.[11] Schumpeter's (*ibid.*) entrepreneur could be a manager or the owner of a business, but is more likely to be an independent contractor or artisan (Klein and Cook 2006, 345). Schumpeter (1911 [2002], 78) posits that people who establish their businesses lose the entrepreneurial character as soon as they settle down to running the business.

Schumpeter (1911 [2002], 66) defines innovations broadly as: i) the introduction of a new good, ii) the introduction of a new method of production, iii) the opening of a new market, iv) a new source of supply of raw materials, and v) a new organization of (monopolistic) industry. While inventions are more or less exogenous to the economic system (*i.e.* given from the outside of the system), the entrepreneur is the one who transfers inventions (*i.e.* uses knowledge) into economic innovations. New products and processes make older ones obsolete, which results in economic development (*ibid.* 67). New combinations that lead to economic development are *»as a rule embodied in new firms, which generally do not arise out of the old ones but start producing beside them«* (*ibid.* 66). Clusters of innovations change

[11] This is a distinction to the Marshallian entrepreneur – a manager in the widest meaning. (Schumpeter 1911 [2002], 77).

the structure of the economy and disequilibrate the economic system, which is referred to as the process of *creative destruction*. The process of creative destruction, which is the essence of economic development, causes both gain and pain. However, protection of industries and preservation of unproductive jobs will lead to economic stagnation and decline.

Even though Schumpeter was a defender of capitalism and advocated that it sparks entrepreneurship, he was (especially in his later writings) somewhat pessimistic about its prospects. He was pessimistic also about the future of the entrepreneur, who will eventually become less important or obsolete. Some authors (*e.g.* Freeman 1982) believe that this pessimistic view comes from observing the development of the economy of his time (*i.e.* a rise of large corporations). Many authors (*e.g.* Freeman 1982, 8; Carree *et al.* 2002) distinguish between Schumpeter's (1911 [2002]) early views on entrepreneurship and the view he developed in his (*ibid.* 1942 [1976]) later work.[12] Langlois (2007, 20–23), by contrast, asserts that ideas about the diminishing role of the entrepreneur and the rise of larger business were present already in Schumpeter's earlier (pre-1942) writings and that one cannot speak about a major shift in Schumpeter's philosophical orientation. However, in his later writings, Schumpeter (1942 [1976]) goes somewhat further and proposes that innovations will get under the control of large businesses and will become more routinized.

Knight (1921) establishes the entrepreneur primarily as an uncertainty-bearer who undertakes uncertain projects and partly insures the rest of the society against the potential consequences of uncertainty. Knight's entrepreneur (1921, part III, chapter IX) belongs to a narrow class of producers who forecast future business prospects, direct technological process and control production. A gap between the point in time when he needs to make a decision and the point of the project realisation is a source of uncertainty.[13] Decision-making involves perception and inference. Entrepreneurs need to infer what the future situation would have been without their interference, and what change will be introduced by their action. Their inference is never completely accurate and complete (Knight 1921, part III, chapter VII). Entrepreneurial ability, which is limited, depends on one's ability to effectively deal with uncertainty. Some entrepreneurs have better forecasting ability than others have and may eliminate much of the uncertainty for the business and the market. Furthermore, entrepreneurs also need to have abilities for good judgement, self-confidence and some luck to prove successful (Knight 1921, Part III, chapter IX; van Praag 1999, 323).

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[12] In his early writing, Schumpeter (1911 [2002]) advocated that competitive markets are beneficial in the sense that they spread the gains of innovations widely. In his later work, Schumpeter (1942) argues that some degree of monopoly is preferable to perfect competition, since innovative activities are driven by short-term profits opportunities. He values competition from the new commodity and the new technology rather than perfect competition with identical goods and equal prices.

[13] Knight (1921, part III, chapter VII) makes a distinction between risk, which allows for statistical inference, and real uncertainty that (due to unprecedented unique events) does not allow one to assess probability on the basis of relative frequency (see also Casson 2003, 221).

Presumably motivated by the rise of corporations in the early 20th century, Knight (1921) explains that the reduction of uncertainty is possible through consolidation. He believes that the overall uncertainty is reduced as different uncertainties (uncertain projects) are brought under the roof of a large business (Casson 2003, 222).[14] Shareholders of large businesses hire entrepreneurs as specialized managers, who are most able to run business under uncertainty. Knight (1921) does not expect problems with moral hazard. He sees two guardians: supervision and profit-related incentive. The latter he calls the residual income (entrepreneurial or pure profit), which is the difference between the revenues of the business and fixed remuneration to other factors of productions (all contractual payments including imputed return to capital). The entrepreneur's income is not determined *a priori*; it is what is left after contractual payments are determined (Knight 1921, part III, chapter IX; see also Casson 2003, 220–223).

Let us now sum up the two theories in a few sentences. Schumpeter (1911 [2002]) recognizes leadership skills as important for the entrepreneur but puts more emphasis on the innovative capability of the entrepreneur (the capability of applying invention to the production processes). However, he does not agree with Knight (1921) that the entrepreneur *per se* is a risk-bearer; he might be if he owns the capital. Namely, he believes that the capitalist, who owns the capital and/or lends funds to an entrepreneur, bears the risk of a business venture (Casson 2003, 223). While the central role of the Schumpeterian entrepreneur is to create changes that move the economy, the primary function of the Knightian entrepreneur is to bear uncertainty (see also Iversen *et al.* 2005, 4–7, or refer to van Praag 1999, 329–324).

2.1.4 Austrian disequilibrium theories of entrepreneurship

The early wave of economists belonging to the so-called Austrian school of economic though, among the most prominent being Carl Menger, Friedrich von Wieser, and Eugen von Böhm-Bawerk, presented many important economic concepts incorporated in the mainstream[15] economics but paid little attention to entrepreneurship. While the early Austrian economics was in accordance with the tenets widely accepted by the profession, later (post World War II) generations of Austrian economists developed rather an alternative paradigm in economic science (Boettke and Leeson 2002, 3). Irrespective of the generation, Austrian economists mostly agree that free markets are superior to government intervention.

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[14] This view is close to the transaction theory of the firm, set out by Ronald Coase (1937), according to which the main reason for establishing a firm is to avoid costly market transactions. Putting more activities under a firm managed by an entrepreneur lowers transaction costs involved in these activities.

[15] We understand *mainstream* as something which is accepted by the contemporary profession at large.

Entrepreneurship theory was developed by the post World War II generation of Austrian economists. They held a controversial view on the market process and on uncertainty inherent in the economic process, which was initiated by Friedrich A. von Hayek and Ludwig H. E. von Mises in 1930s. Hayek (1937, 41–43) posits that market equilibrium could be reached only if final prices are known in advance, which enables planners to set price equal to marginal costs, and minimize average costs. The neoclassical (Walrasian) model equilibrium is guaranteed through *a priori* adjustment of production and plans, which is not plausible in real life. In practice, agents need subsequently to reconcile their plans with one another, which makes the state of equilibrium rather an exceptional market situation.

Von Mises (1949) supplements Hayek's (1937) theory about prevailing disequilibrium states on the markets by his notion on the entrepreneur's role. Von Mises (1949, 249) states that the entrepreneur is the driving force of the market process. Economies are characterized by disequilibria, which provide opportunities for profit. Profit-seeking entrepreneurs appraise the current and the future economic situation (prices and quantities of goods at the market and potential profits) and try to exploit perceived business opportunities. They not only respond to the changes in market conditions but also create them. Through their profit-seeking production plans, entrepreneurs push the market in the direction of clearing (towards equilibrium). However, due to uncertainty and lack of information, entrepreneurs cannot completely accurately appraise the situation at the marketplace, which keeps the economy most of the time out of equilibrium. While payments to other factors of production (including capital) are deterministic, the entrepreneurs' income (profit)[16] is uncertain, since they earn an excess or deficit of realized revenues over deterministic factor payment (as previously noted by Knight 1921). In a hypothetical equilibrium without uncertainty, there would be no profit or loss (while the capitalist would still earn interest rates) and no room for the entrepreneur. Entrepreneurship is the crucial element of the market economy, since it strives to allocate the economy's resources to their highest value use (Klein 2008, 178).

The Austrian economist Kirzner (1973) popularized and supplemented von Mises' (1949) notion of entrepreneurship as a mechanism that drives markets toward equilibrium. Kirzner (1973, 69) presumes that the economy is generally in the state of disequilibrium due to shocks constantly hitting the economy, due to lack of market coordination, and because of widespread unawareness of the opportunities for the beneficial change, which he calls market ignorance. Entrepreneurs are people who are sensitive (alert, in Kirzner's words) to new information about buying and selling possibilities in the market. The main function of the entrepreneur is to discover information that is valuable in the satisfaction of wants (to detect

[16] It seems appropriate to mention that Mises (1949) followed the marginal productivity theory of distribution developed by his Austrian predecessors, which postulates that workers earn wages, capitalists earn interest, and owners of specific factors earn rents. The entrepreneur earns what is left – an excess or deficit of a firm's realized revenues over these factor payments (Klein 2008, 178).

business opportunities). By whom and how the discovered opportunities are exploited, and how exactly markets are brought closer to equilibrium, is not clearly explained by Kirzner (Klein 2008, 176). Kirzner (1973, 32 and 74) treats business opportunities (changes at the market place) as exogenous and thus independent of entrepreneurial action.[17] Kirzner's idea of entrepreneurship as alertness has become widely accepted. Gunning (1997, 17–18) extends this idea by adding that alertness is relevant if it leads to discoveries accompanied by an incentive to act. When entrepreneurs believe that their discovery can earn profits, they will change their plans by buying production factors and by producing a saleable good. Entrepreneurs move the economy towards equilibrium by acting as arbitragers not solely by their alertness. Gunning (*ibid.*) adds that Kirzner would probably agree with his interpretation. To sum up, Kirzner (1973) believes that economies are characterized by disequilibria, and entrepreneurship is the ability to deal with these situations. While Kirzner (1973) believes that entrepreneurship moves the economy towards equilibrium (which is, however, never fully realized), Schumpeter (1911 [2002]) believes that profit-seeking entrepreneurial action in waves disrupts the general state of equilibrium, which is then re-established at a higher level of development (Figure 2.1).

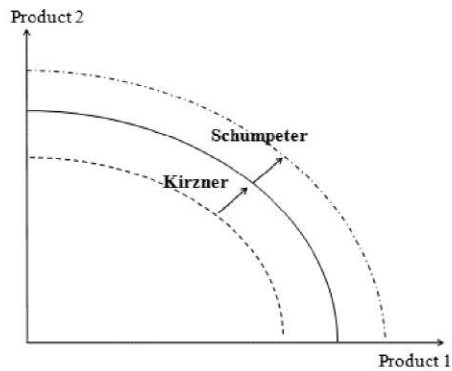

Figure 2.1: A production-possibility frontier illustrating the views of Schumpeter and Kirzner on the function of the entrepreneur

Source: Landström 1999 in Karlsson, Friis and Paulsson 2004, 6.

Though rarely cited in this respect, also Schultz (1975) provided his concept of entrepreneurship. Schultz (1975, 829) argues that after the market equilibrium has been disturbed by an exogenous shock, it takes time before the equilibrium is re-established. The

[17] This is to some extent similar to Schumpeter's (1911 [2002]) view that entrepreneurs transfer the existing inventions into innovations. The creation of inventions as opportunities is outside the domain of the entrepreneur.

process of adjustment depends on the costs and returns of the activities available to agents to adjust to changes and on the efficiency of their action. According to Schultz (1975), the market disequilibrium is the consequence of a slow reallocating process, rather than unawareness of opportunities as argued by Kirzner (1973). In disequilibrium, the agents allocate resources sub-optimally. According to Schultz (1975), entrepreneurship is the ability to adjust to exogenous changes and to improve efficiency by reallocation of resources. Entrepreneurial ability and efficiency can be increased by experimenting and by investing in human capital (through education, training, experience, health care *etc.*). Schultz (*ibid.*) believes that entrepreneurship is present in different spheres of human action: in business, academic life, agriculture, even in the household and elsewhere (Klein and Cook 2006, 346–347; Iversen, Jørgensen and Malchow-Møller 2008).

2.1.5 Leibenstein's alternative view on entrepreneurship

Leibenstein (1978) developed the X-efficiency theory, which is a theory of the (in)efficiency of intrafirm (rather than market) processes. Leibenstein (1978) argues that businesses are neither profit maximizers nor cost minimizers. Namely, managers leading businesses suffer from selective rationality, individual inadequacies, and discretionary effort. Deviation from the assumptions of the neoclassical paradigm leads to *X-inefficiency*, which occurs when, due to a lack of competitive pressure, a business is not producing the maximum output it could, given the resources. Wrong or wasteful (inefficient) use of resources creates a gap between the output produced by a business and its potential output, which creates opportunities for entrepreneurs. Entrepreneurs respond creatively and increase the efficiency of resource allocation. They represent a threat (*i.e.* competition) to inefficient businesses and force them to maintain a certain degree of efficiency. According to Leibenstein (1978), the function of the entrepreneur is twofold: i) to improve the efficiency of the existing production processes by providing necessary factors (venture capital and managing skills), and ii) to fill the gap between the actual and potential output by perceiving where the market fails, to connect different markets, to make up for their failures, and to develop new goods or processes that raise the efficiency of production. Leibenstein (1978) therefore combines the elements of Schumpeter's (1911 [2002]) theory of entrepreneurship with the elements of Say's (1803 [2001]), Knight's (1921), and Kirzner's (1973) concepts of entrepreneurship. Summing up, Leibenstein (1978) distinguishes between *routine entrepreneurship*, which is close to management, and *Schumpeterian entrepreneurship*, whose role is to fill the gap between the actual and potential output. Casson (2003, 217) argues that few economists would object to Leibenstein's main idea; however, there are some doubts about his method of analysis. More particularly, Casson (*ibid.*) reproaches him with the implicit use of some of the principles he attacks, with rational behaviour of agents being one of them.

2.1.6 Contemporary views on entrepreneurship

In the last two decades, economic literature has developed different views on entrepreneurship that mostly combine and/or extend the concepts of the preceding authors. Some of the most prominent modern concepts are those of Baumol (1990), Shane and Venkataraman (2000), Casson (2003), Audretsch and Keilbach (2005), and Acs *et al.* (2005, 2006, 2010).[18]

Baumol (1990) developed a theory of productive and unproductive entrepreneurship. Baumol (1990, 896–897) argues that his theory is an extension of Schumpeter's theoretical model for the determinants of the allocation of entrepreneurship among productive and unproductive activities. Baumol (1990, 897) discusses that, if entrepreneurs are defined simply as persons who are ingenious and creative in finding ways that add to their own wealth and power, then one should expect that not all of them will be concerned with adding value to society as a whole. While some entrepreneurial activities create wealth and are beneficial for society, others redistribute the existing resources and serve the interest of (a small group of) individuals. The first group of activities is related to productive entrepreneurship, while the latter is referred to as unproductive entrepreneurship. Unproductive activities are as well some sort of innovations, since they concern, for example, discovery of a previously unused way of diverting rents to those who are first in exploiting it. Baumol (1990, 898) continues that part of the entrepreneurship can be even destructive. He concludes that rules of the game (economic, political, and legal institutions), which affect the rates of return to different entrepreneurial activities, play an important role in determining to which extent entrepreneurship will be allocated to productive or unproductive activities. In this way, institutions have the power to affect the economy's productivity growth (*ibid.* 916–919).

Casson (2003, 20), whose view is close to Knightian entrepreneurship, defines: »*An entrepreneur is someone who specializes in taking judgmental decisions about the coordination of scarce resources.*« He analyses parts of this definition and explains that the definition is on principle institution-free, by which he means that entrepreneurs can operate in different institutions and within various economic systems. He adds, however, that in practice entrepreneurship is identified in relation to the private sector in a market economy and his work follows this convention.

Drawing from the Austrian school of economic thought, Venkataraman (1997), Shane (2000) and Shane and Venkataraman (2000) have developed their own perspective on entrepreneurship. The two economists focus on the role of opportunities in the entrepreneurial process and, following Kirzner (1973) and others, postulate market disequilibrium as a source of entrepreneurial opportunities. Technological advancement, which is exogenous from the

[18] The authorship order is different for publications in different years. The other three authors are: Audretsch, Braunerhjelm, and Carlsson.

entrepreneur's perspective, provides profitable opportunities. However, these opportunities are not very obvious (at least not to all persons) and do not appear in the form of neat packages, as articulated by Venkataraman (1997, 123). Entrepreneurs must be able to identify and discover these opportunities. According to Shane (2000), opportunity discovery depends on the distribution of information in the society, where the discovered opportunities mostly depend on the information entrepreneurs already possess. Due to different prior knowledge and experience, different people tend to discover different opportunities in given technological changes (Venkataraman 1997). Shane and Venkataraman (2000) propose that investigation of entrepreneurship involves a study of the opportunity discovery process by potential entrepreneurs.

More recently, Audretsch and Keilbach (2005), Acs *et al.* (2007, 2009), and Braunerhjelm *et al.* (2010) developed the knowledge spillover theory of entrepreneurship. They oppose the view in the entrepreneurship literature (held, for example, by von Mises 1948 and Kirzner 1973) that opportunities are exogenous. They refer to the new growth theory, especially to Romer's model (1990a) of endogenous technological change, suggesting that opportunities are endogenous to the economic system. While the new growth theory predicts that knowledge spillovers lead to technological change, it offers no insight into how new knowledge spills over and what is the driving force behind the knowledge spillovers. Acs *et al.* (2007, 8) argue: »*While the new growth theory is a step forward in our understanding of the growth process, the essence of the Schumpeterian entrepreneur is missed*«. According to the knowledge spillover theory of entrepreneurship, entrepreneurial activity plays a crucial role in the spillover of tacit[19] knowledge. Incumbent businesses and organizations investing into new knowledge are unable to exhaust fully and completely the ensuing opportunities to commercialize that knowledge, which opens up opportunities for entrepreneurs. They, however, need to identify and exploit these opportunities. In this respect, they follow Shane and Venkataraman (2000). According to the knowledge spillover theory of entrepreneurship, entrepreneurship emerges as an endogenous response to opportunities generated by investments in new knowledge. The role of the entrepreneurs is to transmit knowledge into economically relevant knowledge, which boosts economic growth.

2.1.7 Comparison and synthesis

We have shown that no broad consensus about the concept of entrepreneurship has been reached so far. Economic literature mostly focuses on certain aspects of entrepreneurship, while their view on some other dimensions often stays vague. Table 2.1 summarizes the main

[19] Tacit knowledge is one of the elements of rival/excludable knowledge. It includes personalized knowledge possessed by individuals and groups; including particular experiences and insights developed and owned by researchers and business people (Acs *et al.* 2006, 8).

functions of the entrepreneur as defined by the leading economists in this field. The table shows that the functions of the entrepreneur that most commonly appear in the definitions are:

- managing (coordination, allocation, direction of resources, decision-making);
- risk- or uncertainty-bearing,
- perceiving/anticipating business opportunities,
- innovating.

Table 2.1: Summary of the entrepreneur's functions according to different concepts and theories

Year	Authors(s)	Main function(s) performed by the entrepreneur
1725	Cantillon	- risk-bearing - allocation of resources (arbitrage)
1803 [2001]	Say	- coordination (the key role) - decision-making - risk-bearing
1848	Mill	- risk-bearing and management of business
1890	Marshall	- managing - risk-bearing - innovating (seeking opportunities to minimize costs, adapting to changes)
1911 [2002]	Schumpeter	- managing business (everyday function) - perceiving business opportunities - transferring knowledge into economic innovations, i.e. carrying out new combinations of resources (the key role) - disrupting the economy's equilibrium and thus boosting economic development
1921	Knight	- judging the current situation and forecasting future business prospects - uncertainty-bearing - directing technological process and controlling (managing)
1937 [1948]	Mises	- appraising the current and the future economic situation - exploiting perceived business opportunities - allocating the economy's resources to their highest value use (managing) - uncertainty bearing - equilibrating the economy (pushing the market in the direction of clearing)
1973	Kirzner	- discovering information that is valuable in the satisfaction of wants (detecting business opportunities)
1975	Schultz	- adapting to market changes and speeding up reallocating process - experimenting and improving the efficiency of resource reallocation
1978	Leibenstein	- managing and completing production resources - filling the gap between the actual and potential output (by innovating)
1990	Baumol	- productive entrepreneurship (creates wealth and is beneficial for society) exercising functions of the Schumpeterian and Knightian entrepreneurship - unproductive entrepreneurship (redistributes the existing resources and serves the interest of a small group of individuals)
2003	Casson	- taking judgmental decisions - coordination of scarce resources
1997 2000	Shane and Venkataraman	- identifying and discovering exogenous opportunities by the use of prior experience and knowledge
2005 2006 2010	Audretsch, Keilbach, Acs, Braunerhjelm and Carlsson	- responding to opportunities generated by investments in new knowledge - transmitting knowledge into economically relevant knowledge

Schumpeter (1911 [2002]) and Knight (1921) were the first to develop their concepts of entrepreneurship into theories. Their entrepreneurs share several functions, but the theories place the emphasis on different aspects of entrepreneurship. While the central role of Schumpeter's entrepreneur is to create changes that move the economy, the primary function of Knight's entrepreneur is to bear uncertainty and to protect the rest of society from

uncertainty. While the views of Kirzner (1973) and Casson (2003) on the entrepreneur are somewhat closer to Knight's theory, the concepts of Shane and Venkaramaran (2000), Audretsch and Keilbach (2005) and Acs *et al.* (20067are closer to Schumpeter's theory. Leibenstein (1978) and Baumol (1990) join the two classical views.

Anyway, if we strive for a synthetic but still simple definition, it is convenient to stick to the concise interpretation provided by Iversen *et al.* (2005, 10), who conclude: »entrepreneurship is probably best considered a multifaceted concept, involving innovation, risk-bearing, and management«. As suggested by the authors (*ibid.*) we bear in mind that this description does not capture all entrepreneurial activity and requires that researchers are precise about which aspect of entrepreneurship is considered in a given context.

Let us also mention that forming a concise and unambiguous definition of the entrepreneur is one of the starting points (and aims at the same time) of the ongoing OECD–Eurostat Entrepreneurship Indicators Program (EIP). EIP (Eurostat–OECD 2009, 6) tried to merge different concepts of entrepreneurship by elaborating the following definition: »Entrepreneurs are those persons (business owners) who seek to generate value through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets.«

2.2 Entrepreneurship in theoretical economic models

Despite numerous publications that regularly appear in the field of entrepreneurship, the entrepreneur is still mainly excluded from micro-economic theoretical materials of mainstream journals and textbooks, and much space is instead devoted to market failures (Baumol 2008, 2). However, to evaluate the impact of different factors on entrepreneurship and to investigate its role in the economy, entrepreneurship has been incorporated into various macroeconomic models with microeconomic foundations (the latter means that the optimal behaviour of an individual is explicitly considered in the model). The most common representation of an entrepreneur in such models is related to the utility maximizing paradigm.

With the seminal paper by Lucas (1978) on the size distribution of businesses, the entrepreneur started to appear in micro-based macroeconomic models in the shape of the self-employed manager or business owner. The model of Lucas (1978) presents the choice of a utility maximizing individual between two alternative occupations (paid employment and management as self-employment), where this choice is incorporated into a GE framework. He assumes that individuals are heterogeneous with respect to managerial talent and that there exists a certain distribution of talent among individuals. An individual becomes a manager if his/her talent reaches some lower threshold. The distribution of entrepreneurial abilities in society affects the size distribution of businesses in the economy.

In general, the occupational choice models explain how persons, who differ with respect to certain characteristics (*e.g.* managerial or other kind of entrepreneurial ability or risk-attitude), choose between occupational alternatives (*e.g.* dependent employment and self-employment). Entrepreneurs in these models appear mainly in the role of organisers of production processes (managers) and seem to be close to Knight's definition of the entrepreneur. There are two main groups of the occupational choice models according to the source of heterogeneity of individuals:

- In the first group of the occupational choice models, persons are assumed to be homogeneous with respect to their productivity in production processes but have different entrepreneurial abilities (*e.g.* ability to manage). Lucas (1978) and Lazear (2004), for example, model heterogeneity within entrepreneurial ability as a parameter in the production functions, while Jovanovic (1982) demonstrates it by a parameter in the cost function (Iversen *et al.* 2005, 8).
- In the second group of the occupational choice models (Kihlstrom and Laffont 1979; Kanbur 1979; Parker 2005), persons differ from each other in terms of their risk attitudes. Different types of uncertainties (demand uncertainty and price uncertainty) divert individuals from becoming entrepreneurs or, under certain circumstances, attract them to entrepreneurship. These models do not provide an unambiguous answer about the sign of the link between risk aversion and the amount of entrepreneurship. Static models of risky entrepreneurship have been extended for the cost of switching occupation, which requires adding a time dimension. In a dynamic framework with included cost of occupation switching (see Dixit and Rob, 1994), individuals switch from paid employment to self-employment when output in self-employment due to shocks exceeds some upper threshold. Conversely, self-employed persons leave their occupation when shocks drive output in self-employment below some lower threshold. When output varies between the two thresholds, individuals remain in their current occupation. In this case, the switching cost deters them from moving. The greater the risk aversion, the closer are the two thresholds and the more likely is switching (Parker 2004, 46–54).

Regarding the focus and the aims of the analysis, occupational choice GE models can be classified into the following two groups (see Quadrini 2009):

- theoretical occupational choice GE models aiming at investigating factors that affect the occupational choice of individuals (taking personal characteristics like skills/ability/talent and risk aversion as given);
- a growing body of theoretical occupational choice GE models linking entrepreneurship to economic development and growth.

The first group of occupational choice GE models tries to answer why some individuals choose to work in self-employment while others choose to work for someone else. A large body of these models focuses on the importance of finance (external and internal capital) for the start-up process. Evans and Jovanovic (1989) study whether personal wealth is important

for the individual's choice to become an entrepreneur. According to their simple theoretical framework, an individual chooses to become an entrepreneur if his net wealth is bigger than a certain threshold. They provide some empirical support for the implication that wealthier individuals are more likely to become entrepreneurs than less wealthy individuals. However, empirical evidence provided by other authors casts doubts about the importance of financial constraints for the individual decision to enter entrepreneurship. While financial constraints may not be particularly relevant for the individual's occupational decision, they could affect investment and saving decisions of entrepreneurs (Bohacek 2006) or corporations (Buera 2009) and thus influence the scale/scope of businesses and opportunities for paid employment. In this way, financial constraints can indirectly affect the number of self-employed at the aggregate level. For a concise review of this group of models, see Quadrini (2009).

The second group of the occupational choice GE models links entrepreneurship to economic development and growth. The neoclassical growth theory (*e.g.* the Solow's 1956 growth model) posits that savings and physical capital accumulation are the main sources of output growth and takes technological progress as given (*i.e.* exogenous to the economic system). Differently, the new/endogenous growth theory asserts that technological progress is determined by forces that are internal to the economic system. Two main sources of technological advancement are: i) human capital accumulation (Lucas 1988; Romer 1990b) and/or ii) innovations (Romer 1990a; Aghion and Howitt 1992; Grossman and Helpman 1991). Especially innovation-based growth models give an important role to the entrepreneur and many of them rest on the assumption that innovation is inherent in entrepreneurship.

Several authors, for example Baumol (1968, 68) and Leibenstein (1978), warn that entrepreneurial action cannot be simply quantified and described by a function. They hold the opinion that entrepreneurship is not merely a utility maximizing behaviour and is therefore difficult to be analysed using the traditional tools of economics like the GE model. While Casson (1982) firstly widely criticises the neoclassical theory, in the second (*ibid.* 2003) edition of the same work he recognizes that sophisticated neoclassical theory is immune to some of the criticisms in the first edition of this book.

In the monograph, we incorporate the occupational choice between self-employment (in the form of innovative entrepreneurship) and dependent employment in the production sector in a GE model with steady-state growth. The monograph leaves several psychological and sociological factors aside and focuses on the rational behaviour of economic agents as postulated by the neoclassical theory. We decided to accept the latter simplification in order to be able to theoretically analyse the impact of chosen labour market institutions on entrepreneurship and the role of entrepreneurship in the economy as a whole.

2.3 Measurement of entrepreneurship

The theories and views on the role of entrepreneurship in the economy and its determinants arise, at least partly, from the observed situation and trends in the socio-economic environment. Nevertheless, they need to be verified by empirical studies that take suitable statistical approaches using real and consistently collected data. The main difficulties faced by empirical researchers remain the lack of a uniform definition or concept of entrepreneurship, problems with finding its empirical counterpart, and difficulties with creating timely consistent and internationally comparable datasets on the agreed indicator(s) of entrepreneurship.

Studies addressing the link between entrepreneurship and economic performance mostly focus on a single country (employing time-series data on entrepreneurship across industries and/or across regions).[20] There are rather few cross-country studies investigating the importance of entrepreneurship for the economy and its determinants. They mostly employ data on self-employment or business ownership (*e.g.* Thurik *et al.* 2008, Carree *et al.* 2007 and 2002, van Stel and Carree 2004, and Blanchflower 2000) or data for indices from the Global Entrepreneurship Monitor (*e.g.* Thurik, 2008 and van Stel, Carree and Thurik 2005). Another group of international studies employs indicators of business dynamics (*e.g.* Scarpetta *et al.* 2002, Bartelsman *et al.* 2004, van Stel and Diephuis 2004, Klapper, Amit, and Guillén 2010). The three groups of studies in general confirm positive impacts of entrepreneurship on economic performance, but the findings are not very robust and conclusive about the size of the impact and about the mechanisms through which entrepreneurship affects real economic variables. Advances in this field of research are impeded by a lack of internationally comparable data series related to entrepreneurship.

This section presents an overview of alternative macroeconomic indicators of entrepreneurship employed in economic literature and possible sources of internationally comparable data. The aim is to draw attention to the empirical results of the variable and data source selection. The starting points of our research are Iversen, Jørgensen and Malchow-Møller (2008), who review macroeconomic measures of entrepreneurship and relate them to theoretical concepts; Godin, Clemens and Veldhuis (2008), who present a digest of indicators to compare entrepreneurship in the United States and Canada; and Vale (2006), who analyses the consistency of business dynamics data coming from different sources. We supplement the list of indicators provided by aforementioned studies. Each indicator is related to the closest theoretical concept of entrepreneurship that exposes a specific dimension of entrepreneurship. We also examine correlations between data for alternative indicators and check how robust the results are to the choice of entrepreneurship indicator and the data source. Another aim of

[20] To our best knowledge, van Praag and Versloot (2007) provide the most exhaustive review of the literature investigating the impact of entrepreneurship on economic performance.

the section is to highlight the multidimensional nature of entrepreneurship, which should be taken into account in any research focusing on the impact of entrepreneurship on economic performance.

The first step in measuring entrepreneurship is a choice or elaboration of a definition of the entrepreneur and trying to find its best empirical counterpart. No broad consensus about the concept of entrepreneurship has been reached in economic literature so far. Most comprehensive and from certain aspects alternative theories of entrepreneurship have been to our opinion developed by Schumpeter (1911 [2002]), Knight (1921), and Kirzner (1973). Due to the integrity of their approach, theoretical and empirical literature sometimes takes these theories as benchmarks (*e.g.* Godin, Clemens and Veldhuis, 2008). Even though Schumpeter (1911 [2002]), Knight (1921) and Kirzner (1973) attribute to the entrepreneur similar day-to-day tasks, they seem to diverge with respect to the strategic role of the entrepreneur in society. Recall that (concisely and simplified) prominent dimensions of the Knightian entrepreneur are uncertainty bearing and managing, while the crucial dimension of the Schumpeterian entrepreneur is innovativity, which in waves (through the process of creative destruction) distorts the market equilibrium that is then re-established at a higher level of economic development. The distinctive dimension of Kirznerian entrepreneurship is sensitivity or alertness to new business opportunities.

While it seems difficult to capture all entrepreneurial activity and all its aspects into a single definition, it is even harder to construct a corresponding empirical measure or its proxy for empirical analysis. Even if we managed to succeed in both, we confront practical limitations related to data collection in different countries and across time. Considering these limitations, we first draw attention to a review of five broad groups of empirical indicators (with corresponding international databases) describing some aspect of entrepreneurship (Table 2.2).

Table 2.2: Indicators of different aspects of entrepreneurship

Indicator	Data source	Coverage across countries and years	Concept/aspect
SELF-EMPLOYMENT INDICATORS			
Standard self-employment rate	OECD (2009a)	30 OECD countries, from 1990 to 2007	Knightian
Business ownership rate	COMPENDIA (by EIM)	23 OECD countries, from 1970 to 2007	Knightian
ENTREPRENEURIAL ACTIVITY (EA) INDICES			
Nascent EA	Global Entrepreneurship Monitor	From 1999 (10 countries) to 2009 (53 countries)	Schumpeterian
Young firm EA			Knightian
Established business EA			Knightian
Opportunity EA			Kirznerian
BUSINESS DENSITY AND BUSINESS CREATION INDICATORS			
Business density	World Bank Group Entrepreneurship Survey – WBGES	From 2000 (42 countries) to 2007 (41 countries)	Knightian
Enterprise birth rate	Eurostat (2010)	22 EU countries, from 1997 to 2006 (incomplete)	Schumpeterian
Enterprise birth rate	OECD (2010e)	From 1995 (3 countries) to 2004 (4 countries) with the greatest coverage in 2001 (20 countries).	Schumpeterian
Enterprise entry rate	International Benchmark of Entrepreneurs – IBE (by EIM)	From 1995 to 2007, 9 EU countries[3], the United States , Japan	Schumpeterian
Corporate business entry rate	World Bank Group Entrepreneurship Survey WBGES	From 2000 (39 countries) to 2007 (37 countries)	Schumpeterian
OTHER INDICATORS OF ENTREPRENEURSHIP			
Propensity to entrepreneurship	Flash Eurobarometer Survey on Entrepreneurship	From 2000 to 2004 (EU-15[1] and the United States), 2007 and 2009 (EU-27[2], 10 non-EU countries).	Knightian
Digest of indicators	Entrepreneurship Indicators Project EIP (by OECD and Eurostat)	From 2005 to 2009, coverage across the OECD countries depends on the year	Knightian, Schumpeterian, Kirznerian
INDICATORS OF INNOVATIVITY			
R&D expenditures in GDP	OECD (2009a)	30 OECD and 9 other countries, from 1981 to 2007	Schumpeterian
Triadic patent families per million inhabitants	OECD (2009a)	30 OECD and 10 other countries, from 1990 to 2006	Schumpeterian
Sales of new-to-market products (% of firm's turnover)	Eurostat Community Innovation Survey CIS	EU-15[1], 2004 and 2006	Schumpeterian
Sales of new-to-firm products (% of firm's turnover)			Schumpeterian
Summary innovation index	European Innovation Scoreboard EIS	From 2001 (EU-15[1], US, Japan) to 2009 (37 countries)	Schumpeterian

Note: [1] EU-15 stands for the old (pre-2004) member states of the EU; [2] EU-27 denotes 27 EU member states as of year 2007; [3] These nine EU countries are: Belgium, Denmark, Finland, France, German, Ireland, Italy, Netherlands and United Kingdom.

After briefly introducing each of the indicators, we relate it to the theoretical concept, posit its most apparent strengths and weaknesses and present the current coverage of the corresponding database(s). We then examine correlations between data for alternative

indicators (or data for the same indicator coming from different sources) and analyse the concordance of country rankings with respect to: i) different measures of Schumpeterian entrepreneurship, ii) different measures of Knightian entrepreneurship, and iii) measures of Kirznerian entrepreneurship. The results of the analysis are important for setting up a framework for investigating the impact of labour market institutions on entrepreneurship and indirectly (through entrepreneurship) on economic performance.

2.3.1 Self-employment and business ownership

The measure most often employed in international studies to analyse the amount of entrepreneurship is the self-employment rate, largely because it is measured in most countries. In line with the *ILO Guidelines for measuring employment*, self-employment jobs are jobs where the remuneration directly depends upon the business profits. The self-employed makes the operational decisions affecting the business (including one-person operations), or delegates such decisions while retaining responsibility for the welfare of the enterprise. Self-employed are all workers who are not treated as employees and are, according to the ILO classification, categorized in four groups: *employers*, *own-account workers*, *members of producers' cooperatives*, and *contributing family workers*. This classification indicates that unpaid family workers should be treated as self-employed because they work for family gain. OECD (2000) and van Stel (2005), for example, exclude them from the category of self-employed, which may importantly affect the results of self-employment analysis across countries as argued by Blanchflower (2000).

The OECD Labour Force Survey (henceforth OECD LFS) follows the *ILO guidelines*, while the Eurostat Labour Force Survey (henceforth Eurostat LFS) distinguishes the following professional statuses of workers: *employees*, *employers*, *self-employed*, and *family workers* (Eurostat 2009). Both, employers and self-employed, are persons who work in their own business, but the former at the same time employ other people. Eurostat's definition of self-employment thus excludes not only family-workers but also employers. This is considered as self-employment in the narrow sense.

OECD (2009a) defines self-employment rate as the share of self-employment in total civilian employment (*i.e.* total employment less the members of the armed forces). It provides data for 30 OECD member states for the period 1990–2007 with shorter series for few countries. Since, according to the standard ILO definition, any person aged 15 or over who works for more than one hour per week is counted as being employed, self-employment rates are very high in countries with many small family businesses or farms (*e.g.* in Greece, Italy, and Poland). We confront the OECD self-employment rates with self-employment rates calculated using Eurostat LFS data (in line with the Eurostat LFS classification), in particular:

- self-employed in the narrow sense as percentage of total employment;
- self-employed plus employers as percentage of total employment;

- self-employed plus employers plus family members as percentage of total employment, which is by definition close to the OECD self-employment rate.

Two broader self-employment rates based on the Eurostat LFS data (outlined in points 2 and 3) roughly coincide with the OECD figures or (especially for the indicator under point 2) fall below the OECD figure. A comparison of Eurostat figures for all the three indicators (under points 1, 2 and 3) reveals that the ranking of countries based on the narrowest measure (outlined under point 1) stays very close to the rankings based on the broader measures. Spearman ranks order correlation coefficient (ρ) between the narrowest self-employment rate (point 1) and the OECD self-employment rate equals 0.95 (t 12.10). We conclude that in most OECD countries the ranking is largely determined by the numbers of self-employed who do not employ other people.

The OECD self-employment rate can be considered as a proxy for Knightian entrepreneurship, since the crucial difference between self-employment and paid employment lies in the type of remuneration received, where the remuneration of self-employed as defined by ILO is uncertain (Iversen, Jørgensen and Malchow-Møller 2008, 22).

Van Stel (2005) addresses inconsistencies in the OECD's data on self-employment. The main problem he detects is varying statistical treatment of owners and managers of incorporated[21] businesses (incorporated self-employed), as this category of workers is classified as wage-and-salary workers in some countries, and as self-employed workers in other countries. The Dutch research organization EIM Business and Policy research (henceforth EIM) made corrections to the OECD's self-employment estimates: it included owners-managers of incorporated small businesses and excluded unpaid family workers, self-employed in the agriculture, hunting, forestry and fishing sectors, and individuals who are self-employed as a secondary occupation. A harmonized dataset is called COMPENDIA (COMParative ENtrepreneurship Data for International Analysis) and the indicator is named *the business ownership rate*. It is calculated as a share of business owners in the total labour force. COMPENDIA is based on the following definition of business ownership (van Stel 2005, 7): »the total number of incorporated and unincorporated self-employed outside the agriculture, hunting, forestry and fishing industries who carry out self-employment as their primary employment activity.« In other words, business owners are unincorporated self-employed (sole proprietors and partners) as well as incorporated self-employed with less than 50 employees (owners-managers of incorporated businesses) in the non-agricultural sector, where contributing family members are excluded. COMPENDIA database covers 23 OECD countries (EU-15 plus Iceland, Norway, Switzerland, the United States, Japan, Canada, Australia and New Zealand) over the period 1972–2007 (EIM 2010a).

[21] Throughout the dissertation, we use the term incorporated to denote registered legal persons. Unincorporated businesses are officially recognized natural persons.

We agree with Iversen, Jørgensen and Malchow-Møller (2008), who say that the small business ownership rate seems to be a good proxy for Knightian entrepreneurship. The authors (*ibid.*, 26) warn, however, that including owners and managers may overestimate Knightian entrepreneurship since not all managers bear uncertainty. But since the EIM's business ownership rate includes only businesses with less than 50 employees, the number of which should approximately equal the number of business owners, this should not cause a serious bias (van Stel 2005). While small business ownership rate might not say much about the innovativity of entrepreneurial persons as understood by Schumpeter,[22] it is partly related to Kirznerian entrepreneurship. Namely, self-employed and small incorporated businesses need to perceive (and then exploit) new market opportunities to be able to survive. An even better indicator of Kirznerian entrepreneurship would perhaps be the number of high-growth businesses per capita or per active person. Namely, businesses that perceive business opportunities may explore their niche and expand; other businesses stagnate, shrink or decay. To our knowledge, a harmonized cross-country database on the number of high-growth businesses per capita or per active person is not yet available.[23]

2.3.2 Global Entrepreneurship Monitor indicators

The Global Entrepreneurship Monitor (henceforth GEM) is a large survey-based study of entrepreneurship that provides sets of different indicators of entrepreneurship. GEM was launched in 1999, when it covered 10 countries, and has been extended to 54 countries up to 2009. Under the GEM survey, individual-level data[24] on different aspects of entrepreneurship (*e.g.* stages of development, entrepreneurial motivation and other determinants) are collected by national teams in the same way and approximately at the same time of year. Using these data, GEM calculates entrepreneurship indices that measure different aspects of entrepreneurship (Bosma and Levie 2010, 61; EIM 2010b):

- *total (early-stage) entrepreneurial activity (TEA) index* measures the relative number of people currently setting up a business or owning and managing a business paying salaries up to 42 months. It can be broken down into:
- *nascent entrepreneurial activity index,* measuring the relative number of people currently setting up a business (salaries are paid 0 to 3 months);

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[22] Schumpeter (1911 [2002, 66]) interprets innovations broadly as: i) the introduction of a new good, ii) the introduction of a new method of production, iii) the opening of a new market, iv) a new source of supply of inputs, and v) a new organization of (monopolistic) industry.

[23] OECD–Eurostat Entrepreneurship Indicators Programme provides recent data for the share of high-growth enterprises (employment and sales definition) in all enterprises. Since countries with the same share of high-growth enterprises may show a different number of high-growth firms per capita or per active person, we do not find it a good proxy for Kirznerian entrepreneurship.

[24] A sample of interviewees consists of a certain number of adults between 18-64 years. The size of the sample depends on the country.

- *young firm entrepreneurial activity index,* measuring the relative number of people owning and managing a business that exists (i.e. pays salaries) 3 to 42 months;
- *established businesses activity index* measures the relative number of people owning and managing a business that exists more than 42 months;
- *opportunity entrepreneurial activity index* measures the relative number of people involved in early-stage entrepreneurial activity out of opportunity;
- *necessity entrepreneurial activity index* measures the relative number of people involved in early-stage entrepreneurial activity out of necessity.

All indices are calculated as the respective number of people relative to the population aged from 18 to 64 years.

Among the enumerated GEM indices, Knightian entrepreneurship is best described by the *young firm entrepreneurial activity index* and the *established businesses activity index*; together they measure the relative number of people already owning and managing a business, which all bear uncertainty (though young firms are usually more exposed to uncertainty). Owners of young and established firms earn residual income, which is uncertain, with uncertainty-bearing being the most prominent feature of the Knightian entrepreneur. The *Nascent entrepreneurial activity index* seems to be the most appropriate proxy for Schumpeterian entrepreneurship, since start-ups tend to embed innovativity (at least in the broad sense as defined by Schumpeter 1911 [2002]). Recall that in line with Schumpeter's (1911 [2002], 66) early view, an innovative entrepreneur as a rule operates in a new business. Lastly, *Opportunity entrepreneurial activity index* reflects Kirznerian entrepreneurship, taking into account that alertness to business opportunities is the distinctive feature of the Kirznerian entrepreneur.

2.3.3 Business density and business dynamics

A fundamental requirement in measuring business density and dynamics (*i.e.* business creation and business destruction) is a clear definition of a measurement unit or statistical business unit. Legal business units[25] are not completely comparable across national business registries, as they reflect national administrative and legal requirements that differ across countries (Eurostat–OECD 2008, 10). International definitions of businesses provided by Eurostat (EC Regulation 696/93), the System of National Accounts (SNA-93), and the International Standard Industrial Classification of all Economic Activities (ISIC) distinguish three common *statistical business units*:

- Enterprises,
- Establishments (or local kind of activity unit) and
- Enterprise groups.

[25] Note that a legal unit may be either a legal person or a natural person.

The choice of the statistical unit might affect the results of analysis. Let us see, for example, what happens when the operations of the original enterprise are expanded by creating a new establishment (*i.e.* another local kind of activity unit). If business units are defined as establishments, this expansion results in a business entry without growth in the original business unit (establishment, in this case). If, on the other hand, we define business units as enterprises, no entry occurs while the original business unit doubles in size. The most commonly used statistical business unit across countries is the enterprise, though it suffers from a lack of international data comparability. The problem is the following. Bigger economies are likely to exhibit lower entry rates relative to small economies, since the establishment of a new branch by an existing enterprise in another region (within a large country) is not recognized as a business entry, while it would be recognized if the region were beyond the international border (see Eurostat–OECD 2008, 10–11).

The definition of an enterprise used by Eurostat[26] and followed in SNA-93 and ISIC reads »Enterprise is the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations. It may be a sole legal unit.« Note that the enterprise as just defined includes incorporated and unincorporated businesses (Eurostat–OECD 2008).

Economic literature uses different terms to address enterprises in the spirit of the Eurostat definition. The terms *firm*, *enterprise* and *undertaking* are commonly considered synonyms in economic literature; especially the first two terms are used interchangeably throughout the monograph.[27] Regarding the legal form, we distinguish enterprise as a legal person (a legal entity that can own property, make contracts, can sue and be sued in its own name) and enterprise as a natural person (a business entity without the legal personality).[28] The term *establishment* relates to a local kind of activity unit, implying that an enterprise may consist of (*i.e.* own) several establishments (*e.g.* for production, administration, R&D, sales). We use the term *business* as a general term referring to either enterprise or establishment.

Business-level data in different countries are collected by national business registers, national social security providers or their statistical agencies, and private organizations. These data can be aggregated at the industry or at the overall country level. While there might be some missing values or breaks due to methodological changes in time-series for an individual country's data, international comparability of data on business dynamics (regardless of the

[26] The source is the Council Regulation (EEC) 696/93.

[27] The term *company* is often used to designate legal persons, while many authors use the terms company and enterprise equivalently.

[28] Natural persons (unincorporated businesses) include sole proprietors, partnerships and other associations of persons.

level of aggregation) may suffer from additional problem issues. The first issue of data comparability is related to the unit of measure (enterprise *versus* establishments)[29] used by national business registers, agencies or private databases. Another issue is related to the size threshold for businesses included into a database. While some registers include also sole proprietors and other single-person businesses, some others consider only businesses of at least a certain size in terms of the number of employees or, in a few countries, the sales (Bartelsman, Scarpetta and Schivardi 2003, 11). An additional problem issue is that in some databases it is difficult to distinguish between the creation of a genuinely new business (birth of a business) and its death from the business entry and exit related to take-overs, mergers or acquisitions (Hult 2003, 2; Brandt 2004, 12).

In the follow-up of this subsection, we review the existing sources of cross-country aggregate data on the stock of businesses and business dynamics.

Business density

An example of a static business-level indicator is *business density rate*, which is defined as the number of businesses divided by the size of a certain population in a country (*e.g.* total population, working age population, total labour force, number of employed persons). Van Praag and Versloot (2007, 4) suggest that entrepreneurial businesses are businesses that satisfy one of the following characteristics: (i) They employ fewer than 100 employees; (ii) They are younger than 7 years old; (iii) They are new entrants into the market. The thresholds they suggest might, however, be subject to a debate. According to this definition, we can measure entrepreneurship by *entrepreneurial business density rate* (*i.e.* the number of entrepreneurial businesses divided by the size of a certain population in a country).

The business ownership rate as computed by EIM (2010a) is based on data on self-employment and data on incorporated businesses with less than fifty employees. The indicator is therefore partly an individual-level indicator and partly a business-level indicator, and fits into this section as well.

Regardless of the stated characteristics an entrepreneurial business should possess, we also present the *business density rate* provided by the *World Bank Group Entrepreneurship Survey* - WBGES (World Bank Group 2008). The WBGES business density rate measures the number of all enterprises that are legal persons (multiplied by a thousand) per working-age

[29] The enterprise as a unit of measurement may not yet be available in statistical business registers of all countries. The United States, for example, base their business statistics on establishments. Countries reporting to Eurostat use different units of measurement (enterprises or establishments) and impose different criteria (*e.g.* size threshold) for the inclusion of businesses into official business statistics (Scarpetta *et al.* 2002, 9-10).

individual in a country. The indicator, therefore, does not consider natural persons (such as sole proprietors) and other unincorporated associations. While it is not a good proxy for the Schumpeterian entrepreneurship, it partly captures Knightian entrepreneurship.

Business density rate can be calculated also from other data sources, for example Eurostat data on the total number of enterprises (incorporated and unincorporated) in industry and services, excluding public administration and management activities of holding companies. Dividing the total number of enterprises as reported by Eurostat by the working active population yields the Eurostat *total business density rate*.

Business dynamics indicators

Business demography (or business dynamics) data are dynamic indicators describing changes within the number and/or structure of businesses, more particularly business creation (entry or birth) and destruction (exit or death). Commonly used relative business demography indicators ar: business entry/birth rate, business exit/death rate, turnover/turbulence/churn rate (the sum of the previous two), net entry/birth rate (entry/birth rate less exit/death rate), and volatility rate (turbulence rate less net entry/birth rate).[30] *Business birth* reflects the creation of a genuinely new business within the economy, while *business entry* reflects the appearance of a new business within the economy, whatever the demographic event (it may be the birth of a business, or a merger, renaming, or spin-off). *Business death* reflects the actual decay of a business, while b*usiness exit* reflects the abolishment of an existing business due to its death (for financial or other reasons) or a takeover, a merger, renaming and other reasons. Thus, the business birth and business death are narrower terms than the business entry and exit, respectively.

Business creation (business entry or even better, business birth) is closely related to Schumpeterian entrepreneurship. As already described, the main function of the Schumpeterian entrepreneur is to innovate (*i.e.* carry out new combinations) where new combinations are primarily embodied in new businesses. The Schumpeterian entrepreneurs lose entrepreneurial character as soon as they settle down to running the established businesses (Schumpeter 1911 |2002|, 66). Thus, business entry rate, or even better,[31] business birth rate may therefore be considered as good proxy Schumpeterian entrepreneurship.

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[30] Definitions of the turnover/turbulence/churn rate, net entry/birth rate, and volatility rate are approximate; the exact definitions depend on the specific case and may differ between studies.

[31] The definition of business entry implies that the term includes, for example, also renaming and spin-offs, which may not be linked to innovative (entrepreneurial, in the Schumpeterian sense) activity. By contrast, business birth reflects only genuinely new businesses and tends to be a more appropriate indicator of Schumpeterian entrepreneurship.

Business creation and destruction can be considered at different levels: business-level, industry/sectoral level and macroeconomic/aggregate level (Robinson, O'Leary and Rincon 2006, 5). At the industry and macroeconomic level we may express business creation and destruction in relative terms (as entry and exit rates or, similarly, as birth and death rates). It is worth mentioning that measurement of business creation and destruction at a higher level of aggregation is likely to hide reallocation of resources from one sector to another and therefore yield lower figures for business churning. Namely, a switch between two sectors may be considered as a churn (exit and entry) when measured at the sectoral level, while it is not taken into account as business dynamics at the aggregate (*i.e.* country) level (Robinson, O'Leary and Rincon 2006, 13).

EIM constructed a dataset called *International Benchmark of Entrepreneurs* (henceforth IBE), which contains data about business (more particularly, enterprise) entry and exit rates. The database provides figures for nine EU countries (see Table 2.2), the United States, and Japan for the period 1995–2007. The database includes all (incorporated and unincorporated) businesses and does not provide size-class and sector distributions. The agricultural sector is excluded from the dataset. Data come from national business registers, national statistical offices, Eurostat, Amadeus (Bureau van Dijk), and Compustat and are made comparable across countries and over time. EIM's (2010c) IBE considers only *active enterprises*, which are enterprises with at least one working member of at least one hour a week. An *entry* is defined as establishment of a new enterprise by a new entrepreneur (start-up) or by an existing entrepreneur, for which one person works at least one hour a week. An *exit* is abolishment of an enterprise where one person worked at least one hour a week due to a bankruptcy or because an entrepreneur voluntary stopped conducting his/her business. *Entry (exit) rate* is calculated as the number of enterprise entries (exits) divided by the total number of active enterprises in a certain period.

As shown in Table 2.2, data on business entry rates are provided also by the WBGES. WBGES (Klapper, Amit and Guillén 2010, 4) defines its unit of measurement as »any economic unit of the formal sector incorporated as a legal entity and registered in a public registry, which is capable, in its own right, of incurring liabilities and of engaging in economic activities and transactions with other entities.« WBGES database (provided by The World Bank Group 2008) includes registered businesses regardless of their size in terms of employment or sales. Businesses that need to be duly registered (incorporated) are those that have legal entities separated from their owners (*i.e.* they are legal persons). Partnerships and sole proprietorships do not have a separate legal entity (*i.e.* they are without legal personality) and are not obliged to register. Entry rates are calculated as a percentage of newly registered businesses in the total of previous year registered businesses (Klapper, Amit and Guillén 2010, 16). WBGES currently provides data on registered business entry for 82 countries covering the period 2000–2007 (the data series is, however, shorter for several countries). Data sources are the Amadeus database, Dun and Bradstreet (for the United States) and other

sources. As exposed by Vale (2006, 11), restriction of WBGES to incorporated businesses raises additional comparability issues related to variations in the propensity of businesses to incorporate. This will differ between countries depending on the cost and complexity of registration procedures, tax incentives, reporting burdens and possibly even cultural factors.

Data on business (more precisely enterprise) birth rates have been gathered from national business registries of the EU member states under *Eurostat Business Demography* – EBD (Eurostat 2004, 2010). Vale (2006, 11) argues that the Eurostat project is probably the most successful international project, since it follows methodology at the national level in great detail and tests its results using pilot studies. The project focuses on enterprise births and deaths rather than entries and exits, since they reflect the creation of genuinely new businesses and the actual decay of businesses. Enterprise birth (death) rates are calculated as the ratio of the number of enterprise births (deaths) to the total number of active enterprises in the year in question. An advantage of Eurostat data sets is that they make available a relatively detailed sectoral breakdown of the data on births and deaths of enterprises. The Eurostat (2010) database on enterprise births and deaths currently covers 22 countries over the period 1997–2006 but is incomplete, with very short-time series for several countries and some missing values in the series. However, its methodology is probably more exact than the methodology of alternative databases.

Another data source for business (more precisely, enterprise) birth and death rates is the OECD (2010e) business demography database. The OECD birth rates are in general close to the Eurostat data on birth rates (EBD birth rates). Differences in data are somewhat more apparent for the four OECD countries that entered the EU in 2004. Whereas the OECD business demography database covers some of the most developed non-European countries (which are not covered by the EBD), it provides somewhat shorter data series than the EBD. Datasets on enterprise death rates are even more lacking than enterprise birth rate series.

2.3.4 Other indicators of entrepreneurship

In 2000, the European Commission (2010a) launched the *Flash Eurobarometer Survey on Entrepreneurship* (FESE), which is an opinion survey about the entrepreneurial mindset of individuals aged 15 and over. The FESE has been published in years 2000–2004, 2007 and 2009. In 2000 the survey covered the old EU member states (EU-15) and the United States. The last issue (*ibid.* 2009) covers all 27 EU member states (EU-27), Norway, and 9 non-European countries (including the United States and Japan). FESE investigates Europeans' attitudes towards entrepreneurship by posing the following question to interviewees:[32] »Suppose you could choose between different kinds of jobs, which one would you prefer: i)

[32] In 2009, the minimum sample size was about 500 for smaller and about 1000 for larger countries.

being an employee; ii) being self-employed; iii) none of these«. FESE calculates the percentage of persons aged 15 and over who declared that they would prefer to be employees than self-employed. FESE thus measures propensity to entrepreneurship, which may differ from the actual self-employment rate in a country. There are various reasons why potential entrepreneurs do not start up their own businesses, which include a lack of innovative ideas and/or perceived market opportunities and unfavourable business environment.

In 1992, the European Commission established *The Observatory of European small and medium sized enterprises* (SMEs), henceforth referred to as the Observatory. In 2002, 2003, and 2007 the Observatory interviewed thousands of SMEs in the EU member countries. The Observatory survey enquired into the general characteristics of active enterprises, their perceptions on business constraints, competition and human resources problems, and data on internationalisation and innovation in the countries surveyed. The main goal of the project was to provide an empirical foundation for the design of SME policies (European Commission 2010b). In 2008 the Observatory was replaced by the SME Performance Review (SPR). Under the SPR project, the Report on European SMEs is prepared on a yearly basis together with the Small Business Act (SBA)[33] fact sheets, which provide more in-depth country-level information. The SPR embraces not only data obtained by their own survey (continuation of the Observatory survey) but also statistics on entrepreneurship[34] from other sources (more particularly, from GEM, FESE, EBD database and Eurostat indicators on high-growth enterprises).

In 2006, the OECD launched the *Entrepreneurship Indicators Project* (EIP) with the aim of building internationally comparable statistics on entrepreneurship and its determinants. In the following year, Eurostat joined the project and, since 2007, we are talking about a joint OECD–Eurostat EIP. The EIP acknowledges entrepreneurship as a multifaceted concept that may be affected by the multitude of factors. The proposed entrepreneurship framework includes a complex set of indicators to be measured (Eurostat–OECD 2009):

- entrepreneurship and entrepreneurial performance (firm-based indicators, employment-based indicators, other indicators of entrepreneurial performance);
- determinants of entrepreneurship;
- the impact of entrepreneurship on economic growth, job creation and poverty reduction.

[33] In 2000, the EU member states adopted the Lisbon strategy aiming at sustainable economic growth and more and better jobs. The strategy acknowledges the contribution of the SMEs to the EU's prime economic objectives. In 2008, the European Commission adopted the Small Business Act for Europe (SBA), which establishes a comprehensive SME policy framework for the EU Member States. Since 2008, the SME Performance Review (SPR) annually gathers and analyses information on the SMEs to enable monitoring the implementation of the SBA (European Commission 2010c).

[34] SBA fact sheets cover not only data on entrepreneurship but also gather indicators related to topics covered by the Observatory survey.

Currently results of the first two rounds of data collections under the EIP are available. The last (second) edition of the EIP publication *Measuring Entrepreneurship* (Eurostat–OECD 2009) presents indicators of: (1) entrepreneurship and its performance and (2) determinants of entrepreneurship across countries. We are more interested in the indicators of entrepreneurship and its performance, which are further divided into:

- structural indicators on enterprise population (structure of enterprises by size class, structure of employment by size class, structure of value added by size class, structure of exports by size class);
- indicators of entrepreneurial performance (employer enterprise births and deaths, survival rates, share of enterprises by age, share of high-growth enterprises, share of gazelles, employment creation and destruction by births and deaths);
- timely entrepreneurship indicators (*i.e.* chain indices for enterprise entry and exit rates).

For the majority of indicators, data are available for chosen OECD and EU countries for years 2005 and 2006. For the timely entrepreneurship indicators, data refer to the period 2005–2009. The database is still incomplete for some indicators, with missing data for numerous countries.

In the selected OECD and EU countries, micro enterprises (*i.e.* firms with 9 employees or less) on average represent almost 84 percent of all enterprises. The importance of micro enterprises is less pronounced in terms of employment, value added and exports. Micro enterprises offer slightly more than 26 percent of jobs offered by all enterprises. On the other hand, large enterprises on average provide almost one third of all jobs offered in the OECD countries.

In 2006 the birth rate of employers (*i.e.* enterprises employing at least one person in the considered period) in the manufacturing sector ranged from 4.4 percent in Norway to 9.6 percent in Canada, and on the average amounted to 7.3 percent. The same two countries also reached the lowest (3 percent in Norway) and the highest (8.8 percent in Canada) death rates of employers in manufacturing, while the average death rate in this sector stood at 6.7 percent. Birth and death rates in the service sector are on average higher (11.7 percent and 8.9 percent, respectively). Smaller enterprises (especially enterprises with no more than 4 employees) have significantly higher birth and death rates than their larger counterparts. Data on birth and death rates of employers, however, do not cover all OECD and EU countries but only from 16 to 20 selected countries (depending on the indicator and data available).

The EIP also published data on survival of enterprises that were established in 2004 and 2005 and observed in 2006. The average one-year survival rate of enterprise cohorts in the manufacturing sector in the selected OECD and EU countries is about 82 percent. The average two-year survival rate of enterprise cohorts operating in the manufacturing sector is around 74 percent. Thus, most firms that die within the first two years have fallen into decay

already in the first year of operation. Survival rates in the service sector are somewhat smaller; the average one-year survival rate is about 80 percent and the average two-year survival rate is slightly below 69 percent.

The EIP also looks at another interesting indicator with a dynamic dimension – the share of high-growth enterprises in the population of enterprises with 10 or more employees. The growth can be measured regarding two criteria: the number of employees or turnover of an enterprise. The indicator is calculated for a limited number (11) of the OECD and EU countries. Their ranking depends on the chosen criterion of growth (number of employees versus turnover).

A subset of high-growth enterprises that are born five years or less before the end of the three-year observation period is called the gazelles. Gazelles are thus a group of high-growth start-ups, which are especially important for job creation. Regardless of the criterion of growth, the average figure for the group of selected OECD and EU countries is roughly the same for the manufacturing and service sector.

The EIP database also provides chain indices for enterprise entry and exit rates for selected countries. Firm entry rates show a similar pattern across countries in the period 2005–2009. The time movements of firm entry rates suggest that the economic crisis negatively affected firm entries. While a decrease in entry rates in the United States and the United Kingdom was observed already in 2007, several other countries reported a fall one year later. Exit rates increased in almost all countries after 2007.

2.3.5 Innovation indicators

Schumpeterian entrepreneurship exposes innovativity as the key aspect of entrepreneurship. Being already familiar with the Schumpeter's (1911 [2002, 66]) definition of innovation, in this section we provide basic statistical concepts of innovation and commonly employed indicators of innovativity.

In 1992, the OECD and Eurostat developed guidelines for the collection and use of data on innovation activities known under the name *Oslo Manual.*[35] According to the revised version of the Oslo Manual (2005, 46) the innovation is »the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations«. Beside product and process innovations, the Oslo Manual (2005) thus also considers

[35] The Oslo Manual (OECD–Eurostat 2005) is related to the Frascati Manual (OECD 2002b), which is a document a document setting forth the methodology for collecting statistics about research and development (R&D).

marketing and organizational innovations. The simplified definitions of the types of innovations read (*ibid.* 17):

- *product innovations* involve significant changes in the capabilities of goods or services;
- *process innovations* represent significant changes in production and delivery methods;
- *organisational innovations* refer to the implementation of new organisational methods such as changes in business practices, workplace organisation or in the firm's external relations;
- *marketing innovations* involve the implementation of new marketing methods such as, changes in product design and packaging, in product promotion and placement, and in methods for pricing goods and services.

Measurement of innovation has played an important role in the investigation of the link between entrepreneurship and innovation and their effect on economic performance. The amount of innovation activities can be measured by proxy variables, which usually reflect only a certain aspect of the respective phenomenon. Measures of innovative activities have typically involved one of the three aspects of innovative processes (Acs and Audretsch 2005, 57):

- inputs devoted to innovative processes such as R&D expenditures;
- intermediate output, such as the number of inventions which have been patented;
- innovative output, such as the share of firms' revenue from the sale of new products and services.

The effort of a country (its government and private sector) to attain advances in research and development (R&D) is commonly measured in terms of expenditure on R&D activities. The term R&D activity in this context covers basic research, applied research, and experimental development. A country devotes a certain share of its income to R&D with an aim to increase its stock of knowledge and inspire prospects for inventions and their application (innovations). When comparing financial assets devoted to innovative activities across countries, expenditure on R&D in a country is usually expressed as a percentage of the country's GDP. The disadvantage of the expenditure on R&D in GDP as an indicator of innovativity is that it measures only the resources devoted to R&D activities and not the amount of innovative activity actually realized; another disadvantage is that a considerable extent of R&D is informal. So, let us move on to the output measures of innovative processes.

The output of a country's R&D activities is partly captured by patent-based indicators that count the number of inventions registered by businesses and individuals from a certain country. The patent-based indicators of the European Patent Office (EPO), the Japan Patent Office (JPO) and the United States Patent and Trademark Office (USPTO) give considerably different results, since not all inventions are patented at all the three offices. To provide an internationally comparable patent-based indicator, the OECD has developed the *triadic patent families*. OECD defines *a patent family* as a set of inventions patented at all three of these

major patent offices. It attributes patents to the country of residence of the inventor and to the date when the patent was first registered. It includes only patents applied in the same set of countries and thus eliminates home advantage and influence of geographical location. OECD (2009a) calculates a number of triadic patent families for 30 OECD member states and 10 other countries for the period 1990–2006. For the purpose of international comparisons, OECD recommends expressing the number of triadic patent families per million inhabitants. The disadvantage of the patented inventions is that they may show the stock of new technical knowledge but not the economic value it generates, since invention does not always result in innovation. Since the process for registering an invention might be lengthy and expensive, many inventions are not patented –especially not at all three international offices, and particularly not those of small firms.

The examples of indicators of the last phase of the innovation process, *i.e.* the application or the commercialization of inventions, are: i) the share of SMEs introducing product or process innovations, and ii) the percentage of business' turnover that comes from new or renewed products. Both types of indicators are provided by the Eurostat Community Innovation Survey (CIS) and are currently available for the years 2004 and 2006. The second indicator, the percentage of business' turnover that comes from new or renewed products, appears on two varieties:

- sales of new-to-market products as a percentage of the firm's turnover;
- sales of new-to-firm products as a percentage of the firm's turnover.

New to market innovation is defined as the introduction of a new good or service by the firm onto its operating market before other competitors. *New to firm innovation*, on the other hand, denotes the introduction of a significantly improved good or service to the firm that was already available from competitors in the operating sector.

Since 2001, Eurostat's European Innovation Scoreboard (EIS) collects and annually publishes a wide range of innovation indicators that are calculated using the statistics from Eurostat and other internationally recognised sources. EIS has been evolving over time, and more indicators have been added to the study and included into the summary innovation index (SII). The last edition of the EIS (2009) includes 31 innovation indicators (traditionally) divided into three groups: enablers, firm activities, and output. Due to changes in methodology and the number of indicators included, SII scores for different years in the period 2001–2009 are not directly comparable. Harmonized SII scores for 37 countries (31 European and 6 non-European) are available for the period 2003–2007 (EIS 2007). The SII, which for the observed period covers 25 innovation indicators, takes the value from a lowest possible performance of 0 to maximum possible performance of 1.

2.3.6 Comparisons of indicators of entrepreneurship

For the purpose of empirical analysis, we organise the indicators, for which comprehensive datasets are available, along three benchmark concepts of entrepreneurship: Knightian, Schumpeterian and Kirznerian. The classification of indicators based on their relations to the benchmark theoretical concepts (presented by Figure 2.2) is a starting point for the examination of correlations between different indicators and the analysis of concordance of country rankings based on alternative indicators related to the same concept of entrepreneurship. We use country-level annual data for the period 2000–2007, where the actual coverage across countries and time depends on availability of data for each of the indicators.

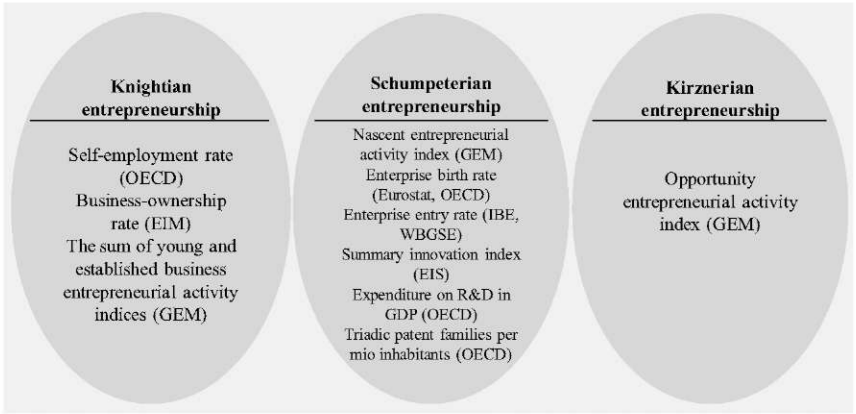

Figure 2.2: Benchmark concepts of entrepreneurship and the corresponding measures

Table 2.3 presents the correlation coefficients between indicators related to the Knightian concept of entrepreneurship. All three indicators are significantly positively correlated with each other. By employing Friedman's nonparametric test of concordance of country rankings, we show that the choice of the indicator of Knightian entrepreneurship matters for the results of analysis. The results of the test (chi-square of 72.031 with significance of 0.000, where the sample size is 113) show that the three indicators lead to different countries' relative performance (rankings). The choice of the indicator in empirical research can therefore importantly affect the results of analysis.

Table 2.3: Correlation coefficients between indicators of Knightian entrepreneurship

Indicators of Knightian entrepreneurship		Self-employment rate (OECD)	Business ownership rate (IBE)	Young and established business entrepreneurial activity (GEM)
Self-employment rate (OECD)	rho	1.000	0.770**	0.208*
	(N)	(184)	(184)	(113)
Business ownership rate (IBE)	rho	0.770**	1.000	0.244**
	(N)	(184)	(200)	(115)
Young and established business entrepreneurial activity (GEM)	rho	0.208*	0.244**	1.000
	(N)	(113)	(115)	(130)

Note:

Calculations are based on annual data for chosen OECD countries for the period 2000–2007.

N denotes the number of observations and rho stands for the correlation coefficient.

* Correlation coefficient is significant at the 5% (2-tailed), ** Correlation coefficient is significant at the 1% (2-tailed). N is the number of observations and rho is the correlation coefficient.

Source: Own calculation based on data from EIM (2010c), OECD (2009a), and GEM (compiled by EIM 2010b).

Measures that can be considered as proxies for Schumpeterian entrepreneurship show surprisingly various patterns across countries (Table 2.4). By reviewing the correlation coefficients, we can divide the indicators of Schumpeterian entrepreneurship into two main groups. The first group consists of the four indicators of business creation and the GEM nascent entrepreneurial activity index, while the second group includes the indicators in the last three columns of Table 2.4 (the three innovation indicators). This grouping is supported by the principal component analysis (PCA), which extracts two significant components of Schumpeterian entrepreneurship, together explaining about 75 percent of total variance of Schumpeterian entrepreneurship (Table 2.5). The first component is mainly represented by the EIS innovation summary index, triadic patent families per million inhabitants and R&D expenditures. The second component is represented by the GEM nascent entrepreneurial index, WBGES entry rate, and IBE entry rate.[36] Since entering businesses are in general smaller than incumbents are, and since big businesses and/or incumbents are in a relatively favourable position regarding investments into R&D and patents, the dimensions seem to be related to the size (besides the age) of businesses.

[36] We retained the latter two indicators of business creation because they contain longer data sets.

Table 2.4: Correlation coefficients between indicators of Schumpeterian entrepreneurship

Indicators of Schumpeterian entrepreneurship		Nascent entrepreneurial activity index (GEM)	Birth rate (Eurostat)	Birth rate (OECD)	Entry rate (WBGES)	Entry rate (IBE)	Summary innovation index (EIS)	Triadic patent families per million inhabitants (OECD)	R&D expenditures in GDP (OECD)
Nascent entrepreneurial activity index (GEM)	rho	1.000	0.282*	0.284	0.371**	0.410**	-0.148	-0.276**	-0.147
	(N)	(129)	(55)	(22)	(111)	(61)	(105)	(107)	(101)
Birth rate (Eurostat)	rho	0.282*	1.000	0.896**	0.323**	0.691**	-0.436**	-0.405**	-0.248*
	(N)	(55)	(135)	(31)	(111)	(33)	(88)	(99)	(76)
Birth rate (OECD)	rho	0.284	0.896**	1.000	0.319*	0.715**	0.095	-0.107	-0.190
	(N)	(22)	(31)	(68)	(51)	(25)	(12)	(68)	(45)
Entry rate (WBGES)	rho	0.371**	0.323**	0.319*	1.000	0.551**	0.132	0.167*	-0.039
	(N)	(111)	(111)	(51)	(208)	(67)	(135)	(164)	(131)
Entry rate (IBE)	rho	0.410**	0.691**	0.715**	0.551**	1.000	0.236	-0.269**	-0.217*
	(N)	(61)	(33)	(25)	(67)	(87)	(54)	(77)	(83)
Summary innovation index (EIS)	rho	-0.148	-0.436**	0.095	0.132	0.236	1.000	0.906**	0.834**
	(N)	(105)	(88)	(12)	(135)	(54)	(170)	(115)	(106)
Triadic patent families per mio inhabitants (OECD)	rho	-0.276**	-0.405**	-0.107	0.167*	-0.269*	0.906**	1.000	0.852**
	(N)	(107)	(99)	(68)	(164)	(77)	(115)	(203)	(153)
R&D expenditures in GDP (OECD)	rho	-0.147	-0.248*	-0.190	-0.039	-0.217*	0.834**	0.852**	1.000
	(N)	(101)	(76)	(45)	(131)	(83)	(106)	(153)	(170)

Note: See Table 2.3.

Table 2.5: Component matrix and score coefficient matrix

	Component matrix		Component score coefficient matrix	
Indicator / variable	Component 1	Component 2	Component 1	Component 2
Nascent entrepreneurial activity index	-0.263	0.577	-0.098	0.313
Entry rate (World Bank Group)	-0.555	0.576	-0.208	0.313
Entry rate (EIM)	-0.355	0.798	-0.133	0.433
European innovation scoreboard - SII scores	0.697	0.671	0.261	0.364
Triadic patent families per mio inhabitants	0.919	0.016	0.344	0.009
R&D expenditures in GDP	0.916	0.298	0.343	0.162

It is important to mention that even though there is a highly significantly positive relationship between the four indicators of business creation, the country rankings are significantly sensitive to the choice of the business creation indicator or the source of data. This can be proved by Friedman's nonparametric test of concordance of country rankings. The test yields a chi-square of 20.000 with significance of 0.000, where the sample size is 30, which points to a statistically significant difference in countries' relative performance with regard to the alternative indicators of business creation. The choice of the appropriate measure of business creation and its data source can therefore affect the results of empirical analysis.

The choice of the indicator among the three innovation indicators (EIS summary innovation index, triadic patent families per million inhabitants, and R&D expenditures in GDP) can also

significantly influence the results of analysis. Disconcordance of country rankings with respect to these three indicators is confirmed by Friedman's test, yielding a chi-square of 174.200 with significance of 0.000, where the sample size is 90. The test rejects the null hypothesis (H_0) that there is no difference in countries' relative performance regarding the three innovation indicators.

An indicator that is closest to the Kirzner's concept of entrepreneurship is the GEM opportunity entrepreneurial activity index. Since this is the only indicator clearly related to Kirzner's concept, the analysis of correlations is not being taken into account. Instead, Table 2.6 presents the correlation coefficients of this index with other indicators of entrepreneurship. Kirznerian entrepreneurship (as measured by the *opportunity entrepreneurial activity index*) is strongly positively correlated to both Knightian and especially Schumpeterian entrepreneurship, as measured by the sum of GEM young firm and established business activity indices and GEM nascent entrepreneurial activity index. Somewhat surprisingly, Kirznerian entrepreneurship does not turn out to be significantly correlated with two other measures of Knightian entrepreneurship: the OECD self-employment rate and EIM's business ownership rate. Kirznerian entrepreneurship is positively correlated with all four measures of business creation, where only the correlations with the World Bank Group's entry rate and EIM's entry rate are statistically significant. The reasoning behind could be that alertness to business opportunities leads to their exploitation mainly by new firms. Since new solutions/ideas drive the obsolete solutions of incumbents out of the market, the stock of entrepreneurship as measured by the self-employment rate does not significantly change. Perceiving and exploiting business opportunities does not necessarily involve patenting of technical inventions, which allows for the GEM's opportunity entrepreneurial activity index to be significantly negatively correlated with triadic patent families per million inhabitants.

Table 2.6: Correlation coefficients between GEM's opportunity entrepreneurial activity index and other indicators of entrepreneurship

Kirznerian entrepreneurship: opportunity entrepreneurial activity index (GEM)		
Other indicator of entrepreneurship	rho	N
Self-employment rate (OECD)	-0.068	115
Business ownership rate (EIM)	0.213*	118
Nascent entrepreneurial activity index (GEM)	0.865**	128
Young and established business entrepreneurial activity index (GEM)	0.781**	129
Birth rate (Eurostat)	0.415**	55
Birth rate (OECD)	0.327	22
Entry rate (World Bank Group)	0.372**	112
Entry rate (EIM)	0.730**	64
Summary innovation index (EIS)	-0.044	108
Triadic patent families per million inhabitants (OECD)	-0.212*	109
R&D expenditures in GDP (OECD)	-0.153	105

Note: See Table 2.3.

Summing up, the results of the empirical analysis for chosen OECD countries for the period 2000–2007 highlight the multidimensional nature of entrepreneurship. Moreover, the results indicate that, regardless of which dimension of entrepreneurship we investigate, the outcome and implications of empirical research might be sensitive to the choice of the indicator of entrepreneurship (related to the dimension we investigate) and its data source. These findings have at least two implications:

- The results of empirical studies (investigating the impact of entrepreneurship on economic performance) that use different indicators as proxy variables for entrepreneurship should be compared with great care, since different indicators of entrepreneurship seem to highlight its different dimensions and may not provide consistent results and implications about the same phenomenon.
- Studies should focus on a specific aspect of entrepreneurship rather than trying to be too general in interpretation. One should be very explicit in describing the investigated aspect of entrepreneurship or very precise about the theoretical concept of entrepreneurship that is closely related to the investigated phenomenon.

2.4 The importance of entrepreneurship for economic performance: A brief survey

It is widely recognized that entrepreneurship creates jobs, increases productivity and drives economic growth. However, probably partly due to the unclear definition of entrepreneurship and problems with its measurement, evidence about the link between entrepreneurship and economic performance is not very robust and some of the mechanisms behind are poorly understood.

In this section, we review empirical literature on the impact of entrepreneurship on economic performance in terms of the level of employment and its growth, output growth and productivity growth. We divide the studies into two broad groups. The first group includes

studies that employ measures of Knightian entrepreneurship such as self-employment rate and business ownership rate. The second group comprises empirical analyses of the role of business dynamics (related to Schumpeterian entrepreneurship) in the economy. Since entrepreneurship might affect economic performance through innovations, we devote special attention to the relationship between the two.

Empirical literature studies the role of entrepreneurship at different levels: at micro level (*i.e.* at the level of individual business or entrepreneur), at the sectoral level or at the macro-level (*i.e.* aggregate/country level). We devote more attention to studies focusing on the effects at the macro- or sectoral level.

2.4.1 Self-employment or business ownership and economic performance

This subsection reviews recent (post-2000) evidence on macroeconomic importance of entrepreneurs defined as persons who are self-employed (following the ILO definition) or who own and manage businesses regardless of their legal form (following the EIM's definitions of business owners-managers). Since these indicators are best related to the Knightian concept of entrepreneurship (as discussed in the previous section), the reviewed studies highlight the link between Knightian entrepreneurship and economic performance.

The review of microeconomic studies verifying whether growth of businesses (in terms of output or the number of employees) depends on their size and age is provided by Van Praag and Versloot (2007) and Thurik *et al.* (2008). Several studies reject Gibrat's (1931) law stating that growth of businesses is independent of their size and conclude that smaller businesses grow faster. As argued by Thurik *et al.* (2008, 5) this suggests that at the macro level a larger presence of small businesses, which are often related to entrepreneurship, positively affects economic growth. This has been among others confirmed by Carree and Thurik (1998) and Audretsch *et al.* (2002), who regress GDP growth on structural change variables (*i.e.* share of large businesses in total employment and growth of small firms relative to growth of large firms, respectively). Using data for 13 and 18 European countries, respectively, covering the early 1990s, both studies conclude that a greater share of smaller firms leads to higher economic growth.

The relationship between entrepreneurship (as measured by self-employment rate or business ownership rate) and aggregate unemployment is mutual with the causality running in both directions. On one hand, high unemployment pushes people towards self-employment (*the push / refugee / escape effect*), which may not always be good for economic growth. This effect can, however, be stifled by the lack of market opportunities and personal wealth needed to set up a business. On the other hand, an increased self-employment rate may stem from new market opportunities and entrepreneurial ideas (*the opportunity / pull / entrepreneurial / Schumpeterian effect*) that lower unemployment and enhance economic growth. There are at

least two international empirical studies testing the existence of these two relationships between business ownership and unemployment. The first is the study by Audretsch, Carree and Thurik (2001), who estimate the system of two regression equations by the weighted least squares method employing data for 23 OECD countries over the period 1974–1998. The second is the study by Thurik *et al.* (2008) that tests a two-equation vector-autoregressive (VAR) model using data for 23 OECD countries for the period 1974–2002. Both studies confirm that on one hand, unemployment pushes persons into self-employment, but on the other hand, self-employment reduces unemployment. Thurik *et al.* (2008) estimate that the second effect is larger than the first one.

The first in the range of studies examining the impact of self-employment or business ownership on economic growth is from Blanchflower (2000). He regresses real GDP growth on the change in self-employment rate over the preceding period controlling for a set of country dummies plus a lagged dependent variable as explaining variables. Using data for 23 OECD countries in 1966, 1976, 1986 and 1996, he finds no evidence on the positive impact of self-employment rates on GDP per capita growth. More recently, Carree and Thurik (2008) have conducted a regression analysis to investigate the impact of a change in business ownership rate on a change in employment and labour productivity. They use data for 21 OECD countries covering the period 1972–2002, and identify three separate effects of a change in business ownership (*i.e.* net entry into business ownership) on employment: i) *direct positive effect* of net entry; ii) *indirect negative effect* due to crowding out of existing capacities, and iii) *positive supply-side effect*. They then conclude that the overall effect of a change in business ownership rate on employment growth is positive but find no evidence on its impact on labour productivity growth. Using data for 18 European countries over 1981–1998, Acs *et al.* (2005, 2009) estimate the equation regressing GDP per capita growth on non-agricultural self-employment rate, indicators of R&D and human capital, and country dummies. They find that, in addition to measures of R&D and human capital, entrepreneurial activity serves to promote economic growth. Erken, Donselaar and Thurik (2009) test the impact of entrepreneurship as measured by business ownership rate (corrected for the level of economic development)[37] on total factor productivity growth in six different models. Using data for 20 OECD countries covering the period 1971–2002, they find that entrepreneurship has a significantly positive impact on the development of total factor productivity levels irrespective of chosen model specification. Lastly, Braunerhjelm *et al.* (2010) test their

[37] In Erken, Donselaar and Thurik (2009), entrepreneurship is measured as the development of deviations from the equilibrium business ownership rate (see Carree *et al.* 2007). In other words, entrepreneurship is computed as the ratio between the actual business ownership rate and the equilibrium business ownership rate, which depends on the stage of economic development. Erken, Donselaar and Thurik (2009) believe that the importance of entrepreneurship increases with increasing levels of economic development (while its own level decreases) and correct the business ownership rate for the influence of per capita income.

theoretical model demonstrating how economic growth depends on knowledge accumulation and its diffusion through entrepreneurship. Their regression analysis confirms that business ownership positively contributed to GDP growth in 17 OECD countries in the period 1981–2002. They (*ibid.*) also show that the importance of business owners-managers increased in the 1990s.

There are few international studies estimating a structural (more precisely, three-equation) model describing the relationship between business ownership and economic development. The first equation acts as a definition and describes the *equilibrium business ownership rate* as a function of economic development (usually the function is U-shaped[38] or, alternatively, L-shaped). The second equation of the model explains the deviation of business ownership rate from the equilibrium rate of business ownership (depending on the deviation of unemployment rate from the average unemployment rate and on the deviation of labour income share from the average labour income share). The third equation predicts economic growth, which may be penalized by the rate of business ownership being out-of-equilibrium. The three equations therefore determine the shape of the equilibrium rate of business ownership, the speed of convergence towards this rate, and the out-of-equilibrium growth penalty (see Carree *et al.* 2007, 2–3). The model was first introduced by Carree *et al.* (2002) and answers two questions: i) what is the relationship between the business ownership rate and the stage of economic development?, and ii) is there an optimal or equilibrium rate of entrepreneurship where departure from this rate in either direction harms economic growth? Using data for 23 OECD countries over the period 1976–1996, Carree *et al.* (2002) find evidence that the long-term relationship between the business ownership rate and economic development is rather L-shaped than U-shaped. This suggests that a higher stage of economic development implies a lower business ownership rate. Concerning question ii), their (*ibid.*) results show that deviations from the equilibrium business ownership rate in either direction (due to exogenous shocks and institutional changes) damage economic growth, suggesting that too few or too many business owners deter economic development. The same conclusions were reached by van Stel and Carree (2004), who estimate the three-equation model on data for 21 OECD countries over the period 1972–1998. Finally, Carree *et al.* (2007) revise their study from 2002 using data for 23 OECD countries over the period 1972–2004. Like their 2002 study, the updated study does not reveal evidence of a superior statistical fit of a U-shaped long-term or equilibrium relationship between business ownership rate and the stage of economic development when compared to the L-shape. Concerning question ii), the 2007 study suggests that having a business ownership above the equilibrium rate does not damage

[38] The U-shaped relationship between business ownership and the stage economic development suggests that the business ownership rate is high in low-developed economies and starts to decrease as the country develops but slopes upward again at the later stage of economic development.

economic development in terms of growth of aggregate output per capita. On the other hand, there appears to be a growth penalty for having too few business owners.

Summing up, international studies relating business ownership to economic performance in general suggest that business ownership increases employment and reduces unemployment. While recent evidence confirms the positive impact of business ownership on growth of GDP, GDP per capita and total factor productivity, the results do not seem to be very robust. Empirical data in general show that the relationship between the stage of economic development (measured by GDP per capita) and the business ownership rate is L-shaped rather than U-shaped, suggesting that the business ownership decreases as the economy develops. According to Erken, Donselaar and Thurik (2009), the economic relevance of a certain amount of entrepreneurship increases with increasing levels of economic development. In other words, developed countries make better use of entrepreneurship.

2.4.2 Business dynamics and economic performance

The list of empirical studies that verify whether creation and/or destruction of businesses (or business turnover/churning/turbulence, net entry and volatility) positively affect economic growth is far shorter than the list of studies relating self-employment or business ownership to economic growth. The results of studies reviewed in this subsection uncover the impact of Schumpeterian entrepreneurship on economic performance, taking into account that business dynamics indicators are related to Schumpeter's (1911 [2002]) early view on entrepreneurship.[39]

One type of approach taken by researchers to investigate the impact of business creation and destruction on sectoral (total) factor productivity is *decomposition of labour or multi-factor productivity growth* into: i) within-firm component and ii) reallocation components (changes in market shares amongst incumbents and entries and exits of new businesses to the market). Using the OECD firm-level data for the chosen set of OECD countries, Scarpetta *et al.* (2002), OECD (2003) and Bartelsman, Haltiwanger and Scarpetta (2004) show that within-firm improvements in labour productivity (*e.g.* due to reorganization or adoption of better technology) are the main source of labour productivity growth. However, a large fraction of growth in labour productivity is explained also by reallocation of inputs and outputs from less productive to more productive incumbents or new businesses. The assessed contribution of

[39] Schumpeter's (1911 [2002], 66-67) early view on entrepreneurship is not related only to indicators of business creation (entry or birth) but also to other indicators of business dynamics, such as the business turnover rate or the volatility rate. Namely, entry of new innovative businesses drives less efficient businesses out of the market and disequilibrates the economic system; the equilibrium is then established at a higher level of economic development. In his later work, Schumpeter (1942, 83) calls this process the *creative destruction*. Schumpeter (1911 [2002], 67 and 74; 1942, 83) sees the process of creative destruction as the essence of economic development.

the process of creative destruction (net entry) to labour productivity growth is between 20 and 50 percent. Scarpetta *et al.* (2002) and OECD (2003) also show that the contribution of business churning is even higher for multi-factor productivity growth (compared with its contribution to labour productivity growth). The study reveals that dynamic processes are found to be even more important in high-tech industries. Bartelsman, Haltiwanger and Scarpetta (2004) explain that the process of creative destruction affects industry productivity *directly* by reallocating resources towards uses that are more productive and *indirectly* through the effects of increased market contestability (new competition forces incumbents to operate more efficiently). Using the same method, Foster, Haltiwanger, and Krizan (2001) show for the United States manufacturing sector observed from 1977 to 1987 that the contribution of net business entry to total factor productivity growth depends critically on the time period over which the changes are measured. They suggest that the role of entrants and exits is substantially higher in the longer run (five and ten years) compared to the shorter run. Disney, Haskel and Heden (2003) decompose total and labour productivity growth of the manufacturing sector in the United Kingdom observed in the period 1980–1992. They attribute productivity growth to: i) internal restructuring (*e.g.* adoption of new technology and organizational change) and ii) external restructuring (with the entry of more efficient businesses they steal the market share from less efficient businesses). They confirm the high importance of external restructuring for labour productivity growth and ever higher for total factor productivity growth. Moreover, they suggest that external competition importantly affects internal restructuring.

Regression analyses on the relevance of business dynamics for economic performance mostly focus on a single country. Aghion *et al.* (2004) show that in the manufacturing sector in the United Kingdom over the 1980s, more entry (instrumented by a higher share of industry employment in foreign firms) led to faster total factor productivity growth of domestic incumbent firms and thus to faster aggregate productivity growth. They therefore suggest that new business entries increase contestability[40] on the market and force the incumbents to improve their performance (*positive indirect effect* of firm entry). Based on regression analysis of total factor productivity in 40 Dutch regions in the period 1988–1996, Bosma and Nieuwenhuijsen (2000) find some evidence of the positive impact of business turbulence on total productivity growth (especially in the service sector, while in manufacturing it may not be statistically significant). Cincera and Galgau (2005) and Loayza, Oviedo and Servén (2005) provide moderately supportive industry-level and cross-country evidence on the impact of business creation on economic growth. Cincera in Galgau (2005) estimate the relationship between business entry (and exit) rates and different indicators of macroeconomic

[40] The term *contestability* is developed by Baumol (1982) and reflects a threat of competition (rather than competition itself) that stimulates businesses in a non-competitive business environment to act competitively.

performance. They disclose a changing relationship between an increase in the business entry rate and the impact on output growth, with a rise in the contemporaneous entry rate leading to higher output growth and an increase in the once-lagged entry rate having a negative impact on output growth. An increase in the once-lagged exit rate will have a negative effect on output growth. Loayza, Oviedo and Servén (2005) estimate the effect of business dynamics (more specifically, business turnover) on labour productivity growth using the country-level data for manufacturing for chosen OECD and Latin American countries (altogether 7 countries) over the period 1988–2001. Their results suggest that business turnover (adjusted for the volatility of the economy) positively affects labour productivity growth – mainly due to entry and exit of businesses.[41]

Economic performance can also be measured in terms of employment and its growth. Van Stel and Suddle (2007) investigate the link between business creation and employment growth in 40 Dutch regions observed over the period 1988–2002. They regress regional employment growth averaged over three years on start-up rates with several lags and chosen controls. They find a positive but rather small effect of new business creation on regional employment growth in the Netherlands and confirm that the effect is strongest in manufacturing. Their study suggests (for the Netherlands) that the maximum effect of new businesses on regional employment growth is reached after about six years. The finding that business creation positively affects regional employment change, but with a considerable time lag is also confirmed by Fritsch and Mueller (2008) for regions in West Germany observed from 1983 to 2002. The findings of this study suggest that the positive effect exists in the longer run but may fail to emerge, or be even negative in the shorter run. In the short run, the fall in employment due to crowding-out of competitors (*the negative indirect effect*) may outweigh the positive impact of job creation by new businesses (*the positive direct effect*). The opposite time pattern of the influence of firm entry on employment change is discovered by Acs and Mueller (2008) for 320 Metropolitan Statistical Areas (MSA) in the United States observed over the period 1990–2003. Their results show that the employment effect was decreasing over time and faded away after six years. In the longer run, there seem to be a counterbalance between the negative indirect effect and the positive direct effect of new business creation on employment change. The study of Acs and Armington (2004) only partly confirms the positive association between births of businesses and employment growth in the United Kingdom. By analyzing local economies in the United Kingdom over the 1990s, they find that business births contribute more to employment growth than the expansion of incumbent

[41] Loayza, Oviedo and Servén (2005) decompose labour productivity growth into three components: i) *within contribution*, which is an increase in productivity due to productivity improvements within incumbents; ii) *between contribution*, which is an increase in productivity coming from reallocation of resources between businesses; and iii) *net entry contribution*, which represents a rise in productivity due to entry and exit of businesses. They estimate that a rise in labour productivity mostly arises from the last component.

business only in the service sector alone. Van Stel and Diephuis (2004) provide cross-country evidence (for 6 OECD member states observed over the period 1992–1999) on the positive impact of net business entry rates on employment growth. Their results suggest that the effect is stronger for the manufacturing sector compared to services.

After relating business creation to employment growth, the following question naturally arises: Who creates more jobs new businesses or incumbents? In the sense of net job creation (gross job creation less gross job destruction) at the aggregate level, the results speak in favour of new businesses. The analysis of the United States private sector over the period 1980–2005 recently provided by Haltiwanger, Jarmin and Miranda (2009), shows that the fraction of employment accounted for by business start-ups is about 3 percent per year. While new businesses do not seem to create many jobs when compared to the overall employment, they do turn out to be an important source of net job creation when comparing these 3 percent to the average annual net employment growth of about 1.8 percent in the same period. Disregarding jobs created by new businesses, the net employment growth for the private sector in the United States is on average negative. However, new business creation is virtually the source of all job creation in the economy, since new businesses create jobs but cannot directly destroy them (for new businesses, net job creation equals gross job creation). Thus, business births by definition lead to positive net job creation while incumbent business create and destroy jobs and tend to show lower or even negative net job creation at the aggregate level. However, in the first couple of years after their establishment young businesses exhibit not only high rates of job creation but also high rates of job destruction, and even turn out to be net job destroyers.

Summing up, there is quite robust evidence on the positive impact of business creation on labour and total productivity growth and on employment growth in regional and national economies. The identified types of effects of business creation are:

- *positive direct employment and productivity effects* (due to job places offered by new businesses and due to the high growth-potential of surviving new businesses);
- *negative indirect employment effect* (due to jobs destroyed in less efficient businesses that are forced to cut employment or exit the market);
- *positive indirect effect* on productivity and potentially also employment (due to increased contestability on the market that forces incumbents to improve their performance).

Time horizons of different types of effects (*i.e.* the time lag with which business creation affects a certain economic variable and the duration of the effect) are less clear.

Indicators of business dynamics are only one group of indicators related to Schumpeterian entrepreneurship. Let us also add some evidence on the link between entrepreneurial activity indexes as constructed by GEM that at least partly reflect Schumpeterian entrepreneurship and macroeconomic performance. Thurik (2008) and van Stel, Carree and Thurik (2005) look

at the relationship between GEM entrepreneurial activity indices and economic performance in terms of GDP per capita, GDP growth and the innovation index as computed by the World Economic Forum (WEF). Using 2007 data for 42 countries, Thurik (2008) finds evidence on the U-shaped relationship between entrepreneurship and level of economic development. The U-shape seems somewhat stronger in the case of per capita income than in the case of the innovation index. Van Stel, Carree and Thurik (2005) confirm for 36 countries observed over the period 1999–2003 that entrepreneurial activity by nascent entrepreneurs and owner-managers of young businesses affects economic growth, but the sign of the effect depends upon the level of GDP per capita. In developed countries, the impact of entrepreneurship on GDP growth turns out to be positive, while for developing countries the results imply a negative impact of entrepreneurship on GDP growth. In line with these evidences, entrepreneurship seems to play a different role in countries at different stages of economic development.

2.4.3 Entrepreneurship and innovation

After reviewing some recent evidence on the positive impact of business creation on economic growth, we direct our attention to the channel through which different types of entrepreneurship (in particular, Knightian and Schumpeterian entrepreneurship) might affect economic performance.

Van Praag and Versloot (2007, 18–19) review studies that have tried to verify the relationship between firms' characteristics (*e.g.* size and age) and their innovation activities. They examine the results of 16 micro-level (*i.e.* business-level) studies published in the period 1995–2007 focusing on innovation activities of businesses in individual countries. The starting point of their analysis is the definition that entrepreneurship embraces businesses with less than 100 employees, businesses younger than 7 years, and new entrants. All other businesses form a control group *and* are referred to as the counterparts of entrepreneurial businesses. Nevertheless, van Praag and Versloot (2007) arrive at the following conclusions:

- Entrepreneurial businesses invest no more in innovation than do their counterparts (in terms of R&D expenditure per employee);
- Entrepreneurial businesses seem to be more efficient in the production of innovations than their counterparts (i.e. have more patents per employee and they are cited more often);
- The commercialization of innovations (in terms of the share in sales) is relatively high for entrepreneurial businesses;
- Entrepreneurial businesses and their counterparts are equally likely to adopt low cost innovations, whereas the counterparts are more likely to adopt higher cost innovations.

Van Praag and Versloot (2007) conclude that entrepreneurial businesses and their counterparts contribute equally importantly to innovations in society. The results of their

study, however, indicate that entrepreneurial firms tend to be more efficient in their innovative activities and that innovations are more important for entrepreneurial businesses than are their counterparts.

Reviews of the older studies provided by Baldwin and Scott (1987), Cohen and Levin (1989) and Acs and Audretsch (1990) point to a divergence of the research results regarding the link between small (presumably entrepreneurial) businesses and innovation activities. A broadly cited study in this respect is the one by Acs and Audretsch (1988), who investigate the connection between industry innovations (*i.e.* new processes, products and services) and industry structure (*i.e.* competitiveness as measured by the dominance of firms of a specific size and entry barriers) in the United States. They show that there is relatively more innovation in sectors where large firms dominate, though innovation activity occurs mostly in the smaller businesses of those industries. They conclude that small firms innovate in order to remain competitive in environments with lower levels of concentration. Recently, Dolfsma and van der Panne (2008) estimated the same relationship using Dutch data. Their results depart from those of Acs and Audretsch (1988) and show that sectors where SMEs predominate are more innovative.

The results presented above highlight the importance of Knightian entrepreneurship for innovations in society. The link between Schumpeterian entrepreneurship and innovation is an unexplored area and calls for further research. Advances in this field are hampered by poor sources of data for indicators of Schumpeterian entrepreneurship (*e.g.* business dynamics indicators and nascent entrepreneurial activity index) on one hand, and unclear distinction between indicators of innovativity and indicators of Schumpeterian (innovative) indicators on the other. We came across two studies that are worth mentioning in this respect. The first is the macroeconomic cross-country study of Wennekers *et al.* (2005), who regress GEM 2002 data for nascent entrepreneurship in 36 countries on the index of innovative capacity (taken from World Economic Forum's 2001–2002 Global Competitiveness Report). They find evidence of the U-shaped relationship between entrepreneurship and innovations and show that the correlation for more developed countries such as the United States and Europe is positive. The second is the study of Acs and Varga (2005), who regress the number of patent applications in selected industries on different indicators of (innovative) entrepreneurship (GEM total early-stage entrepreneurial activity index, the level of R&D expenditure, total number of patents available in the economy, and a proxy of agglomeration of researchers). Using 2001 data for 9 European countries, they conclude that entrepreneurship has a significantly positive but weak impact on innovations in the analysed European countries.

The theoretical model we develop in the monograph, demonstrates how the entry of new businesses (as one of the indicators of Schumpeterian entrepreneurship) can be related to product innovations; the model therefore relates business creation to innovative activities. While it is difficult to empirically test a direct relationship between business dynamics and

innovativity, it is nonetheless possible to analyse certain mechanisms that highlight this relationship. We attempt to do so in the empirical part of the monograph, where we test the hypotheses of the monograph and related qualitative predictions of the theoretical model.

2.5 Economic determinants of entrepreneurship: A brief survey

A large body of empirical research in economics has investigated what determines the individual's decision to become an entrepreneur (*i.e.* to establish a business and/or become self-employed). While some other social scientists devote much attention to the role of personal characteristics and social networks, economists mostly focus on the role of institutions and economic policies. In the monograph, we are especially interested in the impact of labour market institutions and policies on entrepreneurship, but take into account also other factors that might affect the amount of entrepreneurship. This will be especially important in the empirical part of the monograph that focuses on the impact of labour market variables on entrepreneurship, where it is important to control for factors that interfere with a specific causal relationship.

This subsection provides an overview of empirical studies that investigate the role of institutions and economic policies for entrepreneurship measured by different indicators. We divide these studies into two main groups. The first group comprises studies related to self-employment and business ownership, which may be used as proxies for Knightian entrepreneurship. The second group consists of studies examining factors of business dynamics, which may serve as a proxy for Schumpeterian entrepreneurship.

2.5.1 Economic determinants of self-employment and business ownership

Determinants of self-employment and business ownership rates are summarized by Wennekers (2006). He divides major determinants of self-employment and business ownership into two groups: economic indicators and demographic variables. We supplement his list on economic indicators. The review of the results of the studies investigating the effects of demographic variables on entrepreneurship is beyond the scope of this section.

Earlier empirical studies (*e.g.* Acs *et al.* 1994; Yamada 1996) suggest that *the stage of economic development* (measured by GDP per capita) negatively affects the self-employment rate. There is, however, some evidence of the reversal of this relationship in highly developed economies, especially if a harmonized dataset for the self-employment rate is used, considering also incorporated business owners (the so-called business ownership rate). The empirical study of Carree *et al.* (2002) confirms a *U-shaped* relationship between the business ownership rate and the stage of economic development. This pattern might be related to the structure of the economy. Namely the business ownership rate is in general considerably higher in the services sector than in manufacturing. Economies with a high share of broadly

defined service sector in the economy thus exhibit high business ownership rates compared to economies with a relatively small share of the service sector (van Stel and Carree 2004).

Empirical studies that investigate the influence of *labour market institutions* on self-employment rate or business ownership rate lead to the following conclusions:

- The level of entrepreneurial income relative to the wage rate positively affects the self-employment rate.[42] This relationship is among others affected by the relative bargaining power of trade unions. Relative union bargaining power measured by union density is found to have a negative effect on the business ownership rate in the OECD countries (Ilmakunnas and Kanniainen 2001; Kanniainen and Vesala 2005).
- Unemployment benefit replacement rate and other social security entitlements in general negatively affect self-employment or business ownership rate, as shown by Carrasco (1999) for Spain, and by Parker and Robson (2004) and Kanniainen and Vesala (2005) for the OECD countries. A common interpretation is that an increase in unemployment benefit entitlements increases the opportunity costs of entrepreneurship.
- The relationship between the relative minimum wage and self-employment appears to be negative (empirical evidence for the United States is provided by Bruce and Mohsin 2006, Garrett and Wall 2005, and Kumar and Schuetze 2009). The minimum wage acts as an opportunity cost to an entrepreneur and sets a lower bound on the wages of workers employed by an entrepreneur. In the United States, for example, there is a large share of self-employed in industries that rely on low-wage workers. For such small businesses, an increase in the minimum wage makes it more difficult to remain profitable (Garrett and Wall 2005, 16–17).
- Robson (2003) shows that the strictness of employment protection legislation did not significantly affect the self-employment rate in thirteen OECD countries from the mid-1960s to mid-1990s. Differently, Kanniainen and Vesala (2005) find evidence on a significantly negative relationship between different measures of employment protection legislation and self-employment rate, using pooled quinquennial data from 19 OECD countries over the period 1978–1998.

The impact of *unemployment* – which is found to be affected by different labour market institutions – on self-employment, is less clear. Due to fewer chances of finding a paid job, the high unemployment rate may push individuals into self-employment, which is sometimes called self-employment out of necessity.[43] Additionally, high unemployment in low regulated

[42] Refer to Parker (2004, 68-70) for a survey of the empirical evidence for this relationship.

[43] Blanchflower (2004) and Rissman (2003) argue that many individuals choose self-employment due to limited job opportunities. Empirical studies show that unemployed workers are two to three times more likely to become self-employed than wage employed workers; see Evans and Leighton (1989)

labour markets lowers the pressure on wages and salaries of workers and thus decreases the opportunity cost to a potential entrepreneur. However, in case of relatively high unemployment benefits and social transfers, unemployment does not necessarily force individuals to start their own businesses. Blanchflower and Oswald (1998) and Blanchflower (1998, 2000) provide evidence that the negative impact of unemployment on (variously defined) self-employment rates prevails in most OECD countries.

In line with common wisdom, *taxes* influence human behaviour in the following basic manner: a value added tax and a sales tax reduce personal consumption, personal income taxes reduce the incentive to work, corporate income taxes reduce the incentive to start or expand a business, and capital gains taxes reduce the incentive to invest (Garret and Wall 2005, 8). The empirical evidence on the relationship between *fiscal policy variables* and self-employment rate suggests:

- Personal income tax rate positively influences self-employment (Parker and Robson (2004) for the OECD countries; Schuetze (1998) for the United States and Canada; Garret and Wall (2006) for the United States). In case of high level of taxation, individuals are presumably motivated to enter self-employment in order to legally optimize their tax liability by tax planning or to increase the opportunity for tax evasion. Bruce (2000) investigates the effects of changes in the payroll tax treatment of self-employment income *vis-à-vis* wage income in the United States. He suggests that an increase in the average tax rate applied to self-employment income (keeping the average tax rate for wages unchanged) decreases the probability of entry into self-employment and lowers the probability of exit from self-employment. On the other hand, an increase in the marginal tax rate for self-employment income (keeping the marginal tax rate for wages unchanged) increases entry into self-employment. The first (negative) impact is related to the change in the relative net (after-tax) return on alternative forms of labour. The second (positive) impact might be related to the incentive to evade or avoid taxes. Investigating the effects of the 1986 and 1993 income tax reforms in the United States, Moore (2004) on the other hand finds no evidence of a consistently significant effect of (personal and corporate income) tax changes on self-employment.
- Employer's social security contributions negatively affect self-employment (Parker and Robson (2004) for the OECD countries).

Ilmakunnas *et al.* (1999) analyse the relationship between *income inequality* (Gini coefficient) and self-employment rate. Let us just mention that income disparity is partly related to labour market institutions and the fiscal policy of a country. For the OECD countries, the authors (*ibid.*) find evidence of a positive relationship between the measure of degree of income

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and Kumar and Schuetze (2009) for the United States, Kuhn and Schuetze (2001) for Canada, Carrasco (1999) for Spain.

inequality and self-employment rate. However, the reversed causality cannot be ruled out. More evidence is needed to reach conclusions for this relationship.

A set of *financial variables* that have been subject to investigation in relationship to self-employment includes personal wealth, inheritances, housing prices, and access to venture capital. Theoretical models (*e.g.* Evans and Jovanovic 1989) well demonstrate the negative impact of liquidity constraints for start-ups on entrepreneurship, which is supported by several empirical studies (*e.g.* by Holtz-Eakin *et al.* 1994, Blanchflower and Oswald 1998, and Quadrini 1999). Hurst and Lusardi (2004), however, cast doubt on this relationship.

Many of the above relationships are influenced by the prevailing perception in society about future business prospects and the level of uncertainty avoidance (the degree of risk-aversion) in a country or culture. The better the anticipated future prospects, the greater is the propensity to entrepreneurship. By contrast, the higher the level of uncertainty avoidance the lower are the prospects for entrepreneurship.

The Fraser Institute (2010) publishes the *economic freedom index*, which contains measures of the quality of institutions in five areas: the size of government and taxation, private property and the rule of law, access to sound money, trade regulation and tariffs, and regulation of business, labour and capital markets. Hall and Sobel (2006) argue that creative individuals are more likely to engage in productive market entrepreneurship, like product innovation in areas with a good institutional setup reflected in the high value of the Fraser Institute's index of economic freedom. By contrast, rigid institutions motivate individuals to engage in unproductive or even destructive entrepreneurship (using Baumol's (1990) terminology) to capture transfers of existing wealth through manipulation of the political or legal process (*e.g.* by lobbying). Kreft and Sobel (2005) provide some empirical evidence that the institutional structure as measured by the Fraser Institute's index of economic freedom affects entrepreneurial activity (measured by the number of sole proprietors), which is the source of economic growth. Hall and Sobel (2006) expose Ireland and Estonia as good examples of countries where proper institutional reforms have contributed to higher economic growth. The results of the analysis of the relationship between the business ownership rate and the Fraser Institute's freedom index provided by Nyström (2008) confirm that in the OECD countries a smaller government sector, better legal structure with higher security of property rights and less regulation of credit, labour and business markets tend to increase the self-employment rate.

Educational attainment of individuals might also appear as relevant in determining the level of entrepreneurship. However, empirical studies that have investigated the impact of education (one of the indicators of human capital) on the occupational choice of individuals give rather

mixed results. Van der Sluis *et al.* (2008) provide a meta-analytic review[44] of almost a hundred studies conducted in the period 1980–2002 that measure the impact of formal schooling on entrepreneurship selection and performance in industrial countries. While the results show that there is no evidence of a systematic relationship between an individual's level of education and the probability of selection into entrepreneurship, they suggest the positive influence of formal education on entrepreneurial performance measured in various manners (*e.g.* as earnings, profits, survival and growth of businesses). As argued by Le (1999), the ambiguous effect of education on (entry into) self-employment might be explained by two effects of education on occupational choice that work in the opposite direction and presumably cancel out. On one hand, education enhances managerial ability and increases the probability of becoming self-employed. On the other hand, a higher level of education may generate better outside options, which decreases the likelihood of becoming an entrepreneur instead of a wage employee. Thus, the theory does not yield a clear prediction on the overall effect of education on self-employment (van der Sluis *et al.* 2008, 797–798). Dickson, Solomon, and Weaver (2008) examine thirty post-1995 studies that measure the relationship between education and entrepreneurship. Their results are somewhat different from the conclusions drawn by van der Sluis *et al.* (2008). Dickson, Solomon, and Weaver (2008) conclude that an individual's educational level is positively associated with the probability of selection into entrepreneurship (or self-employment).

2.5.2 Economic determinants of business dynamics

Due to the lack of timely consistent and internationally comparable data on business dynamics there are few comprehensive empirical studies examining the determinants of business creation and destruction. New business creation has been recognized as an important engine of economic growth, which calls for additional analyses that would contribute to a more complete picture of the business environments that promote new business creation.

Before presenting the results of studies investigating the determinants of business dynamics (in particular business creation), let us devote few lines to a diagram by Hall and Sobel (2006) depicting the process of transformation of economic inputs and resources into entrepreneurial outcomes (*i.e.* new goods, new businesses, patents). Figure 2.3 demonstrates that the amount of entrepreneurial outcomes generated from a given amount of economic inputs depends

[44] Van der Sluis *et al.* (2008) employ meta-regression analysis (MRA) as a quantitative tool to synthesize previous research findings on the effects of education on selection into entrepreneurship (self-employment) and entrepreneurial performance. The database contains journal articles, book chapters, and working papers published after 1980 and before December 2002 that relate education to: (i) entry into entrepreneurship (self-employment), (ii) stock of entrepreneurship (whether an individual currently is an entrepreneur), and (iii) the various entrepreneurial performance measures (such as earnings, profits, survival and growth of businesses).

primarily on the rules of the game (*i.e.* institutions) under which entrepreneurs operate. These are formed by public policies, among which is also the labour market policy. Hall and Sobel (2006) argue–and many studies confirm–that improving the rules of the game for entrepreneurs may positively affect the entrepreneurial outcome.

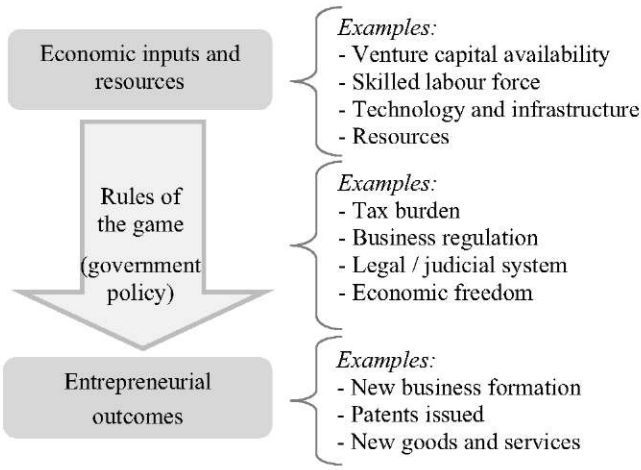

Figure 2.3: The process of transformation of economic inputs and resources into entrepreneurial outcomes

Source: Hall and Sobel 2006, 5.

Empirical studies have addressed various economic determinants of business dynamics. We classify them into the following groups: development of the financial sector (influencing the ease of financing entrepreneurial ventures), product market regulation (including administrative procedures regarding business start-ups and business operation), property rights legislation, judicial system (guaranteeing contract enforcement), labour market regulation, and taxes and duties related to work and business operation. In the context of Figure 2.3, development of the financial sector represents an economic input into the entrepreneurial process, while product and labour market regulation, tax and property rights legislation, and judicial system constitute the rules of the game that govern the behaviour of businesses and individuals.

The start-up of new businesses often requires substantial capital. Lack of capital due to poor development of the capital market or (at micro level) due to the personal financial background of a potential business founder, may divert people from starting up their own businesses. This suggests that entry rates should be lower in countries with less developed financial systems. In an article analysing the evolution of financial development across countries in the 20th century, Rajan and Zingales (2003) emphasize the importance of the level of financial development for business creation and economic performance. They measure financial

development by the ease of obtaining finance for a sound entrepreneurial project and by the confidence with which investors anticipate an adequate return (*ibid.* 9). They argue that a well developed financial system weakens the opposition of incumbent businesses and facilitates the entry of newcomers.

There is considerable evidence suggesting that favourable financial development fosters business creation. Let us briefly review the most recent. Klapper, Laeven and Rajan (2006) employ the Amadeus data set of more than 3 million firms from 21 European countries to show that financial development positively affects new firm creation in sectors that are more dependent on external financing. Alfaro and Charlton (2006) analyse the same relationship using an even more abundant firm-level data set from WorldBase (compiled by Dun and Bradstreet) referring to years 1999 and 2004. On the final sample of about 24 million firms in nearly 100 countries, they find that reducing restrictions on international capital flows enhances firm entry. More evidence on the positive impact of financial system development on new firm entry is provided by De Serres *et al.* (2006), who created their own more or less comparable dataset on firm entry in 25 OECD countries by merging data from different sources (OECD firm-level database, Eurostat Structural Business Statistics database, World Bank Group). Moreover, using harmonized firm-level data for 16 industrialized and emerging economies, Aghion, Fally and Scarpetta (2007) replicate the findings from Klapper, Laeven and Rajan (2006) that financial development fosters new firm entry in sectors that depend more heavily upon external finance and the entry of small firms. Financial development, however, appears to have either no effect or even a negative effect on the entry of large businesses. Aghion, Fally and Scarpetta (2007) also conclude that both private credit and stock market capitalization are important for promoting the entry of businesses. Chavis, Klapper, and Love (2010) analyse what types of financing are important for new businesses relative to older ones. By examining a unique firm-level database that contains over 70,000 firms in over 100 countries (constructed from 170 World Bank Group's Enterprise Surveys) they conclude that in all countries younger firms have less reliance on bank financing and more reliance on informal financing. They also find that the access to bank finance for younger firms is relatively better in countries with better rule of law. They suggest that improvements to the legal environment and credit information infrastructure are disproportionately beneficial for promoting access to formal finance by young firms.

There are several institutions (forming the rules of the game) that might appear relevant for business dynamics. We separately address product and labour market regulation, property rights legislation and income taxes.

Product market regulation refers to a set of regulations that might restrict competition in the product markets. Indicators of product market regulation constructed by the OECD summarize information on economy-wide and industry-specific regulatory provisions that cover the following areas (Conway *et al.* 2005, 9):

- state control of business enterprises (public ownership and government's involvement in business operations with price and other means of controls);
- legal and administrative barriers to entrepreneurship (licenses and permits systems, administrative burden of interacting with government, administrative burdens for corporations and sole-proprietors, legal limitations on the number of competitors allowed in a business sector, antitrust exemptions);
- barriers to international trade and investment (foreign ownership barriers, most-favoured-nation tariffs, discrimination against foreign firms at the procedural level, regulatory barriers to international trade and foreign investment).

Stringent *product market regulations* are expected to impede the entry of new businesses and to lower competition amongst incumbents. Scarpetta *et al.* (2002) provide one of the most thorough studies on the role of policy and institutions for business dynamics using two types of data: a firm-level database for ten OECD countries and industry-level data for a broader set of countries. Their regressions show a negative and in most cases statistically significant influence of the stringency of product market regulation on firm entry rates. Administrative regulations of entrepreneurial activities seem to have a particularly strong negative effect on business entry rates. By controlling for the size of firms, they also find out that product market regulations are more likely to hinder market access of small and medium-sized firms.

Klapper, Laeven and Rajan (2004, 2006) provide a cross-country study on the role of entry regulations, especially the cost of fulfilling the *bureaucratic requirements* to register a limited liability company, for new business entries. Using the Amadeus data set covering more than 3 million firms from 21 Western and Eastern Europe countries, they calculate entry at the two-digit NACE[45] industry level averaged over the years 1998 and 1999. For the United States, they employ the comparable Dun & Bradstreet data set covering 7 million corporations. They conclude that costly entry regulations hamper the creation of new firms, especially in industries that naturally have high entry. They also find that, by discriminating against small firms, entry regulations increase the average size of successful entrants in high-entry industries. More evidence that business entry regulation in general impedes the setting up of businesses is provided by Djankov *et al.* (2002), Desai, Gompers and Lerner (2003), World Bank (2004), and Loayza, Oviedo and Servén (2005).[46] Studies in general conclude that detailed and *costly bureaucratic processes* related to licence and permission applications and cthe omplicated procedure for legal registration of an incorporated on non-incorporated business might divert potential entrepreneurs from starting their own business. However,

[45] NACE (Nomenclature statistique des Activités économiques dans la Communauté Européenne) stands for the Statistical Classification of Economic Activities in the European Community.

[46] A survey of the literature examining the effects of making business entry easier is provided by Djankov (2008).

bureaucratic entry barriers have been shown to impede entry in countries with relatively little corruption, while in corrupt countries entry barriers can be circumvented (Djankov *et al.* 2002; Klapper, Laeven and Rajan 2004, 2006). Additionally, Klapper, Laeven and Rajan (2004, 5) warn that in industrialized countries not all regulations inhibit entry. Regulations in some areas may even positively affect new firm formation, for example accounting standards and their stricter enforcement that improve the functioning of the financial sector.

Another factor that might affect business creation is *protection of intellectual property*. Strong patent protection, for example, excludes imitators for a certain period out of the market and in this way protects incumbent firms that own the patents. Small entrants often do not have enough finance or intellectual capital to invent new products and procedures and/or to patent them and might see their business opportunity as imitators. Thus, strong patent protection might impede firm entry. On the other hand, individuals might be motivated to innovate and enter the market (despite being small) if they know that the output of their research will be legally protected. Klapper, Laeven and Rajan (2006, 620) conclude that countries that better protect intellectual property have more entry in R&D intensive industries. The result is robust to a choice of the indicator (World Economic Forum's measure of intellectual property rights versus the Heritage Foundation's property rights index). Their findings are in line with the conclusions of Claessens and Laeven (2003).

Labour market regulation in the form of *employment protection laws* might affect industries in different directions. Compliance with employment protection laws prevents a firm from firing its employees or makes it costly to do so. Strong employment protection might be particularly costly for small businesses, which are expected to face bigger problems with keeping their employees through economic downturns than do their larger counterparts. From this point of view, strict employment protection is expected to inhibit entry of new businesses, particularly small ones. On the other hand, employment protection laws protect employees and give them the confidence to join small and newly born firms (Klapper, Laeven and Rajan 2006, 619–620). The results of the empirical study provided by Scarpetta *et al.* (2002) show the negative overall effect of strict employment protection legislation on the entry of small- and medium-sized firms. Klapper, Laeven and Rajan (2006) support these findings by adding the convincing evidence that strong employment protection hampers the entry of small- and medium-sized firms in labour intensive industries. There are two more studies confirming the negative effect of tight employment protection legislation on business creation. Using a harmonized firm-level database that involves 16 industrial, developing and emerging economies and covers the 1990s, Haltiwanger, Scarpetta and Schweiger (2006) find that stringent hiring and firing regulation has a relatively large adverse impact on the entry and exit of small firms and their associated job creation and destruction. Lately, Aghion, Fally and Scarpetta (2007) confirm significantly negative impact of stringent employment protection on the creation of firms of most size categories, in particular in sectors that are characterized by more volatility in employment.

Some evidence on the detrimental effect of labour market regulations on firm entry and exit rates is provided also by Loayza, Oviedo and Servén (2005). They run regressions of entry, exit and turnover rates (using industry-level data and, alternatively, country-level data for the manufacturing sector) on the product market regulation index, labour market regulation index, and the index of fiscal burden imposed through direct taxation. The index of labour market regulation they employ combines the union density (*i.e.* the percentage of workers that belong to a union), the minimum mandatory working conditions, and the regulation on firing and hiring of workers. The regressions of the industry-level entry and exit data for 12 European and Latin American countries and the United States covering the period 1990–2001 on the aforementioned indices give evidence of the negative impact of labour market regulation on business entry and exit. The result holds for both variants of the regression: the first variant with the usual entry and exit rates, and the second variant where entry and exit rates are corrected for the impact of economic shocks. However, regressions with aggregated (country-level) turnover rates in the manufacturing sector disclose no significant relationship between labour market regulation and firm turnover rates. The study of Loayza, Oviedo and Servén (2005) shows no robust evidence on the (direction of the) impact of fiscal regulation on firm dynamics (entry, exit and turnover rates).

While several studies investigate the relationship between labour market institutions and static indicators of entrepreneurship, such as self-employment rate or business ownership rate, there is little empirical research relating individual labour market institutions (*e.g.* unionization rate, relative unemployment benefits, the level of labour income taxation) to business dynamics. OECD (2002a, 7), for example, recognizes that product and labour market institutions are important determinants of business creation and economy-wide productivity improvements. More precisely, they posit that strict hiring and firing rules, minimum wage provisions and administrative extension of collective agreements can raise the costs faced by new entrants, which are often small-sized firms, and may therefore impede business creation. OECD (2002a), however, provides no empirical evidence on the impact of minimum wage provisions and administrative extensions of collective agreements on business creation. The impact of labour market institutions (in particular, bargaining power of trade unions, unemployment benefit replacement rate, and labour income taxes) on business creation is one of the cores of the monograph and is analysed theoretically in sections 3 and 4, and empirically in section 5.

3 THE IMPORTANCE OF LABOUR MARKET INSTITUTIONS

The hypotheses of the monograph suggest that labour market institutions have the power to affect economic performance directly through the labour market and indirectly by affecting entrepreneurial ventures and efforts. In this section, we first provide motivation to study labour market institutions and then shed some light on the mechanisms through which labour market institutions might affect entrepreneurship.

3.1 Motivation to study labour market institutions

In the 1970s and until the mid 1980s, Monetarist and new Keynesian economists and policy-makers favoured macro-economic explanations and policy measures to stabilise an economy and boost economic growth. As Freeman (2008, 3) noted, labour market institutions were treated as more or less peripheral to economic performance in this period. Economic patterns after the mid 1980s have alluded to the possible role of labour market institutions in explaining differences in aggregate economic performance and have brought labour market institutions into the centre of research interest of many theoretical and empirical economists.

Europe's performance regarding the labour market has been relatively poor in the last three decades. As shown in Table 3.1, the average employment rate in the EU-15 was lagging behind employment rates in the United States, New Zealand, Canada, Australia, and Japan throughout the period 1980–2007.

Table 3.1: Employment trends around the world in the period 1980–2007

Year(s)/Country	EU-15	United States	Canada	Japan	Australia	New Zealand	NMS-6
Employment rate (in %)							
1980	63.15[1]	67.20	66.10	66.80	65.20	-	-
1990	60.89	72.00	67.00	69.30	66.00	68.00	61.52
1995	61.39	72.50	67.50	69.20	67.70	70.10	61.48
2000	65.40	74.10	70.90	68.90	69.30	70.70	59.43
2007	68.17	71.80	73.60	70.70	72.90	75.40	63.00
1980-1994	61.43[2]	69.66	67.11	67.79	65.22	68.27[3]	-
1995-2007	64.95	72.57	70.65	69.24	69.52	72.12	60.67
Annual growth of employment rate (in %)							
1980	0.27[1]	-1.03	1.07	0.00	1.24	-	-
1990	-0.50	1.12	0.75	-0.29	2.01	2.87	-0.85
1995	0.85	0.69	0.75	-0.14	2.58	3.09	0.00
2000	1.69	0.27	1.29	0.00	1.32	0.86	-1.32
2007	1.05	-0.28	0.96	1.00	0.97	0.27	1.98
1980-1994	-0.07[2]	0.39	0.16	0.25	0.16	-0.76[3]	-
1995-2007	0.92	-0.02	0.73	0.16	0.77	0.80	0.21

Note:

Employment rate expresses the share of persons of working age (15 to 64 years) in employment. Growth rates of employment rates for individual countries over the observed period are calculated as geometric averages of annual growth rates.

EU-15 stands for the European Union up to 2004; NMS-6 stands for six of the EU countries that joined the EU in 2004 (Czech Republic, Estonia, Hungary, Poland, Slovakia, and Slovenia). For EU-15 and NMS-6 we report non-weighted arithmetic averages.

[1] Includes only 8 of the EU-15 (Finland, France, Germany, Italy, the Netherlands, Portugal, Spain, and Sweden).

[2] Includes all EU-15 apart from Austria. For some countries shorter series are included (starting at the latest from 1983/84).

[3] Refers to the period 1986–1994 (for employment rates) and 1987–1994 (for growth in employment rates).

Source: OECD (2009a).

According to unemployment rates, the EU-15 and EU-6 (as defined below, Table 3.1 and Table 3.2) were also performing poorly relative to the United States and Japan ever since the mid 1980s and until the onset of the economic crisis in 2007. However, unemployment rate in the United States almost doubled in 2009 relative to 2007. This could partly be due to the relatively flexible labour market. In the EU-15, the increase was for around 35 percent and the unemployment rate in 2009 was for the first time below that in the United States. However, since the beginning of 2010 the unemployment rate in the United States has been relatively stable or has even shown a loose downward movement, while the average unemployment rate in the EU-15 does not yet show a tendency to decrease.

Table 3.2: Unemployment rates (in %) around the world in the period 1980–2009

Year(s)/Country	EU-6	EU-15	United States	Canada	Japan	Australia	New Zealand	NMS-6
1980	5.5	-	7.1	7.5	2.0	6.1	2.2	-
1985	9.7	-	7.2	10.6	2.6	8.3	4.2	-
1990	7.2	6.8[1]	5.6	8.1	2.1	6.7	8.0	-
1995	10.5	9.3	5.6	9.5	3.1	8.2	6.5	10.2
2000	7.0	6.5	4.0	6.8	4.7	6.3	6.1	11.6
2007	6.1	6.2	4.6	6.0	3.9	4.4	3.7	7.2
2009	9.1	8.4	9.3	8.3	5.1	5.6	6.1	9.5
1980-1994	8.6	7.8[2]	7.0	9.7	2.5	8.1	6.2	-
1995-2007	7.9	7.4	5.0	7.7	4.3	6.5	5.5	10.1
2008-2009	7.6	7.2	7.6	7.2	4.6	4.9	5.2	8.0

Note:

EU-6 consists of Belgium, Italy, the Netherlands, Spain, Sweden and United Kingdom. For EU-15 and NMS-6 see the note below Table 3.1. For EU-15 and NMS-6 we report non-weighted arithmetic averages.

1 Includes all EU-15 apart from Austria and Germany.

2 For some countries shorter series are included.

3 Refers to the period 1986–1994.

Source: OECD (2010g).

3.2 Literature on labour market institutions and economic performance

Economists, who were occupied by persistent unemployment before the late 1970s (often referred to as Keynesians), generally explained unemployment by nominal wage rigidity, which was assumed rather than explained. In the early 1980s, economic theorists (mostly New Keynesians) started developing theories that explain real wage rigidities.[47] As high levels of unemployment in the EU-15 seemed to be reluctant to Keynesian and other conservative strategies, researchers were trying to come up with new explanations. Although some foundations were laid down already in the 1980s (by Diamond 1982, Mortensen 1982, and Pissarides 1985), the early 1990s can be seen as a shift from investigating contract (or real wage) rigidities to investigating the broad category of labour market rigidities (Guerrazzi and Meccheri 2009, 4–5). The latter refer to wage setting institutions (minimum wage legislation and collective bargaining arrangements), unemployment benefit system, employment protection legislation, and labour income taxation.

A range of theoretical macroeconomic models have tried to jointly qualify the implications of *labour and product market regulation* for macroeconomic performance and thus to highlight the mechanisms through which certain effects might be realized (*e.g.* Blanchard and Giavazzi 2003; Amable and Gatti 2004; Ebell and Haefke 2006). These are mostly models of

[47] McDonald and Solow (1981), Diamond (1982), Mortensen (1982), Rubinsten (1982), Shapiro and Stiglitz (1984), Pissarides (1985), and Akerlof and Yellen (1986).

monopolistic competition in the product market with different kinds of imperfections in the labour market (*e.g.* efficient bargaining, search and matching frictions on the labour market, and efficiency wage mechanism). The two types of regulations are often jointly investigated, since one affects the other. These studies in general conclude that making either the labour or the product market more competitive will to some extent lead to higher employment, aggregate output, and welfare. While the deregulations are the long-term welfare improving, they might cause short-term costs in terms of lower rents and wages. These models, however, do not take entrepreneurship into account.

The significant variation in *labour market institutions* across countries around the world has motivated economists to empirically investigate the impact of labour market institutions on economic performance. Checchi and Lucifora (2002), ECFIN (2004, 18–19), Baker *et al.* (2004), Bassanini and Duval (2006) – and recently Eichhorst, Feil and Braun (2008) – provide exhaustive overviews of empirical studies examining the real effects of labour market institutions. In general, they suggest that unemployment is positively related to generous unemployment benefits, to a high tax wedge, and to a high collective bargaining coverage (this is among others confirmed by Amable, Demmou and Gatti 2007 and Destefani and Mastromatteo 2009). On the other hand, active labour market policies and a high degree of coordination in wage bargaining unemployment tend to reduce unemployment. The roles of employment protection legislation and union density are less certain. While most of the earlier studies find no significant impact of union density on the unemployment rate, Amable, Demmou and Gatti (2007) suggest that the impact is positive. Some evidence about the link between labour market institutions and economic growth is provided by Nickell and Layard (1999), Blanchard and Wolfers (2000), Wyplosz (2000), Bertola, Blau and Kahn (2007) and IMF (2003).

The gap between abstract liberal economic beliefs and concrete agenda-setting efforts was bridged by the influence of the OECD (1994) Job Study on policy-making. The study recognized that due to labour market rigidities economies fail to adapt satisfactorily to changes, thus impeding employment and sustainable growth of output (OECD 1994, 30). Consequently, the OECD's recommendations to policy makers were to increase flexibility in working time, to make wages and other labour costs more responsive to market pressures, to weaken employment security provisions, to rethink the unemployment benefit systems, and to introduce active labour market policies. Different measures of labour market deregulation were in the first stage placed more or less independently on the agendas of most governments of EU-15 countries. In 2000, the EU-15 countries adopted the *Lisbon strategy* (European Council 2000) describing the priority objectives of the EU for the period 2000–2010. The employment part of the Lisbon strategy promotes policies for workforce activation (*i.e.* make-work-pay policies) and the concept of flexicurity (*i.e.* the coexistence of flexibility and security in the labour market). The Lisbon strategy attributes the highest level of importance to improving productivity performance along with achieving robust employment growth in

different groups of the active population. Although the targets set in 2000 were not literally reached, employment developments so far have been promising. There is evidence that labour market policies (such as the introduction of flexible employment contracts and working-hours arrangements alongside more employment-friendly wage bargaining practices) in pursuit of stronger job growth have been paying off (European Commission 2007).

3.3 Channels through which labour market institutions affect entrepreneurship

The career of an entrepreneur (Schumpeterian, Knightian or Kirznerian) might greatly differ from typical dependent employment. Let them be innovators, uncertainty-bearing business owners and managers, or persons alert to business opportunities, entrepreneurs have a high degree of freedom (*e.g.* freedom to hire others, freedom to organise their work, freedom to express their creativity) and independency. At the same time, they more directly depend on their own managerial and innovation abilities, alertness to business opportunities, and the business environment. What drives a person to become an entrepreneur, and how might labour market institutions affect this occupational decision? In this section, we match the empirical evidence on economic determinants of entrepreneurship with theoretical economic models illustrating the mechanisms through which labour market institutions affect entrepreneurship.

In line with the occupational choice theory, a person's choice to become an entrepreneur is affected by the present value of expected income stream related to entrepreneurship *vis-à-vis* alternative occupations (*i.e.* paid/dependent employment and unemployment). The relative income of an entrepreneur can be affected by different labour market institutions such as union bargaining power, minimum wage level, unemployment benefit system, and labour income taxation.

3.3.1 Union bargaining power, unemployment benefits and minimum wages

The standard result from the models of collective bargaining[48] (the right-to-manage bargaining model, efficient bargain model, and search-matching model) is that the negotiated wage rate is increasing in *trade union bargaining power*. The negotiated wage rate represents two different costs to entrepreneurs: an opportunity cost and, if they employ other people, labour cost related to business operation. Occupational choice models with imperfect competition in the labour market (the examples are Kanniainen and Vesala 2005, Kanniainen and Poutvaara 2007, and Kanniainen and Leppämäki 2009) in general suggest that an increase in union bargaining power leads to an increase in the bargained wage rate and, consequently, to a decrease in the number of entrepreneurs. Kanniainen and Leppämäki (2009) show in an

[48] A survey of alternative standard (and less standard) models is provided by Booth (1995).

occupational choice model with risk-bearing (Knightian) entrepreneurs that an increase in the relative bargaining power of trade unions raises the risk of entrepreneurial failure, thus discouraging entrepreneurship and reducing employment opportunities. They conclude that high price uncertainty, combined with strong trade unions that set wages above the competitive level, represent a harmful combination for entrepreneurship.

What also matters for entrepreneurship is the *generosity of the unemployment benefit system*. Unemployment benefit entitlements depend on the level of out-of-work incomes during spells of unemployment (*i.e.* unemployment benefits) and on the unemployment benefits duration. An increase in either of the two components increases the value of the workers' outside option, which improves the bargaining position of trade unions and drives the negotiated wage upwards. The negative impact of unemployment benefits on entrepreneurship through higher negotiated wages is demonstrated by Kanniainen and Vesala (2005) and by Kanniainen and Leppämäki (2009).

The above-mentioned occupational choice models focus on a decision between entrepreneurship and paid employment and disregard the fact that the unemployed may as well decide to become entrepreneurs. An increase in the negotiated wage rate (following an increase in the bargaining power of trade unions or an increase in the value of the outside option) might lower labour demand and increase unemployment. Some of the jobless persons might decide to escape unemployment by entering self-employment, which increases the number of entrepreneurs (at least in the Knightian sense). This is, for example, considered in Poshke (2008). Thus, we have different mechanisms at work, and what is the net result of their interplay is theoretically unclear. Empirical studies have provided some support for the negative impact of union density on self-employment or business ownership rate (Ilmakunnas and Kanniainen 2001; Kanniainen and Vesala 2005) and the negative relationship between relative unemployment benefits and self-employment (Carrasco 1999; Parker and Robson 2004; Kanniainen and Vesala 2005).

Kumar and Schuetze (2009) show in a search and matching framework with occupational choice that *higher minimum wage* and *higher unemployment benefits* reduce the number of entrepreneurs by lowering the transition rate of unemployed workers to self-employment. In a steady state of their model economy, (Knightian) entrepreneurs on average earn less than wageworkers, which is in line with the empirical literature. They confirm the theoretical model's predictions by estimating a transition equation (from unemployment to self-employment) using micro data for a sample of households in the United States covering the period 1977–96. Additional empirical evidence on the negative relationship between the relative minimum wage and self-employment rate is provided (for the United States) by Bruce and Mohsin (2006) and Garrett and Wall (2005).

3.3.2 Employment protection

Poschke (2008) provides a theoretical analysis of the impact of employment protection on entrepreneurship. In a search-matching model[49] with occupational choice, he analyses (besides other issues) what the impact of higher firing costs is on two types of decisions: a decision between paid employment and entrepreneurship and a decision between unemployment and entrepreneurship. He concludes that a longer expected duration of unemployment due to higher firing costs reduces the value of unemployment and prompts more of the unemployed to set up a business. Contrary, longer expected duration of unemployment in the case of entrepreneurial failure discourages workers/employees from entrepreneurship. Which of the effects prevails and what is the overall outcome for the number of entrepreneurs or entrepreneurial entry is theoretically indeterminate. Kanniainen and Vesala (2005), who take into account only the employee-entrepreneur decision, suggest that employment protection enhances the entrepreneurial risk and discourages entry. Empirical evidence about the relationship between the strictness of employment protection legislation and self-employment rate is somewhat mixed, while there is quite robust evidence on the negative relationship between tightness of employment protection legislation and business entry. Robson (2003) finds no evidence of a significant relationship between strictness of employment protection legislation and self-employment, while the regressions of Kanniainen and Vesala (2005) suggest a significantly negative relationship. Scarpetta *et al.* (2002), Klapper, Laeven and Rajan (2006) Haltiwanger, Scarpetta and Schweiger (2006) and Loayza, Oviedo and Servén (2005) provide evidence on the negative effect of strict employment protection legislation on the entry of new businesses, particularly small- and medium-sized.

3.3.3 Labour income taxation

An individual's occupational choice might also be influenced by *tax treatment of entrepreneurial income relative to wage and salary income.* The already mentioned theoretical model of Kumar and Schuetze (2009) suggests that a lower proportional wage tax and a higher proportional business tax (imposed on the income of self-employed persons) reduce the transition rate from unemployment to self-employment and therefore lower the

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[49] Search-matching models (the standard version is developed by Mortensen 1982 and Pissarides 1990) assume that labour market is characterized by job search and matching frictions (job search and vacancy filling are time-consuming and costly). The process of matching between workers and jobs is described by a matching function that determines the flow of new matches. Search and matching frictions induce unemployment. The wage is assumed to satisfy an axiomatic Nash bargaining solution. A worker and the firm split the gains from production in excess of this threat point (*i.e.* the value of unemployment for a worker and the cost of a vacancy for a firm).

self-employment rate. Using micro data for a sample of households in the United States observed over the 1970s and 1980s, Bruce (2000 and 2002) empirically tests the impact of differential tax treatment of the self-employed persons on both the entry and exit decisions. Bruce (2000) finds that an increase in the relative average tax rate for self-employment income decreases the probability of entry into self-employment. Surprisingly, he also finds (*ibid.* 2000 and 2002) that an exogenous increase in expected marginal tax rate on self-employment income (holding the wage tax rate constant) increases the probability of entry and reduces the probability of exit from self-employment. These results might be a sign of tax avoidance and/or tax evasion. Gordon and Cullen (2002), who use a sample of individual-level tax return data for the United States covering the period 1964–1993 (this period spans several important tax reforms), obtain different results. Their study gives the somewhat surprising result that personal income tax rate cuts in the United States reduced entrepreneurial activity. Since personal tax rates were cut, particularly at the top, a drop in entrepreneurial entry might be partly due to less publicly provided risk sharing, as described in the follow-up.

Another characteristic of a tax system that might affect entrepreneurial entry is *tax progressivity* (*i.e.* taxation at the average tax rate that rises with the level of income). Let us start our discussion by observing an entrepreneur who is a sole proprietor and is thus liable to pay (usually progressive) income tax. If the entrepreneur's exposure to uncertainty and high-level of abilities are compensated by a relatively high income, progressive income taxation might affect the allocation of individuals between entrepreneurship and paid employment. Progressive income taxation reduces the return to risky activities and thus acts as a tax on success, which may discourage risk-taking. In line with this reasoning, we expect the relationship between tax progressivity and entrepreneurship to be negative. On the other hand, progressive taxation might encourage entrepreneurial entry by providing some kind of insurance against negative business outcome, since a relatively bad business outcome also implies taxation at a lower tax rate, [50] or by taking into account motives for tax avoidance or tax evasion. Using micro data for a sample of households in the United States observed over the period 1979–1992, Gentry and Hubbard (2000) find evidence of a negative impact of an increase in personal income tax progressivity on the probability of entry into self-employment for the United States. However, they find no evidence that the entry into self-employment is affected by the level of the tax rate *per se*. In the monograph, we assume linear income taxes

[50] In case of progressive income taxation or taxation with imperfect loss offsets, successful entrepreneurs, who earn relatively high business profits, pay taxes at higher effective tax rates, while less successful entrepreneurs pay taxes at lower effective tax rates. By assuming risk-neutral individuals, this asymmetric tax treatment of entrepreneurial success can discourage entry into risky entrepreneurship. If we assume risk-averse agents, progressive taxation or a tax system with imperfect loss offsets encourages entry into risky entrepreneurship, because it provides a form of insurance against progressive income taxation, and taxation with imperfect loss offsets may thus serve as a *publicly provided risk sharing* (Gentry and Hubbard 2000, 283).

and leave aside the issue of tax progressivity, since this would additionally complicate the theoretical GE model.

The entrepreneur may decide to incorporate and pay taxes according to a *corporate income tax rate schedule*, which is proportional in many countries. Gordon and Cullen (2002) show theoretically how taxes can affect the incentive to be an entrepreneur, due to differences in tax rates charged on incorporated business profit relative to wage income. They also show that the decision to incorporate depends on differences in the tax treatment of business losses and profits through a progressive personal income tax rate structure and through the option to incorporate. Their (*ibid.*) theoretical and empirical analyses (the latter is for the United States) suggest that a cut in personal tax rates reduces total entrepreneurial activity, due to the following effects. As already mentioned, lower personal income taxes imply less publicly provided risk sharing, which makes self-employment less attractive to risk-averse individuals. Secondly, a reduction in personal income tax rate lowers tax savings from deducting business losses[51], which discourages risky business ventures. Additionally, fewer firms will decide to incorporate, since a lower personal tax rate (keeping corporate income tax rate unchanged) reduces tax savings from incorporation.

Incorporated or not, entrepreneurs might exploit tax avoidance (or even tax evasion) opportunities and significantly reduce their effective tax burden. Especially when payroll taxes (personal income taxes related to wage income, social security contributions, and other payroll taxes) are relatively high, employers are encouraged to contract-out work to self-employed workers. This artificially raises the self-employment rate as one of the measures of entrepreneurship. Some of these issues are addressed by Parker (2004, 249).

Summing up, the examined literature explains the mechanisms through which different labour market institutions can affect entrepreneurship. In line with the examined literature, union bargaining power and unemployment benefits in general negatively affect entrepreneurship in the form of self-employment or business ownership rate, while the effect of the level of income taxation on self-employment is unclear. The examined literature speaks about the impact of selected labour market institutions on Knightian entrepreneurship, while relatively little has been done on the impact of labour market institutions on Schumpeterian entrepreneurship in the form of business creation. In the subsequent sections of the monograph, we examine the impact of trade union power, unemployment benefit replacement rate, and tax rate on labour income for entrepreneurship in the form of business creation and (directly and indirectly) on economic growth. By theoretical and empirical examination of the impact of chosen labour market institutions on business creation, we test hypotheses 1 to 3.

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[51] For a sole proprietor, a deduction of the operating loss means that a loss from sole proprietorship can be deducted from the individual's personal income from other sources (*e.g.* from any salary, wages, income from business ventures or other earnings).

By empirical assessment of the direct impact of chosen labour market institutions on economic growth, we test hypothesis 5.

4 GENERAL EQUILIBRIUM (GE) GROWTH MODEL WITH INNOVATIVE ENTREPRENEURSHIP AND LABOUR MARKET RIGIDITIES

In this section, we build a GE model with the endogenous, more particularly, innovation-based growth and unionized labour market theoretically, in order to test hypotheses 1 to 3 that relate chosen labour market institutions to entrepreneurship in the form of business creation, and hypothesis 4 that relates business creation to economic growth. We therefore theoretically verify the thesis statement that entrepreneurship can serve as a channel through which labour market rigidities hurt economic performance in terms of employment and growth.

The main source of growth in the presented GE model is technological progress, which is driven by the continuous process of business entries and exits. For the sake of tractability of the model we assume that all technological progress is embodied in new businesses, which is in line with Schumpeter's (1911 [2002], 66) early ideas on the role of entrepreneurship. The model is parameterised, calibrated to match data for the EU-15 in the period 1995–2007, and simulated, to explore its predictions about the effect of labour market institutions on business dynamics and the impact of the latter on aggregate output growth. The model rationalises the evidence from previous research (Scarpetta *et al.* 2002; Bartelsman, Haltiwanger and Scarpetta 2004; Disney, Haskel and Heden 2003; Aghion *et al.* 2004; Foster, Haltiwanger, and Krizan 2001) that business entries and exits increase aggregate productivity growth by shifting resources from old and less productive businesses to new and more productive ones. Moreover, it shows how labour market policies and institutions may affect the process of creative destruction by affecting the occupational choice of individuals.

4.1 Introduction to the model

An extensive body of economic literature has examined the effects of labour market institutions on economic performance in terms of (un)employment, aggregate output, and economic growth (*i.e.* the growth of employment, aggregate output, and total factor productivity). The reviewed empirical studies provide robust evidence that labour market institutions do matter for aggregate economic performance. The mechanism through which labour market regulations affect macroeconomic performance has received less attention in economic literature – at least in relation to entrepreneurship. The reviewed empirical studies also provide some evidence that labour market institutions influence entrepreneurship (proxied by self-employment or business ownership rate, business entry rate and other indicators) and convincing evidence on the positive impact of entrepreneurship (in the form of business dynamics in particular) on economic performance. The following question naturally arises: (How) can entrepreneurship act as a channel of transmission of the effects of labour market regulation on macroeconomic performance?

The GE model of a closed economy, presented in this section, demonstrates how (innovative or Schumpeterian) entrepreneurs, as the bearers of business dynamics and technological

progress, transmit the effects of chosen types of labour market regulation onto the level of employment and aggregate output growth. Its purpose is not to provide an integral analysis of the determinants of employment and economic growth, but rather to theoretically establish the link between chosen labour market institutions, the creative destruction of businesses and macroeconomic performance. As argued by Aghion and Howitt (2004, 1), endogenous growth models are not solely a tool for understanding the macroeconomic structure of growth, but also a framework for understanding different microeconomic issues related to institutions, policies and incentives that may affect economic growth.

The model defines *the entrepreneur* as a relatively independent innovating agent, who brings new goods varieties to the market place and whose income depends on his/her innovating abilities. Innovations in the form of new product varieties are directly linked to new business creation, which is considered a good proxy for Schumpeterian entrepreneurship. The *labour market institutions* considered represent the trade union's relative bargaining power and the level of unemployment benefits or other social transfers. Since taxes in our model are collected with the aim of financing unemployment benefits, the two variables are directly related. *Macroeconomic performance* is measured in terms of the level of employment and aggregate output growth.

4.2 Literature review

The theoretical model we present is related to four strands of standard economic literature that will be described in this subsection. We start by describing the theory of economic growth, where the emphasis is on endogenous or new growth models. Then we move to occupational choice theory, which is embedded in our GE model of innovation-based growth. Since entrepreneurial innovations are motivated by the expected stream of future profits, we also briefly review the industrial organization literature that is most relevant for our model (more precisely, literature related to monopolistic competition). The combination of profit earning firms and workers with some bargaining power relative to firms opens up an opportunity for wage negotiations. Thus, we also refer to the theory of collective wage and employment bargaining.

4.2.1 Related economic growth theory

Until the late 1980s, economic growth had been theoretically explained mainly with physical capital accumulation, population growth, and exogenous technological progress (*i.e.* technological progress determined outside the system). The *exogenous growth models* (*e.g.* Solow's 1956 and Swan's 1956 models) predict that capital accumulation is insufficient for perpetual growth of output per capita, which is due to diminishing returns on capital as it is assumed that labour cannot be accumulated. A continual rise in per capita output is possible in exogenous growth models but fully depends on exogenous technological progress. While

exogenous growth models allow economic policy to affect economic growth (by affecting accumulation of capital) in the short run, they leave no space for the role of economic policy in affecting the long-run growth of per capita output. The exogenous growth model that is perhaps the most closely related to ideas in our work is the one introduced by Campbell (1998). The model shows how exogenous technological shocks[52] lead to entry of businesses that are advanced in technology and cleanse the economy of less efficient businesses, leading to higher productivity and output growth.

Endogenous growth models build on microeconomic foundations (*i.e.* incorporate incentives for individual behaviour) and make economic growth vulnerable to economic institutions and policies in the long run. Lucas (1988)[53] and Romer (1990b) have presented the pioneering models of endogenous growth, which internalize technological progress by introducing knowledge and human capital as explicit factors of production and show how technology, and therefore long-run growth depend on internal processes of the economy. Recently, Braunerhjelm *et al.* (2010) presented a theoretical model that establishes a link between knowledge accumulation and economic growth. In their model, entrepreneurship serves as one of the transmission mechanisms that convert the existing knowledge into economic relevant knowledge and drive economic growth. Since entrepreneurship is endogenous to the system, this opens up a possibility for economic policy to enhance commercialization of knowledge and economic growth by stimulating entrepreneurship through lowering administrative and other obstacles.

Innovation-based models present another strand of endogenous growth theory. In the models of Romer (1990a) and Grossman and Helpman (1991, chapter 3) innovations appear in the form of new product varieties, where the quality of new varieties is comparable with that of the old product variables. By increasing the diversity of products available at the market place, innovations drive economic growth. These types of models are called *variety-expansion models of growth* or *growth models with horizontal innovations*. Differently, in the models of Aghion and Howitt (1992), Grossman and Helpman (1991, chapter 4), Segerstrom (1998), and their followers, innovations result in technologically more advanced or higher-quality intermediate product varieties which render lower-quality product varieties obsolete and drive

[52] In our case, technological change is endogenous to the system, *i.e.* it is determined by the behaviour of individuals and thus vulnerable to economic policy measures and institutional changes.

[53] Lucas (1988) presents human capital as an explicit factor of production and assumes that production exhibits constant returns on human capital. Owing to the latter assumption, human capital accumulation in his model appears as the main source of sustained economic growth. Since accumulation of human capital responds to incentives within the economy, economic growth might be affected by economic factors also in the long run. Rebelo (1991) extended the model of Lucas (1988) by introducing a combination of physical and human capital that can be accumulated without diminishing returns. His model gives taxation policy the power to affect perpetual economic growth (see Aghion and Howitt 1999, 330).

economic growth. The positive impact of product variety churn on economic performance is in line with Schumpeter's (1942 [1976], 83) concept of creative destruction. These later models are referred to as the *quality-ladder models of growth*, *growth models with vertical innovations* or *Schumpeterian growth models*. Summing up, innovation-based growth models can be divided into two subgroups: i) product-variety expansion models and ii) quality-ladder or Schumpeterian growth models, but some models combine the two approaches.[54] The model we present corresponds to the group of quality-ladder or Schumpeterian growth models.

We present an innovation-based growth model that borrows the idea of Aghion and Howitt (1992) and Grossman and Helpman (1991, chapter 4) that quality improving innovations lead to technological advances, which are the primary source of economic growth. Both models incorporate the process of creative destruction, where the newest products (*i.e.* products of the highest quality) render the old (lower-quality) products obsolete. In both models, the aggregate output growth is affected by the reallocation of workers between production and research sectors, which affects the amount of quality improving innovations per fixed period of time and economic growth. Let us briefly describe the main characteristics of each of the two models and draw the parallels with the model we present.

The model of Aghion and Howitt (1992) incorporates the idea of creative destruction as presented by Schumpeter in the second (post-1942) period of his research. Businesses invest into research (*i.e.* hire researchers) in order to produce better quality intermediate/industrial goods and thus become the market leader who captures a monopoly rent. By employing higher-quality inputs, the final goods sector downsizes the average cost of production and increases its output. Economic growth is thus driven by innovating businesses. The model of Aghion and Howitt (1992) distinguishes three types of businesses: businesses producing the final good, the market-leader (the monopolist) in the intermediate goods sector, and research businesses attacking the monopoly position of the market leader. In the model of Aghion and Howitt (1992), firms in the intermediate goods sector that are not industry leaders hire researchers to develop higher quality intermediate goods. When a research firm succeeds in bringing a better-quality variety of the intermediate good to the market, it steals the monopoly position from the previous market leader, who is pushed into opposition where it invests into research (and does not produce intermediate goods). Another interpretation is that the previous market leader dies. The model embeds innovative activities that can be seen as R&D expenditures of established firms, which need to decide how many researchers to hire, rather

[54] In the product-variety expansion models, an invented variety of the intermediate good is produced forever. New inventions and therefore greater product variety increase overall productivity, without old product-varieties being replaced by new ones. Contrary, in quality-ladder models there is a fixed number of goods that increase in quality over time. A firm that develops a new quality of a given good replaces the firm that currently produces the same good with a less efficient technology. This is perhaps somewhat closer to the real world, where there are many cases in which a new product makes an old one obsolete.

than innovations related to entrepreneurial ventures. Moreover, the number of research firms (which could be taken as a proxy for Schumpeterian entrepreneurship) is due to constant returns to scale indeterminate.

In the model of Grossman and Helpman (1991, chapter 4), so-called entrepreneurs observe the product market and target their research at particular industrial/intermediate goods and try to develop superior versions of these goods. New versions of goods then displace the old versions (vintages), which raises the average quality of a given set of industrial goods. A continuous rise in the quality (*i.e.* productivity) of industrial goods enables a sustained growth of the aggregate product. In this model, an entrepreneur (an innovating incumbent firm that is currently not the market leader in the industry) hires researchers to develop innovations, where the probability of becoming a new market leader is uncertain. In developing a better-quality variety of targeted good, researchers do not need to start from the scratch but obtain ideas and valuable information by inspecting and analysing the most recent variety of the good. The model therefore embeds a spillover from innovations. The model is solved for the research intensity of innovating firms, which is the number of employed researchers by a representative entrepreneurial firm. The model does not directly enable one to derive the number of innovating/entrepreneurial firms or the rate of entrepreneurship.

The model we present departs from Aghion and Howitt (1992)[55] and Grossman and Helpman (1991, chapter 4) in three fundamental respects. Firstly, entrepreneurs in our model are innovating agents with heterogeneous innovative abilities who are relatively independent from incumbent manufacturing firms and whose income depends on their innovative abilities. Individuals in our model decide to become innovating entrepreneurs since they assess that their innovative abilities are high enough to earn at least as much as workers who are employed in the manufacturing sector. The model thus embeds the individual's occupational choice. Secondly, product innovations in our model are closely related to new business creation[56] that drives some of the firms with obsolete products out of the market. The model thus explicitly embeds a basic form of industry dynamics. By creating a close link between the output of innovative entrepreneurship and new firm creation, we try to incorporate Schumpeter's (1911 [2002], 67) notion that the entrepreneur loses its entrepreneurial

[55] Aghion and Howitt (1999, 2004) propose extensions of their 1992 model. In all versions of the model, the innovation rate, which depends on the amount of resources invested in research, determines the length of the period in which the local monopolist enjoys the monopoly power. As the new innovation arrives, the monopolist is replaced by the next innovator in that product. None of the extended versions is formulated in a way to express the number or the share of (successful) innovating firms in the economy and none explicitly models firm dynamics; they also assume competitive wage formation.

[56] We believe that innovation in new businesses is more likely to involve new products. Since many of these goods are durable, new firms introduce more innovative technology or new business processes (Baily and Kirkegaard 2004, 99-100).

character as soon as he/she settles down to running the business. By assuming a close link between innovations and new business creation, we also circumvent the problems with the measurement of innovative entrepreneurship and its output (*i.e.* the number of new products launched in the marketplace). Thirdly, we take into account imperfections in the labour market (more particularly unionization, unemployment benefit insurance and labour income taxation) that may affect the individual's occupational decision. Unionization of the manufacturing sector raises the wage above the competitive level and affects the allocation of labour between manufacturing and innovative entrepreneurship.

The third point of departure has already been addressed by several studies. While the first generation of the innovation-based growth models assumes perfectly competitive labour markets, more recent models of this kind take into account different imperfections in the labour market (De Groot 1996; Palokangas 1996, 2004, 2005; Lingens 2003, 2007; Meckl 2004[57]; Quintero-Rojas, Adjemian and Langot 2008). Still, these models do not explicitly embed the process of business dynamics (*i.e.* they abstain from modelling the process of business entry and exit) and do not enable one to derive measures of Schumpeterian entrepreneurship (*e.g.* business entry and exit rates or business turnover rate). They do not address the first two points of our departure from Aghion and Howitt (1992) and Grossman and Helpman (1991, chapter 4). Like the model we present, these models use the closed-economy frameworks (*i.e.* they assume no international trade in goods and factors of production). Let us briefly discuss the predictions of these models.

Lingens (2003), for example, extends the quality-ladder growth model of Aghion and Howitt (1992). The intermediate goods sector employs low-skilled and high-unskilled labour, but the research sector hires only high-skilled labor. Low-skilled labour is organised into a union, which bargains with the monopolist over the wage paid to low-skilled workers. As in Aghion and Howitt (1992), there is only one producing firm in the intermediate goods sector (the monopolist), which is after a certain period of time replaced by a successful innovator. Due to constant returns to scale in research, the number of research firms is indeterminate. Thus, the model does not explicitly solve for the variable that describes the amount or the rate of Schumpeterian entrepreneurship in the economy (the number of research firms, or even better, the business entry rate in the intermediate goods sector). Lingens (2003) concludes that higher bargaining power of the union increases unemployment, while the growth effect is ambiguous. This is related to the two countervailing effects of the trade union on economic

[57] Since the model of Meckl (2004) does not involve trade unions, we discuss it separately. Meckl (2004) extends the model of Aghion and Howitt (1999) – an extended version of Aghion and Howitt (1992) – for efficiency wages. He assumes that wages in production and research sectors depend on workers' effort and shows that the introduction of efficiency wages causes the expansion of the research sector. The expansion of the research sector due to efficiency wages leads on one hand to higher unemployment, and on the other hand to higher aggregate output growth.

growth. On one hand, higher wages squeeze expected gains from innovations, which deteriorates growth. On the other hand, the union lowers the marginal product of high-skilled labour and consequently the high-skilled wage in manufacturing. This causes migration of high-skilled labour from manufacturing to the research sector, which enhances output growth. The factor that is decisive for the sign of the union's effect on output growth is the elasticity of substitution between high-skilled and low-skilled labour; the impact is negative for the elasticity below one. Similar conclusions are derived by Palokangas (2004), who extends the same model for a unionized labour market and adds international coordination of labour market policy. Quintero-Rojas, Adjemian and Langot (2008) use a modified version of the model of Aghion and Howitt (1992) and extend it for efficient wage bargaining. They conclude that powerful trade unions increase labour costs and lead to higher unemployment and lower economic growth.

Let us also mention that Lingens (2007) and Palokangas (1996, 2000) extended also the variety-expansion framework of Romer (1990a), which led them to the same conclusion that there are two countervailing mechanisms at play and that the final effect of trade unions on the rate of economic growth depends on the elasticity of substitution between two types of labour. This holds for both, the centralized and the decentralised wage bargaining setup. De Groot (1996) constitutes a somewhat different two-sector variety-expansion model of growth. A competitive traditional sector produces a consumption good with the use of production workers, who are compensated by the competitive wage. The high-tech sector hires production and research workers to produce differentiated high-tech goods. Production workers in the high-tech sectors are unionized, which leads to a wage differential between the two sectors. A certain percentage of jobs in the high-tech sector are destroyed in each period. Due to a positive wage differential between the high-tech sector and traditional sector, people are motivated to wait as unemployed persons for a job in the high-tech sector. This reduces an effective supply of labour, which lowers employment in both sectors and dampens economic growth. De Groot (1996) also shows that a rise in unemployment benefit leads to the same results as an increase in union bargaining power, since it reduces the opportunity cost of being unemployed, increases the value of unionized workers' alternative (outside option) and pushes up negotiated wages. De Groot's (1996) model assumes the exogenous number of firms in the high-tech sector and abstains from the issue of firm dynamics.

Summing up, theoretical analyses suggest that the process of product (and implicitly business) *creation and destruction* acts as a mechanism that facilitates new (more efficient) technology adoption and is one of the drivers of economic growth. The theoretical analysis of the indirect impact of trade union power and the level of unemployment benefits on economic growth, where explicitly modelled business dynamics serves as a channel of transmission, has not yet been elaborated. We fill this gap by embedding a simple form of creative destruction of businesses (*i.e.* business dynamics that helps to shift resources from less productive uses to ones that are more productive) into a quality-ladder growth model. We show how chosen

labour market institutions can influence business dynamics, which transmits this effect into lower/higher output growth. Our setup therefore establishes a more explicit link between labour market institutions, creative destruction of businesses, and economic performance (employment and output growth). We thus return to Schumpeter's ideas in his early (*i.e.* pre-1942) period of research and establish start-ups as the underlying force of economic development.

4.2.2 Occupational choice theory

The literature, which is also relevant for the model, is occupational choice theory. Its foundations have been laid down by the seminal contribution of Lucas (1978). In Lucas' model, agents differ with respect to abilities and choose between being entrepreneurs or workers. We borrow this idea to model the choice of an agent between working as an entrepreneur in the innovative sector or as a worker employed in the production sector.

Examples of theoretical models investigating the impact of trade union's power on the occupational choice of individuals are Kanniainen and Vesala (2005) and Kanniainen and Leppämäki (2009). Kanniainen and Leppämäki (2009) theoretically analyse the impact of union power on the occupational choice of an individual between paid employment and entrepreneurship. They consider the Knightian entrepreneur who runs a business and earns an uncertain profit. They show that an increase in union power triggers two countervailing effects. By lowering business profits, union bargaining power reduces expected profits of a new venture and increases the risk that an entrepreneur will be unable to recover its initial investment. Increased risk of business failure discourages individuals from entrepreneurship. On the other hand, stronger unions tend to decrease the probability of finding a job, thereby having a counter (*i.e.* positive) effect on entrepreneurship. Kanniainen and Leppämäki (2009) show that the negative effect dominates over the positive effect and conclude that strong unions deter the rate of entrepreneurship. In a related model, Kanniainen and Vesala (2005) show that in most cases (*i.e.* excluding the extreme cases regarding success probability, high labour productivity, or abnormal profit differential in the good and bad states), powerful trade unions and generous unemployment benefits reduce Knightian entrepreneurship in the economy.

In our model, the individual may choose between paid employment in established manufacturing firms and relatively independent research work. Since the main function of the researcher is to innovate, they might be considered as innovating or Schumpeterian entrepreneurs. An alternative interpretation is that researchers produce knowledge, which is considered to be commercialized[58] when new products are brought into the market place (*i.e.*

[58] This interpretation is partly inspired by Braunerhjelm *et al.* (2010).

produced by businesses, which are market entrants in our model). In the spirit of the latter interpretation (which we prefer), Schumpeterian entrepreneurship is expressed as a number of new businesses (market). Irrespective of interpretation, the choice of individuals depends on their innovative and other entrepreneurial abilities and aptitude, and on the wage paid by the manufacturing sector.

4.2.3 Theory of industrial organization

The third strand of relevant literature is industrial organization literature focusing on monopolistic competition. Namely, expectations about future profits are an important stimulus for investing in innovative activities. To include innovative entrepreneurship into a GE model, adoption of monopolistic competition in the product market is crucial. More than three decades ago, Dixit and Stiglitz (1977) presented the model of monopolistic competition and product differentiation, which is today considered as classic. The framework has been commonly used to model the product diversity issue in the context of different kinds of partial equilibrium and GE models; lately especially in the interaction with international trade. However, in some cases an adjusted version of the Dixit-Stiglitz (1977) model used in Weitzman (1985) and more recently also in Blanchard and Giavazzi (2003), seems to be more appropriate. The difference between the Weitzman (1985) and the Dixit-Stiglitz (1977) approach lies in the role of the number of product varieties available on the market. According to the latter, the number of product varieties consumed directly affects the utility of a consumer, while in Weitzman (1985) the utility level depends only on the volumes consumed and not directly on the number of existing firms/product varieties. Our framework builds on the Weitzman (1985) type of preferences rather than the standard Dixit-Stiglitz (1977) formulation. This is related to our decision to demonstrate the role of entrepreneurship in the form of business creation (and destruction) with the use of the quality ladder mechanism. While Young (1998) and Howitt (1999), for example, merge the expanding-variety framework with the quality ladder mechanism, our model for the sake of tractability (note that other imperfections are incorporated in the model) takes into account only the latter. Assuming away the expansion of product variety is an important limiting assumption of the model. Some empirical studies (especially in the field of international trade; Hahn 2010, for example) take into account the co-existence of the expansion of product variety and product creation and destruction, and confirm that they both contribute to economic growth.

4.2.4 Labour economics theory

The last strand of literature important for our model is the labour economics theory. The combination of profit earning firms and workers with some bargaining power relative to firms opens an opportunity for negotiations for higher wages. We adopt the efficient firm-union bargaining framework as first introduced in the seminal paper by McDonald and Solow

(1981). For theoretical contributions on this issue, we also refer to Blanchard and Giavazzi (2003) and Fiori *et al.* (2007), who adopted efficient bargaining setups in their papers on labour market and product market deregulation. This type of efficient bargaining (over wages and employment) can also be found in Dut and Sen (1997), who have examined the impact of the bargaining power of workers on the aggregate variables in a simple micro-founded GE model of a closed economy. In their model, a rise in the workers' bargaining power increases the real wage, which raises aggregate (consumer) demand. This stimulates aggregate output and employment in the economy, which is probably due to the fact that Dut and Sen (1997) do not take into account the possible spill-over effects of higher wages on other sectors. Our model fills this gap by considering the impact of wage-setting in one sector on other sectors of the theoretical economy.

4.3 Model setup

The theoretical economy consists of three sectors: (i) perfectly competitive final (composite) good sector, (ii) monopolistically competitive intermediate goods sector and (iii) an innovative sector. The final goods sector buys differentiated intermediate goods and assembles them into the composite good consumed by individuals. The intermediate goods sector consists of a large number of monopolistically competitive firms that employ labour and produce differentiated intermediate goods for the final goods sector. Profits created by firms in the intermediate goods sector accrue to their equity holders, who invest into new business projects (*i.e.* new firms). New firms buy blueprints from the innovative sector in order to produce new varieties of differentiated intermediate goods. The role of new firms is therefore commercialization of new ideas and technology (this interpretation is close to Braunerhjelm *et al.* 2010), which in our model means bringing new intermediate goods to the marketplace.

We assume that inventions occur only in the innovative sector and that they are commercialized by start-ups.[59] The main reason for leaving innovations of incumbent firms aside lies in computational simplicity and tractability of the model. Nevertheless, the simplification can be partly defended by using Baumol's (2002a, 33–36; 2002b, 6) finding that most of the revolutionary ideas in the United States have been provided by small businesses and independent entrepreneurs, while routine innovation is preponderant in large enterprises. According to Baumol (2002, 36), R&D in incumbent firms is run by managers rather than entrepreneurs. Since (especially in the United States) incumbents tend to be larger than entrants (Scarpetta *et al.* 2002; OECD 2003; Bartelsman, Scarpetta and Schivardi 2003;

[59] We therefore depart from Chandler (1977), Schumpeter (1942, 106) and Galbraith (1962), who at the time defended the position that innovation and technological progress lie in the domain of large corporations, and rather follow Schumpeter (1911 [2002], 66) and Baumol (2002b).

Brandt 2004), we can draw a parallel between new firms and innovating activities that presumably disproportionately contribute to technological advancement.[60] Capital vintage models (*e.g.* Campbell 1998) defend an innovative advantage of new firms by the argument that, unlike incumbents new firms do not need to retool their production processes to adopt new technologies (OECD 2003, 130).

The economy is populated with $\bar{L}$ individuals and each of them is endowed with one unit of labour, which he/she supplies inelastically. A certain percentage of individuals consider entering the innovative sector; the economy's labour endowment therefore constitutes the pool of prospective entrepreneurs. Others search for jobs only in the intermediate goods sector. Let us denote the number of agents employed in the intermediate goods sector by L_p and the number of innovative entrepreneurs by L_n. The labour market is non-competitive, as described in the follow-up, and there exists involuntary unemployment in size of $U_l = L - L_p - L_n$. The sequence of events in the labour market is the following:

- At the beginning of each period, each firm-level union bargains with the firm over the wage and the level of employment (but not about whom exactly to employ).
- Given the negotiated wage, a certain percentage of individuals consider whether to enter entrepreneurship or get employed as wageworkers in the intermediate goods sector.
- Individuals that do not decide for an entrepreneurial career compete for jobs in the intermediate goods sector; due to imperfections in the labour market, some of them end up jobless.

4.3.1 Consumer preferences and their inter-temporal choice

All individuals are postulated to have the same preferences over lifetime consumption of the final good. They are modelled as a representative agent who maximizes an *inter-temporal utility function* of the form:

$$U(Q_t) = E_t\{\sum_{t=1}^{T} \beta^{t-1} u(Q_t)\}, \qquad \text{with } \beta = \frac{1}{1+\rho}, \tag{1}$$

where $u(Q_t)$ is an instantaneous utility function depending on Q_t, which denotes the consumption of the final good in period t (priced at P). Hereby it is assumed that there is no disutility from supplying labour. E_t stands for the expected value operator conditional upon

[60] As explained in section 2.4.2, the results of decompositions of labour and multifactor productivity growth provided by the 2003 OECD growth study (OECD 2003, 138) lead to the conclusion (somewhat tentative, however) that new businesses contribute to an important share of MFP growth by using new technologies and an appropriate combination of inputs that improves the efficiency of the production processes. In contrast, incumbent businesses have been increasing their labour productivity mainly by capital deepening (*i.e.* by substituting capital for labour), without necessarily significantly improving the efficiency of production processes, or by exiting the market.

information available in period t. Individuals discount future values of consumption with ρ, which denotes the subjective rate of time preference (also called subjective discount rate). ρ designates the degree of impatience in consumption and is assumed to be non-negative and constant.

We assume a frictionless Walrasian credit market. Each individual is free to borrow and to lend at market interest rate r_t. Any feasible consumption path must therefore obey the following *flow budget constraint*:

$$W_t - W_{t-1} = r_t W_{t-1} + Y_t - Q_t. \tag{2}$$

Hereby, Y_t denotes the flow of income (from wage-employment or entrepreneurship) in period t, and W_t (W_{t-1}) is the stock of wealth at the end of period t ($t-1$). Since no bequest motive is included in the model and the constraint is assumed to bind, we get the following *terminal condition*: $W_T = 0$, which means that $Q_T = (1 + r_t)W_{T-1} + Y_T$.

The optimal allocation of consumption across time is obtained by maximizing (1) with respect to Q_t, subject to (2), by considering the initial wealth and the terminal condition. The optimal allocation of consumption across time requires that the marginal cost of saving an extra unit of consumption in period t and carrying it over into period $t+1$ should be equal to the marginal benefit. Thus, the optimal consumption path satisfies the following *Euler equation*:

$$\frac{\partial u(Q_{t-1})}{\partial Q_{t-1}} = \frac{(1+r_t)}{(1+\rho)} \frac{\partial u(Q_t)}{\partial Q_t}. \tag{3}$$

The growth of the household's consumption from one period to the next depends on the relationship between r_t and ρ. If the interest rate exceeds the rate of time preference, then households will desire a rising pattern of consumption over time. If the interest rate is less than the rate of time preference, then consumption will fall over time. In the borderline case (when $\rho = r_t$) the desired consumption path is kept constant over time.

In our model, the representative agent pursues the utility function, which is linear in the amount of the final good: $u(Q_t) = Q_t$. The latter says that the level of utility derived from the consumption of a good equals the quantity consumed. In our case (3) is satisfied when the market interest rate equals the subjective discount rate:

$$r = \rho, \tag{4}$$

with ρ being exogenous to the system. Since ρ is assumed to be constant, we have: $r = r_t = r_{t-1}$.

Individuals diversify their portfolios by investing in equities of different firms. Firms in the monopolistically competitive intermediate sector earn positive profits. These profits accrue to equity holders and are used to finance innovation activities.

In the follow-up, we focus on the economy's steady state in period t and mostly neglect time subscripts (the latter are used only when we examine inter-temporal patterns). As will be shown in the follow-up, physical capital is not included in the model.[61]

4.3.2 Final good sector

Competitive final good producers buy intermediate goods and assemble them into the final good. Production technology is described by a normalized symmetric constant elasticity of substitution (CES) function as introduced by Blanchard and Giavazzi (2003):[62]

$$Q = \left(M^{-\left(\frac{1}{\sigma}\right)} \int_{\omega \epsilon \Omega} \left(\kappa(\omega) q(\omega)\right)^{\frac{\sigma-1}{\sigma}} d\omega\right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1, \tag{5}$$

where Q denotes the output of the final good, $q(\omega)$ is the quantity of variety ω of the intermediate good that is used as an input, and Ω is a set of M available varieties of the intermediate good ($\omega \epsilon \Omega$). The parameter $\kappa(\omega)$ stands for the quality/productivity of an intermediate good variety ω. We assume that final good producers cannot precisely compare the quality of input varieties and optimize their decisions by treating the quality parameter as equal across intermediate good varieties, *i.e.* $\kappa(\omega) = \kappa$. σ denotes the elasticity of substitution between any two intermediate input varieties and is assumed to exceed 1 in order to guarantee that $0 < (\sigma - 1)/\sigma < 1$ (see Dixit and Stiglitz 1977, 298). Following Blanchard and Giavazzi (2003, 881-882), we normalize the final output by factor $M^{-1/\sigma}$, which assures that the variety of inputs does not directly increase the productivity of the production process. The latter deviates from Ethier (1982), where the productivity of a given stock of inputs rises with the number of available input varieties.[63] The technology exhibits constant returns to scale. The CES form of the production function yields aggregate demand functions of particularly

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[61] See also Grossman and Helpman (1991, chapter 4), Aghion and Howitt (1992; 1999, chapter 2), Gancia and Zilliboti (2005, section 2), Lingens (2003, 2007), and Quintero-Rojas, Adjemian and Langot (2008).

[62] Blanchard and Giavazzi (2003) introduce the adjusted CES consumer utility function. We interpret the function in the spirit of Ethier (1982); see also Felbermayr and Prat (2007). The use of a final good production function that does not explicitly include labour is common in economic growth literature (see, for example, Grossman and Helpman 1991, 87).

[63] Ethier's (1982) production function was utilized in Romer's (1987) model on endogenous growth with expanding product variety. The model shows that under monopolistic competition on the product market, sustained growth can be achieved through the increased specialization of labour across an increasing range of activities (Gancia and Zilibotti 2005, 5).

simple forms (Grossman and Helpman 1991, 46). It also allows for taking into account product market regulation, which is assumed to affect σ. Product market deregulation increases competition in the intermediate goods market and can be presented by an increase in σ.

Contrary, increased stringency of product market regulation (*e.g.* introduction of tariff barriers) leads to a lower degree of product market competition and reduces the elasticity of substitution between product varieties; lower σ raises the price mark-ups of intermediate goods producers (Blanchard and Giavazzi 2003, 885and 899).[64]

In each period, a competitive firm maximizes its profit function: $max\Pi = PQ - \int_{\omega\epsilon\Omega} p(\omega)q(\omega)d\omega$ subject to technology (5). Profit maximizing behaviour gives the following static demand for an intermediate good variety ω:

$$q(\omega) = \frac{Q/\kappa}{M}\left(\frac{P}{p(\omega)/\kappa(\omega)}\right)^{\sigma} = \frac{Q}{M}\left(\frac{P}{p(\omega)}\right)^{\sigma}\kappa^{\sigma-1}, \qquad (6)$$

where $p(\omega)$ is the price of variety ω and P is the aggregate price level. For a large number of intermediate goods varieties, σ approximates the absolute value of the price elasticity of demand for a certain variety. The greater the number of varieties the more precise this approximation becomes (see Helpman and Krugman 1985: 118–119). The demand function (6) shows that the demand for an intermediate goods variety decreases with its quality-adjusted price and with the number of available intermediate goods varieties, while it increases with the aggregate price level and the aggregate output Q adjusted for the average quality of intermediate inputs. Since the final good is produced under conditions of perfect competition, its price (the aggregate price index) reads:

$$P = \left[M^{-1}\int_{\omega\epsilon\Omega}\left(\kappa p(\omega)\right)^{1-\sigma}d\omega\right]^{\frac{1}{1-\sigma}}. \qquad (7)$$

As will be presented in the follow-up, all firms in the intermediate goods sector use the same technology with the same productivity and negotiate with unions with the same relative bargaining power. Consequently, they sell the same quantity of intermediate good varieties, $q(\omega) = q$, and charge the same price, $p(\omega) = p$. We can show that the price of the final good equals the quality-adjusted price of intermediate goods varieties: $P = p/\kappa$. Inserting the latter into (6) yields: $q(\omega) = Q/(M\kappa)$.

[64] In Blanchard and Giavazzi (2003), σ is in the long run thought of as an increasing function of the number of goods available in the market. In the short run, the number of firms is taken as given, which makes σ fixed. We treat σ as exogenous to the model.

4.3.3 Intermediate goods sector

The intermediate goods sector is comprised of a large but finite number (M) of monopolistically competitive firms. We first describe their production technology and related costs, and then move on to firm dynamics.

Production and costs

All firms in the intermediate goods sector use the same production technology to produce different intermediate goods varieties. For analytical purposes, we abstract from capital and use labour as a sole factor of production. The production technology exhibits constant marginal returns to labour and is described by the following production function:

$$q(\omega) = \varphi l(\omega), \tag{8}$$

where φ designates the level of productivity ($\varphi > 0$), and $l(\omega)$ stands for the quantity of labour used in the production of variety ω. Firms in each period face variable costs, which are directly linked to the quantity of production. The only fixed cost is the entry cost in the form of the price of a blueprint (it could be divided among the subsequent periods of operation and therefore represent a fixed cost per period). Each firm produces only one variety of the intermediate good and faces a variety-specific demand (6). The decision of a firm to produce only one intermediate goods variety is related to the combination of constant (rather than diminishing) marginal returns to labour and fixed entry cost related to each variety it would like to produce. As each firm tries to optimize its performance, it produces a variety of the intermediate good that is not supplied by any other firm; every firm therefore produces a unique variety. A possible justification for this assumption is that imitation is costly and a copier would have to share the rent with another firm that produces the same variety. Another justification is that the right to produce a certain variety of the intermediate good is protected by a perpetual patent (see Helpman and Grossman 1991, 49).

Since the differentiated intermediate goods market is not perfectly competitive, firms in the short run earn positive profits. The profit function for a production firm in the intermediate goods sector reads:

$$\pi(\omega) = \big(p(\omega)\varphi - w(\omega)\big)l(\omega), \tag{9}$$

where $p(\omega)$ is the price of variety ω of the intermediate good and $w(\omega)$ denotes the gross wage rate.

Entry and exit

According to Schumpeter (1942 , 83), the essential feature of a capitalist system is continuous change of economic structure caused by incessant creation of new goods, new methods of production, new consumers or markets, and new forms of industrial organization and incessant destruction of the old ones. This process, which he calls the *creative destruction*, determines the evolutionary character of the capitalist process. In line with Schumpeter's (1911 [2002], 66) early writings, new combinations of resources are embodied in new businesses »*that do not arise out of the old ones but start producing beside them*«. We explicitly embed this notion into the presented model.

In case of a positive amount of innovations (in the form of new blueprints for intermediate goods varieties), the monopolistically competitive intermediate goods sector is characterized by a continuous process of entries of new firms and exits of incumbent firms. To enter the intermediate goods sector, each firm has to buy a blueprint for a specific variety of the intermediate good it intends to produce. The price of a blueprint has the nature of a fixed entry cost, which is sunk. Due to the entry of new firms, δ percent of the incumbents are driven out of the market in each period.[65] Parameter δ therefore represents the probability of death of an incumbent firm, which will be made endogenous to the model (*i.e.* it will no longer be an exogenous parameter, but will be determined in equilibrium by other parameters). In a steady state, the number of firms, M, does not change. In other words, there is a balance between the number of firms that enter the sector in the considered period, M_e, and the number of firms dying in the same period, δM. Equilibrium therefore implies: $M_e = \delta M$.

There is no other barrier to entering the intermediate goods sector but the fixed entry cost, which equals the price of a blueprint for a new variety of the intermediate good. A firm enters the sector if the present value of its expected future profits (taking account of the probability of death in each period) exceeds or at least covers the fixed cost of entry. Mathematically this can be expressed:[66]

$$v_e = \sum_{t=0}^{\infty}(1 - r - \delta)^t \pi(\omega)_t - p_n \geq 0, \tag{10}$$

$$v_e = \frac{\pi(\omega)}{\delta + r} - p_n \geq 0. \tag{11}$$

[65] This feature of the model is one of the main points of departure from the models of Grossman and Helpman (1991, chapter 4) and Aghion and Howitt (1992), who do not explicitly embed firm dynamics.

[66] The simplification regarding profit discounting is made for the sake of tractability of the model and should not importantly affect the qualitative results.

In case of a negative value of v_e, a firm does not enter the sector. If v_e is positive, more and more firms enter the sector, such that in equilibrium (11) holds with equality. The entry condition can therefore be written as:

$$p_n = \frac{\pi(\omega)}{\delta+r} = \frac{1}{\delta+r}\left[\left(p(\omega)\varphi - w(\omega)\right)l(\omega)\right]. \qquad (12)$$

4.3.4 Innovative sector

The innovative sector consists of a potentially large number of *innovative entrepreneurs* (or, more precisely, inventive entrepreneurs), who invent blueprints for new intermediate goods varieties. A blueprint is a model or a prototype of a new variety of the intermediate good. New product designs or blueprints are proprietary information and are protected by perpetual patents. Innovative entrepreneurs are relatively independent in the sense that their incomes depend on their ability to innovate (*i.e.* ability to create and develop new intermediate good varieties). They may collaborate with each other and with the entering firms, but are not closely related to incumbent firms. Since innovators are heterogeneous with respect to their innovative abilities, the amount of innovative entrepreneurship is measured in terms of their output rather than the number of innovators.

In every period, a fixed fraction ε of all individuals, $\bar{L}$, consider entering the innovation sector. Nevertheless, not all agents that consider starting an entrepreneurial career actually decide to give up wage-employment and start developing their ideas as innovative entrepreneurs. They choose their occupation by comparing prospective earnings in both occupations (after observing the negotiated wage and assessing their innovation abilities). We assume that these agents believe they have good chances to get a job in the intermediate goods sector.[67] The concept of occupational choice which we adopt is closely linked to Lucas (1978).

Whereas labour has homogeneous ability when used to produce differentiated goods, it is characterized by heterogeneous ability when engaged in innovative activities. We assume that the aggregate distribution of innovative abilities stays constant over different time periods.[68] Whether a worker who considers starting an entrepreneurial career actually becomes an entrepreneur, depends on the level of his/her innovation ability designated by a. The ex-ante cumulative distribution of innovation abilities is denoted by $F(a)$ and the corresponding

[67] This assumption is related to our expectation that innovative entrepreneurs are people who choose their entrepreneurial career out of opportunity and not out of necessity (*i.e.* out fear from unemployment).

[68] Innovation abilities of some agents may cease from one period to another, while other agents may become more innovative, which keeps the aggregate distribution of innovative abilities unchanged.

probability density function (PDF) by $f(a)$. Let us for simplicity assume a uniform ex-ante distribution of innovation abilities among agents, which gives the following PDF:

$$f(a) = \begin{cases} \frac{1}{a_{max} - a_{min}} & if \quad a_{min} < a \leq a_{max} \\ 0 & \text{otherwise} \end{cases}. \tag{13}$$

Due to the symmetry assumption embedded in (5) and homogeneity of firms with respect to productivity level ($\varphi(\omega) = \varphi$ in (8)) in the intermediate goods sector, all blueprints produce the same flow of expected future profits and are sold for equal prices. The price of a blueprint represents the value of the rents it is expected to create:

$$p_n = \sum_{t=0}^{\infty}(1 - r - \delta)^t \pi(\omega) = \frac{\pi(\omega)}{\delta + r}, \tag{14}$$

which is equals to (12).

In every period an entrepreneur i faces a fixed research cost of f_n and invents $(M/\bar{L})a_i$ blueprints, where a_i denotes his/her innovative ability (*i.e.* ability to create and develop ideas about new goods) and $M/\bar{L}$ is the number of existing intermediate goods varieties per capita. Therefore, entrepreneur i supplies $(M/\bar{L})a_i$ efficiency units of labor. Following Grossman and Helpman (1991, 44), we assume that ideas within a certain period of time do not become exhausted and in line with Romer (1990a) we assume the positive technological spillover effect of technology. This effect is reflected in factor M in an entrepreneur's production function.

Since entrepreneurs with the same level of ability produce the same number of blueprints per period and earn the same level of personal income, we hereinafter drop the subscript i. Gross personal income of an entrepreneur in the innovative sector can be written as:

$$I(a) = p_n \frac{M}{\bar{L}} a - f_n. \tag{15}$$

If the ability of an entrepreneur is too low to earn at least the wage paid in the intermediate goods sector, he or she decides to become a worker.[69] If his/her ability is high enough to produce blueprints with required efficiency, he/she becomes an innovative entrepreneur. The discounted expected lifetime value of entrepreneurship, $V^n(a)$, is presented by the following Bellman equation (neglecting time indices):

$$V^n(a) = I(a) + (1 - \delta_n)\beta V^n(a) + \delta_n \beta V^w(a), \tag{16}$$

[69] We assume that $\varepsilon\bar{L}$ agents, who choose between the two occupations, believe they have good chances to get a job in whichever firm in the intermediate goods sector and neglect the probability of ending up unemployed.

where β is the discount factor ($\beta = 1/(1+\rho) < 1$, with ρ standing for the subjective discount rate). We took into account that in every period an entrepreneur can be hit by a negative shock (that forces him to exit the innovative sector) with exogenous probability δ_n. The discounted expected lifetime value of being a worker, V^w, is:[70]

$$V^w(a) = w + (1-\varepsilon)\beta V^w(a) + \varepsilon\beta max\{V^n(a), V^w(a)\}, \tag{17}$$

where ε is the probability that an agent will have an opportunity and the motivation to reconsider entering entrepreneurship in the next period. The ability a^*, that makes an agent indifferent between becoming an entrepreneur and getting employed in the intermediate goods sector, satisfies: $V^n(a^*) = V^w(a^*)$. It follows that the occupational choice condition reads:

$$l(a) \geq w. \tag{18}$$

The occupational choice condition requires that the personal income of an entrepreneur may not fall below the wage earned by workers in the intermediate goods sector. The expression (18) holds with equality for the marginal worker with $a = a^*$:

$$p_n \frac{M}{\bar{L}} a^* - f_n = w, \tag{19}$$

where we took into account (15). Equations (14) and (19) yield the following *cutoff ability of an entrepreneur*:

$$a^* = (\delta + r)\frac{\bar{L}}{M}\frac{w+f_n}{\pi(\varphi)}. \tag{20}$$

We know that a^* satisfies: $a_{min} \leq a^* \leq a_{max}$. An agent with innovation ability below a^* decides to get employed as a wage-worker. The probability that a person, who considers the entrepreneurial path, actually decides to become an innovative entrepreneur therefore equals $[1 - F(a^*)]$. Ex-post distribution of innovative abilities (*i.e.* distribution of abilities among established innovative entrepreneurs) is:[71]

$$\hat{f}(a) = \begin{cases} \frac{f(a)}{1-F(a^*)} = \frac{1}{a_{max}-a^*} & if \quad a^* < a \leq a_{max} \\ 0 & \text{otherwise} \end{cases}. \tag{21}$$

In a steady state, the number of innovative entrepreneurs, L_n, stays constant. Flow into entrepreneurship, $\varepsilon[1-F(a^*)]\bar{L}$, equals the flow out of entrepreneurship, $\delta_n L_n$. If we for the

[70] See also Hakobyan (2008).

[71] The steady state condition requires equalization of entry and exit in the innovative sector: $\varepsilon\bar{L}[F(a) - F(a^*)] = \delta_n L_n \hat{F}(a)$. Since $L_n = [1 - F(a^*)]\bar{L}$, we have: $\hat{F}(a) = \frac{F(a)-F(a^*)}{1-F(a^*)}$.

sake of simplicity assume that $\varepsilon = \delta_n$, the equilibrium number of innovative entrepreneurs equals:

$$L_n = [1 - F(a^*)]\bar{L} = \frac{a_{max} - a^*}{a_{max} - a_{min}}\bar{L}. \quad (22)$$

The equation (22) shows that the higher the cutoff entrepreneurial ability a^*, the lower the number of entrepreneurs. Note that a^* is endogenous to the model; it can be affected by institutional and policy parameters, as will be shown later on.

Once an entrepreneur with relative innovate ability $(a/a^*) \geq 1$ enters the innovative sector, he or she earns in gross terms:

$$I(a) = p_n \frac{M}{\bar{L}} a - f_n = (w + f_n)\frac{a}{a^*} - f_n. \quad (23)$$

The average and the total personal incomes of innovative entrepreneurs ($I(\tilde{a})$ and I, respectively) are:[72]

$$I(\tilde{a}) = (w + f_n)\frac{\tilde{a}}{a^*} - f_n \quad (24)$$

and

$$I = L_n I(\tilde{a}) = L_n\left((w + f_n)\frac{\tilde{a}}{a^*} - f_n\right). \quad (25)$$

where $\tilde{a}$ denotes the average ability of established entrepreneurs and is calculated as $\tilde{a} = \int_{a_{min}}^{a_{max}} a\hat{f}(a)da = (a_{max} + a^*)/2$.[73] Once we are familiar with the equilibrium value of the endogenous variable a^*, the total blueprint production function in the economy can be calculated as:

$$Q_n = \int_i^{L_n} \frac{M}{\bar{L}} a_i di = L_n \frac{M}{\bar{L}}\left(\int_{a_{min}}^{a_{max}} a\hat{f}(a)da\right) = L_n \tilde{a}\frac{M}{\bar{L}}, \quad (26)$$

where $\tilde{a} = (a_{max} + a^*)/2$. Since each entering firm buys one blueprint, the market-clearing condition for blueprints reads:

$$M_e = Q_n = L_n \tilde{a}\frac{M}{\bar{L}}. \quad (27)$$

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[72] $\tilde{I}(a) = \int_{a^*}^{a_{max}}\left((w + f_n)\left(\frac{a}{a^*}\right) - f_n\right)\hat{f}(a)da = \left(\frac{w+f_n}{a^*}\right)\int_{a^*}^{a_{max}} a\,\hat{f}(a)da - f_n = (w + f_n)\frac{\tilde{a}}{a^*} - f_n.$

[73] $\tilde{a} = \int_{a_{min}}^{a_{max}} a\,\hat{f}(a)da = \int_{a_{min}}^{a^*} a\,\hat{f}(a)da + \int_{a^*}^{a_{max}} a\,\hat{f}(a)da =$
$0 + \int_{a^*}^{a_{max}} a\,\hat{f}(a)da = \int_{a^*}^{a_{max}} \frac{a}{a_{max} - a^*}da = \frac{a_{max}^2 - (a^*)^2}{2(a_{max} - a^*)} = \frac{a_{max} + a^*}{2}.$

We can now express the endogenous firm entry rate (which in equilibrium equals the exit rate) as:

$$\delta(a^*) = \frac{M_e}{M} = \frac{L_n \bar{a}}{\bar{L}} = \frac{(a_{max})^2 - (a^*)^2}{2(a_{max} - a_{min})}. \tag{28}$$

As already indicated, we use $\delta(a^*)$ as an indicator of innovative entrepreneurship. It is apparent that an increase in the cutoff ability leads to a reduction in the firm entry rate: $\partial\delta(a^*)/\partial a^* = -a^*/(a_{max} - a_{min}) < 0$. If there are some factors that drive a^* upwards, the innovative sector produces fewer blueprints relative to the number of existing firms. This results in a lower firm entry rate and thus in less intense creative destruction. As expressed by (20), a^* depends on the gross wage rate, w, and the aggregate profit, $M\pi(\varphi)$. Factors that influence these two categories may also affect a^* and indirectly stifle or stimulate the process of creative destruction.

4.3.5 Aggregation

The aggregate variables refer to the final goods sector and the labour market. Due to the form of aggregate production function (5)[74] and the assumption regarding the quality of intermediate goods varieties (*i.e.* $\kappa(\omega) = \kappa$ in (5)), the aggregate output, Q, turns out to be proportional to the output of a representative firm in the intermediate sector, q. Since firms producing intermediate goods varieties charge the same prices, the corresponding price index P (*i.e.* the aggregate price level) is equal to the quality-adjusted price of intermediate goods varieties. Therefore, the aggregate price level, P, the aggregate output level, Q, the aggregate revenue, R, and the aggregate profit, Π, are given by:

$$P = \frac{p}{\kappa}, \qquad Q = M\kappa q, \tag{29}$$

$$R = Mr, \qquad \Pi = M\pi, \tag{30}$$

with p, q, r, and π designating the price, output, revenue, and the profit of a respresentative firm in the intermediate goods sector.

Total employment in the economy is the sum of employment in the intermediate goods sector and the innovative sector:

$$L_p + L_n = Ml + \frac{a_{max} - a^*}{a_{max} - a_{min}}\bar{L} = \frac{Q}{\kappa\varphi} + \frac{a_{max} - a^*}{a_{max} - a_{min}}\bar{L}, \tag{31}$$

[74] The intermediate goods varieties are used in equal proportions in the final goods production (5), which is called the symmetry assumption. Moreover, the standard Dixit-Stiglitz (1977) form of the CES function is normalized by factor $M^{-(1/\sigma)}$.

with l denoting the representative firm's employment in the intermediate production sector ($l = l(\omega)$).

Since the model lacks a monetary instrument, we can at most determine relative prices. The price of a chosen good can arbitrarily be set to 1 with no loss of generality. We will choose the final good as a *numéraire* and set its price, P, to 1. We will thus measure all prices in the economy in terms of the final good.

4.3.6 Government

The government taxes labour (*i.e.* employment and entrepreneurial) income in order to finance benefits for unemployed individuals and non-productive government spending, G. We assume that there is no public borrowing and that government's budget is kept in balance. The government therefore follows a balanced-budget rule given by the following equation:

$$\tau\left(wL_p + \tilde{I}(a)L_n\right) = \left(\bar{L} - L_p - L_n\right)b + G. \tag{32}$$

Hereby L_p denotes the number of agents employed in the production sector and L_n stands for the number of innovative entrepreneurs in the economy. The number of unemployed persons equals: $U_l = \bar{L} - L_p - L_n$. Gross income from employment, w, and entrepreneurship, $\tilde{I}(a)$, are taxed at a flat rate of 100τ percent. Unemployed persons receive untaxed unemployment benefit in the amount of b. We assume that either unemployment benefit, b, or the tax rate, τ, is endogenous and adjusts to keep the government's budget constraint balanced. Non-productive government spending, G, is taken as exogenous.

4.3.7 Collective bargaining

Each of the $\bar{L}$ individuals in the economy is endowed with one unit of labour, which is supplied inelastically. In each period, a certain percentage of individuals consider entering the innovative sector; others search for jobs in the intermediate goods sector. Wageworkers in the intermediate goods sector are organised into firm-wide unions and bargain with monopolistically competitive firms on how to split the rents from employment. Due to frictions in the labour market (*i.e.* unionization,[75] accessibility of unemployment benefits, and alternative employment options) some of the agents turn out to be jobless.

The sequence of events in the labour market is the following. At the beginning of each period, a firm-level union simultaneously bargains with the firm over the wage and the level of employment (but not about whom exactly to employ). Given the negotiated wage, a certain

[75] Labour market structure characterised by a high degree of unionisation is especially important in the continental European context.

percentage of individuals consider whether to enter entrepreneurship or get employed as wageworkers in the intermediate goods sector. Afterwards, all individuals who do not decide for an entrepreneurial career compete for jobs in the intermediate goods sector, where some of them end up jobless. We now turn to a more precise specification of the bargaining structure and process.

Each of the M firms in the intermediate goods sector bargains with its utilitarian union over both wage rate and employment. The parties are assumed to be risk neutral, so that their expected utilities correspond to the expected monetary compensations lowered for relevant costs. The bargaining process between a firm and its union is modelled as a generalized Nash cooperative game. Our decentralized efficient bargaining setup is close to that of Blanchard and Giavazzi (2003) and especially to Fiori *et al.* (2007),[76] who provide a richer specification of the union's outside option. The fuller specification of the alternative income/wage (the outside option of workers) brings the outcome of efficient bargaining close to the outcome of the standard right-to-manage bargaining model.[77]

Since firms and their unions are small compared to the size of the economy, they do not internalize the macroeconomic effects of the bargaining outcome, and take the aggregate variables and fiscal policy variables as given. This assumption may not be exactly accurate for countries like Finland, Ireland, Slovenia, Norway, Belgium and Greece, where unions have been large at the economy-wide level during the period 1990–2007.[78] However, it may well describe the situation of countries with intermediate degrees of unionization (*e.g.* France, Germany, and Italy) or predominant company-level bargaining (*e.g.* United Kingdom, Japan, Canada, New Zealand, the United States, and the Baltic states). We assume that pre-

[76] The general equilibrium model of Fiori *et al.* (2007) has a different structure and includes beside the monopolistically competitive sector also a public sector, where employment is set exogenously. The alternative wage is modelled as a weighted average of untaxed unemployment benefit, wage earned in the public sector, and wage earned in some other firm in the private sector. Our definition of the alternative wage is similar, but we replace the wage in the public sector by the average personal income earned by an entrepreneur in the innovative sector. Since the number of entrepreneurs is determined endogenously, the weight of the average entrepreneurial income is endogenous to the model.

[77] In the standard right-to-manage model, introduced by Layard and Nickell (1985; 1990), a firm and the trade union negotiate about the wage. According to the negotiated wage, a firm unilaterally determines the level of employment (*i.e.* the solution lies on the labour demand curve). The outcome of this model is inefficient, since one party can improve its position (*i.e.* increase its utility) without worsening the position of the other party. In the efficient bargaining model introduced by McDonald and Solow (1981), firms and trade unions simultaneously bargain over both wages and employment. This yields a wage-employment contract curve that is off the demand for labour curve. The bargaining game yields a Pareto efficient/optimal outcome.

[78] In centralised environments, large trade unions recognise their market power and take into account both inflationary and unemployment effects of wage increases, while unions operating at the individual firm or plant level have limited market power (Calmfors and Driffill 1988, 13).

commitment to future wage and employment policies is ruled out. Employment in the production sector and the wage rate are determined period by period. Following Lingens (2003, 96), we assume that unemployed agents do not lose their skills and that the probability of finding a new job is independent of the individual employment history. We therefore rule out the insider power of workers. These assumptions lead to a somewhat simplified picture of the wage-setting procedures in OECD countries but make the model analytically tractable and avoid time-consistency problems that would arise if, for example, pre-commitment is not ruled out (see also Maffezzoli 2001).

There are two possible outcomes of the bargaining: (i) the parties reach an agreement or (ii) the parties fail to close an agreement. If an agreement is reached, a firm employs $l(\omega)$ workers; $\left[\bar{l}(\omega) - l(\omega)\right]$ of union members have to opt for an alternative option: they can get employed with some other firm in the production sector, they can become entrepreneurs, or they can become unemployed. Here $\bar{l}(\omega)$ denotes the number of a firm's union members.[79] The gross value of an agreement for a union (its expected gross utility) is given by: $\Gamma_{gross} = (1-\tau)wl(\omega) + (1-\tau)w_a\left[\bar{l}(\omega) - l(\omega)\right]$, where w_a denotes the gross alternative income/wage. Hereby, we assumed that there is no disutility from work.

As mentioned, union members of each firm have three outside options (*i.e.* (un)employment options outside the firm), which are captured by the definition of the gross alternative wage:

$$w_a = \left(\frac{\bar{L}-L_n-L_p}{\bar{L}}\right)\frac{b}{1-\tau} + \frac{L_p}{\bar{L}}w + \frac{L_n}{\bar{L}}\tilde{l}(a) = \frac{b}{1-\tau} + \left(\tilde{l}(a) - \frac{b}{1-\tau}\right)\frac{L_n}{\bar{L}} + \left(w - \frac{b}{1-\tau}\right)\frac{L_p}{\bar{L}}, \quad (33)$$

where b is monetary compensation for the unemployed, w is the gross wage rate paid by other firms, and $\tilde{l}(a)$ is the average gross income of an entrepreneur (net of fixed operating cost) per period. Here, we assumed that the unemployment benefit is tax-free. In case of failed negotiations, workers impose their threat of shutting down the firm. In this case, all the union's members have to opt for one of the alternative options. The value of the fall-back position (if the negotiation fails) is therefore: $\Gamma^0 = w_a\bar{l}(\omega)$. The difference between the expected utilities in case of an agreement and a disagreement is called the net utility function (or the reaction function). It is equal to: $\Gamma_{net} = (1-\tau)|w(\omega) - w_a|l(\omega)$. In case of an agreement, a firm expects to earn the profit $\pi(\omega)$. If an agreement is not reached, the firm loses the entire group of workers and earns zero profit. It follows that the net utility function of the firm reads: $\pi(\omega)_{net} = |\varphi p(\omega) - w(\omega)|l(\omega)$. The parties try to reach a Pareto efficient agreement on how to split net surpluses from employment. The respective Nash joint surplus, which is to be maximized with respect to $l(\omega)$ and $w(\omega)$, reads:

[79] We assume that $\bar{l}(\omega)$ is exogenous and meets the condition: $\bar{l}(\omega) \leq \frac{\bar{L}}{M}$.

$$\Omega = \beta ln|(1-\tau)(w(\omega)-w_a)|l(\omega) + (1-\beta)ln|\varphi p(\omega) - w(\omega)|l(\omega). \qquad (34)$$

In monopolistic competition, a firm chooses its employment level by setting the price so as to maximize its profit. Since a firm's choice of price, $p(\omega)$, implies its output, $q(\omega)$, and thus also employment, $l(\omega)$, the optimal bargaining outcome can also be obtained by maximizing (34) with respect to $p(\omega)$ instead of $l(\omega)$. Maximizing (34) with respect to $p(\omega)$, while taking $w(\omega)$ and the aggregate variables as given, yields the first of the first order conditions:

$$p(\omega) = \left(\frac{\sigma}{\sigma-(1-\beta)}\right)\frac{w(\omega)}{\varphi} = \left(1+\frac{(1-\beta)}{\sigma-(1-\beta)}\right)\frac{w(\omega)}{\varphi}. \qquad (35)$$

This shows that the price is set as a mark-up over the marginal cost $w(\omega)/\varphi$ (note that $(1-\beta)$ and $(\sigma-(1-\beta))$ are by definition positive). Maximizing (34) with respect to $w(\omega)$, while taking $p(\omega)$ and the aggregate variables as given, yields the second of the first order conditions:

$$w(\omega) = \beta\varphi p(\omega) + (1-\beta)w_a. \qquad (36)$$

This shows that the negotiated wage is calculated as a weighted average of the intermediate good's price multiplied by the productivity parameter, $\varphi p(\omega)$, and the gross alternative wage, w_a. Weights correspond to the bargaining power parameters of a trade union and the firm, respectively. The higher β, the higher is the bargained wage. Merging the first order conditions gives the following pricing rule:

$$p(\omega) = \frac{\sigma}{\sigma-1}\frac{w_a}{\varphi} = \left(1+\frac{1}{\sigma-1}\right)\frac{w_a}{\varphi}, \qquad (37)$$

and the gross wage rate:

$$w(\omega) = \frac{\sigma-(1-\beta)}{\sigma-1}w_a = \left(1+\frac{\beta}{\sigma-1}\right)w_a. \qquad (38)$$

We may observe that both the price and the gross wage rate can be expressed as mark-ups over the gross alternative wage. Taking account of (37) and (38), a firm's profit can be expressed as a function of the gross alternative wage:[80]

[80] Standard microeconomic theory states that profits are maximized at the point where the marginal product of the input equals its marginal cost. By taking into account (37) and (38), we can expresses the marginal revenue (MR) and the marginal cost (MC) as:

$$MR = \left(\frac{\sigma}{\sigma-1}\right)\frac{w_a}{\varphi}, \qquad MC = \frac{w}{\varphi} = \left(\frac{\sigma-(1-\beta)}{\sigma-1}\right)\frac{w_a}{\varphi}.$$

Note that a bargained position $(p(\omega), w(\omega))$ is chosen off the profit maximum $(MR \neq MC)$, which is a familiar result from the efficient bargaining problem.

$$\pi(\omega) = \frac{1-\beta}{\sigma-1} w_a l(\omega). \tag{39}$$

Choosing the final good as a *numéraire* and setting $P = 1$ (note that $p(\omega) = \kappa P$), gives the following real gross alternative wage:

$$\frac{w_a}{P} = \kappa\varphi \frac{\sigma-1}{\sigma}, \tag{40}$$

and the real gross wage rate:

$$\frac{w(\omega)}{P} = \kappa\varphi \frac{\sigma-(1-\beta)}{\sigma}. \tag{41}$$

Notice that the real gross wage rate positively depends on the quality parameter κ, labour productivity in the intermediate sector, φ, the union bargaining power, β, and the elasticity of substitution between any two varieties of the intermediate good, σ. In the extreme case with β approaching to zero, the real gross wage rate is equal to the real gross alternative wage, w_a. Another extreme is when β is set to **1**, in which case the real gross wage rate is equal to $\kappa\varphi$ (note that $p(\omega)/P = \kappa$). It is straightforward that higher union power β implies a higher real gross wage rate ($\partial(w(\omega)/P)/\partial\beta = \kappa\varphi/\sigma > 0$, for all values of the parameters). The size of the impact of a change in institutional parameter β depends on the values of the structural parameters κ, φ and σ. The higher the quality level of intermediate inputs, or higher labour productivity in the intermediate goods sector, higher is the increase in the relative gross wage rate due to a small increase in the union bargaining power. Contrary, the higher the elasticity of substitution between intermediate goods varieties (*i.e.* the higher the competition in the intermediate goods sector), the lower is the increase in the real gross wage rate due to a small increase in the union bargaining power.

Since an increase in union bargaining power increases the real gross wage rate paid by the firm (41), the firm raises the price of its product (35), sells a lower quantity of products (6) and thus hires fewer workers. At the aggregate level, we can illustrate this effect in the following way. Taking into account the specification of the gross alternative wage (33), we may observe a connection between the bargained gross wage rate (and thus the bargaining power of unions) and employment. By inserting (40) and (41) into (33), we expect that a higher wage level (due to higher bargaining power of trade unions) leads to lower employment level, holding other things constant. However, due to interactions of the intermediate goods sector with the innovative sector, the relationship is not trivial (as will be shown in the follow-up).

Let us now also shed some light on the implications of increased competitiveness of the intermediate goods market (*e.g.* due to product market deregulation) illustrated by higher σ. As shown by (35), higher σ implies a lower mark-up of price over the marginal cost in the intermediate goods sector. Lower nominal prices of intermediate goods varieties raise the

level of employment in firms in the intermediate goods sector. Lower prices of intermediate goods varieties also lower the aggregate price level. Since the aggregate price index is chosen to be the *numéraire* ($P = 1$), an increase in σ reflects in a higher real gross alternative wage ($\partial(w_a/P)/\partial\sigma = \kappa\varphi\sigma^{-2} > 0$) and in a higher real gross wage rate ($\partial\,(w(\omega)/P)/\partial\sigma = \kappa\varphi(1-\beta)/\sigma^2 > 0$). The final theoretical impact of higher competitiveness in the intermediate goods market on the expected stream of profits of a firm in this sector and therefore on the price of blueprints is ambiguous (it depends on the combination of parameter values). For most probable values of parameters, however, the amount of innovative entrepreneurship will decrease (partly due to a higher real gross wage rate in the intermediate goods sector and, in certain cases, also due to lower prices of blueprints), and the overall impact on the unemployment rate will be weakly positive as shown in the follow-up by simulations.

4.3.8 Growth of the economy

The model as described so far shows how the level variables (*i.e.* the aggregate output and the aggregate employment) are determined in the theoretical economy. Changes in labour market institutions can lead to some level effects, but so far the model does not predict any growth effects. To obtain sustained increases in per capita output, we add technological changes (*i.e.* changes in the quality of intermediate goods) to the model. The equilibrium as defined in this section can be understood as *balanced growth equilibrium*, since it requires a constant percentage change in the aggregate output in every period. Note that in this section also we again dismiss the time subscript for the variables that stay constant in the steady state.

Let us rewrite the aggregate production function:

$$Q_t = \left[M^{-\frac{1}{\sigma}} \int_{\omega\varepsilon\Omega} \left(\kappa(\omega)_t q(\omega)\right)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}}, \qquad \sigma > 1, \tag{42}$$

where $\kappa(\omega)_t$ and $q(\omega)$ are the quality and the quantity of the intermediate good variety ω used in the final good sector, respectively.[81] A fraction of intermediate goods that are replaced by new varieties of superior quality in every period is equal to $\delta(a^*)$. Namely, the innovative

[81] In every period, $\delta(a^*)$ percent of intermediate good varieties are replaced by new varieties of superior quality. By the law of large numbers, each variety faces the same probability of being replaced by a higher-quality variety. We assume that the final good producer recognizes that new intermediate goods varieties bring higher quality than the ones he/she decides to replace. The final good producer, however, does not distinguish the quality of the intermediate goods varieties he combines in the production process in that period. Thus, within a certain period all intermediate goods varieties used in productions are perceived to have the same $\kappa(\omega) = \kappa$ in the production function (5). Consequently, all producers in the intermediate sector are paid the same price per unit of their intermediate goods varieties.

sector in each period creates Q_n blueprints for new intermediate goods ($Q_n = M_e$), which replace lower-quality goods produced by incumbent firms. In the next period, M_e (or $\delta(a^*)$ percent) of monopolistically competitive firms produce better quality intermediate goods that amplify productivity in the final good sector. The quality/productivity of an intermediate good variety in period $t+1$ equals:

$$\kappa(\omega)_{t+1} = \begin{cases} \gamma\kappa(\omega)_t & \text{with probabilty} \quad \delta(a^*) \\ \kappa(\omega)_t & \text{with probabilty} \quad (1-\delta(a^*)) \end{cases}, \tag{43}$$

with γ being larger than 1 ($\gamma > 1$). The expected productivity of an intermediate good variety used as an input in the final good sector can be written: $\kappa(\omega)_{t+1} = \delta\gamma\kappa(\omega)_t + (1-\delta)\kappa(\omega)_t = |(\gamma-1)\delta+1|\kappa(\omega)_t$.

This leads to the following expected growth rate of the aggregate output:

$$g = \frac{Q_{t+1}-Q_t}{Q_t} = (\gamma-1)\delta(a^*). \tag{44}$$

By endogenizing the growth rate of the aggregate output (making it dependent on $\delta(a^*)$) we assume that the long-run growth is not driven by exogenous (technological) changes[82] but by the scope of innovative activity as reflected in the rate of business creation and destruction. Indirectly, long-run economic growth in this way depends on the institutional setup which makes public policy potentially capable of affecting the long-run economic growth. Equation (44) also predicts that the expected economic growth positively depends on parameter γ measuring the size of innovations, *i.e.* the size of increases in quality of new intermediate goods varieties that are used as inputs in the final goods sector. The more radical the innovation, the higher γ. More precisely, the expected growth of the economy is proportional to the incremental size of innovations, $(\gamma-1)$.[83]

Growth rate of output per capita can be expressed as $g_{Q/L} = \frac{(\gamma-1)\delta(a^*)+1}{g_L+1} - 1$, where g_L denotes growth rate of population.

It is straightforward that higher cutoff innovation ability, a^*, deteriorates technological progress and therefore negatively affects economic growth ($\partial g/\partial a^* < 0$ and $\partial g_{Q/L}/\partial a^* < 0$). This is due to the negative influence of an increase in a^* on the process of creative destruction ($\partial\delta(a^*)/\partial a^* < 0$). Factors that positively affect a^* can damage the process of creative destruction and weaken long-run economic growth.

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[82] In the neoclassical growth model, the economic growth depends on exogenous population growth and exogenous technical progress.

[83] In this interpretation, we follow Aghion and Howitt (2005).

4.4 Summary of the model and its equilibrium

The model's building blocks are summarized in Table 4.1. In our analysis, we focus on equilibrium rather than transitional dynamics and for this reason drop the time subscripts. Exceptions are equations describing the dynamics of the state variables (so-called flow equations).

Table 4.1: Building blocks of the model

Building blocks with the equations	
Consumer behaviour	
• $\max_{Q_t} U(Q_t) = E_t\{\sum_{t=0}^{T} \beta^t Q_t\}$, with $\beta = \frac{1}{1+\rho}$	(F.1)
• s.t. $W_t - W_{t-1} = r_t W_{t-1} + Y_t - Q_t$.	
• This maximization problem yields: $r_t = \rho$.	(F.2)
Final good sector	
• $Q = \left(M^{-\left(\frac{1}{\sigma}\right)} \int_{\omega \epsilon \Omega} \left(\kappa q(\omega)\right)^{\frac{\sigma-1}{\sigma}} d\omega\right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1.$	(F.3)
• $max\Pi = PQ - \int_{\omega \epsilon \Omega} p(\omega) q(\omega) d\omega$ s.t. (F.3) gives the demand for a variety ω of the intermediate input: $q(\omega) = \frac{Q}{M}\left(\frac{P}{p(\omega)}\right)^{\sigma} \kappa^{\sigma-1}$.	(F.4)
• Aggregate price index: $P = \left[M^{-1} \int_{\omega \epsilon \Omega} \left(\kappa p(\omega)\right)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$.	(F.5)
Intermediate goods sector	
• Production technology: $q(\omega) = \varphi l(\omega)$.	(F.6)
• Firm's profit function: $\pi(\omega) = \left(p(\omega)\varphi - w(\omega)\right) l(\omega)$.	(F.7)
• Entry condition: $\frac{\pi(\omega)}{\delta + r} - p_n \geq 0 \rightarrow p_n = \frac{\pi(\omega)}{\delta + r}$.	(F.8)
• Since firms have the same technology with the same labour productivity parameter, and bargain with unions with the same relative power, we have: $p(\omega) = p$, $q(\omega) = q$, $w(\omega) = w$, $l(\omega) = l$, and therefore $r(\omega) = r$ and $\pi(\omega) = \pi$.	
Innovative sector	
• *Ex-ante* distribution of entrepreneurial innovative ability:	
• $f(a) = \begin{cases} \frac{1}{a_{max} - a_{min}} & if \quad a_{min} < a \leq a_{max} \\ 0 & \text{otherwise} \end{cases}$	(F.9)
• Occupational choice (at the margin): $p_n \frac{M}{L} a^* - f_n = w$.	(F.10)
• Price of a blueprint: $p_n = \frac{\pi}{\delta + r} = \frac{1}{\delta + r} \lvert (p\varphi - w) l \rvert$.	(F.11)
• The two previous equations lead to the cutoff ability: $a^* = \frac{(\delta + r)(w + f_n)}{(p\varphi - w)} \frac{L}{l_p}$.	(F.12)
• *Ex-post* distribution of entrepreneurial innovative ability:	(F.13)

- $\hat{f}(a) = \begin{cases} \frac{1}{a_{max}-a^*} & if \quad a^* < a \leq a_{max} \\ 0 & \text{otherwise} \end{cases}$.
- Equilibrium number of entrepreneurs: $L_n = \left[1 - \hat{F}(a^*)\right]\bar{L} = \frac{a_{max}-a^*}{a_{max}-a_{min}}\bar{L}$. (F.14)
- Income of an average entrepreneur: $I(\tilde{a}) = (w + f_n)\frac{\tilde{a}}{a^*} - f_n$. (F.15)
- Output of the innovative sector: $M_e = Q_n = L_n \frac{M}{\bar{L}}\tilde{a} \;\; L_n \frac{M}{\bar{L}} \frac{(a_{max}+a^*)}{2}$. (F.16)
- Endogenous entry rate: $\delta(a^*) = \frac{M_e}{M} = \frac{L_n}{\bar{L}}\tilde{a} = \frac{(a_{max})^2-(a^*)^2}{2(a_{max}-a_{min})}$. (F.17)

Aggregation

- Main aggregates: $P = \frac{p}{\kappa}, \;\; Q = M\kappa q, \;\; R = Mr, \;\; \Pi = M\pi$. (F.18)
- Labour demand in the intermediate goods sector: $L_p = Ml = M\frac{q(\omega)}{\varphi} = \frac{Q}{\kappa\varphi}$. (F.19)
- Unemployment rate: $\frac{U_l}{\bar{L}} = \frac{\bar{L}-L_p-L_n}{\bar{L}}$. (F.20)

Government

- Balanced-budget constraint: $\tau\left(wL_p + I(\tilde{a})L_n\right) = \left(\bar{L} - L_p - L_n\right)b + G$. (F.21)

Collective bargaining

- Gross alternative wage/income (worker's outside option):
- $w_a = \left(\frac{\bar{L}-L_n-L_p}{\bar{L}}\right)\frac{b}{1-\tau} + \frac{L_p}{\bar{L}}w + \frac{L_n}{\bar{L}}I(\tilde{a})$. (F.22)
- Logarithm of the generalized Nash product:
- $ln\Omega = \beta ln[((1-\tau)w(\omega) - w_a)l(\omega)] + (1-\beta)ln[\varphi p(\omega) - w(\omega)]l(\omega)$. (F.23)
- $max_{w(\omega),p(\omega)}\, ln\Omega$ yields:
- $p(\omega) = \left(\frac{\sigma}{\sigma-(1-\beta)}\right)\frac{w(\omega)}{\varphi}$, (F.24)
- $w(\omega) = \beta\varphi p(\omega) + (1-\beta)w_a$. (F.25)
- Plugging one equation into another and choosing the final good as a *numéraire* ($P = 1$) gives the real gross alternative wage rate and the real gross wage rate:
- $\frac{p}{P} = \frac{p(\omega)}{P} = \frac{\sigma}{\sigma-1}\frac{1}{\varphi}\frac{w_a}{P} \rightarrow \frac{w_a}{P} = \kappa\varphi\frac{\sigma-1}{\sigma}$, (F.26)
- $\frac{w}{P} = \frac{w(\omega)}{P} = \kappa\varphi\frac{\sigma-(1-\beta)}{\sigma}$. (F.27)

Growth of the economy

- Aggregate output (note time indices): $Q_t = \left|M^{-\frac{1}{\sigma}}\int_{\omega\varepsilon\Omega}\left(\kappa(\omega)_t q(\omega)\right)^{\frac{\sigma-1}{\sigma}} d\omega\right|^{\frac{\sigma}{\sigma-1}}$ (F.28)
- Expected value of the quality parameter:
- $\kappa(\omega)_{t+1} = \begin{cases} \gamma\kappa(\omega)_t & \text{with probabilty} \quad \delta(a^*) \\ \kappa(\omega)_t & \text{with probabilty} \quad \left(1-\delta(a^*)\right) \end{cases}$, with $\gamma > 1$ (F.29)
- Expected (log-run) growth rate of the aggregate output:
- $g_Q = \frac{Q_{t+1}-Q_t}{Q_t} = g_\kappa = (\gamma-1)\delta(a^*)$ (F.30)

Note:

Parameters and exogenous variables
ρ: subjective discount rate
r: nominal interest rate
σ: elasticity of substitution between any two varieties of the intermediate good (>1)
φ: productivity parameter in the intermediate goods sector
f_n: fixed cost faced by an entrepreneur
a: individual's entrepreneurial ability, $a \epsilon [a_{min}, a_{max}[$
β: union bargaining power
γ: the size innovation
$\bar{L}$: total number of workers in the economy
G: non-productive government spending other than unemployment benefits
τ: tax rate on individual's income
b: unemployment benefit[84]
t: time period
Mathematical operators/functions
E: expectation operator
$\hat{f}(a)$: *ex-post* distribution of entrepreneurial ability
$f(a)$: *ex-ante* distribution of entrepreneurial ability
$F(a)$ and $\hat{F}(a)$ are the corresponding cumulative distribution functions

Endogenous variables
U: aggregate utility index
W: wealth of individuals
Q: composite (final) consumption good
$q(\omega)$: quantity of a variety ω of the intermediate good
$\kappa(\omega)$: quality of an intermediate good variety ω $(\kappa(\omega) = \kappa)$
$p(\omega)$: price of an intermediate good variety ω
$\pi(\omega)$: profit of a firm in the intermediate goods sector
$r(\omega)$: revenue of a firm in the intermediate goods sector
$l(\omega)$: number of workers employed by a firm in the intermediate goods sector
l_w: total number of workers employed in the intermediate goods sector
M: number of firms in the intermediate sector
P: aggregate price index
R: aggregate revenue
Π: aggregate profit
p_n: price of a blueprint
a^*: cutoff entrepreneurial ability
$\tilde{a}$: average entrepreneurial ability
$I(a)$: income of an entrepreneur with ability a
L_n: number of entrepreneurs
δ: entry rate into the intermediate goods sector
w: gross wage rate $(w(\omega) = w)$
w_a: gross alternative wage rate
U_t: aggregate unemployment level

Let us now characterize the steady state, which requires that the aggregate variables do not change. In the first stage of steady-state analysis, we ignore the growth block. The equilibrium of the model is determined by the following six equations: the cutoff ability (F.12), the gross alternative wage specification (F.22), the equilibrium real gross alternative wage (F.26), the equilibrium real gross wage rate (F.27), the equilibrium firm entry rate (F.17), and the government's balanced-budget constraint (F.21). Let us write an equivalent but downsized formulation of the system. For this purpose, we first assume that the government arbitrarily chooses the tax rate on labour income and adjusts the level of unemployment benefit to balance its budget. The case when the government discretionary chooses the level of unemployment benefit, while the income tax rate is determined endogenously, is also considered but the results of this step of derivations are not explicitly reported. From the definition of the gross alternative wage, (F.22), and the balanced-budget constraint, (F.21), we first derive the *employment rate for the intermediate goods sector* as a function of a^* and the parameters in the model:

[84] In equilibrium, the balanced government budget constraint (F.21) needs to hold. Therefore, by determining τ exogenously, b is pinned down by this condition, taking G as given. If we let τ to be determined endogenously by the model, we can set b arbitrarily.

$$\frac{L_p}{\bar{L}} = \frac{(1-\tau)(\sigma-1)}{\sigma-(1-\beta)} - \left(\frac{a_{max}+a^*}{2a^*} + \frac{\sigma}{\sigma-(1-\beta)}\frac{f_n}{\kappa\varphi P}\frac{a_{max}-a^*}{2a^*}\right)\left(\frac{a_{max}-a^*}{a_{max}-a_{min}}\right) + \frac{\sigma}{\sigma-(1-\beta)}\frac{G}{\kappa\varphi P\bar{L}}. \quad (45)$$

Hereby, we also made use of (F.15), (F.26) in (F.27). Secondly, we plug (F.26) and (F.27) into the *cutoff ability function* (F.12) and express $L_p/\bar{L}$:

$$\frac{L_p}{\bar{L}} = \left(\frac{(a_{max})^2-(a^*)^2}{2a^*(a_{max}-a_{min})} + \frac{\rho}{a^*}\right)\left(\frac{\sigma-(1-\beta)}{1-\beta} + \frac{\sigma}{1-\beta}\frac{1}{\kappa\varphi}\frac{f_n}{P}\right). \quad (46)$$

The cutoff ability equation, (46), is related to the size of the entrepreneurial sector. The intersection of the two curves determines how labour is allocated between the production sector and the innovative sector. The allocation of labour between the two sectors affects the process of creative destruction and is the key factor of long-term economic development.[85]

We have arrived at the two conditions that define the model's *static equilibrium*: (45) and (46). They can be solved for equilibrium values of a^* and L_p/L that determine other endogenous variables in the model (*i.e.* $\delta(a^*)$, L_n, u). We now add the growth block. The growth equation (F.30) together with (45) and (46) determines the *balanced growth path (BGP) equilibrium*. The BGP equilibrium is a long-run equilibrium where all variables depending on time grow at constant rates while other variables stay constant. In our case, a balanced growth path is a path along which the long-run (expected) technology parameter κ and aggregate output grow at constant (persistent) rate: $g_Q = g_\kappa = (\gamma - 1)\delta(a^*)$.

4.5 Sensitivity analysis

To test the first four hypotheses of the monograph and to verify the research statement, we compare the predictions of the model for the equilibrium rate of business creation, economic growth rate and, additionally, for the unemployment rate, as we vary: (i) the bargaining power parameter or (ii) the unemployment benefit (or, alternatively, the tax rate on labour income). Moreover, we highlight the predictions of the model regarding the effects of changes in other parameters such as the elasticity of substitution between intermediate good varieties, which may serve as a proxy for competitiveness in the intermediate goods market, the cost of getting a credit/loan (*i.e.* the interest rate), and the fixed cost of entrepreneurship.

Sensitivity analysis or comparative statics investigates the effects of small finite changes (or infinitesimal changes, when analysed analytically) in a varied parameter on endogenous variables, holding the form of functions and the values of other parameters constant. In other words, comparative statics is concerned with the sensitivity of a model's solution to small

[85] The allocation of labour across sectors is crucial for economic growth also in the models of Grossman in Helpman (1991, chapter 4) and Aghion and Howitt (1992). In these two models, however, the allocation of labour is determined by maximization of the expected flow of firm's profits from research (and not by occupational choices of individuals as in our model).

changes in parameters. We take a deterministic approach to sensitivity analysis, which means that we adhere to the steady-state sensitivity analysis and do not investigate transitional dynamics between two equilibria.

Due to the nonlinearity of relationships between endogenous variables and between the variables and some of the parameters in the model, we conduct a numerical sensitivity analysis. Based on a set of chosen parameters, numerical methods quantify the results of our theoretical model. However, due to the stylized nature of the model, we interpret the results of the quantitative analysis by focusing on the sign (not on the magnitude) of the effects of parameter changes on variables. Based on numerical sensitivity analysis, we thus draw conclusions about the qualitative relationship between the observed variables and key parameters in the model. The robustness of some of the results is checked analytically (more precisely, by partial derivative-based analysis).

4.5.1 Parametrization and solution method

The first step in numerical sensitivity analysis is determination of a set of parameters used in the model. In line with common practice in economic literature, we import the values for some of the parameters from other studies.[86] Some of the parameters, such as the tax rate on labour income and the level of unemployment benefits (relative to gross wage rate), are set to match their empirical values observed in the EU-15 in the period 1995–2007. The rest of the parameters are calibrated[87] to match the empirical values of targeted variables (*i.e.* the unemployment rate, the rate of creative destruction of businesses, and the rate of economic growth) in the EU-15 in the period 1995–2007.

We adopt the following parameterization on the annual basis. Recall, that the final good is chosen as a *numéraire*, thus $P = 1$. The population is normalized to unity, $\bar{L} = 1$. Chosen maximum and minimum innovative ability levels are: $a_{min} = 0$ and $a_{max} = 1$, respectively. We further set the productivity parameter for the intermediate goods sector equal to 1 ($\varphi = 1$). These choices do not affect the qualitative results of the analysis. For the purpose of calculating a static equilibrium, we set the quality parameter, κ, equal to 1. However, we let this parameter change endogenously from one period to another, when we take into account also the growth block of the model. The time preference parameter, which equals the steady state real interest rate, is 4 percent as in de Walque *et al.* (2009).[88]

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[86] Since we do not intend to evaluate policy in quantitative terms, less precise estimates of the model's parameters do not seem to be critical (especially, because the results of the model are robust to small changes in these parameters).

[87] Calibration of parameters is the procedure of choosing or adjusting a set of parameter values so that the model better reproduces the behaviour of chosen (target) variables in the real economies.

[88] Some authors (*e.g.* Shimer 2005) set instead the real annual interest at 5 percent.

Government's balanced-budget constraint implies that the government can discretionally set either the tax rate on labour income or the level of unemployment benefit when its non-productive spending is exogenously given. We conduct two types of exercises. In the first, the government discretionary sets the tax rate and lets the unemployment benefit be determined endogenously. In the second, we assume that the government chooses the level of unemployment benefit and adjusts the tax rate to balance the government's budget. The total average tax rate (including social security contributions of employees and employers), τ, expressed as a percentage of the total labour cost, is set to 36.6 percent for EU-15. This corresponds to the average tax wedge for a hypothetical two-earner family with two children (where the first earner has the average wage and his/her spouse earns two thirds of the average wage) as estimated by OECD (2007, 64) for EU-15 in 2007. Various values of b have been used in economic literature. De Walque *et al.* and Shimer (2005), for example, set b equal to $0.4w$ for Europe. We set b equal to $0.32w$ for the EU-15. This corresponds to the OECD (2010a) estimate of the average gross replacement rate (*i.e.* b/w) in the EU-15 amounting to 32 percent.

The form of the mark-up of price over marginal cost is model specific. The efficient bargaining in our model leads to the following pricing rule: $p = (\sigma/(\sigma - (1-\beta)))\, w/\varphi$, where w/φ represents the marginal cost of production in the intermediate goods sector. The empirical study of Christopoulou and Vermeulen (2008), for example, suggests that the mark-up factor, $\sigma/(\sigma - (1-\beta))$, is equal to 1.2 in the Euro Area for the period 1993–2004, which implies the following relationship between β and σ: $\sigma = 6(1-\beta)$. However, if we want to replicate the OECD (2010a) estimate of the average gross replacement rate in the EU-15, we need to choose the parameters in the mark-up factor (σ or β) to guarantee that the alternative gross wage equation ((F.22) in Table 4.1) holds for the targeted value of b/w. We have decided to choose the union bargaining power β arbitrarily and to calibrate σ to make (F.22) hold for $b/w = 0.32$.

There is no strong empirical evidence on the relative bargaining power of unions across Europe. The estimates of the union bargaining power in different sectors in France provided by Cahuc, Postel-Vinay and Robin (2006) range from 0 to 0.17 for low-skilled workers. The results of the empirical study by Dumont, Rayp and Willeme (2006) suggest that the bargaining power of unions at sector level in Belgium, France, and Italy, on average amounts to 0.494. Several theoretical models (*e.g.* Walque *et al.* 2009, 20 and Dao 2008, 16) assume that firms and unions have equal bargaining power and set β to 0.5 (*i.e.* they assume symmetric bargaining). This assumption does not appear to be appropriate for our model, since the outside option of workers is the alternative gross wage ((F.22) in Table 4.1) and not simply the level of unemployment benefit. This suggests a significantly lower (model specific) union bargaining power. We assume that the average union bargaining power in the EU-15 is equal to 0.15 ($\beta = 0.15$).

Parameters σ, f_n, G and γ are calibrated, *i.e.* derived from the model, to match the targeted values of the main endogenous variables presented in Table 4.2 and chosen parameters. The targeted unemployment rate is 7.4 percent, which corresponds to the non-weighted arithmetic average of harmonized unemployment rates in the EU-15 countries over the period 1995–2007 (data are from OECD 2010b). The average rate of creative destruction (calculated as the business turnover rate divided by two) in the EU-15 over the same period is 8.73 percent (data come from EIM 2010c). The average economic growth rate in the EU-15 over the period 1995–2007 equals 3.1 percent. The indicator of economic growth, which we use in the calibration procedure, is the annual percentage change of total real GDP. Data for real GDP come from The Conference Board Total Economy Database – TEDI (2010), compiled by the Groningen Growth and Development Centre.

Table 4.2: Targeted values of variables used for calibration

Country group	Unemployment rate	Rate of creative destruction	Growth rate of real GDP
EU-15	7.4	8.73	3.10

Note: All data refer to the period 1995–2007. The unemployment rate and the rate of creative destruction are calculated as simple arithmetic averages for the EU-15 over the observed period. The rate of creative destruction is calculated as the IBE business turnover rate divided by 2 and refers to nine EU countries (see Table 2.2).

Sources: TEDI (2010) for growth rate of GDP per hour, EIM (2010c) for the rate of creative destruction, and OECD (2010b) for harmonized unemployment rate.

In the process of parameter calibration, we follow the next steps:

- We first insert the targeted value for the rate of creative destruction into equation (F.17) in Table 4.1, which gives the corresponding equilibrium value of a^*.
- By inserting the equilibrium value of a^* into (F.14) in Table 4.1, we get the equilibrium number of innovative entrepreneurs, L_n.
- Then we insert derived values of a^* and L_n into (F.20) in Table 4.1 and use the targeted value of the unemployment rate to obtain the equilibrium value of L_p.
- Given the equilibrium values of a^*, L_n, L_p, and chosen parameters, we calibrate parameters σ and f_n to jointly satisfy equations (F.17) and (F.22) in Table 4.1.
- Having the equilibrium values of a^*, L_n, L_p, σ, f_n, and chosen parameters, we use the government balanced-budget constraint ((F.21) in Table 4.1) to derive the value of G.
- Finally, parameter γ is calibrated to satisfy the growth equation ((F.30) in Table 4.1) for the targeted values of the rate of creative destruction and economic growth.

The calculation procedure is carried out in Matlab. We report the results in Table 4.3.

Table 4.3: Baseline parameter values for the benchmark economy

Parameter	Meaning	Source
	Normalization	
$P = 1$	Aggregate price index	Assumption
$\bar{L} = 1$	Economy's labour endowment	Assumption
$\varphi = 1$	Labour productivity in the intermediate goods sector	Assumption
$\kappa = 1$	Time varying quality parameter	Assumption
$a_{max} = 1$	Span of innovative abilities,	Assumption
$a_{min} = 0$	$a \in [a_{min}, a_{max}]$	
	Observed parameters	
$r = \rho = 0.04$	Interest rate	de Walque *et al.* (2009)
$\tau = 0.366$	Average tax wedge	OECD (2007)
$b = 0.32w$	Unemployment benefit	OECD (2010a)
	Assumed parameters	
$\beta = 0.15$	Labour union's relative bargaining power	Assumed (slightly below the estimate of Cahuc *et al.* (2002) for France)
	Calibrated	
$\sigma = 5.5790$[89]	Elasticity of substitution between intermediate good varieties,	Calibrated to match targeted values of the unemployment rate and the rate of creative destruction and the above parameters.
$f_n = 0.0598$	Fixed operating cost of an innovative entrepreneur	
$G = 0.2687$	Non-productive government spending	
$\gamma = 1.3551$	Size of innovations (intermediate goods improvements)	Calibrated to match the targeted economic growth rate and the targeted rate of creative destruction.

To calculate the steady state for the benchmark economy (*i.e.* the economy with the structure presented by the theoretical model and parameter values presented in Table 4.3) we use Matlab. Given the parameters, the built-in function *fsolve* helps to solve the system of non-linear equations (45) and (46) by the multivariable Newton-Raphson iterative method (Judd 1998, 167–168). After the system is solved for equilibrium values of a^* and $L_p/\bar{L}$, we calculate the equilibrium rate of creative destruction, $\delta(a^*)$, the equilibrium number of innovative entrepreneurs, $L_n(a^*)$, and the unemployment rate, $u = (L - L_p - L_n)/\bar{L}$. The equilibrium value of $\delta(a^*)$ implies the balanced growth path of the aggregate output.

Figure 4.1 illustrates static equilibrium for the benchmark economy. The *cutoff ability curve* implies a negative relationship between the cutoff innovative ability and employment in the intermediate goods sector. This holds in general for any combination of appropriate parameter values (*i.e.* parameter values in line with the assumptions of the model). The reasoning behind the negative slope of the cutoff ability curve is the following. The sum of profits in the intermediate goods sector is proportional to employment in this sector. The higher the profits (and thus labour demand and employment) in the intermediate goods sector, the higher is the price of blueprints invented by entrepreneurs, and the lower is the cutoff innovative ability.

[89] Calibrated value of σ implies that the mark-up of price over marginal cost equals 1.18, which is close to the empirical estimate for Euro Area provided by Christopoulou and Vermeulen (2008).

The *employment curve* for the intermediate goods sector shows positive relationship between employment in this sector and the cutoff ability of innovative entrepreneurs. This holds for any combination of appropriate parameter values. The reasoning behind the positive slope of the employment curve in the intermediate goods sector is the following. A rise in the cutoff innovative ability lowers the number of innovative entrepreneurs and increases the average earning of an entrepreneur. Total earnings in the innovative sector, however, decrease. This negatively affects the (nominal) gross alternative wage, which leads to a lower nominal gross wage rate. Consequently, labour demand in the intermediate goods sector increases, which implies a positive slope of the employment curve for the intermediate goods sector in plane $a^*-L_p/\bar{L}$. The equilibrium of the model is reached at the point where the two curves intersect (Figure 4.1).

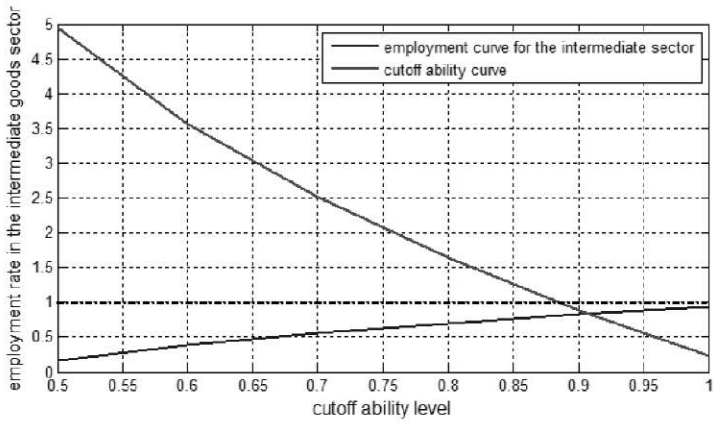

Figure 4.1: Determination of equilibrium for the benchmark economy

Note: The parameters used for solving the system are specified in Table 4.3. The horizontal line presents the upper threshold for the employment rate.

Regardless of the values of parameters in the model, we can confirm hypothesis 4 of the monograph that the (equilibrium or long-run) rate of business creation boosts economic growth. This directly follows from the derived BGP along which the long-run (expected) technology parameter κ and aggregate output grow at constant (persistent) rate: $g_Q = g_\kappa = (\gamma - 1)\delta(a^*)$. If γ is treated as exogenous, the relationship turns out to be linear.

In the follow-up, we test hypotheses 1 to 3, which relate three selected labour market institutions to business creation and economic growth. We test the hypotheses by analysing the sensitivity of the model's solution for the benchmark economy with respect to changes in the following parameters: i) union bargaining power, ii) the level of unemployment benefit and, alternatively, iii) tax rate on labour income. Additionally, we examine the sensitivity of the model's solution with respect to changes in the elasticity of substitution between intermediate goods varieties and other parameters in the model. By varying one of the

parameters (holding all other parameters constant), we compute new equilibrium values of variables. Based on the comparison of equilibria (*i.e.* comparative statics), we draw conclusions about the relationship between parameters and the observed variables in the benchmark economy. The robustness of some of the conclusions is investigated analytically.

4.5.2 The role of trade unions

In this section, we test hypothesis 1 of the monograph by analysing the impact of changes in the union bargaining power parameter, β, on equilibrium values of endogenous variables in the benchmark economy. We start our exercise with a set of baseline parameters presented in Table 4.3 and then increase the union bargaining power parameter from 0.15 to 0.3, keeping all other parameters constant.

Figure 4.2 illustrates that an increase in relative union bargaining power in the benchmark economy moves the *cutoff ability curve* upward towards the right. This is partly due to the higher opportunity cost of an innovating entrepreneur in terms of higher gross wage rate (which would increase a^* even if employment in the intermediate goods sector did not change) and partly due to the lower price of blueprints (which would fall and increase a^* even if employment in the intermediate goods sector did not decrease). We can show that this holds for all appropriate parameter values that correspond to assumptions and definitions of the model (*i.e.* $\sigma > 1$, $0 \leq \beta \leq 1$, $a_{min} < a^* \leq a_{max}$, and all parameters take non-negative values).

Figure 4.2 also illustrates that an increase in relative union bargaining power in the benchmark economy pushes the *employment curve* for the intermediate goods sector downward, which is due to a decrease in labour demand in the intermediate goods sector that follows a hike in the real gross wage rate. This effect holds even when we significantly change the values of calibrated parameters (*i.e.* σ, f_n and G) in Table 4.3.

The post-change curves (dashed lines in Figure 4.2) balance at higher cutoff ability level compared to the baseline case. In the benchmark economy, the overall effect of an increase in relative union bargaining power on employment in the intermediate goods sector turns out to be negative.

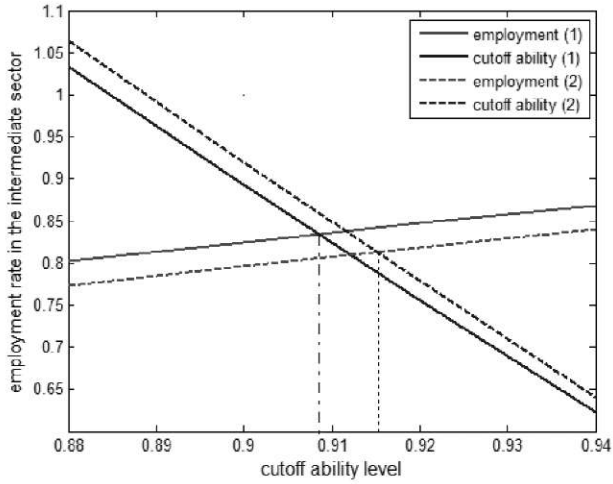

Figure 4.2: Simulation of the impact of an increase in relative union bargaining power on equilibrium in the benchmark economy

Note: Solid lines represent the employment curve and the cutoff ability curve (*i.e.* (45) and (46)) for the baseline value of union bargaining power parameter for the benchmark economy (*i.e.* $\beta = 0.15$). Dashed lines represent the curves for $\beta = 0.3$. All other parameters are in both cases set to values in Table 4.3, except for the unemployment benefit, which is determined endogenously.

Keeping all other parameters constant, we now gradually change the union bargaining power parameter by 0.05 starting from 0 until it reaches 0.7. Figure 4.3 displays the relationship between the union bargaining power and key variables in the model (the cutoff innovative ability, the unemployment rate, the rate of creative destruction, and the growth rate of the aggregate output) as suggested by the results of simulation.

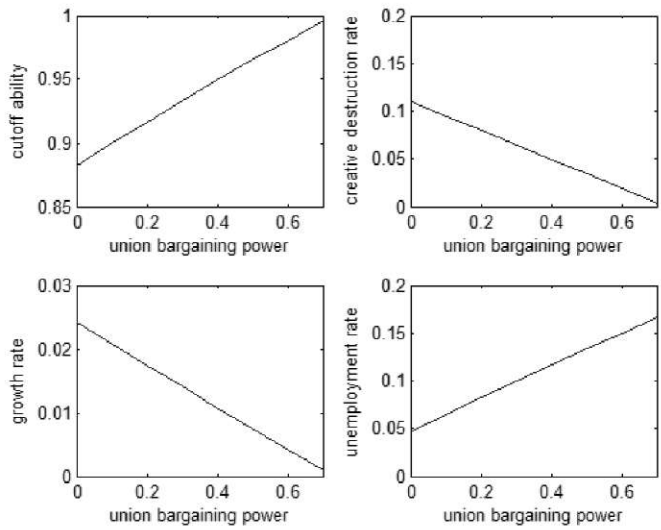

Figure 4.3: Relationship between the union bargaining power and key variables in the model for the benchmark economy

Note: Results are based on simulations with varying union bargaining power while keeping other parameter values constant (*i.e.* equal to values in Table 4.3) with an exception of the unemployment benefit, which is determined endogenously.

The first plot in Figure 4.3 (in the upper-left quarter) depicts a positive relationship between the union bargaining power parameter and the cutoff innovative ability level in the benchmark economy. The second plot in Figure 4.3 (in the upper-right quarter) suggests that an increase in relative union bargaining power in the benchmark economy dampens the process of creative destruction. The third plot in Figure 4.3 (in the lower-left quarter) depicts that higher relative union bargaining power in the benchmark economy lowers the growth rate of the aggregate output (and output per capita). The fourth plot in Figure 4.3 (in the lower-right quarter) suggests that an increase in relative union bargaining power in the benchmark economy leads to a higher unemployment rate.[90] In particular the first three relationships are robust to considerable changes in parameter values for the benchmark economy.

In line with the results of theoretical analysis, we accept hypothesis 1 that an increase in the union bargaining power negatively affects the (equilibrium) business entry rate and,

[90] The standard (partial equilibrium) model of efficient bargaining suggests that higher wages can be reached without sacrificing employment (Cahuc and Zylberberg 2004, 398). The richer specification of the alternative wage as introduced by Fiori *et al.* (2007), which we borrow, brings the outcome of the efficient bargaining model closer to the outcome of the right-to-manage model and implies that higher bargained wages may lead to higher unemployment.

indirectly, economic growth in the form growth in GDP per capita, keeping other things constant. The implication that powerful trade unions lead to lower economic growth is in line with the theoretical prediction of Quintero-Rojas, Adjemian and Langot (2008).

4.5.3 The role of unemployment benefits

When the level of government's non-productive spending is set exogenously, the government can discretionarily choose either the level of unemployment benefit or the tax rate on labour income. Let us first consider the case when the government decides on the level of unemployment benefit, in which case the tax rate on labour income is endogenous to the model. This will help us to test hypothesis 2 stating that generous unemployment benefits negatively affect business creation and (indirectly) economic growth.

Unemployment benefit presents one of the elements of the alternative wage. Gross wage in the intermediate goods sector is set as a mark-up over the gross alternative wage. A rise in the (nominal) gross alternative wage due to a higher level of unemployment benefit therefore leads to higher (nominal) gross wage and lower labour demand in the intermediate goods sector. However, since higher (nominal) gross wage raises prices of intermediate goods and in the final instance also the aggregate price level, the real gross wage (*i.e.* w/P) stays constant as suggested by equation (F.27) in Table 4.1. Since a higher level of unemployment benefit relative to (nominal) gross wage implies a higher tax rate on labour income, the real net wage (*i.e.* $(1-\tau)w/P$) received by workers falls.

Due to a decrease in employment in the intermediate goods sector, the sum of profits earned in the intermediate goods sector and spent on blueprints provided by innovative entrepreneurs decreases. This lowers the prospective income of an innovative entrepreneur and increases the cutoff innovative ability. In line with equation (F.16) in Table 4.1, an increase in the cutoff innovative ability following a rise in the relative unemployment benefit negatively affects the amount of innovative entrepreneurship. Individuals are now less motivated to experiment in the field of entrepreneurship and altogether produce a lower quantity of novel intermediate goods. This results in a decrease in the rate of creative destruction (as is evident from equation (F.17) in Table 4.1, considering that the cutoff innovative ability increases). The latter impedes economic growth, as suggested by equation (F.30) in Table 4.1 and as depicted in Figure 4.4 (by the plot in the lower-left quarter). Since both employment in the intermediate sector and the amount of innovative entrepreneurship decrease following an increase in unemployment benefit, the unemployment rate in the benchmark economy increases (Figure 4.4).

The results of simulation for the benchmark economy support hypothesis 2 that generous unemployment benefits negatively affect the (equilibrium) rate of business creation and the growth of the aggregate output per capita.

Let us also compare the results with the previous literature. The implication that a higher unemployment benefit replacement rate hampers economic growth is in line with Quintero-Rojas, Adjemian and Langot (2008). The model with two different types of labour (low-skilled and high-skilled) presented by Lingens (2007) allows for the opposite effect of unemployment benefits. In his (*ibid.*) model, unionization affects the economy through two different channels: i) unionization decreases the incentive to invest into research and lowers economic growth; ii) since unionization leads to unemployment of low-skilled labour, the economy becomes more high-skilled abundant, which leads to expansion of the research sector and higher economic growth. The overall impact of unionization on economic growth is thus theoretically ambiguous in the model of Lingens (2007).

Our result, that an increase in unemployment benefits raises unemployment, is in line with the results of standard right-to-manage union bargaining models and models of search and matching in the labour market (Holmlund 1997; Cahuc and Zylberberg 2004, 692–701). Differently, the standard model of efficient bargaining introduced by McDonald and Solow (1981) allows that the value of the outside option increases without harming (or by even increasing) employment. The result of our simulation exercise also matches empirical evidence (see Holmlund 1997 for a review) that increased benefit generosity causes higher overall unemployment. Our model, however, does not have the capability of showing that a generous unemployment benefit system leads to longer spells of unemployment.

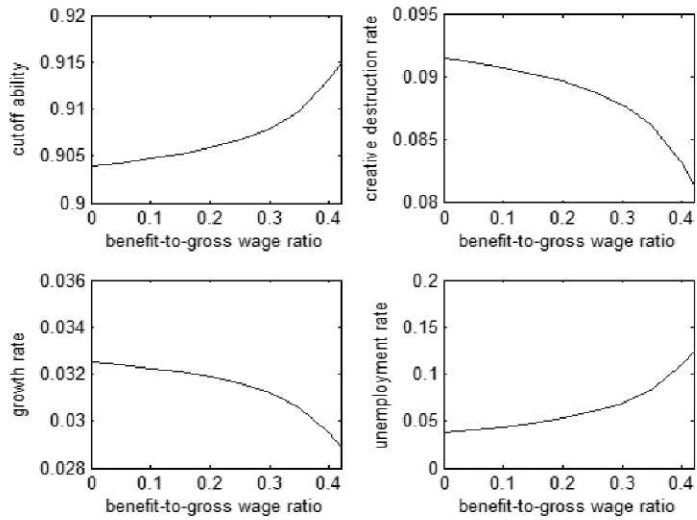

Figure 4.4: Relationship between the level of unemployment benefit and key variables in the model for the benchmark economy

Note: Results are based on simulations with varying relative unemployment benefit while keeping other parameter values constant (*i.e.* equal to values in Table 4.3) with an exception of the tax rate on labour income, which in this case is determined endogenously.

Let us now move on to the case when the government discretionary chooses the tax rate on labour income and the level of its non-productive spending, while the unemployment benefit is determined endogenously. This will allow us to test hypothesis 3 of the monograph stating that tax burden on labour income negatively affects business creation and, indirectly, economic growth.

When non-productive spending by the government is kept constant, the level of unemployment benefits adjusts to a change in the tax rate on labour income to balance the government's budget. Figure 4.5 suggests a positive non-linear relationship between the tax rate and the level of unemployment benefit (relative to the gross wage rate) for reasonably small changes in the tax rate.

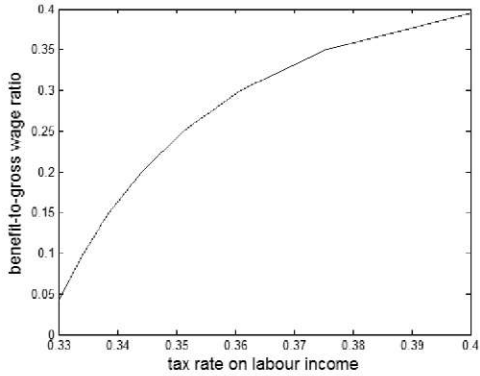

Figure 4.5: Relationship between tax rate on labour income and the relative level of unemployment benefit

It is straightforward (and evident from Figure 4.6) that a reasonably small increase/decrease in the tax rate on labour income (*i.e.* up to approximately four percentage points in each direction) in the benchmark economy leads to:

- an increase/decrease in the cutoff innovative ability,
- a decrease/increase in the rate of creative destruction,
- a decrease/increase in the rate of economic growth,
- an increase/decrease in the unemployment rate.

The results for the benchmark economy therefore support hypothesis 3 that tax burden on labour income negatively affects business creation and, indirectly, economic growth.

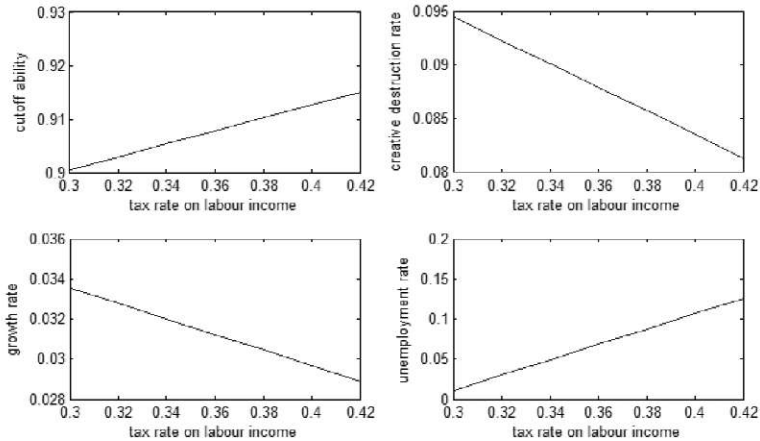

Figure 4.6: Relationship between tax rate on labour income and key variables in the model for the benchmark economy

Note: Results are based on simulations with varying tax rate on labour income while keeping other parameter values constant (*i.e.* equal to values in Table 4.3) with an exception of the relative unemployment benefit, which in this case is determined endogenously.

4.5.4 The role of intellectual property right protection, product market regulation and other institutional parameters

The model assumes that entering businesses that buy blueprints for new intermediate goods varieties are granted perpetual patent right over production of unique product varieties. *Protection of (intellectual and other) property rights* in our model is important for the intensity of creative destruction, since it reduces the risk of investing into new business ventures, and is therefore beneficial for aggregate economic growth.

The simulation exercise reveals that the model predicts a negative impact of increased *product market competition* (presented by an increase in the elasticity of substitution between intermediate good varieties) on the process of creative destruction and therefore on economic growth in the benchmark economy (Figure 4.7). Higher product market competition (and thus product market deregulation) in our model lowers profits in the intermediate goods sector, which reduces prices of blueprints produced in the innovative sector. This raises the cutoff innovative ability and lowers the intensity of creative destruction. Consequently, the aggregate output growth decreases. In the benchmark economy, higher product market competition increases employment in the intermediate goods sector and decreases the number of innovative entrepreneurs. The overall impact on the unemployment rate turns out to be positive, which is a rather unappealing feature of our model.

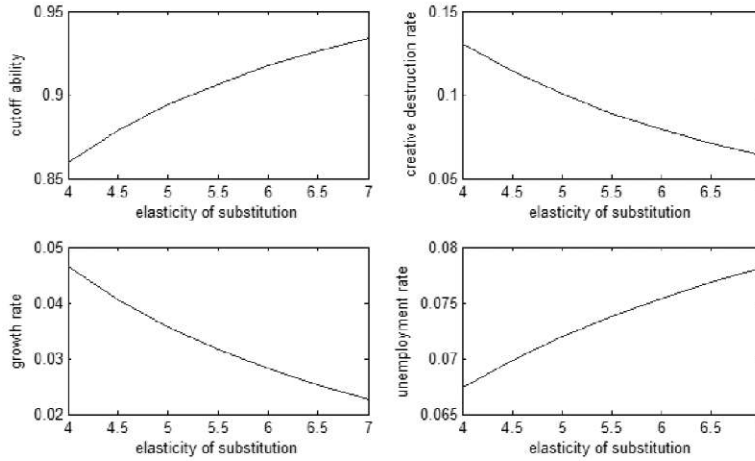

Figure 4.7: Relationship between the elasticity of substitution and key variables in the model for the benchmark economy

Note: Results are based on simulations with varying elasticity of substitution between intermediate goods varieties while keeping other parameter values constant (*i.e.* equal to values in Table 4.3), with an exception of the relative unemployment benefit, which is determined endogenously.

The negative effect of product market competition on innovative activity is also established by Aghion and Howitt (2004, 19), who call it the *Schumpeterian effect of product market competition*. They, however, further develop their expository model to add the fostering effect of product market competition on growth, called the *escape competition effect*. In line with the extended version of their model (*ibid.* 19–20), the first (negative) effect is relevant for firms that start below the technology frontier, while the second (positive) effect is significant for firms that start at the technology frontier and are prepared to innovate to escape competition. This extension, which is above the scope of our theoretical analysis, brings their model closer to a common wisdom that higher product market competition may positively affect the aggregate output growth.

An increase in the market interest rate, r (which is equal to ρ), lowers the expected return on investment into new intermediate good variety and pushes the cutoff ability curve in plane a^*-$L_p/\bar{L}$ upward toward the right, while the position of the employment curve remains unchanged.[91] It is straightforward that a higher interest rate implies higher cutoff innovative ability and a lower rate of creative destruction, which is detrimental for economic growth.

[91] The first derivative of the right hand side of (46) with respect to ρ (taking a^* as given) is positive for all parameters that are in line with the assumptions and definitions of the model. At the same time, the first derivative of the right hand side of (45) with respect to ρ (taking a^* as given) is equal to zero.

As we increase the *fixed cost* of an innovative entrepreneur, f_n, the employment curve presented by equation (45) moves downward in plane $a^* - L_p/\bar{L}$, while the cutoff ability curve presented by (46) shifts upward toward the right.[92] This increases the cutoff innovative ability and lowers the rate of creative destruction, which leads to lower economic growth.

[92] The first derivative of the right hand side of (45) with respect to f_n (taking a^* as given) is negative for all parameters that are in line with the assumptions and definitions of the model. At the same time, the first derivative of the right hand side of (46) with respect to r (taking a^* as given) turns out to be positive for all appropriate parameter values.

5 EMPIRICAL ANALYSIS OF THE IMPACT OF LABOUR MARKET INSTITUTIONS ON ENTREPRENEURSHIP AND ECONOMIC GROWTH

In this section, we empirically test the five hypotheses of the monograph and compare the empirical results with qualitative predictions of the theoretical model developed in the preceding section. We first briefly review empirical studies that are most closely related to ours. Then we present data employed in the empirical analysis and provide some stylized facts and descriptive statistics using TSCS data for nine EU countries included in the IBE database (see Table 2.2) and the United States. Afterwards, we discuss the methodology and the modelling strategy for the assessment of the impact of labour market institutions on Schumpeterian entrepreneurship in the form of business creation and the impact of the latter on economic growth. Finally, we present the results of the regression analysis and draw parallels with the simulation results for the theoretical model.

5.1 Introduction

The hypotheses of monograph (and predictions of the theoretical model, which confirm hypotheses 1 to 4), will be tested empirically using the country-level data for nine EU countries included in the IBE database (see Table 2.2) and the United States for the period 1995–2007 when assessing the impact of selected variables on business dynamics, and for the period 1996–2008 when examining the impact of relevant variables on economic growth. By testing the hypotheses, we verify the research statement that entrepreneurship in the form of business creation acts as a channel of transmission of the effects of labour market institutions on economic growth.

Our empirical part is close to Cincera and Galgau (2005) and Loayza, Oviedo and Servén (2005). The studies focus on the role of business dynamics as a channel of transmission of the effects of (different types of) regulations on productivity growth. Both studies follow a two-step regression analysis but differ in certain aspects.

Cincera and Galgau (2005) concentrate on the impact of product market reforms on business dynamics, which can in turn affect macroeconomic performance. In the first step of regression analysis, they estimate the relationship between firm entry (and exit, respectively) and chosen indicators of product market regulations, while controlling for country and industry structural characteristics (such as entry barriers). In the second step, they estimate the relationship between firm entry rate (and exit rate, respectively) and different macroeconomic outcomes. They use industry-level business entry and exit rates calculated on the basis of Dun and Bradstreet data for nine EU member states and the United States for the period 1997 to 2003. They find that product market deregulation leads to an increase in both business entry rate and exit rate. They disclose a changing relationship between an increase in the entry rate and the impact on output growth, with a rise in the contemporaneous entry rate leading to higher

output growth and an increase in the once-lagged entry rate having a negative impact on output growth.

Loayza, Oviedo and Servén (2005) investigate how product market regulation, labour market regulation and fiscal regulation affect the process of business dynamics (business entry, exit and turnover rates) in chosen OECD and Latin American countries. Since they observe no apparent difference between entry and exit rates in the OECD and Latin American countries, they decide to examine whether businesses have the possibility to adjust fully after being hit by large macroeconomic shocks (such as the shocks to terms of trade). In this first step, they estimate the impact of different types of regulations on indicators of business dynamics (adjusted for deviation in terms of trade). For this step, they use industry-level data for twelve countries for the period 1990–2001 (the unbalanced panel). In the second step, they estimate the effect of business dynamics on productivity growth. For the latter step, they use country-level data for seven countries for the period 1988–2001. The study employs synthetic (and static) indices of product market regulation, labour market regulation and fiscal regulation. The results show that the three types of regulation significantly negatively affect the response of business dynamics to shocks. The evidence on the passage of the effects of regulations from business dynamics to productivity growth is weak (*i.e.* it depends on the specification of the model and estimation method).

In our empirical analysis, we follow the two-step approach as in the studies just described, but place more emphasis on labour market institutions, in particular union bargaining power, unemployment benefit replacement rate, and tax rate on labour income.

We proceed as follows. In the next section, we present data on entrepreneurship (more precisely, on business creation and destruction) in the period 1995–2007 for nine EU countries included in the IBE database and the United States and describe basic empirical regularities. In the succeeding section, we present other data used in empirical analysis. In section 5.3 we present the econometric strategy for testing the hypotheses of the monograph. Section 5.4 presents the methodology. Finally, in section 5.5 we provide the interpretation of the results, relate them to the hypotheses and predictions of the theoretical model and address the main limitations of the empirical analysis.

5.2 Data and descriptive statistics

The theoretical model we empirically test has two key dependent or explained variables: the amount of Schumpeterian entrepreneurship measured by the amount of business creation and economic growth. We first present indicators and data sources for these two categories, and then examine indicators and data sources for explanatory or independent variables that, in line with our theoretical model and the existing empirical literature, help to explain the two dependent variables.

5.2.1 Data on entrepreneurship and some stylized facts

The main obstacle to empirical research in the area of entrepreneurship is the absence of a pure definition of entrepreneurship and incompleteness of international databases on entrepreneurship. Since a general indicator of entrepreneurship is still to be built in the near future,[93] researchers employ indicators and proxies that are currently available at national or international levels. Owing to the availability of a relatively harmonized cross-country database, the most widely used indicators of entrepreneurship in international analyses have been the *business ownership rate* and the *self-employment rate*, and in the last few years also GEM entrepreneurial indices. Yet, we know that innovative entrepreneurs that have the crucial role in our theoretical model represent only a small fraction of business owners. According to Iversen, Jørgensen and Malchow-Møller (2008) and in line with our theoretical model, the natural empirical candidate for innovative entrepreneurship is the number of new businesses or start-ups (or, in relative terms, *birth rates of new businesses* or *start-up rates*).

The database on business (more precisely, enterprise) birth and death rates compiled by OECD and Eurostat suffers from limited and incomplete coverage of countries over time with several missing values in data series. The WBGES database covers a greater number of countries than do the previously mentioned databases but includes only entries of incorporated businesses; moreover, data for several countries are provided for a few years only. The most complete panel data set on business dynamics is the IBE dataset provided by EIM; this contains data about business (more precisely, enterprise) entry and exit rates for nine EU countries (see Table 2.2), the United States, and Japan for the period 1995–2007. The database includes all (incorporated and unincorporated) businesses in the non-agricultural sector. The IBE entry rate shows a strong and significantly positive relationship with Eurostat birth rate and OECD birth rate.

Figure 5.1 presents the average IBE figures concerning business dynamics in nine EU countries and the United States for the period 1995–2007.[94] The enterprise turnover and entry rates are the highest in the United Kingdom, Denmark, Ireland, and in the United States. The lowest enterprise turnover, entry and exit rates are observed in Italy, Belgium and France.

[93] Building a cross-country database on entrepreneurship indicators and formation of composite indicator(s) are the main objectives of the ongoing OECD–Eurostat Entrepreneurship Indicators Program (EIP).

[94] We exclude Japan from the database due to several missing values in the observed period.

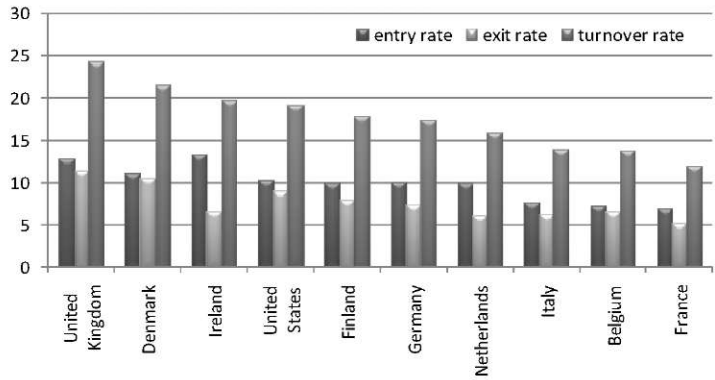

Figure 5.1: IBE entry, exit and turnovers rates (in %) by country, averages for 1995–2007

Note: The turnover rate is defined as the sum of the business entry and exit rates.

Source: International Benchmark of Entrepreneurs compiled by EIM (2010c).

During the period 1995–2007, IBE entry rates were in general above the IBE exit rates, which resulted in positive net entry. The greatest (positive) gap between the entry and exit rates is observed in Ireland. In Germany, the IBE entry rate and exit rate had mostly shown a downward trend throughout the observed period. In most other countries, movements of the IBE entry and exit rates have shown unsteady patterns (Figure 5.2).

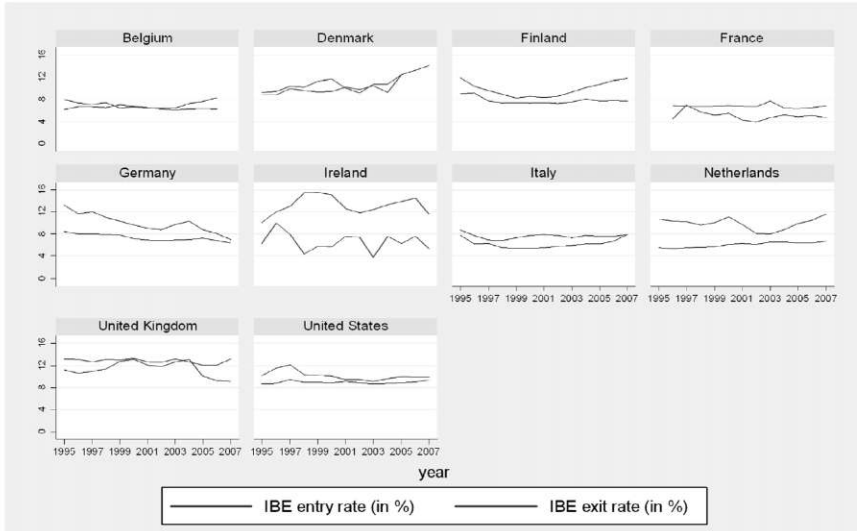

Figure 5.2: Evolution of IBE entry and exit rates in nine EU countries and the United States, 1995–2007

Source: International Benchmark of Entrepreneurs compiled by EIM (2010c).

The available aggregate (*i.e.* country-level) data on business creation and destruction are useful for cross-country comparisons, but do not allow for an in-depth analysis of empirical regularities regarding business dynamics. A more detailed analysis of the process of businesses creation and destruction across industries, and the relationship between business dynamics and firm heterogeneity in size and productivity growth is possible with the use of industry-level data and micro (*i.e.* business-level) data. In the following paragraphs, we summarize the evidence of creative destruction and allocative efficiency that arise from the studies employing industry-level and business-level data:

- Firm turnover/churn rates are substantial and range from 10 to more than 20 percent in industrial countries to even more in transition and emerging countries (Bartelsman, Haltiwanger and Scarpetta 2004 and 2005; Bartelsman, Scarpetta and Schivardi 2003);
- There is a strong positive correlation between (gross) entry rates and exit rates across industries, which may be the result of the process of creative destruction (*i.e.* new firms displacing old obsolete firms) as well as high failure rates amongst new firms in the first years of their life (Scarpetta *et al.* 2002; Bartelsman, Scarpetta and Schivardi 2003; Brandt 2004);
- Entry and exit rates differ considerably across industries. They tend to be higher in services than in manufacturing industries. Entry and exit rates also tend to be higher for more recent industries (*e.g.* in information, communication and technology (ICT)

industry) but tend to decline as the industry matures (Scarpetta *et al.* 2002; Bartelsman, Scarpetta and Schivardi 2003; Brandt 2004);

- Entries and exits are also related to firm characteristics with more churning amongst young and small businesses, which relatively easily enter the market compared to large businesses but find it more difficult to survive (Bartelsman, Haltiwanger and Scarpetta 2004 and 2005; Bartelsman, Scarpetta and Schivardi 2003);
- Since a great share of entering and exiting firms tends to be small relative to incumbents (Brandt 2004), firm flows affect a minor share (only about 5–10 percent) of total employment (Scarpetta *et al.* 2002; Bartelsman, Haltiwanger and Scarpetta 2004 and 2005; Bartelsman, Scarpetta and Schivardi 2003);
- The percentage of entering firms that survive the first two years is between 60 and 80 percent. Only about 40 to 50 percent of entering firms in a given cohort survive beyond the seventh year (Scarpetta *et al.* 2002; Bartelsman, Haltiwanger and Scarpetta 2004 and 2005; Bartelsman, Scarpetta and Schivardi 2003; Brandt 2004);
- New firms that are productive enough to survive expand more rapidly than the incumbent firms (Bartelsman, Scarpetta and Schivardi 2003). Surviving new firms in the United States show a rapid expansion (50-percent increase in employment) in the first seven years, while expansion of surviving new firms in the EU is remaining modest (10–20 increase in employment) (Scarpetta *et al.* 2002);
- Compared to the EU, entrants in the United States are more heterogeneous in terms of size and productivity and are on average smaller, measured relative to the average size of incumbent firms (Scarpetta *et al.* 2002).

5.2.2 Aggregate output level and its growth

Economic growth is the second dependent or explained variable in our econometric model. We measure economic growth in terms of the annual percentage change in real GDP per capita (*grGDPpc*). In line with the convergence hypothesis in standard growth theory, less developed countries tend to catch up with richer ones. Accordingly, when estimating the regression equation for economic growth, we should control for the level of economic development by including the (logarithm of) real GDP per capita as one of the regressors. We use GDP per capita in 2009 United States dollars (*rGDPpc*) from The Conference Board Total Economy Database – TEDI (2010).

In line with hypothesis 4 of the monograph (confirmed by our theoretical model), the growth of the aggregate output per capita is (partly) explained by the (equilibrium) business entry rate. In formulation of the regression model explaining economic growth (*e.g.* the choice of control variables), we follow the theoretical model and relevant empirical studies. The theoretical model assumes that each agent is endowed with only one unit of labour, which deviates from the situation in the real labour market. The latter assumption suggests that we

should control (among others) for the growth of the annual hours worked per person (*grhourspc*) when regressing *grGDPpc* on business entry rate. The alternative would be to use growth in labour productivity per working hour instead of per capita output growth, but we decided to avoid this option. Namely, few institutions, statistical agencies and international organisations provide the estimates of labour productivity and differences in the choice of basic data and methodology that lead to considerable variation in the currently available estimates (OECD 2005, 3).

5.2.3 Other data definitions and their sources

We now present the variables that, according to our theoretical model and previous empirical literature, have important roles in explaining business creation and economic growth.

Labour market institutions

The bargaining power or the importance of trade unions at a certain (national / sectoral / occupational) level can be measured along two dimensions (Nunziata 2001, 5): the proportion of employees covered by collective agreements (*union coverage rate*) and the union membership rate among active workers (*union density*). When the two measures are calculated at the national/aggregate level, they reflect the level of collectivisation. In analysed countries, the union coverage rate exceeds the union density (as shown later in Table 5.1). The first reason is the tradition of employers in some EU countries (e.g. in Sweden, Netherlands, Germany, Ireland, Italy) to apply voluntarily the terms of collective agreement to non-union members. The second reason is the widespread use of extension procedures for wage agreements by which the agreement is binding for all employers and workers, regardless of their membership in the employers' organisation and trade union that signed the agreement (Du Caju *et al.* 2008, 13). Data for the trade union density (*tud*, in percent) used in our analysis are taken from OECD (2010c). Data on the use of extension procedures (*ext*) and the adjusted union coverage rate (*cov*, in percent) come from the Database on Institutional Characteristics of Trade Unions (ICTWSS), compiled by Visser (2009). Fitzenberger and Kohn (2010, 5) speak in favour of union density as the most appropriate measure for union power. They argue that a high number of union members paying membership fees means high union's funding and thus high financial power. They (*ibid.*) add that intensive personal representation in the firm increases individual support for union action and the probability and the length of a strike; this in turn increases potential damage inflicted upon employers if they disregard workers' demands. In our regression analysis, we use the union density as the main indicator of union power. Due to a substantial gap between the union density rate and the union coverage rate in certain countries, we also use two interactive elements. The first is the union density rate multiplied by the dummy variable *ext1*, which takes the value of one when *ext* is equal to 1 (*i.e.* when legal provision for mandatory extension is available but affects less

than 10 percent of the workforce) and zero otherwise. The second is the union density rate multiplied by the dummy variable *ext2*, taking the value of one if *ext* is equal to 2 (*i.e.* legal or organisational provisions for extension are regularly applied and affect at least 10 percent of the workforce) and zero otherwise.

The next variable of our interest is the *gross unemployment benefit replacement rate* (*grossbrr*, in percent), *i.e.* the level of gross unemployment benefit relative to the average gross wage. We use the OECD (2010a) summary measure of benefit entitlements, which is defined as the average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment.

Labour income taxation is measured by the *tax wedge* (*tw*, in percent), presented in the OECD publication Taxing Wages (different years). The tax wedge is calculated by expressing the sum of personal income taxes, employee plus employer social security contributions together with any payroll tax, minus benefits as a percentage of labour costs (OECD 2007, 12). In our analysis, we use the tax wedge for single persons without children at average earnings.

By assuming that trade unions with high bargaining power achieve a relatively favourable negotiation outcome for workers (that among others reflect in a high minimum wage) we can try to estimate the impact of union bargaining on economic performance indirectly. Minimum wage is for this purpose measured by the categorical variable that can take the integer values in the interval from 0 (meaning no national, cross-sectoral or inter-occupational minimum wage) to 8 (denoting that the national minimum wage is set by government discretionary). The data are taken from Visser (2009) and are normalized by being divided by eight. The variable used in the estimation, *mw*, can take nine discreet values in the interval from 0 to 1. The higher the value of *mw* the more rigid is the minimum wage legislation.

Doing Business indicators

For describing the business environment, we use the indicators compiled within The World Bank Group's (2010) Doing Business project. Since data are available only for the post-2004 period, we use 2004 data for all years in the period 1995–2004. The indicators are therefore nearly time-invariant.

Starting a business (*dbstartb*) is an indicator that identifies the bureaucratic and legal hurdles an entrepreneur must overcome in order to incorporate and register a new firm. It examines the procedures, time, and cost involved in launching a commercial or industrial firm with up to 50 employees and start-up capital of 10 times the GDP per capita (World Bank Group 2010). The indicator consists of the four main components: the number of all procedures required to register a firm, average time spent during each procedure, official cost of each procedure, and the minimum capital required as a percentage of GDP per capita. The higher

the value of each of the components, the more difficult it is to start a business. We rescale each of the components according to the following formula: $(x_i - x_{min})/(x_{max} - x_{min})$. The summary *starting a business* indicator is calculated as the arithmetic average of the transformed values of components. It can take the values between 0 and 1; the closer it gets to 1, the heavier are the barriers to starting a business.

Getting credit (dbgetc) is an indicator of the legal rights of borrowers and lenders and the sharing of credit information. It consists of four main components. The first two components (the strength of legal rights index and depth of credit information index) describe how well collateral and bankruptcy laws facilitate lending. The higher the values of the indices, the better the design of collateral and bankruptcy laws and the more credit information is available to facilitate lending decisions. The second two components (public credit registry coverage and private credit bureau coverage) measure the coverage, scope, quality and accessibility of credit information available through public and private credit registries. Since higher values of all components lower the barriers to getting a credit, we rescale each of them according to the following formula: $(x_{max} - x_i)/(x_{max} - x_{min})$. The summary *getting credit* indicator is calculated as the arithmetic average of the four components. It can take the values between 0 and 1; the closer it gets to 1, the harder it becomes for a business to get a credit.

Other control variables

As suggested by theoretical and empirical literature, product market regulation can affect business dynamics and, both directly and indirectly, economic growth. To control for product market regulation in our regressions, we use the economy-wide integrated indicator of *product market regulation* (*pmr*) constructed by OECD (2008b). The indicator summarises regulatory provisions across countries in the following areas: i) state control of business enterprises; ii) legal and administrative barriers to entrepreneurship; and iii) barriers to international trade and investment. The indicator takes values between 0 and 6 with relatively liberal countries having lower indicator values. The available estimates are for 1998, 2003 and around 2008. We use 1998 values of *pmr* for the period 1995–1998, 2003 values of *pmr* for the period 1999–2005, and 2008 values of *pmr* for the period 2006–2008.

Educational attainment (*edu*, in percent) of the population might be important for business creation and (directly and indirectly) for economic growth. The indicator used in our analysis is the share of the population aged between 25 and 64 years with completed tertiary education. Data sources are OECD (2006, 2010f).

Government's share of real GDP (*gov*, in percent) is used for explaining business dynamics as well as economic growth. We expect government spending to crowd out private sector activity, since governments partly execute services that (potentially) compete with the business sector. A high share of government spending is also commonly related to higher tax

burden imposed on businesses and/or private persons, which may also negatively affect business creation and economic growth. We use the PWT 6.3 (Heston, Summers and Aten 2009) indicator for the government's share that measures the percentage share of government expenditures in real GDP per capita at constant prices (the latter is the sum of consumption, investment, government expenditures, and net foreign balance, with all components being expressed in per capita terms).

Investment share of real GDP (*inv*, in percent) is relevant for explaining economic growth since, in line with economic theory, investment provides a stimulus to economic development. We use the PWT 6.3 (Heston, Summers and Aten 2009) indicator of the investment share that measures the percentage of real GDP per capita at constant price devoted to investment in all kinds of capital assets. It thus takes into account gross capital formation (*i.e.* investment in non-financial produced assets) and investments in financial assets.

Empirical studies of business dynamics (*e.g.* Scarpetta *et al.* 2002; Bartelsman, Scarpetta and Schivardi 2003; Brandt 2004) suggest that entry and exit rates tend to be higher in services than in manufacturing industries. Entry and exit rates also tend to be higher for younger industries (*e.g.* ICT) but tend to decline as the industry matures. When regressing the indicator of business dynamics on explanatory variables, we add the share of ICT manufactures in total economy's employment (*eictman*, in percent) to the set of control variables. When we estimate the regression equation explaining economic growth, we take into account the *industry structure* by controlling for the share of employment in the business service sector in total economy's employment (*service*, in percent). The data source for *eictman* and *service* is OECD (2009b).

In explaining business dynamics, we also control for the size of countries, which is measured by the size of their *population* (*pop*) expressed in millions of inhabitants. The source of data is PWT 6.3 (Heston, Summers and Aten 2009). We expect that *pop* negatively affects the statistically measured intensity of business dynamics (see Eurostat–OECD 2008, 10–11).

Openness (*open*, in percent) of a country to international trade may facilitate international technology spillovers and stimulate domestic businesses to increase productivity in order to remain competitive. The data for openness are taken from PWT 6.3 (Heston, Summers and Aten 2009) and express the share of total real value of trade (*i.e.* the imports plus exports) in real GDP in constant prices. Openness is typically positively related to economic growth, although there is some doubt about the robustness of existing empirical results (Andersen and Babula 2008).

In certain variants of the model, we also include a dummy variable for the *legal system*, which at the same time highlights certain cultural, historical and other influences. Legal systems can be roughly divided into the civil law system (also known as Continental European law) and

the common law system (applied in the United States, the United Kingdom, Ireland, Canada, and New Zealand). In the civil law system, the central sources of law to resolve disputes are the constitution and other written codes, while the common law system relies on prior case law rather than only written codes. In the estimation procedure we use a dummy variable *Dcl* that takes the value of one when a common law prevails, and the value of zero otherwise.

The terms of trade (TOT) measure the relationship between prices that exporters receive for selling their output overseas and the price of imports: $TOT = PX/PM$, where *PX* stands for the export price index and *PM* for the import price index. Besides the prices of other goods, *TOT* also includes oil prices (their weight, however, depends on the country considered and their dependence on imported/exported oil). The annual change in terms of trade, *TOTch*, can be calculated as a difference between the annual growth in the export price index and the annual growth in the export price index: $TOTch = \Delta lnTOT = \Delta \ln PX - \Delta \ln PM$. We measure the *volatility in the terms of trade (TOTvol)* as the absolute value of the annual change in the logarithm of terms of trade multiplied by the indicator of trade openness (Gillitzer and Jonathan 2005): $TOTvol = |\Delta lnTOT| \times open$. *TOTch* and *TOTvol* will be used as proxies for exogenous changes causing business cycle fluctuations. They tend to be less subject to endogeneity problems (when included in the business entry equation) than the volatility of GDP (per capita), which we believe is significantly affected by business dynamics. Data for the growth rates of import and export prices are taken from OECD Economic Outlook 2010 (OECD 2010d).

5.2.4 Summary statistics

Table 5.1 summarizes the main variables of interest by country in the period 1995–2007. The data show that countries that experienced a relatively low IBE business entry rate (Belgium, France, and Italy) had bargaining coverage rates well above the average for all considered countries (mostly due to procedures that extend the coverage of a union bargaining outcome to sectors or businesses that do not take part in the negotiations and individuals that are not members of the negotiating unions). On the other hand, countries with the highest average business entry and turnover rates (Ireland, United Kingdom, and United States) had in general very low union density rates and applied no mandatory or compulsory extension of collective agreements to non-organised businesses.

We can furthermore observe that countries with the highest average entry and turnover rates (Ireland, the United Kingdom, and the United States) in general achieved above average growth of output per working hour (*grGDPph*) with Denmark being an exception. On the other hand, countries with below average growth rates of GDP per working hour (Italy, France, and Belgium) showed very low entry and turnover rates. While this is not evident from the table below, the relationship between the growth of GDP per capita and the IBE

business entry rate is even slightly stronger than the relationship between the growth of GDP per working hour and IBE business entry rate.

Table 5.1: Descriptive statistics for main variables in the econometric model, average for the period 1995–2007

Country	entry rate (in %)	exit rate (in %)	turnover rate (in %)	*tud* (in %)	*cov* (in %)	*ext*[1]	*grGDP* (in %)	*grGDPpc* (in %)	*grGDPph* (in %)
Belgium	7.18	6.51	13.69	52.95	96.00	2	2.33	2.22	1.26
Denmark	11.02	10.48	21.50	73.53	77.77	0	2.21	2.26	0.96
Finland	9.89	7.88	17.77	75.24	86.70	1	3.82	3.98	2.43
France	6.85	5.12	11.97	8.32	95.39	2	2.23	1.74	1.78
Germany	9.96	7.32	17.28	24.18	64.15	1	1.58	1.41	1.74
Ireland	13.21	6.59	19.80	38.50	n.a.	0	7.41	6.43	3.86
Italy	7.60	6.21	13.81	34.86	80.46	1	1.56	1.46	0.64
Netherlands	9.89	6.05	15.94	22.68	84.69	1	2.84	2.24	1.62
United Kingdom	12.85	11.42	24.26	29.69	34.95	0	2.94	2.75	2.83
United States	10.19	8.99	19.18	12.80	14.71	0	3.27	2.09	2.04
Average	9.87	7.66	17.52	37.28	70.48		3.02	2.66	1.92

Note:

The averages are calculated as simple arithmetic means of annual data over the observed period (the number of observation for each entry is N=13).

ext stands for mandatory or compulsory extension of collective agreements to nonunionized businesses. *ext* can take the values 0, 1, and 2 with the following meaning:

- 0 applies when legal provision for mandatory extension is not available;
- 1 applies when legal provision for mandatory extension is available, but is not regularly or widely used (*i.e.* it covers less than 10 percent of the workforce);
- 2 applies when legal or organisational provision for extension is available, regularly applied and affects at least 10 percent of the workforce.

Source: EIM (2010c), OECD (2010c), Visser (2009) and TED1 (2010).

Figure 5.3 presents a positive correlation between IBE business entry rate and the growth rate of GDP per capita (the coefficient of determination, R^2, is equal to 0.245). The scatter plot, however, does not disclose the direction of causality between the two variables. In line with our theoretical model, the causality runs from business entry to economic growth. When testing the econometric model, we shall use proper econometric procedures to address the issue of potential endogeneity. Since we use TSCS data, we also need to test for stationary of the two variables. If we can show that at least one of the two series is stationary, we may exclude the possibility that the variables share a common type of stochastic movement (*e.g.* driftless random walk, random walk with drift, or trend), which can make the regression spurious.

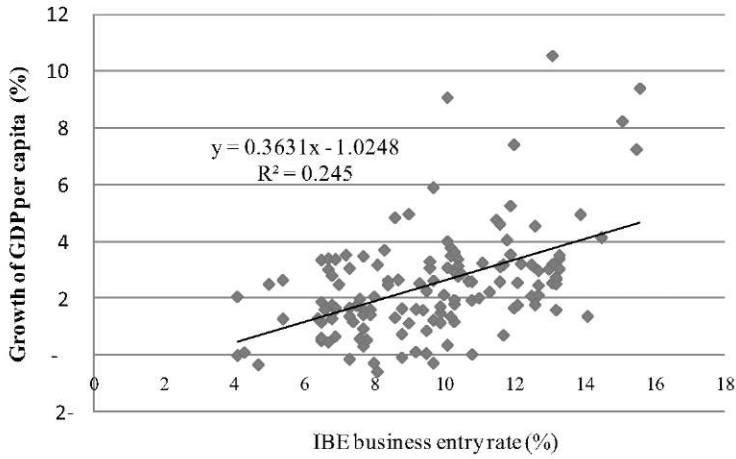

Figure 5.3: Relationship between IBE entry rate and economic growth in selected EU countries, 1995–2007

Source: TEDI (2010) for the growth rate and EIM (2010c) for the business entry rate.

5.3 Econometric framework

Our econometric analysis focuses on two distinct relationships: firstly, on the impact of chosen labour market institutions (and some additional parameters) on business entry and, secondly, on the impact of business entry (and other explanatory variables) and chosen labour market institutions on economic growth. By estimating the empirical model, we test the five hypotheses of the monograph. The estimation of the model enables us to make inferences on whether and how labour market institutions directly and indirectly (through business creation) affect economic growth. It therefore verifies the research statement that business creation serves as one of the channels through which labour market rigidities hurt economic performance in terms of GDP per capita.

The theoretical model suggests the following general form of the empirical model:

$$entryr_{i,t} = \alpha + LMI_{i,t}\beta + MV_{i,t}\gamma + a_i + \varepsilon_{i,t} \quad (47)$$

$$grGDPpc_{i,t} = \delta + \eta(entryr_{i,t-1}) + LMI_{i,t}\theta + CV_{i,t}\kappa + u_i + \nu_{i,t}, \quad (48)$$

where the subscript i denotes a country, and t stands for a time period; $\varepsilon_{i,t}$ and $\nu_{i,t}$ are white noise error terms, while a_i and u_i present country-specific effects (included only when this is necessary, and appropriate as discussed in the follow-up).

The variables used in equation (47) are defined as follows. The dependent or explained variable, *entryr*, is the business entry rate. *LMI* is a vector of labour market institutions[95] that includes: the indicator of union bargaining power (*e.g.* trade union density, *tud*), the gross unemployment benefit replacement rate (*grossbrr*), and the tax wedge on labour income (*tw*). *MV* is a vector of relevant macroeconomic control variables, which includes a measure of product market regulation (*pmr*), the level of educational attainment (*edu*), the indicators of obstacles to starting a business (*dbstartb*) and obstacles to getting a credit (*dbgetc*), the share of ICT manufactures in total economy's employment (*eictman*), total trade as a percentage of GDP (*open*), the size of population (*pop*) and the change in terms of trade (*TOTch*). *TOTch* is included to control for a part of exogenous changes in the business environment and tends to be less subject to endogeneity problems than GDP (per capita) growth rate.

The variables used in equation (48) are defined as follows. The explained variable, *grGDPpc*, denotes the growth rate of real GDP per capita. *CV* is a vector of macroeconomic controls for the growth equation (48). Variables included are: certain variables already included in *MV* (*open, TOTch/TOTvol, edu*), growth in the number of working hours per capita (*grhourspc*), investment to GDP ratio (*inv*), government spending share of real GDP (*gov*), logarithm of real GDP per capita *(lnGDPpc)*, and the share of employment in the business service sector in total economy's employment (*service*) to control for the structure of the economy. We also directly test whether chosen labour market variables (*tud, grossbrr, tw* and *mw*) affect economic growth by including these variables in the set of explanatory variables.

The empirical model presented by equations (47) and (48) is the most general variant of the model. Since the dataset is limited, we search for combinations of control variables that satisfactorily explain the variance of the dependent variable and satisfy certain statistical properties such as low multicollinearity. We start by estimating the most specific version of the model (including only most relevant labour market institutions) and then gradually add other variables as suggested by the theoretical model, economic theory and related empirical studies. If the signs and the significance of the regression coefficients of labour market variables are not substantially different between the variants of the model, we can speak in favour of their robustness.

[95] Labour market institutions are assumed to be exogenous. Namely, a few existing empirical studies on determinants of labour market institutions do not find a significant effect of unemployment/employment on the institutions. This is in line with the assumption that causality mainly runs from institutions to unemployment. We also know that institutional variables are relatively sluggish over time, while unemployment and employment show cyclical patterns, which also approves the assumption made (IMF 2003).

5.4 Methods of estimation

In estimation of the model (47)–(48), we follow the two-step approach elaborated in Cincera and Galgau (2005) and Loayza, Oviedo and Servén (2005). In the first step, we regress business entry rate on indicators of chosen labour market institutions and selected control variables. In the second step, we estimate the relationship between the indicator of economic growth and lagged business entry rate together with selected controls. The model is estimated on TSCS data.

5.4.1 Explaining business entry

In the first step of empirical analysis, we estimate (different variants of) equation (47), which explains variation in the business entry rate across countries and over time. The estimation of (47) will provide us with the results needed to confirm/reject the first parts of hypotheses 1 to 3 (*i.e.* the parts concerning the impact of chosen labour market institutions on business entry).

At the very beginning, we check whether the business entry rate follows a stationary process. For this purpose, we employ Fisher's test for the presence of a panel unit root that is based on an augmented Dickey-Fuller test (Maddala and Wu 1999). Under the null hypothesis, all series are non-stationary, which means that they have unit roots (*i.e.* an autoregression of the residuals on their lags shows a coefficient on the lagged residual term near one). The test is implemented in Stata with the command *xtfisher* written by Merryman (2004). The test rejects the null hypothesis of the presence of a unit root in the business entry rate series for all considered cases: driftless random walk, random walk with drift, and trend .We may therefore conclude that the business entry rate across follows a stationary process.

It is also interesting to verify the results of a full unconditional fixed effect regression of the business entry rate (*i.e.* the regression of *entryr* on country-specific dummy variables). It discloses that 78.7 percent of the total variance in the business entry rate is due to country-specific (cross-sectional or group) effects. We are (among others) interested to find out to which extent these effects can be explained by institutional and other included explanatory variables that vary over countries, but show no or little movement over time. If the explanatory variables do not have the power to explain the major part of cross-country variation in the dependent variable, a simple pooling of the data and estimation of the model by the standard OLS method will yield regression coefficient estimates that suffer from the omitted variable bias. The problem is commonly solved by estimating a fixed effects model that allows each country to have its own (fixed) intercept.

Estimating the fixed effects model means that we observe only within-country (within-group or time-series) variations in our data, while cross-country differences are not being analysed. The fixed effects model does not allow us to include independent variables that vary only by country and not by time, since these variables are perfectly collinear with the country-specific

effects. If the independent variables change only slowly, they can still be included in the model, but their effects will be estimated poorly due to high collinearity with country-specific effects. When cross-sectional (or between-country) variation is relatively large, controlling for this variation leaves little to be explained by the variables of interest. The fixed effects approach therefore requires sufficient variation in explanatory variables over time, which does not hold in our case. Institutional variables, which are in the centre of our interest when estimating equation (47), vary considerably across countries but are relatively rigid over time. By the fixed effects transformation, which focuses on the time dimension of the data, a great deal of interesting information about explanatory variables gets swept away.

There are cases when we can avoid using the fixed effects model despite employing TSCS data. If the model is well specified (*i.e.* it includes explanatory variables that can account for a great deal of cross-country variation in dependent variables), fixed effects appear redundant, since they would capture ignored or unobserved country-specific factors (Beck 2006, 8).

The case when explanatory variables of interest show little or no within-country variation is discussed in Temple (1999). He suggests that a possible solution method is to pool the data (*i.e.* to transform the model into a non-panel framework) and use carefully selected country-group dummy variables. The latter lowers the risk of omitted variables bias and helps to improve the quality of the pooled regression results. The approach suggested by Temple (1999) is appropriate also when we include explanatory variables, for which there is no time series available and we dispose with only one observation for each country (Ilmakunnas and Kanniainen 2001).

In certain cases, problems caused by fixed effects can (at least partly) be solved by using a random effects model (Beck 2006; Beck and Katz 2001). In the random effects model we estimate the parameters (mean and variance) of the distributions of different components of the error term (including country-specific effects)[96] rather than fixed country-specific intercepts as in the fixed effects model. Namely, a random effects model treats country-specific effects as drawn from a normal distribution rather than fixed coefficients. In the random effects model, the explanatory variables are used to explain not only change over time but also differences across units. The most restrictive assumption of the random effects model is that the country-specific component of the error term (a_i in (47)) is uncorrelated with all the explanatory variables ($corr(a_i, Xb) = 0$). This assumes away interesting issues that lead to omitted variable bias (Beck 2006, 8). Due to a specific structure of the error term (*e.g.* $e_{i,t} = a_i + \varepsilon_{i,t}$ in (47)), the random effects model is estimated by the feasible generalized least squares (FGLS). This method estimates the model by ordinary least squares (OLS) and

[96] The error term in the random effects model has in general three main components: a (random) country-specific or cross-sectional component, time-period component, and white noise. In our estimation, we focus on the country-specific component and white noise.

then takes the obtained residuals to estimate the covariance matrix of the errors. Based on the estimated covariance matrix, it transforms the data so that the transformed observations satisfy the assumptions for the classical linear regression model (henceforth Gauss-Markov assumptions; Wooldridge 2002a, 93).

While the random effects model and the fixed effect model may be very useful for panel data, they do not deal with the important issues of heterogeneity in TSSC data (Beck 2006, 8). We expect data series to follow a particular (potentially cross-section specific) *autocorrelation* process, *i.e.* correlation of errors within cross-sectional units. Furthermore, they might also suffer from typical problems with cross-sectional data such as cross-sectional or *groupwise heteroskedasticity* (*i.e.* the errors for different cross-sectional units have differing variances) and *cross-sectional correlation/ dependence* (*i.e.* contemporaneous correlation of errors across cross-section units). Detected violations of Gauss-Markov assumptions will be properly addressed in the process of estimation.

Our estimation strategy is executed in five main stages. In the first stage, we estimate different variants of equation (47) by pooling the data and running the OLS regression. We also include selected country-group variable(s) when this appears necessary and appropriate (*i.e.* when this does not cause the problem of multicollinearity). With Ramsey's (1969) regression equation specification error test (RESET) we verify whether the model as specified suffers from omitted variable bias, *e.g.* omitted fixed effects. For this purpose, we use the Stata post-estimation command *estat ovtest*. For different variants of equation (47), we also run the random effects transformation with selected group variables, if necessary and appropriate. We then run the Breusch and Pagan (1980) Lagrangian multiplier (LM) test for random effects (the Stata post-estimation command is *ttest0*) to test the null hypothesis of zero variances of country-specific residuals. Under the null hypothesis, OLS estimates are consistent. The LM test-statistic follows a Chi-squared distribution with one degree of freedom. If the significance of the LM test is below 0.05, we reject the null hypothesis and estimate the model using the random effects approach (Breusch and Pagan 1980).

In the second stage, we check for the severity of *multicollinearity* among explanatory variables in a pooled OLS regression model by calculating variance inflation factors (VIFs). For further analysis we keep only model specifications (which differ with respect to a combination of included explanatory variables) satisfying the requirement that VIFs for all included explanatory variables are below 10, which is commonly taken as a cut off value (Gujarati 2004, 351 and 362).

For chosen model specifications, we also check for common problems with TSCS data such as autocorrelation, groupwise heteroskedasticity, and cross-sectional correlation. More particularly, we follow the next diagnostic procedure:

- Firstly, we run Wooldridge's (2002b) test for *first-order autocorrelation* in panel data (for this purpose we use Stata command *xtserial*). The null hypothesis is that there is no first-order autocorrelation in the error term. If the significance of F statistic is below 0.05, we conclude that the error term is plagued by autocorrelation (Drukker 2003).
- Secondly, the presence of *heteroskedasticity* in the error term is checked by running two regressions: i) iterated FGLS regression on the selected variables by imposing heteroskedastic error structure across cross-sections and ii) FGLS without any correction (therefore, OLS). Since both regressions produce maximum-likelihood parameter estimates, we can perform a likelihood ratio (LR) test (where we need to correct for the degrees of freedom as suggested by Wiggins and Poi 2003) and conclude which of the models is superior. If the LR test appears significant, we reject the null hypothesis of homoskedastic error term (Greene 2003, 327). To detect groupwise heteroskedasticity in the residuals we use the modified Wald statistic. The test statistic follows a Chi-squared distribution with N degrees of freedom (where N is the number of cross-sectional units) under the null hypothesis of homoskedasticity (Greene 2003, 324). This test is readily available in Stata using the command *xttest3*.
- Thirdly, we test if data series violate the assumption of *independence between cross-sectional units*. Since the time dimension (T) of our data is larger than the cross-sectional dimension (N), for this purpose we use the LM test of independence developed by Breusch and Pagan (1980). This test is readily available in Stata using the post-estimation command *xttest2*.

We inspect the results of all the tests using the regression residuals and conclude which of the Gauss-Markov assumptions are violated in a certain variant of equation (47). If the diagnostic checks confirm that our data violate some of the Gauss-Markov assumptions, we move to the third (last) stage of empirical analysis:

- We estimate the equation (47) by FGLS as proposed by Parks (1967). The underlying assumption is that all aspects of the model are completely specified; this includes autocorrelation of order 1, AR(1),[97] in the error term within cross-sectional units, and/or the presence of cross-sectional correlation and/or heteroskedasticity. If the autocorrelation is not detected, we assume that variances are constant within cross-sectional units.
- We also use an alternative two-step estimator proposed by Beck and Katz (1995). The two-step approach is based on the assumption that the disturbances are heteroskedastic and contemporaneously correlated across cross-sectional units. In the first step, the data are transformed to eliminate autocorrelation of order 1, if necessary. In the second step, OLS is applied to the transformed data, and the standard errors are corrected for

[97] Autocorrelated errors, $e_{i,t}$, that follow an AR(1) process are described by: $e_{i,t} = \rho e_{i,t-1} + \varepsilon_{i,t}$, where $\varepsilon_{i,t}$ are well behaved (normally distributed) error terms with zero mean and fixed variance.

heteroskedasticity and cross-sectional correlation (Chen, Lin and Reed 2010, 2). The second step results in pooled OLS estimates correlated for autocorrelation and with panel-corrected standard errors (PCSEs).

The ongoing professional debate does not give a definite answer as to which of the approaches Parks' (1967) FGLS estimator or Beck's and Katz's (1995) PCSEs estimator is superior regarding statistical properties such as efficiency of estimates, when the data are characterized by groupwise heteroskedasticity, cross-sectional correlation, and autocorrelation. In general, FGLS estimates are asymptotically efficient and perform better than PCSEs in large samples. In relatively small samples, Parks' (1967) FGLS estimator might perform poorly. Beck and Katz (1995) show with Monte Carlo simulations that FGLS can be used when T is at least as large as N. Moreover, they (*ibid.*) provide evidence that even in cases when T is larger than N, Parks' (1967) FGLS estimator produces overconfident[98] standard errors. They suggest that FGLS be employed when T is considerable larger than N (and when T is at least 30). Beck and Katz (1995) show with simulations that their PCSEs estimator produces more accurate standard error estimates than Parks (1967), without any loss in efficiency (*i.e.* without increasing the variance of the estimates). Contrary, Chen, Lin and Reed (2010) show that the Beck's and Katz's (1995) PCSEs estimator is usually substantially less efficient than the Parks' (1967) FGLS estimator, except when the number of time periods is close to the number of cross-sections. They (*ibid.*, 7) warn that the use of the PCSEs estimator may come at considerable cost in efficiency. We have decided to present the results for both estimators (in our case, T is 13 and N is 9).

5.4.2 Explaining economic growth

In the second step of the estimation of model (47)–(48), we estimate the relationship between the indicator of economic growth and lagged business entry rate together with selected controls (thus, equation (48)). Based on the results, we then test hypothesis 4, stating that business positively affects growth in GDP per capita, and hypothesis 5, positing that chosen labour market institutions exert also a direct negative impact on GDP per capita growth. The estimation of (48) will also provide us with the results needed to confirm/reject the second part of hypotheses 1 to 3 (*i.e.* the part of the hypotheses regarding the indirect impact of chosen labour market institutions on GDP per capita growth).

We first verify the time-series properties of the growth rate of GDP per capita. Fisher's test for panel unit root (Maddala and Wu 1999) for different specifications (*i.e.* random walk with or without a drift and random walk with or without a trend) shows that we are dealing with

[98] In statistical terminology, overconfidence in estimating a parameter means that the estimate belongs to a very narrow confidence band. In other words, the probability distribution of the estimate is too narrow.

trend or difference stationary series. We have already shown that our key explanatory variable, the business entry rate, is stationary. For the growth equation, we lower the problems with non-stationarity of the regression residual by including a trend or a lagged growth rate of GDP per capita. In the latter case it is important to check if the coefficient of lagged dependent variable is close to one (Amable, Demmou and Gatti 2007).

Beside stationarity and autocorrelation, we need to address other issues that commonly arise when working with TSCS data: groupwise heteroskedasticity and cross-sectional correlation in the residuals. The strategy is similar as for the estimation of equation (47). In case the business entry rate together with control variables in a certain variant of equation (48) does not explain a major share of variability in GDP per capita (and we can reject the hypothesis of no omitted variables), the model is therefore estimated using the fixed effects. Including country-specific fixed effects into equation (48) should not be problematic, since the centre of our interest is not the estimation of a direct impact of (relatively time invariant) labour market institutions but rather the impact of time-variant business entry rate on GDP per capita growth.

An additional problem when estimating (48) is the potential endogeneity of the business entry rate. The problem of endogeneity of the business entry rate in the economic growth regression equation is somewhat reduced with a simple lagging of the business entry rate. This solution, however, might not be very effective with time-series data (when T is larger compared to N), since temporal correlations among data mean that lagged residuals are likely to be correlated with present residuals. We therefore need to check for endogeneity by employing Granger's (1969) test of causality.

5.5 Description and interpretation of the results

In this section, we describe and interpret (in relation to hypotheses and implications of the presented theoretical model) the results of different variants of the regression model (47)–(48). For estimating different variants of the model, we use TSCS data for nine EU countries (see Table 2.2) and the United States over the period 1995–2007 for equation (47) and over the period 1996–2008 for equation (48).

The section is divided into three parts. In the first part, we present and interpret the results for different variants of the regression equation (47) that differ with respect to the combination of included control variables. In all presented variants of (47), specific combinations of control variables satisfy the assumption of low multicollinearity (VIFs are considerably below 10) and are able to explain the relatively high share of variability in the business entry rate. In most cases, the RESET test cannot reject the hypothesis of omitted variables in a considered equation. In the second part, we present and interpret the results for different variants of the regression equation (48). Variants of the model differ with respect to a combination of

included control variables, which mostly satisfy the same assumption as for the equation (47). However, in most cases the RESET test indicates problems with omitted variables, which calls for the use of country-specific fixed effects. In the third part, we highlight some of the limitations of the adopted estimation strategy.

5.5.1 Labour market institutions and business entry

Let us first examine some indirect evidence on the impact of chosen labour market institutions on business entry. Assuming that strong trade unions manage to achieve relatively high minimum wages and relatively high unemployment benefits, we regress the business entry rate on the minimum wage and gross unemployment benefit replacement rate. This equation is referred to as the indirect entry equation. In a narrowly defined indirect entry equation, we control only for the tax wedge. In a broader version of the indirect entry equation, we include additional control variables: *pmr*, *dstarth*, *dbgetc*, *eictman*, *open*, and *TOTch*, while *Del* is excluded, since it appears highly insignificant.

We start by *preliminary estimation* of both variants of the indirect entry equation by the OLS and random effects approach. For none of the variants does the RESET test reject the hypothesis that the equation has no omitted variables. For the narrow version the equation, the Breusch and Pagan (1980) LM test for random effects detects the presence of country-specific residuals, which implies that we shall use the random effects estimates in this stage of estimation. For the broad version of the indirect entry equation, the presence of random effects in the error terms in strongly rejected, which implies that in this stage we can use the OLS estimates.

The *diagnostic checks* detect the presence of heteroskedasticity in both variants of the indirect entry equation. Wooldridge's (2002b) test for autocorrelation in panel data implies that the residuals in both variants of the model suffer from AR(1). Moreover, the diagnostic tests also show that in both models we have problems with cross-sectional dependence and groupwise heteroskedasticity.

We now decide on the *final method(s) of estimation*. Since the residuals in both the narrow and the broad variant of the indirect entry regression suffer from heteroskedasticity, contemporaneous cross-sectional correlation, and AR(1), we estimate both variants by Parks (1967) FGLS approach and, alternatively, by Beck and Katz (1995) PCSEs approach. The estimation results are provided in Table 5.2. The first and the third column in the block of columns devoted to each variant of the equation show the results when all cross-sectional

units are assumed to follow a common AR(1) process. The second and the fourth column within each block provide estimates under assumption of the panel-specific[99] AR(1) process.

Regardless the method of estimation, the results provide evidence on the negative impact of minimum wage and tax wedge on business entry rates across chosen advanced countries in the period 1995-2007. The size of the impact of the minimum wage cannot be quantified, since *mw* is a categorical variable that can take 9 values in the interval 0 to 1 (*i.e.* we have 9 categories). The estimated regression coefficients show that moving from 0 to 1, *i.e.* from the system without national (cross-sectoral or inter-occupational) minimum wage to the system where national minimum wage is arbitrarily set (without a fixed rule) by government on average decreases the business entry rate by about 1 to 1.4 percentage point, keeping all other factors constant. We find no evidence on the impact of gross unemployment benefit replacement rate on the business entry rate. Among the six control variables, three are found to significantly affect the business entry rate. As expected, *dbgetc* significantly negatively affects the entry rate, while *eictman* and *openk* have positive impacts on business entry rate.

[99] The term *panel-specific* is not completely consistent with terminology when talking about TSCS data. In this case, *cross-section-specific* seems to be a more appropriate term but is avoided here, since it is rarely used in empirical literature.

Table 5.2: Results of estimation of the entry equation including minimum wage, tax wedge and unemployment benefit replacement rate

Equation	(a) Narrowly defined indirect entry equation				(b) Broadly defined indirect entry equation			
Dependent variable: *entryr*	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR(1)	PCSEs, psAR(1)	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR(1)	PCSEs, psAR(1)
Independent variables	1	2	3	4	1	2	3	4
mw	-0.97328	-2.53799	-1.18284	-1.42627	-1.29198	-1.19883	-1.52742	-1.09400
	(0.000)	(0.000)	(0.033)	(0.027)	(0.000)	(0.000)	(0.009)	(0.051)
tw	-0.12436	-0.15091	-0.12051	-0.12887	-0.06362	-0.07085	-0.07767	-0.06631
	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.027)	(0.038)
grossbrr	-0.01333	-0.00496	-0.01775	-0.02655	0.03840	0.01865	0.02119	0.01774
	(0.224)	(0.595)	(0.440)	(0.249)	(0.000)	(0.005)	(0.354)	(0.483)
pmr					-0.14314	0.00356	-0.05586	-0.04642
					(0.396)	(0.967)	(0.912)	(0.920)
dbstartb					-1.76665	-1.86878	-2.71647	-2.09785
					(0.135)	(0.054)	(0.271)	(0.413)
dbgetc					-7.44150	-6.15141	-6.78392	-6.64404
					(0.000)	(0.000)	(0.000)	(0.001)
eictman					1.05496	1.25839	0.89680	1.28680
					(0.000)	(0.000)	(0.070)	(0.007)
open					0.00311	0.00851	0.00746	0.00974
					(0.444)	(0.013)	(0.165)	(0.062)
TOTch					-0.01315	-0.00354	0.00713	0.00719
					(0.324)	(0.605)	(0.879)	(0.871)
constant	16.0811	17.53569	16.28510	17.41471	12.32644	12.08535	13.53924	12.17133
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	130	130	130	130	117	117	117	117
R^2			0.6434	0.8372			0.7010	0.8657
Wald chi^2	96.04	261.64	20.62	22.89	412.75	881.9	107.77	225.31
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: Variable denotations have the following meaning: *entryr* – the business entry rate; *mw* – rigidity of the minimum wage system; *tw* – tax wedge for labour income; *grossbrr* – gross unemployment benefit replacement rate; *pmr* – product market regulation indicator; *dbstartb* – indicator of obstacles to starting a business; *dbgetc* – indicator of obstacles to getting a credit; *eictman* – share of ICT manufactures in total economy's employment; *open* – openess to international trade; *TOTch* – change in terms of trade.

N stands for the number of observations and R^2 for the coefficient of determination. Figures provided in brackets are the significance levels of respective regression coefficients or of a model as a whole.

The equation is estimated by two alternative methods: FGLS – feasible generalized least squares approach and PCSEs – panel correlated standard errors approach. Standard errors are adjusted to take into account: H – heteroskedasticity, CSC – cross-sectional correlation, and cAR(1) or psAR(1) – common or panel-specific autocorrelation.

We now move on to more direct evidence on the impact of chosen labour market institutions on business entry rate. In Table 5.3, we present the results of estimating three variants of

regression equation (47). All three variants regress the business entry rate on the trade union density rate, two interactive elements (*tud*ext2*, *tud*ext1*) that enable us to estimate a differential impact of union density in the presence of mandatory provision for extension of union bargaining outcomes to non-unionized sectors, gross benefit replacement rate, and control variables. The group of controls includes: *pmr*, *dbstartb*, *dbgetc*, *eictman*, *open*, *pop*, *TOTch, and Dcl*. Different variants of equation (47) differ with respect to a combination of chosen control variables as shown in Table 5.3.

In the first stage, we *preliminarily estimate* the three variants of (47) presented in Table 5.3 by the OLS and random effects approach. For the second and the third variant of equation (47), the RESET test does not reject the null hypothesis that the equation has no omitted variables. The RESET test is weakly significant in the first variant of (47), where the null hypothesis can be rejected at 0.0504 level of significance (the results for the first variant shall therefore be taken with caution). The Breusch and Pagan (1980) test of random effects rejects the hypothesis of zero country-specific residuals in the first and the second variant of (47). For these two variants of equation (47) we should therefore use the random effects estimates in this stage of estimation. Differently, for the third variant of (47) the hypothesis of zero country-specific residuals cannot be rejected and the equation can be preliminarily estimated by the OLS method.

In the second stage of estimation, we perform the *diagnostic tests* and confirm the presence of AR(1), cross-sectional dependence, and groupwise heteroskedasticity in all the three variants of equation (47). This implies that within the third stage, we should *correct the estimates* from stage 1 by estimating the three variants of (47) by Parks (1967) FGLS approach and, alternatively, by Beck and Katz (1995) PCSEs approach. Table 5.3 depicts the estimation results for all the three variants of (47) for different estimation procedures and related assumptions. The FGLS estimates with common AR(1) and with panel-specific AR(1) are provided in the first and in the second column, respectively, within the block for each variant of equation (47). Beck's and Katz's (1995) PCSEs estimates with common AR(1) and with panel-specific AR(1) are provided in the third and in the fourth column, respectively, within the block for each variant of equation (47).

The results in Table 5.3, somewhat surprisingly, suggest that in countries with no legal or mandatory provision for extension of bargaining outcome the union density positively affects the business entry rate. The respective regression coefficient has positive signs in all variants of the model and appears significant in most estimations of the first two variants of equation (47). The results, however, show the reverse (therefore negative) impact of union density on the business entry rate in countries where the union bargaining outcomes are extended by law or other rule to at least 10 percent of the workforce that is not directly covered by the negotiations. While in the first two variants of equation (47) the regression coefficient of gross benefit replacement rate, *grossbrr*, turns out mostly positive but very small and highly

insignificant, it becomes significantly negative after controlling for the size of population, *pop* (and due to high colinearity excluding *eictman*), in the third variant of the model.

The first among control variables that is found to significantly affect the business entry rates is World Bank Group's (2010) indicator of obstacles to getting a credit, *dbgetc*. Its impact is negative and highly significant for all the three variants of (47), regardless of the estimation procedure. The regression coefficient for the World Bank Group's (2010) indicator that measures obstacles encountered when starting a business, *dbstartb*, is negative in all cases but appears significant only in the third variant of the model. In the first two variants of the model, country's openness, *open*, in general significantly positively influences the business entry rate, while it does not appear significant in the third variant of the equation. Population, which is present only in the third variant of the model, is found to have a significantly positive impact on business entry rates, regardless of the estimation approach and the underlying assumptions.

Table 5.3: Results of estimation of the entry equation including trade union density and unemployment benefit replacement rate

Equation	Variant 1				Variant 2			
Dependent variable: *entryr*	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR1	PCSEs, psAR1	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR1	PCSEs, psAR1
Independent variables	1	2	3	4	1	2	3	4
tud	0.01632	0.01534	0.02329	0.01837	0.01623	0.01751	0.02328	0.01831
	(0.022)	(0.070)	(0.038)	(0.168)	(0.000)	(0.046)	(0.041)	(0.190)
*tud*ext2*	-0.05961	-0.05592	-0.07114	-0.06709	-0.05985	-0.05461	-0.07091	-0.06540
	(0.000)	(0.000)	(0.000)	(0.000)	(0.104)	(0.000)	(0.000)	(0.000)
*tud*ext1*	-0.01605	-0.01188	-0.01981	-0.01436	-0.01589	-0.01103	-0.01888	-0.01318
	(0.102)	(0.279)	(0.138)	(0.346)	(0.734)	(0.333)	(0.175)	(0.413)
grossbrr	0.00339	0.00418	-0.00850	-0.00445	0.00471	0.00732	-0.00688	-0.00213
	(0.760)	(0.623)	(0.680)	(0.830)	(0.320)	(0.388)	(0.798)	(0.938)
pmr	-0.04932	-0.01602	0.05147	-0.04763	-0.04196	-0.00040	0.06335	-0.03655
	(0.676)	(0.860)	(0.914)	(0.915)	(0.686)	(0.996)	(0.896)	(0.935)
dbstartb	-0.80972	-1.43451	-1.78180	-1.69227	-0.77661	-1.13785	-1.70160	-1.47477
	(0.277)	(0.038)	(0.443)	(0.434)	(0.000)	(0.092)	(0.460)	(0.496)
dbgetc	-7.12481	-6.70883	-6.21803	-6.56652	-7.13072	-5.75613	-6.18396	-6.53704
	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)	(0.003)	(0.004)
eictman	0.90948	1.00026	0.74705	0.92717	0.89714	0.93153	0.71313	0.93948
	(0.000)	(0.000)	(0.186)	(0.056)	(0.000)	(0.000)	(0.292)	(0.110)
pop								
open	0.01687	0.01645	0.02039	0.02112	0.01684	0.01646	0.02032	0.02061
	(0.000)	(0.000)	(0.003)	(0.001)	(0.295)	(0.000)	(0.003)	(0.001)
TOTch	0.01096	0.01845	0.01252	0.01388	0.01070	0.01901	0.01243	0.01412
	(0.270)	(0.015)	(0.781)	(0.741)	(0.951)	(0.010)	(0.785)	(0.737)
Dcl					0.03977	0.56898	0.11540	0.10081
					(0.000)	(0.369)	(0.917)	(0.932)
constant	8.90584	8.78218	9.03742	8.98976	8.85229	8.10601	8.93437	8.81149
	0.000	0.000	0.000	0.000	(0.000)	(0.000)	(0.000)	(0.000)
N	117	117	117	117	117	117	117	117
R^2			0.7181	0.8826			0.7184	0.8821
Wald chi^2	370.46	658.89	312.01	418.39	375.7	658.94	368.69	466.44
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: *tud* – trade union density; *ext1* – a variable taking the value 1, if legal provision for mandatory extension of collective agreements is available and affects less than 10 percent of the workforce, and the value 0 otherwise; *ext2* – a variable taking the value 1, if legal provision for mandatory extension of collective agreements is available and affects more than 10 percent of the workforce, and the value 0 otherwise;; *pop* – population size (in millions); *Dcl* – a dummy variable taking the value 1 if a common-law system applies and value 0 otherwise.

For other denotations, see the note to Table 5.2.

Results of estimation of the entry equation including trade union density and unemployment benefit replacement rate (Table 5.3 continued)

Equation	Variant 3			
Dependent variable: *entryr*	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR1	PCSEs, psAR1
Independent variables	1	2	3	4
tud	0.00309	0.00205	0.02090	0.01630
	(0.750)	(0.840)	(0.132)	(0.243)
*tud*ext2*	-0.04683	-0.04950	-0.07011	-0.07467
	(0.002)	(0.001)	(0.000)	(0.000)
*tud*ext1*	-0.00972	-0.00451	-0.02203	-0.01763
	(0.222)	(0.617)	(0.057)	(0.205)
grossbrr	-.0288435	-0.024209	-0.034336	-0.030685
	(0.010)	(0.012)	(0.054)	(0.113)
pmr	-0.21998	-0.05742	-0.00213	-0.02044
	(0.104)	(0.593)	(0.996)	(0.959)
dbstartb	-3.10765	-3.18931	-3.74864	-3.21423
	(0.000)	(0.001)	(0.042)	0.128
dbgetc	-9.54297	-10.65726	-8.03364	-9.30061
	(0.000)	(0.000)	(0.000)	(0.000)
eictman				
pop	-0.01070	-0.01032	-0.00675	-0.00664
	(0.000)	(0.000)	(0.036)	(0.008)
open	0.012951	0.014955	0.015576	0.014638
	(0.276)	(0.097)	(0.699)	(0.689)
TOTch	0.00560	0.00701	0.01459	0.01744
	(0.361)	(0.189)	(0.087)	(0.009)
Dcl				
constant	14.18485	14.00794	12.66532	12.68327
	(0.000)	(0.000)	(0.000)	(0.000)
N	130	130	130	130
R^2			0.7443	0.9207
Wald chi^2	1448.03	3575.28	830.15	1502.68
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)

Note: *tud* – trade union density; *ext1* – a variable taking the value 1, if legal provision for mandatory extension of collective agreements is available and affects less than 10 percent of the workforce, and the value 0 otherwise; *ext2* – a variable taking the value 1, if legal provision for mandatory extension of collective agreements is available and affects more than 10 percent of the workforce, and the value 0 otherwise;; *pop* – population size (in millions); *Dcl* – a dummy variable taking the value 1 if a common-law system applies and value 0 otherwise.

For other denotations, see the note to Table 5.2.

We estimate two more variants (the fourth and the fifth variant) of equation (47) that regress the business entry rate on trade union density rate and two interactive elements (*tud*ext2*, *tud*ext1*). This time, however, we include the tax wedge for labour income instead of gross benefit replacement rate, as one of the explanatory variables related to the labour market. A group of controls for the fourth variant of equation (47) comprises: *pmr*, *dbstartb*, *dbgetc*, *eictman*, *open*, and *TOTch*. The group of controls in the fifth variant of equation (47) is partly the same, with only *eictman* being replaced by *pop* (keeping them both in the same equation would cause multicollinearity problems) as shown in Table 5.4.

In the first stage of estimation of the fourth and the fifth variant of (47) we perform the OLS and random effects approach. For none of the two variants of equation (47), does the RESET test reject the null hypothesis that the equation has no omitted variables. In line with the results of the Breusch and Pagan (1980) test of random effects, we should take the random effects estimates for both variants of equation (47) in this stage.

In the second stage of estimation of the fourth and fifth variant of (47), we perform the diagnostic tests. We find evidence that the residuals of both variants of (47) are plagued by the AR(1), cross-sectional dependence and groupwise heteroskedasticity. This implies that in the final stage, we should estimate the fourth and fifth variant of (47) by the Parks (1967) FGLS approach and, alternatively, by the Beck and Katz (1995) PCSEs approach. Table 5.4 depicts the estimation results for different estimation procedures and related assumptions.

The results in Table 5.4 do not give robust evidence on the impact of union bargaining power (measured by the union density) on the business entry rate. The respective regression coefficient is significantly positive in the fourth variant of (47) but appears insignificant in the fifth variant of the same equation. The evidence for the reverse (therefore negative) impact of union density on the business entry rate in countries where mandatory extension procedures affect at least 10 percent of the workforce, are relatively robust; the negative impact is, however, rather small (an increase in the union density rate by 10 percentage points decreases the business entry rate by about 0.22 to 0.43 percentage points). In both the fourth and the fifth variant of equation (47), the regression coefficient of the tax wedge is negative. It significantly differs from zero when the two variants of equation (47) are estimated by the FGLS approach with standard errors being corrected for panel-specific AR(1), but appears insignificant when taking the PCSEs approach and correcting for panel-specific AR(1).

The first among control variables that is found to significantly affect the business entry rate is the Doing Business indicator of obstacles in getting a credit. In line with expectations, its impact is negative, substantial in size and highly significant for both variants of equation (47). While in the fourth variant of the equation, country's openness in general significantly positively influences the business entry rate, it does not appear significant in the fifth variant of the equation. We can confirm that the size of population, which is included in the fifth

variant of equation (47), significantly positively affects the business entry rate; this result is robust to changes in the estimation approach and the underlying assumptions. Instead of *pop*, the fourth variant of (47) includes *eictman*, which expectedly has a significantly positive regression coefficient in most estimations.

Table 5.4: Results of estimation of the entry equation including trade union density and tax wedge

Equation	Variant 4				Variant 5			
Dependent variable: *entryr*	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, cAR1	PCSEs, psAR1	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSEs, AR1	PCSEs, psAR1
Independent variables	1	2	3	4	1	2	3	4
tud	0.01789	0.01651	0.02161	0.01910	0.00166	-0.00155	0.01034	0.01268
	(0.011)	(0.038)	(0.052)	(0.192)	(0.806)	(0.845)	(0.339)	(0.382)
*tud*ext2*	-0.05971	-0.04966	-0.06441	-0.05600	-0.02539	-0.02101	-0.03842	-0.04685
	(0.000)	(0.000)	(0.000)	(0.001)	(0.023)	(0.159)	(0.019)	(0.038)
*tud*ext1*	-0.01606	-0.01087	-0.01711	-0.01309	-0.00497	0.00093	-0.01136	-0.01330
	(0.097)	(0.337)	(0.184)	(0.400)	(0.469)	(0.925)	(0.208)	(0.362)
tw	-0.01350	-0.0271	-0.01595	-0.01524	-0.06349	-0.05355	-0.06628	-0.05036
	(0.423)	(0.037)	(0.661)	(0.683)	(0.000)	(0.000)	(0.018)	(0.166)
pmr	-0.02910	-0.03291	0.09454	-0.01747	-0.02919	-0.02707	0.18328	0.09279
	(0.792)	(0.656)	(0.849)	(0.969)	(0.782)	(0.763)	(0.684)	(0.807)
dbstartb	-0.54995	-0.74631	-1.40948	-1.03889	-1.84096	-2.14862	-2.63667	-2.32927
	(0.435)	(0.164)	(0.525)	(0.612)	(0.011)	(0.003)	(0.169)	(0.193)
dbgetc	-6.78126	-5.66781	-6.49901	-6.43052	-10.41115	-10.87504	-9.65891	-10.02960
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
eictman	0.79947	0.92639	0.74228	0.95906				
	(0.001)	(0.000)	(0.196)	(0.044)				
pop					-0.01085	-0.01112	-0.00879	-0.00821
					(0.000)	(0.000)	(0.001)	(0.001)
open	0.01773	0.01676	0.01884	0.01925	0.00008	-0.00112	0.00595	0.00824
	(0.000)	(0.000)	(0.001)	0.000)	(0.987)	(0.817)	(0.422)	(0.231)
TOTch	0.00902	0.01982	0.00996	0.01332	0.00269	0.01291	0.00528	0.01298
	(0.325)	(0.002)	(0.827)	(0.753)	(0.778)	(0.113)	(0.900)	(0.742)
constant	9.37633	9.60142	9.45696	9.29223	15.86484	15.75636	15.01169	14.36806
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	117	117	117	117	130	130	130	130
R^2			0.7189	0.8798			0.7503	0.9525
Wald chi^2	382.88	683.66	340.36	462.59	2147.43	6871.3	1179.34	3257.27
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: see Tables 5.2 and Table 5.3.

5.5.2 Business entry, labour market institutions and economic growth

This section presents the results of estimating different variants of regression equation (48) for growth. The basic variants of (48) regress the growth rate of real GDP per capita, *grGDPpc*, on the business entry rate, *entyr*, and selected control variables. We start by estimating the growth equation including a small range of control variables and then continue by adding more control variables to the equation. The overall group of controls includes: the level of real GDP per capita (in natural logarithm), growth in the number of hours worked per capita, the share of investments in GDP, the share of business service sector in total employment, the share of government expenditure in GDP, openness to international trade, the level of educational attainment of the population, changes and volatility in terms of trade, and time trend (or, alternatively, a lagged value of the growth rate of real GDP per capita).

In the first stage, we *preliminarily estimate* five variants of (48) by the OLS, the random effects and the fixed effects approach. For all five variants of equation (48) (see Table 5.5), the RESET test rejects the null hypothesis that the equation has no omitted variables. This suggests using the fixed or random effects approach rather than OLS to capture at least omitted country-specific effects. The Breusch and Pagan (1980) test of random effects does not reject the hypothesis of zero country-specific residuals only in the fourth variant of (48). Additionally, the results of the Hausman test[100] that verifies the consistency of the random effects estimator for different variants of (48) suggest using the fixed effects approach in this preliminary estimation.

In the second stage of the estimation of (48), we perform the *diagnostic checks* and confirm the presence of AR(1), cross-sectional dependence and groupwise heteroskedasticity in all the variants of equation (48). This implies that within the third stage, we should *estimate* all the variants of (48) by the Parks (1967) FGLS approach and, alternatively, by the Beck and Katz (1995) PCSEs approach. When taking each of the approaches, country-specific dummy variables are included into the set of control variables. Table 5.5 depicts the estimation results for five variants of (48) and different estimation procedures. The FGLS estimates with panel-specific AR(1) are provided in the first column and the PCSEs estimates with panel-specific AR(1) in the second column within the block for each variant of equation (48).

Table 5.5 provides some evidence on the positive impact of the lagged business entry rate on real GDP per capita growth. For four out of five variants of equation (48), the FGLS approach

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[100] Hausman's (1978) specification test is used to compare the (efficient) random effects estimator *vis-à-vis* the (consistent) fixed effects estimator. Under the null hypothesis the random effects estimator is not only efficient but also consistent. The Hausman's (1978) test verifies whether the efficient random effects estimates are significantly different from the fixed effects estimates. If the difference is not significant (*i.e.* the p-value or the exact level of significance is above 0.05), we can take the random effects approach; in other cases we shall stick to the fixed effects approach.

rejects the hypothesis of zero regression coefficient of lagged business entry rate at the exact level of significance of 0.051 or lower. In line with the PCSEs estimates, the lagged business entry rate appears significant in two out of five variants. The results of estimations of the five variants of (48) that disregard country-specific effects[101] robustly confirm a significantly positive impact of lagged business entry rate on the growth rate of real GDP per capita.

In line with the real convergence hypothesis, the impact of the level of real GDP per capita (in logarithm) on GDP per capita growth is significantly negative in all variants of equation (48), regardless of the method used. As suggested by economic theory, the growth in the number of hours worked, *grhourspc*, positively affects GDP per capita growth but is significant only when estimated by the PCSEs approach (and in all the variants of (48) when disregarding country-specific effects,[102] regardless of the adopted estimation approach). The share of government expenditure in GDP, *gov*, shows a significantly negative impact on real GDP per capita growth in all variants of (48) regardless of the method of estimation.

The share of business service sector in total economy's employment, *service*, and openness to international trade, *open*, both mostly have positive signs but do not appear to be significantly relevant (at least not robustly) for real GDP per capita growth when including country-specific effects. Variants 4 and 5 include two different measures related to the terms of trade: the annual percentage change in the terms of trade, *TOTch*, and the measure of volatility in the terms of trade, *TOTvol*. Contrary to our expectations, growth in the terms of trade appears to have a negative impact on real GDP per capita growth, while the volatility in the terms of trade (sometimes used as a proxy for exogenous changes and thus uncertainty in business environment) turns out to promote economic growth.

As shown in Table 5.5, the regression coefficient of *edu* is negative but highly insignificant. The share of investment in real GDP (its lagged version, *L.inv*) significantly negatively affects real GDP growth per capita in the fourth and the fifth variant of (48), which is at odds with standard economic theory. A possible explanation is that past investment activity is partly captured by the business entry rate; moreover, the sign is negative due to using a lagged version of *inv* (to lower endogeneity problems) instead of its contemporaneous values. It can be shown that omitting *entryr* and using contemporaneous investment share in GDP changes the sign of *inv* into significantly positive in the fourth and the fifth variant of (48).

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[101] The results of the tests are available from the authors on request.

[102] The results of the tests are available from the authors on request.

Table 5.5: Five variants of the growth equation estimated by the FGLS and PCSEs

Dependent variable: *grGDPpc*	Variant 1		Variant 2		Variant 3		Variant 4		Variant 5	
Independent variable	GLS FE, H-CSC-psAR(1)	PCSE FE, psAR(1)	GLS FE, H-CSC-psAR(1)	PCSE FE, psAR(1)	GLS FE, H-psAR(1)	PCSE FE, psAR(1)	GLS FE, H-psAR(1)	PCSE FE, psAR(1)	GLS FE, H-psAR(1)	PCSE FE, psAR(1)
L.grGDPpc							0.12268	0.21157		
							(0.223)	(0.123)		
L.entryr	0.14539	0.17610	0.26902	0.27088	0.21156	0.23994	0.27870	0.29646	0.26737	0.27130
	(0.000)	(0.258)	(0.000)	(0.038)	(0.121)	(0.119)	(0.013)	(0.031)	(0.051)	(0.095)
grhourspc					0.13298	0.12018	0.14548	0.06576	0.16370	0.15687
					(0.086)	(0.117)	(0.031)	(0.267)	(0.033)	(0.069)
L.inv			-0.16585	-0.17152	-0.09820	-0.17981	-0.20668	-0.31015	-0.09173	-0.16468
			(0.000)	(0.150)	(0.333)	(0.171)	(0.018)	(0.004)	(0.337)	(0.185)
lnGDPpc	-6.7876	-8.4908	-8.6163	-9.6585	-8.0676	-9.2053	-9.6385	-10.4725	-9.6503	-10.9158
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
services	0.06269	0.14706	0.13924	0.16127	0.02455	0.11513	0.15271	0.27838	0.08038	0.20565
	(0.399)	(0.515)	(0.047)	(0.375)	(0.901)	(0.493)	(0.288)	(0.035)	(0.727)	(0.380)
gov			-1.22115	-1.23854	-1.53476	-1.42700	-1.09643	-1.03917	-1.32673	-1.19148
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
open	0.03411	0.02056	0.01333	0.01279	0.00408	0.00265	0.00196	0.00080	-0.01519	-0.01886
	(0.000)	(0.393)	(0.001)	(0.525)	(0.867)	(0.907)	(0.921)	(0.969)	(0.559	(0.410)
edu					-0.01962	-0.01470	0.03945	0.02839	-0.01635	0.0015
					(0.758)	(0.878)	(0.544)	(0.744)	(0.885)	(0.986)
TOTch							-0.29665	-0.30896		
							(0.000)	(0.000)		
TOTvol			0.00274	0.00276					0.00425	0.00483
			(0.000)	(0.063)					(0.001)	(0.009)
t									0.07125	0.04771
									(0.614)	(0.787)
constant	64.0884	80.1826	104.2978	114.8702	108.7243	117.4702	114.4119	120.1565	121.1677	129.3485
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	120	120	120	120	86	86	86	86	86	86
R^2		0.665		0.839		0.908		0.938		0.910
Wald chi^2	1011.05	660.07	2432.01	731.3	925.33	2644.04	1028.48	3421.55	720.93	919.46
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: *grGDPpc* – growth rate of real GDP per capita; *grhourspc* – growth rate of the annual hours worked per capita; *inv* – investment share of real GDP; *gov* – government spending share of real GDP; *lnGDPpc* – logarithm of real GDP per capita; *services* – the share of employment in the business service sector in total economy's employment; *edu* – the share of population aged 25–64 with completed tertiary education; *TOTvol* – volatility in the terms of trade. If a variable is added to the prefix *L.*, it means that is included with a lag of one year.

For other denotations, see the note to Table 5.2.

We now regress the growth rate of real GDP per capita on a set of labour market variables and chosen control variables as shown in Table 5.6. Since institutional variables show little

variation over time and because we would like to explain also cross-country variation in economic growth, we now estimate the growth equation without including fixed country-specific effects. We take the same strategy as for estimating the entry equation (47).

The results shown in Table 5.6 show that the union density statistically negatively affects real GDP per capita growth only when combined with mandatory or legal provision for extension of bargaining outcomes (recall that we have reached a similar conclusion about the impact of the union density and extension procedures on the business entry rate). The interactive effect of union density and extension procedures appears to be modest; it implies that in countries that apply the bargaining extension procedures an increase in the union density by 10 percentage points leads to a reduction in the growth of real GDP per capita by about 0.2 to 0.75 percentage points, if other factors are kept constant.

Both the tax wedge for labour income and the gross unemployment benefit replacement rate show significant but (regarding the amplitude) rather small impact on the real GDP per capita growth, regardless of the method of estimation. An increase in the tax wedge by 10 percentage points leads to a reduction in the real GDP per capita growth by 0.32 to 0.63 percentage points, while an increase in the gross unemployment benefit replacement rate by 10 percentage points reduces the real GDP per capita growth by 0.26 to 0.30 percentage points (keeping all other factors constant). Control variables (*lnGDPpc*, *grhourspc*, *inv*, *edu* and *open*) all have significant regression coefficients with expected signs.

Table 5.6: Results of estimation of the growth equation including trade union density, tax wedge and unemployment benefit replacement rate

Dependent variable: *grGDPpc*	Direct growth equation 1				Direct growth equation 2			
Independent variables	FGLS, H-cAR(1)	FGLS, H-psAR(1)	PCSE, cAR(1)	PCSE, psAR(1)	FGLS, H-cAR(1)	FGLS,H-psAR(1)	PCSE, cAR(1)	PCSE, psAR(1)
L.grGDPpc	0.05853	0.10903	0.16436	0.12293	0.09236	0.1237	0.17648	0.16111
	(0.421)	(0.082)	(0.204)	(0.330)	(0.224)	(0.061)	(0.123)	(0.135)
lnGDPpc	-13.21667	-12.67429	-10.28221	-12.21215	-12.24001	-13.10495	-10.41372	-12.47638
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
grhourspc	0.25233	0.19563	0.23892	0.17975	0.21880	0.18284	0.21043	0.17475
	(0.001)	(0.002)	(0.007)	(0.019)	(0.005)	(0.006)	(0.006)	(0.006)
inv	0.36503	0.39395	0.24783	0.35513	0.31821	0.39313	0.22324	0.33055
	(0.000)	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)	(0.016)	(0.000)
edu	0.15766	0.13968	0.12172	0.13559	0.13988	0.13588	0.11172	0.12561
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
services	0.09933	0.10809	0.03298	0.08495	0.07689	0.10970	-0.00616	0.06178
	(0.039)	(0.012)	(0.592)	(0.174)	(0.187)	(0.014)	(0.926)	(0.322)
open	0.02144	0.01882	0.02037	0.02004	0.01386	0.01448	0.01415	0.01433
	(0.000)	(0.000)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
tud	0.00022	0.00372	-0.00119	0.0015	-0.00196	-0.00272	-0.00913	-0.00928
	(0.979)	(0.717)	(0.880)	(0.866)	(0.826)	(0.801)	(0.166)	(0.225)
*tud*ext1*	-0.02587	-0.02732	-0.02233	-0.02582	-0.01895	-0.02161	-0.01259	-0.01645
	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)	(0.016)	(0.009)	(0.002)
*tud*ext2*	-0.07519	-0.07551	-0.06090	-0.07229	-0.05168	-0.06135	-0.02918	-0.04562
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.039)	(0.003)
grossbrr	-0.02940	-0.02642	-0.02950	-0.02974				
	(0.006)	(0.036)	(0.008)	(0.041)				
tw					-0.03783	-0.03205	-0.06333	-0.04826
					(0.099)	(0.103)	(0.005)	(0.014)
constant	122.48595	116.08758	98.41063	113.37253	115.95488	121.58471	104.43556	119.55709
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	106	106	106	106	105	105	105	105
R^2			0.657	0.898			0.652	0.891
Wald chi^2	184.51	798.02	514.87	1778.67	160.07	710.34	1326.65	1724.97
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: see Table 5.2 and Table 5.5.

Lastly, we (indirectly) estimate the growth equation (48) that is adjusted in the following way: we exclude the business entry rate and include the until now neglected factors that potentially affect economic growth through business entry. These factors are: the minimum wage, product market regulation, obstacles for businesses to get a credit, obstacles to starting up a business, share of ICT manufactures in total economy's employment. Beside these variables, the set of explanatory variables includes: the tax wedge, the gross unemployment benefit replacement rate, the logarithm of real GDP per capita, and openness to international trade.

Due to little variation of several institutional variables over time, we do not include country-specific dummy variables. The estimation procedure is the same as for the entry equation (47).

The results in Table 5.7 provide additional evidence that the tax wedge significantly negatively affects the GDP per capita growth but the amplitude of the effect is rather small. Similar is valid for the gross unemployment benefit replacement rate, but the statistical significance of the regression coefficient for this variable is somewhat less robust to methodological changes. The minimum wage system does not appear to have a significant impact on the growth of GDP per capita. Moreover, the results show that obstacles to starting up a business importantly negatively affect economic growth: increasing the transformed Doing Business indicator of obstacles to starting up a business from its minimum value (0) to its transformed potential maximum value (1), decreases the real GDP per capita growth by 3.7 to 5.4 percentage points. However, since the maximum value of *dbstarth* indicator actually achieved by a country in the sample is 0.35, it is better to put it this way: an increase in *dbstarth* from 0 to 0.35, decreases real GDP per capita growth by 1.3 to 1.9 percentage points. The transformed Doing Business indicator of obstacles to getting a credit has a negative sign but does not show a significant impact on the growth of real GDP per capita. The share of ICT manufactures (where the business entry rate is relatively high) in total economy's employment significantly positively affects real GDP per capita growth with the impact being relatively strong. An increase in *eictman* by 1 percentage point increases the real GDP per capita growth by 0.64 to 1.10 percentage points (note that *eictman* ranges from 0.4 to 2.7 in the sample of analysed countries). Interestingly, the indicator of product market regulation does not show a significant impact on GDP per capita growth (recall that we have reached a similar conclusion about its impact on the business entry rate). The signs of the control variables (the lagged real GDP per capita growth, the logarithm of real GDP per capita, and openness to international trade) are in line with the signs suggested by economic literature and mostly turn out to be statistically significant.

Table 5.7: Results of estimation of the growth equation including indicators of labour market institutions, business environment and industrial structure

Dependent variable: *grGDPpc*	FGLS, H-cAR(1)	FGLS, H-psAR(1)	FGLS, H-CSC-cAR(1)	FGLS, H-CSC-psAR(1)	PCSE, cAR(1)	PCSE, psAR(1)
L.grGDPpc	0.29675	0.30485	0.20981	0.27853	0.27916	0.30927
	(0.001)	(0.001)	(0.001)	(0.000)	(0.080)	(0.047)
lnGDPpc	-3.00657	-4.15327	-3.20422	-6.45845	-4.76631	-5.63201
	(0.205)	(0.052)	(0.042)	(0.000)	(0.170)	(0.059)
mw	-0.10015	-0.20632	-0.18118	-0.23104	-0.17465	-0.36798
	(0.832)	(0.657)	(0.575)	(0.370)	(0.765)	(0.557)
tw	-0.03388	-0.03455	-0.03677	-0.04565	-0.04609	-0.04496
	(0.139)	(0.116)	(0.002)	(0.001)	(0.097)	(0.095)
grossbrr	-0.01885	-0.0247	-0.02016	-0.03204	-0.02235	-0.03123
	(0.153)	(0.086)	(0.000)	(0.000)	(0.167)	(0.089)
pmr	0.19592	0.00773	0.16839	-0.32782	0.05348	0.08200
	(0.688)	(0.986)	(0.628)	(0.236)	(0.946)	(0.905)
dbgetc	-0.07974	-0.11862	-0.03158	-0.59774	-0.5104	-0.43709
	(0.950)	(0.924)	(0.966)	(0.431)	(0.782)	(0.803)
dbstartb	-4.00887	-4.99389	-3.71653	-5.43003	-4.60729	-5.89631
	(0.042)	(0.018)	(0.000)	(0.000)	(0.070)	(0.041)
eictman	0.92448	0.86613	1.10430	0.67636	0.80365	0.64635
	(0.034)	(0.040)	(0.000)	(0.008)	(0.129)	(0.216)
open	0.01521	0.01604	0.01651	0.01828	0.01727	0.01804
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
constant	33.77366	46.53628	36.05702	72.23239	53.36358	63.22538
	(0.198)	(0.050)	(0.036)	(0.000)	(0.162)	(0.054)
N	117	117	117	117	117	117
R^2					0.659	0.796
Wald chi^2	140.96	228.11	476.25	1169.1	283.74	536.86
(sig.)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: *grGDPpc* – growth rate of real GDP per capita; *lnGDPpc* – logarithm of real GDP per capita. If a variable is added to the prefix *L.*, it means that is included with a lag of one year. For other denotations, see the note to Table 5.2.

The evidence on the positive relationship between the lagged business entry rate and the growth of GDP per capita is robust to changes of specification of equation (48) and methodology of estimation. We lastly need to address also the potential problem of endogeneity of *entryr* in equation (48). For this purpose, we perform Granger's (1969) causality test. As depicted below, the results strongly reject the hypothesis that the business entry rate does not Granger cause the GDP per capita growth. On the other hand, the results do not reject the hypothesis that the GDP per capita growth positively Granger causes the business entry rate.

The test of causality introduced by Granger (1969) is executed in five steps. In the first step, we determine the relevant lag structure for $grGDPpc_{i,t}$ by regressing $grGDPpc_{i,t}$ on its lags (we have chosen to use six time lags in this step). Based on the estimation results we have decided to use two lags of $grGDPpc_{i,t}$ in the following steps in the analysis. In the second step, we determine the relevant lag structure for $entryr_{i,t}$ by regressing $entryr_{i,t}$ on its lags (we have chosen to use five time lags in this step due to the short time series). Based on the estimation results we have decided to use two lags of $entryr_{i,t}$. In the third step, we search for the evidence on causality running from $entryr_{i,t}$ to $grGDPpc_{i,t}$ by estimating the following equation:

$$grGDPpc_{i,t} = \beta_0 + \sum_{s=1}^{2} \beta_s grGDPpc_{t-s} + \sum_{h-1}^{2} \alpha_h entryr_{t-h} + LMI_{i,t}0 + CV_{i,t}\kappa + \nu_{i,t}, \quad (49)$$

Under the null hypothesis that $entryr_{i,t}$ does not Granger cause $grGDPpc_{i,t}$, any lags of $entryr_{i,t}$ that we added to the above equation should have zero regression coefficients. Since the error term is plagued by heteroskedasticity, we use a robust form of t test (*i.e.* corrected for heteroskedasticity). The results show that once lagged $entryr_{i,t}$ significantly positively affects $grGDPpc_{i,t}$. We conclude that $entryr_{i,t}$ Granger causes $grGDPpc_{i,t}$. Somewhat surprisingly, the twice lagged $entryr_{i,t}$ negatively affects $grGDPpc_{i,t}$. In the fourth step, we search for causality running from $grGDPpc_{i,t}$ to $entryr_{i,t}$ by estimating the following equation:

$$entryr_{i,t} = \alpha_0 + \sum_{h=1}^{2} \alpha_s entryr_{t-h} + \sum_{s-1}^{2} \beta_s grGDPpc_{t-s} + LMI_{i,t}\beta + MC_{i,t}\gamma + a_i + \varepsilon_{i,t}. \quad (50)$$

Under the null hypothesis that $grGDPpc_{i,t}$ does not Granger cause $entryr_{i,t}$, the lags of $grGDPpc_{i,t}$ should have zero regression coefficients. Since the error term is plagued by heteroskedasticity, we use a robust form of t test (*i.e.* corrected for heteroskedasticity). The results show that once lagged $grGDPpc_{i,t}$ does not significantly affect $entryr_{i,t}$, while twice lagged $grGDPpc_{i,t}$ shows a significantly negative impact on $entryr_{i,t}$. It is difficult to find arguments for the latter relationship – we believe it might be affected by the dynamics of $entryr_{i,t}$. In general, we cannot reject the hypothesis that $grGDPpc_{i,t}$ does not Granger cause $entryr_{i,t}$ (at least not in the positive direction).

5.5.3 Summary of econometric results and comparison to the theoretical model

Let us now summarize the results of estimation of different variants of regression equations (47) and (48), relate them to the hypotheses of the monograph and compare them to predictions of the theoretical model developed in section 4. The interpretation of the results is accompanied by Table 5.8 and Table 5.9.

The empirical analysis gives a vague picture about the impact of trade union (bargaining) power on Schumpeterian entrepreneurship in the form of business entry. When measured by the *union density* the effect surprisingly appears to be positive (but not robustly significant). If combined with mandatory extension laws, which extend collective agreements to cover also non-union workers, trade union density deters business entry, which is more in line with hypothesis 1 and the prediction of the theoretical model. The empirical model shows the resemblance in the impact of the union density (in interaction with extension procedures) on the business entry rate on one hand, and on the GDP per capita growth on the other hand. This might indicate that the effect of union density on economic growth is being transmitted through business entry as suggested by hypothesis 1. Based on the empirical results, hypothesis 1 cannot be completely (as a whole) accepted neither rejected. Though the union density (with or without extensions of collective agreements) does not show a systematic negative impact on business entry, there are some signs that the effects of union density on economic growth are being (partly) transmitted through the business entry.

The *system of minimum wage setting* shows a significant impact on the business entry: the more rigid the system[103] the lower the business entry rate, which is in the spirit of hypotheses 1 and 2. Namely, the rigidity of the minimum wage system can on one hand be related to the power of trade unions and, on the other hand, to the value of the outside option (the value of employment in another sector, for example). We have shown in the theoretical model that both the union bargaining power and the value of the outside option drive the negotiated wage upwards, which deters business entry. In line with hypothesis 1 and 2 (and prediction of the theoretical model), this in turn damages economic growth, which is not empirically confirmed.

In line with hypothesis 2 (and in line with prediction of the theoretical model), the *unemployment benefit* negatively affects the equilibrium entry rate. We cannot confirm hypothesis 2 (and replicate the respective theoretical prediction) by using empirical data for the unemployment benefit replacement rate and the IBE business entry rate in the analysed countries over the period 1995–2007. The effect of unemployment benefit replacement rate on the growth of GDP per capita appears to be significantly negative as suggested by the theoretical model; however, we cannot confirm that this effect is transmitted through business entry. Based on the results of the regressions, we reject hypothesis 2.

[103] The minimum wage system is considered rigid in case of existence of a national minimum wage and a high degree of government intervention and discretion in setting the minimum wage. In certain countries (Austria, Denmark, Finland, Germany, Italy, and Sweden), collective agreements are the main mechanism used for regulating low or minimum wages, while in some other countries, minimum wages are set by national laws, and strong trade unions can pressure national governments into raising the low wage. Besides, trade unions can also informally campaign for a higher low wage (*i.e.* a *de facto* minimum wage).

Labour income taxation measured by the tax wedge shows negative impact on both the business entry rate and the growth of GDP per capita. The negative effect of the tax wedge on economic growth can be partly transmitted through business entry. The empirical evidence therefore supports hypothesis 3 and is in line with prediction of the theoretical model.

The empirical result that business entry significantly positively affects growth of GDP per capita is relatively robust. We accept hypothesis 4 that entrepreneurship in the form of business creation positively affects economic growth as measured by the growth of GDP per capita.

Lastly, the results of regressions of the growth rate of GDP per capita on chosen labour market variables together with control variables show significantly negative impact of the tax wedge, and in certain formulations of the gross unemployment benefit replacement rate on the growth of GDP per capita. Trade union density negatively affects the growth rate of GDP per capita only when combined with mandatory extension laws (which is similar to its impact on the business entry rate). Comparisons of the estimated regression coefficients of the business entry rate and labour market variables in the growth regression equation to respective regression coefficients in the business entry regression equation suggest that the effect of labour market institutions on economic growth is at least partly direct (*i.e.* not transmitted through business entry). The results are therefore at least partly supportive of hypothesis 5 that chosen labour market institutions (union bargaining power, tax wedge, unemployment benefits) also directly (not through the business creation) affect economic growth in terms of GDP per capita.

Table 5.8 provides a summary of the results of both the empirical model and the theoretical model in relation to the hypotheses of the monograph. The predictions of the theoretical model are in line with all the four hypotheses that can be tested within the presented framework. Estimation results for the regression model (47)–(48) support hypotheses 3 and 4 and at least partly hypotheses 1 and 5, while they reject hypothesis 3. The empirical results moderately support the research statement saying that the considered labour market institutions affect entrepreneurship in the form of business entry and economic performance, and that entrepreneurship serves as one of the channels through which labour market rigidities hurt economic performance in terms of GDP per capita growth.

Table 5.8: Relating results of theoretical and empirical model to the hypotheses

Hypothesis/ Method	Empirical Model	Theoretical model
Hypothesis 1	partly	+
Hypothesis 2	-	+
Hypothesis 3	+	+
Hypothesis 4	+	+
Hypothesis 5	partly	

Note: »+ « denotes confirms, »–« denotes rejects.

In is also interesting to compare the regression results to predictions of the theoretical model that are not included in hypotheses of the monograph (Table 5.9).

Empirical data do not disclose any impact of *product market regulation* on business entry. The theoretical model gives an ambiguous answer about the direction of the impact, but the simulations show that for most probable values of the parameters lower competition provides stimulus for business creation. The disconcordance of empirical results with the results of simulations for the theoretical model might be related to the feature that the theoretical model does not incorporate the escape competition effect introduced by Aghion and Howitt (2004, 19) that is positive and might offset (or even prevail over) the negative Schumpeterian impact of competition on innovation activities and business entry.

The results of the regression analysis support the theoretical prediction that the higher cost of getting finance and starting up a business deteriorate business entry and in turn lower economic growth. The results, however, are not very robust, with the regression coefficients for *dbstarth* and *dbgetc* in some of the variants of regression equations (47) and (48) being insignificant.

Table 5.9: Comparison of the results of the empirical model with implications of the theoretical model

Dependent variable	*entryr*		*grGDPpc*	
Independent variables	Regression estimates	Theoretical model	Regression estimates	Theoretical model
tud	+ / n.s.		n.s.	
*tud*ext2*	–	–	–	–
*tud*ext1*	– (n.s.)		–	
mw	–	–	n.s.	–
grossbrr	n.s.	–	–	–
tw	– / n.s.	–	–	–
pmr	n.s.	+ / am.	n.s.	+ / am.
dbstartb	– / n.s.	–	–	–
dbgetc	–	–	n.s.	–
eictman	+	+(*)	+	+(*)

Note: »+« denotes positive impact, »–« denotes negative impact, »/ n.s.« means slightly or not significant, »(n.s.)« denotes often insignificant, »n.s.« denotes mostly insignificant, »am«. denotes ambiguous, and »(*)« stands for indirect.

Existing empirical literature suggests that the ICT sector faces a higher business entry rate than the total economy. Since our theoretical model does not include business dynamics in two different sectors (*e.g.* low-tech and high-tech sector or mature and young sector), we cannot directly relate our evidence on the positive impact of the share of ICT manufacturing in total employment on business entry and (in turn) on the growth in GDP per capita to the theoretical model. The result does, however, provide some indirect support for a positive relationship between innovativity and business entry as modelled in the theoretical model.

6 CONCLUDING REMARKS

The analysis of entrepreneurship, its determinants and its role in the economy starts with the overview of the concepts and theories of entrepreneurship to show the multidimensional nature of this phenomenon that is difficult to capture in a single definition. Indicators of entrepreneurship from various institutions (providing internationally comparable data) are grouped with respect to selected dimensions of entrepreneurship. For this purpose, we focus on three dimensions of entrepreneurship: the managing and uncertainty bearing as prominent features of Knightian entrepreneurship, innovativity as the prominent feature of Schumpeterian entrepreneurship, and alertness to business opportunities as a distinctive feature of Kirznerian entrepreneurship. For correlation analysis and the analysis of concordance of country rankings with respect to the level of entrepreneurship, we employ data for EU and other OECD countries for the period 2000–2007 drawn from various data sources. The analysis discloses that, regardless of the dimension of entrepreneurship we investigate, the outcome of empirical research might be sensitive to the choice of the indicator of entrepreneurship (related to the investigated dimension) and its data source. These findings have at least two implications:

- The results of empirical studies (investigating the impact of entrepreneurship on economic performance) that use different indicators as proxy variables for entrepreneurship should be compared with great care, since different indicators of entrepreneurship seem to highlight its different dimensions and may not provide consistent results and implications about the same phenomenon.
- Studies should focus on a specific aspect of entrepreneurship rather than trying to be too general in interpretation. One should be very explicit in describing the investigated aspect of entrepreneurship or very precise about the theoretical concept of entrepreneurship that is closely related to the investigated phenomenon.

Our overview and the analysis of entrepreneurship indicators supplements and extends previous analyses by Iversen, Jørgensen and Malchow-Møller (2008), Godin, Clemens and Veldhuis (2008) and Vale (2006).

Following the above conclusions, the monograph reviews (mostly macroeconomic) studies on the determinants of entrepreneurship and its role in the economy separately for two groups of entrepreneurship indicators: i) the self-employment and business ownership rates and ii) business dynamics indicators. The majority of studies find evidence on a significantly positive impact of entrepreneurship in the form of self-employment or business ownership and business creation on economic performance (*i.e.* labour and multifactor productivity, employment, the level of aggregate output, and output growth). The studies show that the institutional environment importantly affects entrepreneurship, regardless of the employed entrepreneurship indicator. However, there are only few studies relating entrepreneurship as measured by business creation or other dynamic indicators to labour market institutions. The monograph partly fills this gap by providing a theoretical and empirical investigation of the

impact of selected labour market institutions on entrepreneurship in the form of business creation and in turn on economic growth.

The hypotheses of the monograph are first tested theoretically with a GE model of a closed economy with endogenous (innovation-based) steady-state economic growth. The model incorporates innovative or Schumpeterian entrepreneurship and takes into account different imperfections on the labour market. It shows how entrepreneurial effort is likely to be influenced by the institutional setup and how this influence can be transmitted to other sectors and economic performance in terms of (un)employment and output growth. The theoretical model is not an extension of a specific paper/model but rather a combination of ideas from several models (in particular Grossman and Helpman 1991, Aghion and Howitt 1992, McDonald and Solow 1981, Blanchard and Giavazzi 2003, Acs *et al.* 2005; Quintero-Rojas, Adjemian and Langot 2008, and Kanniainen and Leppämäki 2009) leading to new mechanisms and interpretation. The model is parametrized and calibrated to match empirical regularities in the EU-15 over the period 1995–2007. The interpretation of the results focuses on the direction rather than size of the impacts of parameter changes. The results of simulations of the theoretical model confirm all the four hypotheses the model is able to test, that is:

- Hypothesis 1 stating that the bargaining power of trade unions negatively affects entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.
- Hypothesis 2 positing that generous unemployment benefits negatively affect entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.
- Hypothesis 3 saying that the tax burden on labour income negatively affects entrepreneurship in the form of business creation and indirectly (through entrepreneurship) economic growth as measured by the growth of GDP per capita.
- Hypothesis 4 stating that entrepreneurship as measured by the chosen indicator of business creation positively affects economic growth as measured by the growth of GDP per capita.

The above four hypotheses and hypothesis 5 (stating that the bargaining power of trade unions, unemployment benefit, and tax burden on labour exert a direct negative impact on economic growth as measured by the growth of GDP per capita) are tested also empirically by estimation of the two-equation regression model. The empirical model is built on the ground of the hypotheses of the monograph, the theoretical model and previous empirical literature, in particular Cincera and Galgau (2005) and Loayza, Oviedo and Servén (2005). For this purpose, we employ TSCS data for nine EU countries and the United States for the period 1995–2007 (the entry regression equation) and the period 1996–2008 (for the growth equation). The model is estimated by two alternative approaches: the Parks (1967) FGLS approach and the PCSEs approach proposed by Beck and Katz (1995). Estimation results for

the regression model support hypotheses 3 and 4 and at least partly hypotheses 1 and 5, while they reject hypothesis 3. We can conclude that the empirical results moderately support the research statement saying that considered labour market institutions affect entrepreneurship in the form of business entry and economic performance and that entrepreneurship serves as one of the channels through which labour market rigidities hurt economic performance in terms of GDP per capita growth.

The empirical analysis contributes to a limited scope of work in the analysis of the role of (Schumpeterian entrepreneurship in the form of) business dynamics as a channel of transmission of the effects of (different types of) regulations on productivity growth. It appears particularly relevant in the European context with relatively strong unions and a generous unemployment benefit system. Improvements in data availability concerning business dynamics and institutional variables across countries, industries, and over time would importantly increase the quality of empirical results.

One of the challenges for our future research is to investigate the role of entrepreneurship as a channel of transmission of the effects of labour market rigidities on economic performance by using the instrumental variable approach. Hereby, finding a convincing instrument for the business entry is of crucial importance for the quality of results. Another challenge is an extension of the theoretical model for additional sectors, and empirical testing of its implications using industry-level data. This extension would provide a more in-depth analysis of the relationship between labour market institutions, business entry, and economic performance, and potentially disclose new mechanisms.

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