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Business Ownership and Sectoral Growth: An Empirical Analysis of 21 OECD Countries

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Abstract:
We investigate the development of business ownership (self-employment) rates over time at the sectoral level and the effect of these rates on sectoral output growth. In an earlier exercise, Carree et al. (2002) presented an analysis of the interrelationship between economy-wide business ownership rates and economic development. Their analysis raised an important research question: to what extent do differences in business ownership rates at the economy-wide level reflect differences in the sectoral structures of economies or differences in business ownership rates at the sectoral level? The current paper investigates this question making use of a sectoral data base of 21 OECD countries for the period 1970-98. Estimation results suggest that there is, on average, a too low business ownership rate in manufacturing and a too high business ownership rate in services.

Keywords: business ownership, economic growth, entrepreneurship, manufacturing, services

JEL-classification: L16, L60, L80

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1. Introduction

The empirical growth literature has generated a long list of regressors assumed to affect economic growth. The regressors range from schooling to climate and from the extent of democracy to life expectancy (see e.g. Bleaney and Nishiyama, 2002). These factors are of considerable importance and it is for example unlikely to find a non-democratic country with an extreme climate to show fast economic growth, except when oil or other natural resources come into play. However, little attention in the empirical growth literature has been devoted to entrepreneurship and competition usually considered vital to economic progress. The lack of economic progress in (formerly) centralized planned economies has been at least partly due to the absence of these private initiatives. A characteristic of these economies was the almost complete absence of small firms and this extreme monopolization was a major factor leading to the collapse of state socialism (see e.g. Ellman, 1993 and Acs, 1996). The incorporation of entrepreneurship and competition into empirical growth models has been hampered by the problem of measurement. However, a small literature has developed that investigates the effect of the industry structure in terms of the share of small firms on economic progress. Examples include Nickell (1996), Carree and Thurik (1998), Audretsch et al. (2002) and Carree (2002a).

Recently, Carree et al. (2002) introduced a model that describes the interrelationship between the rate of business ownership (or interchangeably self-employment) and economic development. This model consists of two equations, which are estimated successively. In the first equation, an "equilibrium" relation is derived between the rate of business ownership and the level of economic development of a country. In the second equation the impact on economic growth of deviating from the "equilibrium" rate is estimated. The basic idea behind the model is that there can be too many or too few self-employed in an economy. A consequence of a *too* high business ownership rate in a country is that economies of scale and scope are not benefited from and that R&D expenditures may be relatively low. A consequence of a *too* low business ownership rate is that new private initiatives and radical new innovations may be less present than in other countries at comparable levels of economic development. Carree et al. present empirical evidence for the "equilibrium" rate of business ownership to depend upon the stage of economic development and that deviating from the "equilibrium" implies a lower economic growth rate.

The paper by Carree et al. suffers from an important limitation. It studies the relationship between business ownership rates at the economy-wide level without taking into consideration the sectoral structure of the economy. It is well-known that business ownership rates are much higher in the service sector when compared to the manufacturing sector. It is therefore possible that the penalty on deviating from the "equilibrium" business ownership rate is *not* a problem of having too few or too many self-employed, but a problem of having a too small or a too large share of the service sector. Carree et al. find that the "equilibrium" business ownership rates tend to increase with the level of economic development for the highly most developed countries (in terms of GDP per capita). This might be caused by increased interest for the option of self-employment as such across the sectors in the economy, but may also be explained from an employment shift in modern economies away from the manufacturing sector towards the service sector. The current paper examines the importance of the *sectoral* component in the Carree et

al. model, using data for 21 OECD countries. The 21 countries include 16 European countries, the United States, Canada, Japan, Australia and New Zealand.
There is a lot of debate about the reasons behind the increase in self-employment rates in developed countries in the last quarter of the 20th century. On the one hand, Audretsch and Thurik (2000) consider it to be a reflection of the shift from a "managed" towards an "entrepreneurial" economy. They claim that there is more room for business ownership in the latter type of economy because of, among others, increasing variety of demand and rapidly changing economic circumstances in which small firms have a comparative advantage with regard to their larger counterparts. These phenomena particularly apply to fully industrialized economies and therefore, this upward trend of business ownership would only be observable in countries at higher stages of economic development. On the other hand, other economists will say that this upward trend of the macro business ownership rate in modern economies is just a reflection of the (employment) share of the service industries increasing at the cost of the manufacturing industries' share. According to these economists it does not imply that also *within* sectors there would be an upward trend in business ownership. The current analysis gathers business ownership data on the sectoral level and applies the model of Carree et al. at this level. In this way, we can determine whether or not the structural changes in business ownership do also apply *within* sectors. In particular, we will estimate the model for two sectors: manufacturing and services.
In section 2 we will discuss the Carree et al. model and adapt it to make it applicable at the sectoral level. We also discuss the relevant literature. In section 3 we discuss the data for the OECD countries. This is followed by the empirical results in section 4. Section 5 is left for discussion.

2. Theory and model

Carree et al. (2000, 2002) introduced a model consisting of two equations with one additional equation defining the "equilibrium" rate of business ownership in period *t*, E_t^*. The dependent variables of the two equations are the four-year change in the business ownership rate, $E_t - E_{t-4}$, and the four-year growth rate of GDP, $(Y_t - Y_{t-4})/Y_{t-4}$. We use the same model configuration in our analysis but adapt it somewhat to apply it to the sectoral level. The model reads as follows.

(1) $$E_{ijt} - E_{ij,t-4} = b_1\left(E^*_{ij,t-4} - E_{ij,t-4}\right) + b_2\left(U_{i,t-4} - \overline{U}\right) + b_3 Y\_share_{ij,t-4} + b_{ITA} D_{ITA} + \varepsilon_{1ijt}$$

(2) $$\frac{\Delta_4 Y_{ijt}}{Y_{ij,t-4}} = c_0 + c_1\left|E^*_{ij,t-4} - E_{ij,t-4}\right| + c_2\, YCAP_{i,t-4} + c_3 Y\_share_{ij,t-4} + c_4 \overset{\circ}{WT}_t + c_5 \overset{\circ}{WT}_{t-2} + c_6 \overset{\circ}{WT}_{t-4} + \varepsilon_{2ijt}$$

(3) $$E^*_{ijt} = f\left(YCAP_{it}\right) \times (1 + b_{OMIB}\, D_{OMIB})$$

The symbols in these equations stand for the following variables:

E: number of business owners as fraction of total employment in sector (sectoral business ownership rate),
E^*: sectoral equilibrium business ownership rate,
Y: sectoral GDP,
$YCAP$: GDP per capita (macro level),
U: unemployment rate,
$\overline{U}$: sample average of unemployment rate,
Y_share: sectoral GDP as fraction of total GDP,
$\overset{\circ}{WT}$: relative growth of world trade (yearly basis),
D_{ITA}: dummy for Italy,
D_{OMIB}: dummy for countries for which number of business owners is defined inclusive of owner/managers of incorporated businesses (OMIBs),
$\varepsilon_1, \varepsilon_2$: disturbance terms in equations (1) and (2), respectively,
i, j, t: indices for country, sector, and year, respectively.

The variables E, E^* and Y are defined at the sectoral level and $YCAP$ and U are defined at the macro level. In the current paper business ownership is defined to include both the self-employed (the unincorporated as well as the incorporated) and the unpaid family workers. More details about this definition and the data sources used are given in section 3. In the remainder of the current section we will describe the three equations in the model in some detail. A more elaborate discussion can be found in Carree et al. (2002). Because the concept of an "equilibrium" rate of business ownership is central to the model, we start with equation (3).

Equilibrium business ownership equation (3)
The (sectoral) equilibrium business ownership rate is assumed to be a function f of (macro) economic development as measured by $YCAP_{it}$. For *low* levels of economic development, we expect the function f to be declining. Several authors (e.g. Kuznets 1971, Schultz 1990) have reported a negative relationship between economic development and the business ownership (self-employment) rate. Their studies use a large cross-section of countries with a wide variety in the stage of economic development. There are a series of reasons for the decline of self-employment, and of small business presence in general, during the early phases of industrialization. Chandler (1990) discusses the importance of investment in production, distribution, and management needed to exploit economies of scale and scope during the period after the second industrial revolution of the second half of the 19th century. It was a period of relatively well-defined technological trajectories, of stable demand and of seemingly clear advantages of diversification.
For *high* levels of economic development the function f may be increasing. Acs et al. (1994) report that a majority of OECD-countries experienced an increase in the self-employment rate during the 1970s and 1980s. Further evidence of a recent increase in self-employment in many OECD countries appears from EIM's data set COMPENDIA. For instance, for the United Kingdom, the number of non-agricultural self-employed (including the incorporated self-employed) as a fraction of total labour force increased from 7.8% in 1972 to 10.5% in 2000, and in the United States

this fraction increased from 8.0% to 10.0% in the same period (see Van Stel, 2003).

There are several reasons for the revival of small business and self-employment in Western economies. First, the last thirty years can be considered a period of industrial restructuring away from traditional manufacturing industries and towards the electronics, software and biotechnology industries. Jensen (1993) uses the term "Third Industrial Revolution" to describe this development. Small firms play an important role in these new industries. Second, new technologies have reduced the importance of scale economies in many sectors. This increases the comparative advantage of small firms relative to large firms (see e.g. Meredith, 1987). Third, from a certain level of economic development onwards, higher income and wealth increase consumer demand for variety (see Jackson 1984) creating new market niches. Fourth, self-employment has become more highly valued as an occupational choice. This "supply side" reason may be derived from a supposed hierarchy of human motivations, ranging from physical needs at the bottom to self-realization at the top (Maslow, 1970). Once the main material needs have been satisfied, a still higher level of prosperity will induce a growing need for self-realization. Because it provides more autonomy and independence, entrepreneurship then becomes more highly valued as an occupational choice than at lower income levels.

Based on these trends in self-employment (business ownership), we expect the equilibrium relation to be U-shaped (first declining and then rising business ownership rates). However, we will also consider L-shaped relationships (ownership rates continuously declining towards an asymptotic minimum rate).[1] We have chosen a parametric approach and have used four different equilibrium functions, two of which are U-shaped and two of which are L-shaped. These are given in equations (3a) through (3d). For ease of presentation we do not show the correction factor $(1+b_{OMIB}\,D_{OMIB})$.

(3a) $E^*_{ijt}=\alpha+\beta\,YCAP_{it}+\gamma\,YCAP^2_{it}$ Quadratic

(3b) $E^*_{ijt}=\alpha-\beta\dfrac{YCAP_{it}}{YCAP_{it}+1}$ Inverse

(3c) $E^*_{ijt}=\alpha+\beta\ln(YCAP+1)_{it}+\gamma\ln^2(YCAP+1)_{it}$ Log-Quadratic

(3d) $E^*_{ijt}=\alpha-\beta\dfrac{\ln(YCAP+1)_{it}}{\ln(YCAP+1)_{it}+1}$ Log-Inverse

The equilibrium rate of business ownership equals α when GDP per capita ($YCAP$) is zero in each of the four equations (3a) through (3d). In equation (3a) the relation between the level of development and the equilibrium rate of business ownership is quadratic. We expect β to be negative as initially economic development is negatively correlated with the business ownership rate. This decline is expected to become smaller over time, so γ is expected to be positive. The minimum of the U-shaped curve is reached for GDP per capita equal to $-\beta/2\gamma$. Another U-shaped relation can be found in equation (3c). Again we expect β to be negative and γ to be positive. In this log-quadratic case the rise of the curve after the minimum has

[1] Carree et al. (2002) concluded that U-shaped functions cannot be statistically discriminated from L-shaped functions.

been reached is less steep than the decline beforehand. Equations (3b) and (3d) give L-shaped equilibrium relations. The equilibrium rate is predicted to decline from α to $\alpha - \beta$ as the level of economic development rises from zero to high levels. We call this equilibrium relation the inverse and log-inverse cases. We compare the four different equilibrium functions on the basis of the explanatory powers in equations (1) and (2). That is, we compare the extent to which the change in the rate of entrepreneurship and the sectoral growth rate can be explained from deviations of the actual business ownership rate from the equilibrium business ownership rate.

The functional form of $YCAP$ in equation (3) is multiplied by a factor $(1 + b_{OMIB}\, D_{OMIB})$. This correction is necessary because the self-employment definitions in our data set vary across countries. In section 3 we will go into detail about these differences in definition. Summarized, one group of countries have self-employed defined as individuals *inclusive* of owner/managers of incorporated businesses (OMIBs) and other countries have a definition *exclusive* of OMIBs. It is clear that this creates an upward bias for the first group of countries as regards the number of self-employed. As these differences in definition are likely to (erroneously) affect the estimated equilibrium functions, we apply the raise-factor $(1 + b_{OMIB}\, D_{OMIB})$. The implicit assumption is that for a given sector the number of OMIBs as a fraction of the total number of business owners is constant for all levels of economic development. Obviously, the estimated b_{OMIB} should be positive.

Business ownership equation (1)

The dependent variable in equation (1) is the growth in the fraction of business owners (self-employed and unpaid family workers) in total sector employment in a period of four years. The *first* explanatory variable in the equation, which has the parameter b_1 assigned to it, is an error correction variable describing the difference between the equilibrium and the actual rate of business ownership (at sector level) at the start of the period. The parameter b_1 is expected to have a positive sign. There are several forces in market economies that may contribute to a process of adapting towards the equilibrium. An abundance of self-employed will lead to low profits and lack of desire to continue family business given that the government does not provide extraordinary support measures to self-employed. A relative shortage of self-employed may indicate entrepreneurial opportunities that will lead to high (net) entry rates given that the government regulations do not result in high barriers to potential entrepreneurs. The existence of a sound entrepreneurial climate and a well-developed (venture) capital market are instrumental in this respect.

The *second* explanatory variable is the lagged unemployment rate acting as a push factor for business ownership.[2] The expected sign of the parameter b_2 is positive. The *third* explanatory variable is the sectoral share in GDP. It is likely that scale advantages rank as an important competitive advantage in a sector in case the sectoral share in an economy is relatively high. Opportunities for new small ventures may be less present in later stages of the life cycle of industries in which

[2] The empirical evidence on the effect of unemployment on business formation is mixed. Evans and Leighton (1989) present evidence that unemployed workers are more likely to enter self-employment than employees. Carree (2002b) finds no effect of unemployment rates on the number of establishment in low entry barrier retail and consumer service industries.

scale economies in production or R&D have become key sources of competitive strength (see e.g. Klepper, 1996). Hence, the expected sign of parameter b_3 is negative. *Finally*, we follow Carree et al. in incorporating a dummy for Italy. Italy, especially Northern Italy, is exceptional in the sense that a relatively high value of GDP per capita is combined with a high and rising self-employment rate.[3]

Economic growth equation (2)
The dependent variable in equation (2) is sectoral economic growth, measured as the relative change in sectoral gross domestic product in a four-year period. The *first* determinant of sectoral growth is the (absolute) deviation of the actual rate of business ownership from the equilibrium rate of business ownership at the start of the period. The deviation is expected to have a negative impact on growth, or $c_1 < 0$. A shortage of business owners is likely to diminish competition with detrimental effects for static efficiency and competitiveness of the national economy. It will also diminish variety, learning and selection and thereby harm dynamic efficiency (innovation). On the other hand, a glut of self-employment will cause the average scale of operations to remain below optimum. It will result in large numbers of marginal entrepreneurs, absorbing capital and human energy that could have been allocated more productively elsewhere.
The *second* determinant is the (economy-wide) level of per capita income at the start of the period. It allows us to correct for the convergence hypothesis of countries. Countries lagging behind in economic development may show faster economic growth than more highly developed countries because they can profit from modern technologies developed in these countries. The expected sign of the parameter c_2 is negative. *Similarly*, we include the sectoral share of GDP to capture regression-to-the-mean effects at a sectoral level. Countries in which a certain sector is already quite large are expected to be confronted with less sectoral output growth than countries in which a sector has a smaller share of the economy. The parameter c_3 is also expected to be negative. The *fourth* determinant is (current and lagged) growth of world trade. Value added growth of exporting firms is dependent on the developments in world trade. The hypothesized effect of growth of world trade is positive, or $c_4, c_5, c_6 > 0$. This holds especially for manufacturing as there are, in general, more exporting firms in manufacturing compared to services.

3. Data

In this section we deal with the data used in the current paper. The section is split up in two parts. First, we discuss the sectoral classification and the required sectoral variables number of business owners, total employment and real value added. Second, we provide an overview of definitions and sources for the variables, either at the sectoral level or at the macro level.

[3] We do not include dummies for *all* countries in the sample. An implication of such a specification is that every country has its own unique equilibrium level. However, this type of country-specific equilibrium levels is not the focus of this study, since we are investigating a "universal" equilibrium function which should be valid for all countries. Also, deviations from country-specific equilibrium levels have quite a different interpretation than deviations from a "universal" equilibrium level, as the former type of deviation ignores the cross-country variation in business ownership rates.

3.1 Sectoral data

We estimate the model for the two main private sectors in a modern economy: manufacturing and services. For these sectors we need data on the number of business owners, total employment and real value added. We have collected these variables for 21 OECD countries for the years 1970-1998, as far as the data were available according to uniform definitions. This has resulted in the so-called "BLISS Oeso Sectoraal" data set, which is operated by EIM. The main data source for "BLISS Oeso Sectoraal" is *OECD National Accounts 1983-1995, Detailed Tables*. Where possible, missing data are supplied from other sources. Below we describe the sector classification used in the data set and describe the above-mentioned variables in some more detail.

Sectoral classification
The sector manufacturing is a one-digit industry in *OECD National Accounts*. For services four one-digit industries in the *OECD National Accounts* have been aggregated: (1) Wholesale and retail trade, restaurants and hotels; (2) Transport, storage and communication; (3) Finance, insurance, real estate and business services; (4) Community, social and personal services. We realise that our definition of the service sector is very broad. The four underlying sectors may be substantially different in structure, so ideally we would want to distinguish between these sectors. However, the composition of these four underlying sectors is quite different for different countries, visible in the numerous country notes on this matter to the statistical tables in the *OECD National Accounts*.[4] Hence, we cannot compare the numbers of business owners in the four underlying service sectors between different countries. These differences in composition do not apply to the aggregate data of the four underlying sectors. Therefore, despite its limitations, we prefer to work with the broad definition of the service sector.[5]

3.1.1 Number of business owners

Collecting harmonized data on the number of business owners at sectoral level for a large number of countries and over a long period of time is not easy for at least three reasons.[6] *First*, business owners (self-employed) are not defined uniformly across countries. In some countries owner/managers of incorporated businesses (OMIBs) are counted as self-employed whereas in other countries they are

[4] For example, for a number of countries the sub-sector Business services, which is part of sector Finance, etc., is included in Community, social and personal services, see OECD (1997a), pp. 100, 212, 351, 368 and 600. For some countries the sub-sector Restaurants and hotels, which is part of Wholesale, etc., is included in Community, social and personal services, see OECD (1997a), pp. 100, 148 and 368. For Italy, a distinction between Finance, etc., and Community, social and personal services has not even been made in the statistical tables of OECD National Accounts. Only aggregate data of these two sectors are included in the tables, see OECD (1997a), p. 431.

[5] A similar problem applies to the one-digit manufacturing sector. In some countries the one-digit sector mining is included in the manufacturing sector. In prevailing cases, we did correct for it with help of data from the Labour Force Statistics. Also, with help of data from other sources, we made a correction in the GDP data for manufacturing to exclude the mining part in these figures.

[6] Measurement problems concerning comparability of new firm formation rates across seven economically advanced countries are identified in a special issue of *Regional Studies*, see Reynolds et al. (1994).

counted as employee. This is because formally an owner/manager of an incorporated business is an employee of his own firm. The different statistical treatment results from a different set-up of labor force surveys in different countries.[7] *Second*, the big interest for entrepreneurship dates only from recent times. This is the reason that consistent measuring of the self-employed also dates from recent times. For some countries reliable data on the number of self-employed are not available, especially for early years and at a sectoral level. *Third*, and directly related to the second problem, in some countries major revisions in the way of measuring the self-employed have taken place in the past. Hence, for these countries numbers of self-employed are not readily comparable over time.
From the description above it becomes clear that we cannot measure the number of self-employed in a uniform fashion for all the 21 countries and for all years in our sample period. Instead, we have made definitions as uniform as possible and work with an unbalanced panel.[8] We end up with two groups of countries, using different self-employment definitions. This is explained below.

Three types of self-employed
Based on legal status, self-employed individuals may be split up in three different types: unincorporated self-employed, incorporated self-employed, and unpaid family workers. For each group we have to decide whether or not we want to include them in our self-employment definition. The most common group of self-employed individuals are the *unincorporated self-employed* and this group is obviously included in our self-employment count. We also want to include the *incorporated self-employed* in our count because they are not fundamentally different from the unincorporated self-employed, as far as "entrepreneurial spirit" is involved: both types of self-employed have chosen to "be their own boss". However, as mentioned earlier, in some countries the incorporated self-employed are treated as employee in the statistical tables, and for those countries it is not possible to measure their numbers. Because we include the incorporated self-employed in our definition, we generally speak of 'business owners' throughout this paper (in order to distinguish from 'self-employed' which is often understood to include only the unincorporated self-employed).
As far as *unpaid family workers* are concerned, we would rather not include them in our self-employment count. Family workers who work in a family member's firm often have little influence on the 'entrepreneurial' decisions taken. Usually they would not start a business in case this family member would not run one already. Therefore, we would have liked not to include them in our count of self-employed. However, although there is information at the *macro* level about the proportions of unpaid family workers in total self-employed in various countries (see the various issues of the *OECD Labour Force Statistics*)[9], there is no information about these proportions at the *sectoral* level. Because sectoral self-employment data in *OECD National Accounts* are inclusive of unpaid family workers and we cannot (in a plau-

[7] See Chapter 5 of *OECD Employment Outlook June 2000*.

[8] This means that the data are not available for the same period of time for all countries and sectors. Instead we work with the maximum amount of data that we were able to collect for each country and sector.

[9] In earlier studies that we performed at the macro level, we have in fact used self-employment data exclusive of unpaid family workers (Carree et al. 2000 and 2002). These studies make use of EIM's data set COMPENDIA, see Van Stel (2003).

sible way) exclude the unpaid family workers from the available figures, we were left no choice but to include them in our self-employment count.

Definitions

As mentioned earlier, the way in which the self-employed are defined in OECD National Accounts is different across countries. Specifically, in some countries the owner/managers of incorporated businesses are counted as self-employed and in other countries they are counted as employee. We do not correct for the difference in definitions in our *data*, as we do not dispose of country- and sector-specific information about the proportions incorporated/unincorporated self-employed. Instead, we correct for the differences in our *model*, by means of a so-called OMIB-dummy.

For the construction of the OMIB-dummy, we must know which countries use the narrow definition of self-employed (excluding the incorporated self-employed), and which countries use the broader one (including the incorporated self-employed). In *OECD Employment Outlook June 2000*, the countries that use the narrow definition and the ones that use the broad definition are given. That is, the definitions as applied in *OECD Labour Force Statistics* are mentioned. In principle, the definition used in *LFS* is also the definition used in *OECD National Accounts*. But this is not necessarily true for all countries. Based on (1) a comparison between the total number of non-agricultural self-employed (including unpaid family workers) according to *OECD Labour Force Statistics* and *OECD National Accounts*; (2) the definition used in each country in OECD Labour Force Statistics as reported by *OECD Employment Outlook June 2000*, p. 158; (3) the country-notes in *OECD National Accounts 1983-1995*; we have been able to distinguish two groups of countries in our dataset: countries using a broad self-employment definition (including OMIBs) and countries using a narrow definition (excluding OMIBs). The countries having a self-employment definition including OMIBs are Belgium, Denmark, France, West-Germany, Greece, Ireland, Italy, Portugal, Spain, United Kingdom, United States and New Zealand. The countries having a self-employment definition excluding OMIBs are Austria, Finland, Netherlands, Sweden, Iceland, Norway, Japan, Canada and Australia. In terms of equation (3), the value of D_{OMIB} is 1 for the first group of countries and 0 for the second group.[10]

Supplementary sources and corrections

As mentioned earlier, the main source for the sectoral data is *OECD National Accounts 1983-1995*.[11] The number of self-employed (in persons) is derived from country tables 15: employment by kind of activity, as the difference between employment of *all persons* and employment of *employees*. Where possible, missing

[10] Two remarks concerning the United States are required here. First, the definition in OECD National Accounts for the U.S. is exclusive of OMIBs. Instead of using these data and classifying the U.S. in the second group of countries (i.e., excluding OMIBs), we made an exception for the U.S. and made an approximation of the number of OMIBs based on information from *The State of Small Business*. The exception was made because we would like to include the number of OMIBs in our definition and we consider the U.S. too important to settle for a definition excluding OMIBs in our data set. Second, the United States is also exceptional in the sense that the self-employment data from OECD National Accounts are exclusive of unpaid family workers, see OECD (1997a), p. 73. Since in the U.S. the number of unpaid family workers is very low (0.1% of total non-agricultural employment in 1996; compare this with, for example 4.1% in Turkey, see OECD, 1997b), this discrepancy in definition with regard to the other countries is very small.

[11] This publication also provides data for years prior to 1983, by means of accompanying disks.

data (including the years 1996-98) are supplied from various other sources, including *OECD Labour Force Statistics* and *OECD National Accounts 1988-98*. Corrections are made to ensure that data from different sources correspond. In some cases country-specific data sources are used to make data comparable with other countries. For example, in *OECD National Accounts* the data for the Netherlands are expressed in man-years instead of persons. Therefore, we used information from the Dutch national accounts (published by *Statistics Netherlands*), to obtain a time series in persons. Also, for the United States, we constructed a series inclusive of OMIBs, making use of information from *The State of Small Business*, issues 1986 and 1996.

Sectoral business ownership data are reported in Table 1. Greece and Italy have the highest business ownership rates (1998) for *manufacturing*, while the Scandinavian countries and the United States have relatively low business ownership rates. Strong increases of the business ownership rate in manufacturing during the period 1970-1998 are found for Ireland, United Kingdom, United States, Canada, Australia and New Zealand, while Denmark, France, Norway, and especially Japan experienced strong decreases in business ownership rates during this period. Belgium, Greece, Italy, Portugal and Spain have the highest business ownership rates (1998) for *services*, while relatively low rates are found for the Netherlands, Sweden, Norway, the United States and Australia. The high proportions of self-employed for the former five countries are partly explained by the relatively high numbers of unpaid family workers in these countries. According to Table 4.2 of *OECD Employment Outlook July 1992*, the proportion of unpaid family workers in non-agricultural civilian employment in 1990 varies from 3.4% (Belgium) to 5.4% (Greece) for these countries. For comparison, this proportion was 0.2% for the United States and Canada in 1990. Strong increases in the business ownership rate during the period 1970-1998 are again found for the United Kingdom, Canada and New Zealand, while Denmark, France and Japan also experienced strong declines in business ownership rate for the service sectors.

Table 1 Sectoral business ownership rates for 21 OECD countries, 1970-1984-1998

Country	Manufacturing			Services		
	1970	1984	1998	1970	1984	1998
Austria [b]	0.051 [1976]	0.044	0.040	0.166 [1976]	0.141	0.138
Belgium [a]	0.057	0.062	0.065	0.309	0.280	0.283
Denmark [a]	0.067	0.048	0.032	0.214	0.173	0.144
Finland [b]	0.031	0.028	0.027	0.133	0.145	0.138
France [a]	0.062	0.049	0.041	0.238	0.171	0.138
West-Germany [a]	0.054	0.042	0.049	0.220	0.165	0.176
Greece [a]	0.320 [1972]	0.300	0.307	0.359 [1972]	0.349	0.335
Ireland [a]	0.038	0.048	0.078	N.A.	N.A.	N.A.
Italy [a]	0.139	0.155	0.164	0.425	0.459	0.437
The Netherlands [b]	0.043	0.045	0.053	0.165	0.131	0.123
Portugal [a]	0.056 [1974]	0.051	0.055	0.365	0.324	0.381
Spain [a]	0.089 [1972]	0.123	0.123	0.411 [1972]	0.398	0.314
Sweden [b]	0.029	0.027	0.031	0.159	0.107	0.124
United Kingdom [a]	0.019 [1972]	0.033	0.059	0.133 [1972]	0.150	0.158
Iceland [b]	0.048	0.026	0.044	0.175	0.133	0.138
Norway [b]	0.051	0.037	0.032	0.126	0.106	0.093
United States [a]	0.022	0.030	0.037	0.117	0.114	0.103
Japan [b]	0.153	0.120	0.070	0.265	0.200	0.137
Canada [b]	0.029 [1976]	0.032	0.040	0.097 [1976]	0.105	0.130
Australia [b]	0.039	0.051	0.089	0.119	0.131	0.123
New Zealand [a]	0.072 [1972]	0.080	0.127	0.135 [1972]	0.140	0.157
Average	0.070	0.068	0.075	0.217	0.196	0.189

Source: "BLISS Oeso Sectoraal". Note: business ownership rates are per total sector employment. Except for U.S., business owners include unpaid family workers. Labels [a] and [b] indicate that owner/managers of incorporated businesses are included ([a]) or excluded ([b]). In case data for the year 1970 are not available, the first year available in the data set is reported.

3.1.2 Total employment

Data on total employment (in persons) are also obtained from *OECD National Accounts 1983-1995* (country tables 15: employment of all persons). Total employment includes self-employed (including OMIBs and unpaid family workers) as well as employees. Again, where possible, missing data are obtained from other sources, including *OECD Labour Force Statistics* and the Dutch national accounts.

3.1.3 Real value added

Sectoral data on real value added are obtained from *OECD National Accounts 1983-1995*, country tables 12: gross domestic product by kind of activity. The value added data are transformed into data expressed in millions of purchasing power parities per US $ at 1990 prices. This enables valid comparison of value added between countries and over time. Again, where possible, missing data are obtained from various other sources, including *OECD Stan*, *OECD Statistical Compendium* (on CD-ROM), and, for Portugal, unofficial statistics from the *Bank of Portugal*.[12]

[12] We are grateful to Jose Mata for providing us with the last-mentioned data.

3.2 Model variables and data sources

The variables incorporated in the model have the following definitions and sources.

E: sectoral business ownership rate: number of business owners in sector as a fraction of total employment in sector. Counts of number of business owners and total employment are described in section 3.1.
Y: sectoral GDP in purchasing power parities per U.S. $ in 1990 prices. This variable is described in section 3.1.
$YCAP$: per capita GDP in purchasing power parities per U.S. $ in 1990 prices (macro level). The underlying variables gross domestic product and total population are from *OECD National Accounts, Detailed Tables*, and from *OECD Labour Force Statistics*, respectively. GDP is measured in constant prices. Furthermore, purchasing power parities of 1990 are used to make the monetary units comparable between countries.
U: (standardized) unemployment rate. This variable measures the number of unemployed as a fraction of total labor force. The labor force consists of employees, self-employed persons, unpaid family workers, military and unemployed persons. The main source for this variable is *OECD Main Economic Indicators*. Some missing data on the number of unemployed have been filled up with help of data from the *OECD Labour Force Statistics* and the *Yearbook of Labour Statistics* from the International Labour Office.
Y_share: sectoral GDP as fraction of macro GDP. Both sectoral GDP and macro GDP are taken from *OECD National Accounts 1983-1995*, country tables 12: gross domestic product by kind of activity. We correct for different value added definitions at *sectoral* level in different countries, i.e., market prices, factor costs, or base prices. The differences result from a different statistical treatment of the items import duties, value added tax, and other indirect taxes. For some countries these items are ascribed to sectors, while for other countries, they are not. We correct for this by taking GDP exclusive of these three items (i.e., the item 'Subtotal') as denominator of Y_share.
ΔWT: growth of world trade (yearly basis). These data are taken from Appendix A4 ("Kerngegevens 1970-2002") of the publication *Central Economic Plan (CEP) 2001*, item "relevante wereldhandel", by *CPB Netherlands' Bureau for Economic Policy Analysis*.
D_{ITA}: dummy for Italy: this variable has value one for Italy, and zero otherwise.
D_{OMIB}: dummy for countries defining the number of business owners *inclusive* of owner/managers of incorporated businesses (OMIBs): this variable gets value one for the countries Belgium through New Zealand (as mentioned in section 3.1.1), and value zero for the remaining countries.

4. Results

The current section is split up in two parts. In the first part we present separate results for manufacturing and services. We also discuss the methods employed to compute the regression models. In the second part we present a model where business ownership rates in manufacturing and services, as well as sector struc-

ture are assumed to simultaneously explain growth at the macro level (growth of GDP per capita).

4.1 Methods and sector results

Equations (1) and (2) are estimated successively. For a given specification of E^* (equation 3a, 3b, 3c or 3d), we substitute the expression into equation (1). This leads to an expression which is nonlinear in the parameters. Therefore we estimate the regression equation using non-linear least squares.[13] After having estimated equation (1), we are able to compute E^*, and hence $|E^* - E|$, using the parameter estimates of the equilibrium function (3). After computing $|E^* - E|$, we are able to estimate equation (2), using OLS.

When estimating the model, we weight observations with population. We consider larger countries such as the U.S. and Japan to be more important in establishing the relationship between business ownership and economic growth than small countries like New Zealand and Iceland. Weighting with population (in the year t-4) implies that all variables (including constants and dummies) are multiplied with the square root of population before the least squares procedure is run. A more detailed description of the weighting of observations can be found in Carree et al. (2002, p. 286). Both for manufacturing and services, the regressions are computed using unbalanced panels. This is caused by missing data for certain countries and years in our sectoral data base. Furthermore, as in Carree et al., uneven years are removed.[14] Our sample contains 245 observations for the manufacturing sector and 231 observations for services. For the exact construction of these samples we refer to the appendix. The estimation results are presented in Tables 2 and 3.

[13] We use the LSQ command in TSP 4.5.

[14] The removal of uneven years has the advantage of diminishing the potential danger of a downward bias in the estimated standard errors of the coefficients that may arise due to overlapping observation periods for consecutive years. The key variables like business ownership rate and GDP per capita change only slowly over time. Hence, it is unlikely that the results will alter much in case the uneven years would have been included.

Table 2 Estimation results model (1)-(2)-(3) **MANUFACTURING** (245 observations)

Eq. (1)+(3), dependent variable four-year growth of sectoral business ownership rate				
	Quadratic	Inverse	Log-quadratic	Log-inverse
Error correction (b_1)	0.084 (5.32)	0.087 (5.61)	0.086 (5.16)	0.085 (5.60)
Unemployment (b_2)	0.054 (3.08)	0.055 (3.30)	0.054 (3.07)	0.053 (3.21)
Sectoral GDP share (b_3)	-0.039 (-2.71)	-0.037 (-3.00)	-0.038 (-2.59)	-0.039 (-3.16)
OMIB-correction (b_{OMIB})	0.293 (1.70)	0.281 (1.65)	0.287 (1.64)	0.293 (1.76)
Italy-correction (b_{ITA})	0.0083 (3.26)	0.0087 (3.68)	0.0086 (3.20)	0.0084 (3.55)
α	0.320 (3.79)	1.40 (4.27)	0.697 (1.27)	1.10 (4.29)
β	-0.019 (-1.69)	1.36 (4.07)	-0.320 (-0.75)	1.31 (4.04)
γ	0.00041 (1.12)		0.042 (0.52)	
R^2_{adj}	0.302	0.305	0.302	0.305
LR Test $\delta = 0$ (5% critical value 3.84)	0.076		0.118	
LR Test $\beta = \gamma = 0$ (5% critical value 5.99)	0.056		0.117	
Eq. (2), dependent variable four-year growth of sectoral GDP				
Constant (c_0)	0.145 (2.67)	0.143 (2.65)	0.144 (2.66)	0.145 (2.68)
Deviation E from E* (c_1)	-0.454 (-3.77)	-0.490 (-4.00)	-0.479 (-3.95)	-0.472 (-3.96)
GDP per capita (c_2)	-0.0012 (-0.71)	-0.0011 (-0.63)	-0.0011 (-0.66)	-0.0011 (-0.68)
Sectoral GDP share (c_3)	-0.493 (-3.75)	-0.497 (-3.79)	-0.493 (-3.76)	-0.488 (-3.72)
World trade (c_4)	0.410 (1.89)	0.411 (1.90)	0.409 (1.88)	0.406 (1.87)
World tr., 2 year lag (c_5)	1.234 (5.81)	1.237 (5.84)	1.235 (5.83)	1.233 (5.82)
World tr., 4 year lag (c_6)	0.559 (2.85)	0.564 (2.89)	0.563 (2.88)	0.562 (2.88)
R^2_{adj}	0.446	0.450	0.449	0.449
EXTRA: Test of robustness				
Deviation E from E* (c_1)	-0.252 (-2.46)	-0.291 (-2.79)	-0.280 (-2.72)	-0.278 (-2.75)
Growth of empl. (c_7)	0.863 (10.3)	0.859 (10.3)	0.859 (10.3)	0.859 (10.3)
R^2_{adj}	0.612	0.615	0.614	0.615

Note: T-values in parentheses. The extra equation uses the same control variables as equation (2).

Table 3 Estimation results model (1)-(2)-(3) **SERVICES** (231 observations)

Eq. (1)+(3), dependent variable four-year growth of sectoral business ownership rate				
	Quadratic	Inverse	Log-quadratic	Log-inverse
Error correction (b_1)	0.164 (9.11)	0.162 (8.98)	0.162 (9.01)	0.159 (8.79)
Unemployment (b_2)	0.111 (4.13)	0.093 (3.62)	0.106 (3.95)	0.088 (3.45)
Sectoral GDP share (b_3)	-0.003 (-0.14)	0.014 (0.94)	-0.001 (-0.04)	0.016 (1.04)
OMIB-correction (b_{OMIB})	0.130 (0.99)	0.307 (1.15)	0.129 (0.91)	0.383 (1.13)
Italy-correction (b_{ITA})	0.048 (9.21)	0.047 (8.95)	0.048 (9.16)	0.046 (8.77)
α	0.556 (4.80)	1.87 (5.13)	1.94 (3.60)	1.33 (4.42)
β	-0.050 (-4.83)	1.92 (5.29)	-1.22 (-3.25)	1.73 (4.64)
γ	0.0014 (4.04)		0.203 (2.88)	
R^2_{adj}	0.402	0.385	0.398	0.377
LR Test $\delta = 0$ (5% critical value 3.84)	0.369		3.33	
LR Test $\beta = \gamma = 0$ (5% critical value 5.99)	7.02		12.2	
Eq. (2), dependent variable four-year growth of sectoral GDP				
Constant (c_0)	0.173 (4.82)	0.163 (4.48)	0.172 (4.71)	0.162 (4.46)
Deviation E from E* (c_1)	-0.110 (-2.39)	-0.053 (-1.22)	-0.087 (-1.94)	-0.051 (-1.16)
GDP per capita (c_2)	-0.0051 (-3.75)	-0.0047 (-3.40)	-0.0051 (-3.66)	-0.0046 (-3.39)
Sectoral GDP share (c_3)	0.058 (0.73)	0.059 (0.74)	0.057 (0.71)	0.060 (0.75)
World trade (c_4)	-0.302 (-2.35)	-0.303 (-2.34)	-0.302 (-2.34)	-0.303 (-2.34)
World tr., 2 year lag (c_5)	0.405 (3.20)	0.417 (3.27)	0.410 (3.23)	0.417 (3.27)
World tr., 4 year lag (c_6)	0.374 (3.19)	0.390 (3.31)	0.382 (3.26)	0.391 (3.31)
R^2_{adj}	0.788	0.783	0.786	0.782
EXTRA: Test of robustness				
Deviation E from E* (c_1)	-0.051 (-1.19)	-0.0057 (-0.14)	-0.032 (-0.76)	-0.0030 (-0.075)
Growth of empl. (c_7)	0.542 (7.07)	0.559 (7.30)	0.549 (7.16)	0.559 (7.31)
R^2_{adj}	0.819	0.817	0.818	0.817

Note: T-values in parentheses. The extra equation uses the same control variables as equation (2).

Equilibrium equation (3)

In Tables 2 and 3 estimation results are given for the four different specifications of the sectoral equilibrium rate of business ownership (3a)-(3d). Based on likelihood ratio tests we try to identify which specification fits the data best. To test the quadratic specification versus the inverse specification, we estimate an additional equation (1), where the equilibrium function is now specified as $E^*_{ijt}=\alpha+\beta YCAP_{it}+\gamma YCAP^2_{it}+\delta YCAP_{it}/(YCAP_{it}+1)$. The quadratic and inverse specifications are special cases of this (artificial) function: the quadratic equilibrium function corresponds to $\delta=0$, while the inverse specification corresponds to $\beta=\gamma=0$. In other words, the quadratic and inverse models are *nested* in the model and, hence, standard likelihood ratio tests apply. This holds analogously for the log-quadratic versus the log-inverse model. The LR test statistics are given in the tables.

For *manufacturing* both null hypotheses $\delta=0$ and $\beta=\gamma=0$ cannot be rejected. This means that U-shaped equilibrium functions cannot be distinguished from L-shaped functions in a statistical sense. The inverse specification has the highest adjusted R^2 values, although the differences are small. The implied asymptotic value of 0.04 for this specification seems plausible. For *services* the likelihood ratio tests point in the direction of a U-shape: the null hypothesis $\delta=0$ is not rejected while the null hypothesis $\beta=\gamma=0$ is. This holds for both types of comparisons: quadratic versus inverse and log-quadratic versus log-inverse. So, after having reached a minimum level, the business ownership rate starts to rise again with increasing wealth (i.e., increasing GDP per capita). For the quadratic specification, the minimum $-\beta/2\gamma$ is reached at 18,129 U.S. dollar (1990 prices). The minimum business ownership rate equals 0.099. Based on this analysis, we will discuss the other estimation results for the specifications with the best statistical fit: L-shape for manufacturing (inverse or log-inverse) and U-shape for services (quadratic or log-quadratic).

Equation (1)

From Tables 2 and 3 we see that error-correction processes are statistically significant for both manufacturing and services. However, the speed of adjustment is low: 16% for services and 9% for manufacturing. A speed of adjustment of 16% means that a deviation of the number of business owners from equilibrium at a certain point in time decreases with 16% in the succeeding four years. The low value of the speed of adjustment is not surprising. The convergence process of the actual business ownership rate towards the equilibrium rate is intrinsically slow because it involves structural changes on the supply side (setting up enterprises, investments in physical and human capital, divestments, etc.) as well as cultural and institutional changes. As some of these processes are especially slow in manufacturing, the lower speed of adjustment for this sector compared to services is not surprising. For instance, it is more difficult to start a business in the manufacturing sector than in the service sector, because on average more start-up capital is required.

We find evidence for the unemployment push hypothesis. For services, every percent point rise in the unemployment rate leads to a rise of 0.11 percent point in the self-employment rate in the succeeding four years. For manufacturing this effect is 0.06 percent point. Again, the smaller effect for manufacturing may be explained by higher set-up costs for starting a new business. A significantly negative sign of sectoral GDP share (parameter b_3) is found only in case of the manufacturing sec-

tor. High shares of manufacturing in a country's economy are associated with subsequently lower business ownership rates. This may reflect the importance of economies of scale in manufacturing.
The estimated correction factor for the number of OMIBs, b_{OMIB}, is plausible, both for manufacturing and services. In the equilibrium functions, the number of OMIBs as a proportion of other self-employed (unincorporated self-employed and unpaid family workers) equals 0.28 and 0.13 for manufacturing and services, respectively. The additional (unexplained) rise in business ownership for Italy is supported by our estimations: parameter b_{ITA} is significantly positive. The effect is much stronger for services though: the parameter is about five times higher for services compared to manufacturing.

Equation (2)
According to the significantly negative estimate of c_1, deviations between actual and equilibrium business ownership rates come at a cost of forgone growth. The effect is stronger for manufacturing than for services. Each percent point difference between E and E^* is associated with a loss of 0.5 percent point subsequent growth in value added (on a four year basis) in manufacturing. For services this effect is only 0.1 percent point. This suggests that deviating from the "optimal" firm size distribution is more important for manufacturing when compared to services. Either having too few or too many entrepreneurial ventures in manufacturing appears to be more damaging to economic performance than when this occurs in the service sector. When there are too few entrepreneurs this may come at the cost of the rate of radical innovations and consequently, economic growth. When there are too many entrepreneurs economies of scale may not be benefited from enough. In Figures 1 and 2 it is shown that for manufacturing the number of business owners is generally too *low* (consistent with a lack of incentives to innovate), while for services the number of business owners is generally too *high*. The latter observation implies that in many countries there are a lot of 'marginal' entrepreneurs, whose efforts and energy could be allocated more effectively working as wage earners. This is especially true for Italy.
The estimations also find evidence for the convergence of countries: GDP per capita has a negative impact on subsequent growth (parameter c_2), although the effect is significant only for services. For manufacturing there is a regression-to-the-mean effect: the parameter of sectoral GDP-share (c_3) is significantly negative. For services the latter effect is not found. Finally, we find a significant positive impact of the growth of world trade on sectoral growth. Looking at the combined effect (the sum of parameters c_4, c_5 and c_6) the effect is larger for manufacturing. Again, this is not surprising, given the bigger orientation on export in this sector.

Test of robustness
As a test of robustness, we also estimated the sector growth equation with employment growth included as an extra explanatory variable. See the last parts of Tables 2 and 3. Note that, by and large, we thus measure labour productivity growth instead of production growth. Although t-values become lower, the estimates of c_1 (growth penalty) remain negative. This gives us some confidence about the robustness of the growth penalty. The coefficient of employment growth c_7 is smaller than one, which suggests decreasing returns to scale. However, this is not necessarily the case. As employment is measured in persons, the low coeffi-

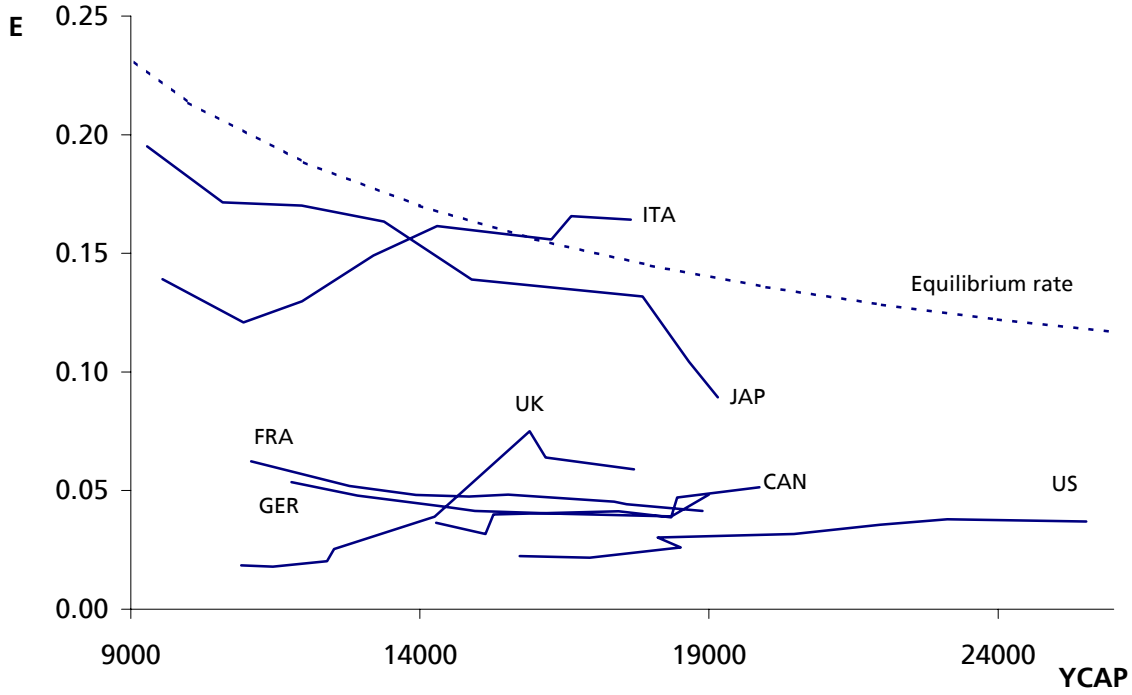
cient may reflect a relative increase in part-time workers (compared to full-time workers). This phenomenon may be stronger for services, considering the low value of the estimated coefficient c_7.

Equilibrium curves

In Figures 1 and 2, we show the equilibrium curves and the actual data for the G7-countries. For the equilibrium curves we choose the specification with the best statistical fit: "Inverse" for manufacturing and "Quadratic" for services. For manufacturing, all G7-countries –except for Italy- are well below the "equilibrium" rate.[15] According to the significant negative parameter estimate of c_1 in equation (2), these deviations from equilibrium are penalised in the form of lower growth rates. So, apparently, there are too few self-employed in the manufacturing industries. Perhaps the low numbers of competitors and new entrepreneurial initiatives result in a lack of innovation incentives and therefore, in lower growth rates. Japan and Italy have been relatively close to the equilibrium curve. According to our model, the relatively high business ownership rate for manufacturing in these countries has favoured economic growth.

[15] In Van Stel and Carree (2002) we provide additional empirical evidence for the validity of the equilibrium curve depicted in Figure 1. In particular, we show that allowing for *country-specific* (hence lower) equilibrium functions is unattractive, both statistically and theoretically. We find no growth penalty any more because structural differences between countries are removed and only time-specific deviations are left.

Figure 1 Actual and equilibrium business ownership rate for G7 countries, 1970-98, manufacturing

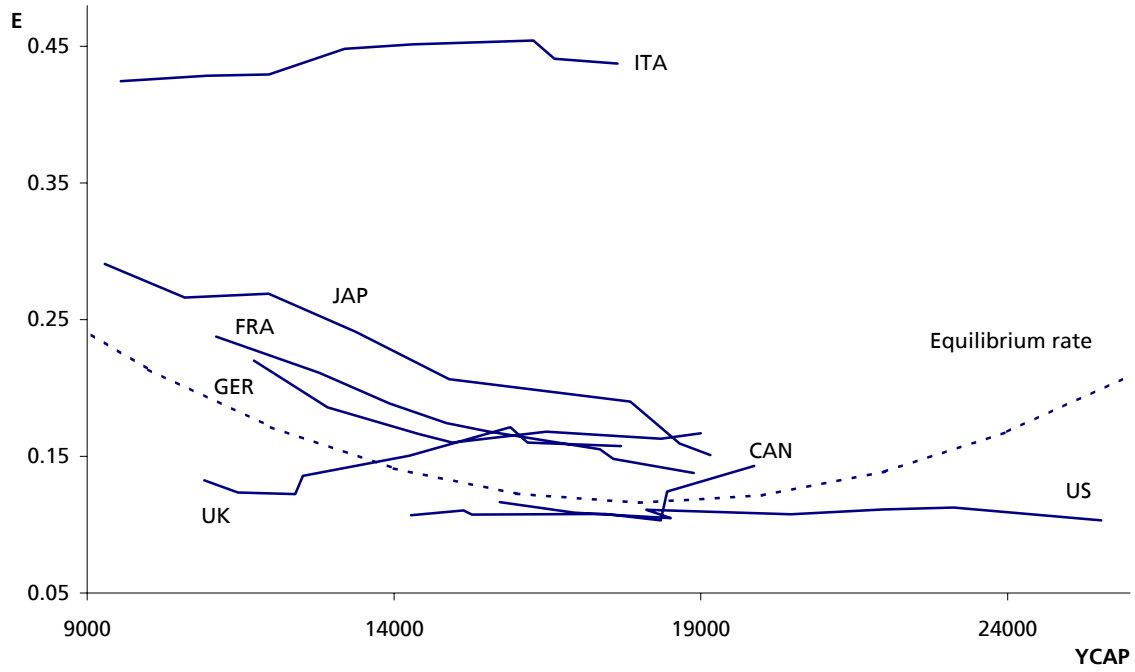


Note: Actual and equilibrium business ownership rates are per total sector employment. Business owners include unpaid family workers and owner/managers of incorporated businesses. Equilibrium rate according to "Inverse" specification in Table 2. Data for Japan and Canada are raised by the estimated factor $(1+b_{OMIB})$ =1.281 to facilitate valid comparison of E and E^*. Per capita income $YCAP$ expressed in purchasing power parities per U.S. $ at 1990 prices.

Contrary to manufacturing, the business ownership rates in most of the G7-countries are above equilibrium for services, the United States being the exception. The U-curved equilibrium function, which was clearly preferred over an L-shape, does not show in the actual business ownership rate data for the G7-countries. Only the United Kingdom and Canada have increasing business ownership rates. Note, however, that most countries still have levels of GDP per capita corresponding to the decreasing part of the curve. That is, they did not yet reach the per capita income corresponding to the minimum level of the parabola. For services, the business ownership rate of Italy lies far above equilibrium. The extremely low scale of operations in Italian service industries appears clearly sub-optimal. It suggests that the majority of these marginal self-employed individuals could work more effectively as wage-earners.[16]

[16] Note that the large distance from equilibrium for Italy (Figure 2) is consistent with the high value of the Italy-dummy in Table 3, while the small distance from equilibrium for manufacturing (Figure 1) is consistent with the low value of the Italy-dummy in Table 2.

Figure 2 Actual and equilibrium business ownership rate for G7 countries, 1970-98, services



Note: Actual and equilibrium business ownership rates are per total sector employment. Business owners include unpaid family workers and owner/managers of incorporated businesses. Equilibrium rate according to "Quadratic" specification in Table 3. Data for Japan and Canada are raised by the estimated factor $(1+b_{OMIB})$=1.130 to facilitate valid comparison of E and E^*. Per capita income $YCAP$ expressed in purchasing power parities per U.S. $ at 1990 prices.

4.2 Effect on macro growth

In the previous sections we analysed the relationship between business ownership and economic growth for manufacturing and services separately. We related deviations between the actual business ownership rate E and the equilibrium or optimal business ownership rate E^* in one sector to value added growth of that same sector. In this section we look at the effect of deviations at the sectoral level to growth at the macro level. In this way we can determine whether deviations in one sector are more harmful to growth than deviations in another sector. We also consider (deviations from the average) sector structure as a possible determinant of economic growth at the macro level. In Table 4 we report the sector shares of manufacturing and services in economy-wide GDP for the 21 countries in our data set, for three years in the period 1970-1998.

Table 4 Sector share in total economy (GDP) for 21 OECD countries, 1970-1984-1998

Country	Manufacturing			Services		
	1970	1984	1998	1970	1984	1998
Austria	0.23	0.23	0.23	0.40	0.46	0.49
Belgium	0.22	0.23	0.21	0.52 [1976]	0.52	0.54
Denmark	0.20	0.21	0.17	0.46	0.44	0.45
Finland	0.22	0.23	0.29	0.34	0.37	0.38
France	0.25	0.24	0.22	0.41	0.47	0.51
West-Germany	0.38	0.33	0.27 [1996]	0.35	0.41	0.50 [1996]
Greece	0.17	0.17	0.14	0.37	0.41	0.47
Ireland	0.19 [1976]	0.21	0.30 [1994]	N.A.	N.A.	N.A.
Italy	0.18	0.21	0.22	0.42	0.47	0.50
The Netherlands	0.21	0.20	0.19	0.48	0.52	0.57
Portugal	0.21	0.23	0.26	0.48	0.43	0.48
Spain	0.23	0.23	0.21	N.A.	0.49 [1986]	0.50
Sweden	0.24	0.23	0.25	0.37	0.39	0.42
United Kingdom	0.30	0.23	0.20	0.45	0.46	0.53
Iceland	0.23 [1980]	0.20	0.16	0.39 [1980]	0.42	0.44
Norway	0.23	0.15	0.11	0.49	0.46	0.44
United States	0.20	0.18	0.22 [1996]	0.48	0.56	0.59 [1996]
Japan	0.26	0.26	0.27	0.42	0.48	0.53
Canada	0.20	0.19	0.18	0.38	0.44	0.48
Australia	0.18 [1974]	0.16	0.13	0.60	0.63	0.68
New Zealand	0.21 [1978]	0.22	0.18	0.51 [1978]	0.50	0.55
Average *	0.23	0.22	0.21	0.44	0.47	0.50

Source: EIM, based on OECD. Note: When 1970 or 1998 data are not available, the earliest or the most recent year available in the data set, are reported. *Excluding Ireland and Spain.

The average sector structure

In order to investigate the effect of sector structure on economic growth we introduce the concept of an average sector structure. Like the sectoral equilibrium business ownership rate equations (3), we choose a specification in which sector structure is dependent on GDP per capita. Because the two sectors manufacturing and services comprise almost all economic activity in most countries, we simply use GDP share of services in a country's total GDP as indicator of sector structure. We choose a log-linear specification for the average sector structure function:

$$(4) \qquad Y\_share_{i,services,t} = \varsigma + \eta\, ln\left(YCAP+1\right)_{it} + \varepsilon_{3it},$$

where Y_share and $YCAP$ are as defined in section 2, and ε_3 is a disturbance term. It is well-known that the share of services in an economy rises with GDP per capita. Hence, the expected sign of η is positive. As parameter ς is interpreted as the share of services when per capita income equals zero, this parameter should also be positive. Equation (4) is estimated as a separate equation (again using weighted least squares) and residuals are interpreted as deviations from the average sector structure.[17] Next, the absolute values of the residuals are inserted in the

[17] Because equation (4) is estimated separately (i.e., not in an error-correction type of equation like (1)), the estimated function should not be interpreted as an equilibrium, but rather as an average.

macro growth equation as an independent variable. Like deviating from an equilibrium business ownership rate, it could be the case that deviating from an average sector structure may hamper economic growth.[18] However, this is far from certain because countries might also benefit from "specialization".
For our macro growth equation we use the equilibrium relations with the best statistical fit found in section 4.1: inverse for manufacturing and quadratic for services. Next we estimate equation (4), to obtain a function for the average industry structure. Finally, the variables thus obtained (deviations for sectoral business ownership rates and industry structure) are used as independent variables in the macro growth equation. This equation reads as follows.

$$\frac{\Delta_4 YCAP_{it}}{YCAP_{i,t-4}} = c_0 + c_1\left|E^*_{i,manuf,t-4} - E_{i,manuf,t-4}\right| + c_2\left|E^*_{i,serv,t-4} - E_{i,serv,t-4}\right| +$$

(5)
$$c_3\left|Y\_share^*_{i,serv,t-4} - Y\_share_{i,serv,t-4}\right| + c_4 YCAP_{i,t-4} +$$

$$c_5 \overset{\circ}{WT}_t + c_6 \overset{\circ}{WT}_{t-2} + c_7 \overset{\circ}{WT}_{t-4} + \varepsilon_{2ijt}$$

where the subscripts *manuf* and *serv* stand for manufacturing and services, respectively, and where the variable Y_share^* is formed by the fitted values of equation (4). Equation (5) is chosen such that results of our macro growth equation are comparable to the sector results presented earlier. In equation (5) we explain macro-economic growth (growth of GDP per capita) from deviations between actual and equilibrium business ownership rate in both manufacturing and services. Furthermore we include deviations from the average industry structure as an independent variable. Results are presented in Table 5.
In Table 5, the results of the first estimated equation are taken from Tables 2 and 3. Based on these equilibrium functions, deviations between actual and equilibrium business ownership rates are calculated. These deviation variables are used in the third estimated equation, along with the deviation from the average industry structure (residuals of equation (4)). The estimation results of this latter equation are also in Table 5. The statistical fit of the average sectoral GDP-share of services is high with an adjusted R^2 of 0.979. The estimated share of services in macro-GDP rises with per capita income as η is estimated to be positive.

[18] Empirical evidence of the impact of sectoral composition on economic growth can be found in Fagerberg (2000) and Carree (2003). They find evidence of countries which have a relatively large or growing share of the electronics industry to show relatively high subsequent productivity growth in manufacturing.

Table 5 Estimation results model (1)-(3)-(4)-(5) **MACRO LEVEL**

Eq. (1)+(3), dependent variable four-year growth of sectoral business ownership rate		
	Manufacturing: inverse case, (245 observations)	Services: quadratic case, (231 observations)
Error correction (b_1)	0.087 (5.61)	0.164 (9.11)
Unemployment (b_2)	0.055 (3.30)	0.111 (4.13)
Sectoral GDP share (b_3)	-0.037 (-3.00)	-0.0027 (-0.14)
OMIB-correction (b_{OMIB})	0.281 (1.65)	0.130 (0.99)
Italy-correction (b_{ITA})	0.0087 (3.68)	0.048 (9.21)
α	1.40 (4.27)	0.556 (4.80)
β	1.36 (4.07)	-0.050 (-4.83)
γ		0.0014 (4.04)
R^2_{adj}	0.305	0.402
Eq. (4), dependent variable GDP-share services in macro-GDP (227 observations)		
ς	0.011 (0.32)	
η	0.171 (13.6)	
R^2_{adj}	0.979	
Eq. (5), dependent variable four-year growth of GDP per capita (227 observations)		
Constant (c_0)	0.307 (3.96)	
Deviation E from E*, manufacturing (c_1)	-0.248 (-1.03)	
Deviation E from E*, services (c_2)	-0.150 (-0.99)	
Deviation from 'optimal' industry structure (c_3)	-0.329 (-1.04)	
GDP per capita (c_4)	-0.011 (-3.64)	
World trade (c_5)	-0.444 (-1.22)	
World tr., 2 year lag (c_6)	-0.024 (-0.067)	
World tr., 4 year lag (c_7)	-0.083 (-0.25)	
R^2_{adj}	0.100	

Note: T-values in parentheses. Estimations of equations (4) and (5) include all observations for which data of manufacturing and services are simultaneously available.

Estimation of the macro growth equation (5) results in negative parameter estimates for all three deviation variables. However, absolute t-values are around one.[19] Although they are not significantly different from zero, the fact that all three coefficients are negative provides an indication that deviating from equilibrium business ownership rates or average sector structure might have a negative impact on per capita income growth. Of course, they are no more than indications because t-values are low.

5. Discussion

In this paper we investigate the development of business ownership (self-employment) rates over time and the effect of business ownership on economic growth, both at the sectoral level. In an earlier exercise, Carree et al. (2002) presented a two-equation model to analyze the interrelationship between economy-wide business ownership rates and economic development. They apply the model to a data set of 23 OECD-countries for the period 1976-96. The paper showed empirical evidence for a (slow) error-correction process for business ownership rates: countries with business ownership rates more or less than the "equilibrium" value for the specific stage of economic development of these countries showed, on average, convergence towards the "equilibrium". In addition, it was found that the "equilibrium" relationship between business ownership rate and stage of economic development (as proxied by GDP per capita) was declining for the larger part of the range of GDP per capita but had the tendency to rise for the highest levels of GDP per capita. The study also provided evidence that countries that had an out-of-equilibrium value of business ownership rate suffered in terms of economic growth foregone.

The analysis performed by Carree et al. (2002) raises an important research question: to what extent do differences in business ownership at the economy-wide level reflect differences in the sectoral structures of economies or differences in business ownership rates at the sectoral level? It is well known that the average business ownership rate in the service sector is much higher than that in the manufacturing sector. Data in the current paper show that the average rate (including unpaid family workers) for OECD-countries was almost 20% in 1984 for the service sector, while it was less than 7% for the manufacturing sector. This has important consequences for the analysis previously performed. The tendency of business ownership rates to increase may be due just to a shift of economic activity from the manufacturing sector towards the service sector in the course of economic development. As a consequence, the penalty found for deviating from the "equilibrium" value of (economy-wide) business ownership may really be a penalty for deviating from a certain structural composition of the economy. This study investigates the "equilibrium" relationship between business ownership rates and economic development, the speed of the error-correction process and the existence (and severity) of the growth penalty when deviating from "equilibrium" for both the manufacturing sector and the service sector for the OECD-countries in the period 1970-98.

The paper develops an adjusted two-equation model relating business ownership rates and economic growth rates at the sectoral level. Specific attention in the

[19] This is not caused by multicollinearity as mutual correlations between the three variables are low.

model is paid to whether national statistical agencies have reported to include owner/managers of incorporated business into the data. Four different types of "equilibrium" relations between business ownership rate and GDP per capita are investigated, two of which have a U-shape (first declining and then rising ownership rates) and two of which have an L-shape (ownership rates continuously declining towards an asymptotic minimum rate). We have collected data for 21 OECD-countries for the years 1970-1998, as far as the data were available according to uniform definitions. The data show that, on average for OECD-countries, business ownership rates in manufacturing have been largely stable at 7%, while they have, on average, been decreasing for the service sector from 22% in 1970 to 19% in 1998. However, in several important industrial economies such as the United Kingdom, the United States, Canada and Australia, business ownership in manufacturing has gone up. Ownership rates in manufacturing remain lower than ownership rates in services though. This confirms that at least part of the increase in the economy-wide share of business ownership is due to the sectoral shift towards the service sector in developed economies.

Results show that the empirical fit of the four different types of "equilibrium" relationships is not too different, both for the case of manufacturing and that of services. However, results for the speed of error-correction are hardly affected by which type is chosen. The estimated speed of error-correction for the manufacturing sector is about 8.5% for a four-year period. This estimated speed is twice as high in the service sector: about 16%. Both in the manufacturing sector and for services there is a positive effect of (lagged) unemployment: countries with high unemployment show higher subsequent business ownership rates both in manufacturing and services. The results show that there is a significant penalty of the business ownership rate deviating from "equilibrium" for manufacturing for each of the four types of the "equilibrium" relationship. For the service sector also a negative effect on growth is found, but it is not always significant and it is far smaller than that for manufacturing.

The analysis confirms the empirical evidence provided by Carree et al. (2002) that differences in business ownership rates matter and disappear over time slowly. The general idea behind the model is that there can be both too many and too few businesses. Too many businesses may mean that economies of scale and scope are not benefitted enough from and that there are probably many "marginal" ventures. Too few business may imply that there is not enough entrepreneurial activity.

The results presented in the current paper make a contribution to the international debate on increasing entrepreneurship as a route to economic growth. For instance, one of the major objectives of the *Global Entrepreneurship Monitor* research program is to gain more insight in the systematic relationship between entrepreneurship and national economic growth (Reynolds et al. 2002). Based on correlation analysis of nation-wide measures of entrepreneurship and economic growth, Reynolds et al. (2002) state that “evidence continues to accumulate that the national level of entrepreneurial activity has a statistically significant association with subsequent levels of economic growth” (p. 6).

The current analysis shows that entrepreneurial activity as far as embodied in self-employment rates *may* benefit economic growth, but is *not always* a route to growth. Our analysis suggests not only that economies can have too few or too many businesses, but also that the extent to which there are too many or too few businesses varies by sector. In particular, the estimated equilibrium curves suggest that having too few businesses is the more likely problem in manufacturing, while

having too many businesses is the more likely problem in the service sector. It would suggest that, not only, the economic benefits of government promoting new (and small) business may be country-specific, but also sector-specific. Such promotion seems most beneficial in the manufacturing sector of countries with very low business ownership rates (like the Scandinavian countries). It may be counter-productive to have similar promotion in the service sector of countries with very high business ownership rates (like Italy).

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Appendix Data availability

The various estimations in the present paper were performed using data from the data base "BLISS Oeso Sectoraal". As this is an unbalanced panel, different numbers of observations per country are used for different estimations. The exact data per country used in the various estimations are reported in this appendix.

In Table A1 the construction of the estimation samples used for the various estimations in this report is given. For manufacturing, there are 245 observations in total, and for services 231 (see Tables 2, 3 and 5). The maximum number of observations for a country is 13 (1974-98; only even years).[20] For countries having less than 13 observations the exact years available are reported in the table.

Table A1: Number of observations per country used for sector estimations

Country	Manufacturing	Services
Austria	10 (1980-98)	10 (1980-98)
Belgium	13	10 (1980-98)
Denmark	13	13
Finland	13	13
France	13	13
West-Germany	13	13
Greece	12 (1976-98)	12 (1976-98)
Ireland	8 (1980-94)	-
Italy	13	13
The Netherlands	13	13
Portugal	11 (1978-98)	13
Spain	12 (1976-98)	5 (1990-98)
Sweden	13	13
United Kingdom	12 (1976-98)	12 (1976-98)
Iceland	8 (1984-98)	8 (1984-98)
Norway	13	13
United States	12 (1974-96)	12 (1974-96)
Japan	13	13
Canada	10 (1980-98)	10 (1980-98)
Australia	11 (1978-98)	13
New Zealand	9 (1982-98)	9 (1982-98)
TOTAL	245	231

Note: Maximum number of observations is 13 (1974-98).

As we saw in Table 5, the number of observations used for the macro estimations is 227. This number is obtained by taking the intersection of the manufacturing and services samples. In Table A1, compared to the services sample of 231 observations, only for Portugal and Australia there are missing observations for manufacturing (viz. 1974 and 1976, for both countries).

[20] Note that in these cases the actual number of available years is 15 (1970-98), due to the four-year lag in the model.