21. SHOPPING WITH FRIENDS GIVE MORE FUN; HOW COMPETITION, INNOVATION AND PRODUCTIVITY RELATE IN DUTCH RETAIL TRADE

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Introduction

This study focuses on the relation between competition, innovation and productivity in the Dutch retail trade. Everyone is very familiar with the retail trade. Sometimes, we do our shopping alone, now and then together with friends. But each of us has frequently or even daily contact with this part of the economy. In fact, the retail trade acts as an intermediate between producers and consumers. The industry is responsible for a considerable part of output and employment of industrialised countries, including the Netherlands. In fact, the share of nominal value added and employment was approximately 4 and 7 percent respectively in 2000 for the Netherlands.

The retail trade is at the forefront of the discussion in an international perspective, since its productivity performance considerably accounts for the difference in productivity growth between EU and US at the aggregated level. The Conference Board states that “... over [a] half of the economy-wide productivity growth lead of the US over Europe after 1995 is accounted for by diverging performance in wholesale and retail trade” (McGuckin et al., 2005).

The Netherlands is not an exception within the EU. According to several sources the labour productivity level and productivity growth in the Dutch retail trade was not outstanding in international perspective in the 1990s (McKinsey 1997, OECD 2004). Although, the Dutch labour productivity per hour worked is above the EU-average, it is much lower than in the US as it could not keep track with the strong productivity growth of the US retail trade after 1995. Also in a longer perspective the Dutch productivity growth performance in this industry is less favourable than for the EU as a whole.

According to The Conference Board, slow adoption of new technologies and differences in legislation may explain the lag of the EU retail trade. This corresponds with earlier findings for the Dutch retail trade of McKinsey in 1997 (McKinsey, 1997) indicating that both aspects are characteristic for the meagre performance of this sector.

The productivity performance of the retail trade might be reason for policy concern. In the 1990s Dutch policy took various measures to enhance competitive forces in product and

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299 We define the retail trade according to the SIC 52-code, this includes industries like supermarkets, department stores, electronic appliances, and so on. This does not include trade in motor vehicles, motorcycles and petrol.
labour markets. These considerations and developments give rise to the following research questions:

• Did competition in the Dutch retail trade change during the 1990s and early 2000s, and what are the main drivers of these changes?

• Did competition affect innovation intensity in this industry?

• Did competition and innovation affect labour productivity (growth) in this industry?

The issues are relevant for two respective reasons. First, recent literature points out that the relation between competition and innovation is ambiguous, as it may follow an inverted U-shape (see Aghion et al., 2002). Second, a positive impact of policy measures on competition may be counteracted by negative effects from other determinants, such as the strong economic growth in the 1990s (see Creusen et al., 2006a).

Using firm-level data for the Dutch retail trade covering the period 1993–2002, we analyse competition, innovation and productivity over time, and analyse their mutual relationship. To our knowledge current studies have only considered separate parts of this three-way relationship. Due to data availability at the time of research, the period at issue in this study is before the current price war in the supermarkets, which started in 2003. We therefore do not go into causes and implications of this recent development.

The structure of this study is as follows. In the next chapter we discuss the characteristics of the Dutch retail trade with a focus on productivity performance in an international and national perspective, and on regulatory reforms. The third chapter explores the available data and introduces several key variables. The fourth chapter provides several theoretical considerations and it presents empirical findings on the relations between competition, innovation and productivity. The final chapter ends with concluding remarks.

The Dutch retail trade

Characteristics of Dutch retail trade

The retail trade is an industry which is continuously transforming and in most countries it is still in the midst of a process of structural change. Beginning at the end of the 1950s with the appearance of the self-service shops and supermarkets, the retail trade has undergone a tremendous metamorphosis. Recent major trends that can be distinguished include larger outlets, consolidation into retail chains, spreading of hypermarkets and increased vertical integration.

Graph 21–1 summarises these developments in terms of the number of firms and output levels, pointing at larger firms. Despite the considerable pickup from 1996 to 1998 the number of firms decreased dramatically over time, whereas the output of the Dutch retail trade improved considerably.300 Note that this temporary pickup partly matches with the

300 Although the number of shops also declined over time, this reduction was smaller indicating that the shops per firm increased due to consolidation.
upturn in the business cycle at that time, but it also corresponds to the introduction of the longer opening hours in 1996. This pattern is less visible in the output of the industry.

Three major forces play an important role in this ongoing transformation of the (Dutch) retail trade: (1) consumers, (2) the government and (3) retailers themselves. First, the shopping behaviour of consumers is continuously changing. These changes are to a great extent determined by factors such as increases in income, higher participation rates of women on the labour market and greater mobility (including an increase in car-ownership).

The second important force in the transformation is the role of the government. As we will discuss more extensively, legislation has shaped the structure of the Dutch retail trade for decades. A number of regulatory reforms may have affected competition in the retail trade as well.

Finally, retailers are continuously transforming their business concepts. Partially, this is a response to changing consumer behaviour and legislation. For example, supermarkets introduced more ready-to-eat meals to accommodate consumers’ shortage of time and large shopping centres appear at several designated locations at the periphery of towns. But firms in retail trade may take various actions to reduce cost and enhance their competitive advantage.

On the one hand, economies of scale can be pursued via larger outlets and consolidation into retail chains. On the other hand, economies of scope can be pursued via horizontal integration. For example, stores specialised in household appliances now sell also DVD-players and computers. In addition, technological developments, especially in the area of ICT, have altered logistic operations in the retail trade. For example, stock control is continuously optimised with the use of scanner data.
These three transformations may have altered the type of competition in the Dutch retail trade. Price levels in combination with product quality remain the main instrument of competition as is demonstrated by the recent ‘price-war’ between supermarkets. However, also the store itself and the (differentiation in) assortment offered are instruments of competition. Moreover, this also incorporates increasing competition between initially different markets such as on the one hand supermarkets with their ready-to-eat meals or DVD-players and on the other hand (fast-food) restaurants and retail sale of electrical equipment respectively. To put it differently, a bundle of products have become closer substitutes over time.

**Productivity performance of the Dutch retail trade**

**An international perspective**


Graph 21–2 displays labour productivity per hours worked for several countries relative to the EU-average (EU=100). Since 1995 the US labour productivity growth accelerated compared to the EU, and the US productivity level quickly caught up and surpassed the Dutch and French retail trade. The labour productivity in Sweden was initially below the EU average, and could neither keep track with the strong US growth pattern. However, it did catch up with the Netherlands around 2000 and is heading towards France with a growth pattern in-line with the US. Still, the differences between the EU-countries and the US in 2002 demonstrate that the productivity gap has become substantial, and that EU-countries may have a considerable catch-up bonus to collect.

Focussing on the Netherlands, we see that until 1987 the Dutch retail trade demonstrated a stronger growth pattern than the EU. But after that the lead in productivity compared to the EU gradually declined and levelled off just above the EU-average. Further, between 1987 and 1995 the Dutch retail trade had a somewhat higher productivity level than the US retail trade. Like other EU-countries, the Dutch retail trade could not follow the steep productivity growth of the US since 1996.

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301 Measurement issues often hamper a productivity analysis, especially in services sectors like the retail trade. Difficulties in measuring output, quality and labour input in terms of hours hinder to gauge the efficiency in these industries.

302 Productivity is a key indicator for the efficiency of a particular firm, industry or for the economy at large. Productivity can be expressed in terms of labour productivity or in terms of total factor productivity (TFP). Labour productivity is a partial productivity concept relating only output to labour. TFP is defined as labour productivity adjusted for (changes in) capital intensity and use of economies of scale within the same technology. TFP growth merely reflects the productivity changes due to reduced X-inefficiency or adaptation of new technologies, but this productivity concept is hard to measure.
The Conference Board attributes the lag in productivity growth of EU-retailers to five determinants (see McGuckin et al., 2005). These determinants are (1) the head-start US of retail trade in the adoption of new (ICT) technologies, (2) the regulatory obstacles within and between EU-countries, (3) the scale advantage of the US retail trade, and (5) culture and taste differences across Europe.

Gordon also emphasizes the impediments in some EU-countries to develop “big box” retail formats (see Gordon, 2004). Following Phelps (2003), Gordon also points to Europe’s underdevelopment of capitalists’ institutions like venture capital, the overdevelopment of corporatist institutions such as employee participation in management and business licensing, social cultural differences and different view on environmental planning.

With regard to the number of outlets per 10,000 inhabitants the Dutch retail trade has fewer outlets than the EU-average (see table 21–1). The Netherlands are however characterised by a high population density. This may enable retailers to obtain economies of scale via larger outlets as they can serve a large group of consumers from one location. The size of the enterprises in terms of employees is above the EU-average. The latter effect is mainly due to the high Dutch part-time factor. Recent Dutch figures from Statistics Netherlands show that in 2000 the average firm in the retail trade employs about 5.7 full-time equivalents.

The Conference Board indicates the reduced opportunity of cross-border scale in the EU as a factor for lower productivity levels compared to the US. Our study purely focuses on the Dutch market itself and it indicates that the retail trade is characterised by constant returns to scale for larger firms (see chapter 4).

I.e. regulatory changes in industries related (complementary) to the retail trade, for example, transportation.
T 21–1  Key figures on efficiency levels of the retail trade, 2000

<table>
<thead>
<tr>
<th></th>
<th>Labour productivity a b</th>
<th>Outlet density c</th>
<th>Employees per enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>110</td>
<td>54</td>
<td>8.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>106</td>
<td>80</td>
<td>3.5</td>
</tr>
<tr>
<td>Germany</td>
<td>105</td>
<td>35</td>
<td>9.0</td>
</tr>
<tr>
<td>France</td>
<td>125</td>
<td>64</td>
<td>4.2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>83</td>
<td>36</td>
<td>14.2</td>
</tr>
<tr>
<td>Sweden</td>
<td>108</td>
<td>65</td>
<td>4.3</td>
</tr>
<tr>
<td>European Union</td>
<td>100</td>
<td>71</td>
<td>6.3</td>
</tr>
<tr>
<td>United States</td>
<td>138</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

a Value added per hours worked, EU = 100.
b Source: RUG (2004), GGDC, 60-Industry database.
c Outlet density is defined as number of enterprises per 10,000 inhabitants. Source: OECD (2004).

A national perspective

In addition to the international comparison we provide in table 21–2 figures on the performance of the Dutch retail trade compared to other industries in the Netherlands. In terms of value added (prices of 1995) the share of the retail trade remains quite stable at just over 4 per cent in the 1990s, whereas other Dutch services industries experienced a rise of their share in the Dutch economy.

T 21–2  Dutch retail trade in a national perspective, 1990-2002

<table>
<thead>
<tr>
<th></th>
<th>Share in economy</th>
<th>Labour productivity in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total economy</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Market sector</td>
<td>69.0</td>
<td>73.0</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>18.0</td>
<td>16.9</td>
</tr>
<tr>
<td>Services</td>
<td>46.7</td>
<td>53.2</td>
</tr>
<tr>
<td>Retail trade</td>
<td>4.1</td>
<td>4.1</td>
</tr>
</tbody>
</table>


The figures on the labour productivity growth reveal that the growth rates of the retail trade are lower than the growth rates of the market sector. However they are similar to the values for services as a whole. Moreover, linked to the upturn in the business cycle growth over the period 1997–2002 has improved for the Dutch retail trade.

The relatively meagre productivity growth in the retail trade, particularly between 1991 and 1996, may point to other factors besides the decline in economic growth. Studies of the
OECD (2002) and Van der Wiel (2001) indicate that the poor growth performance in this period might be caused by the relatively low use of ICT technology when compared to other countries.

Regulatory changes in Dutch retail trade

During the 1990s several regulations have changed the institutional setting of the Dutch retail trade. This might have had an effect on the intensity of competition. We will first briefly discuss some general changes followed by a discussion on several regulations specific for the Dutch retail trade.

Main regulatory changes

Most OECD-countries have shifted their attitude from tight government control to a confidence in market mechanisms and incentives to enhance welfare in the 1990s (see Gonenc et al., 2000). In this regard, the new Competition Act of 1998 in conjunction with the founding of the Dutch Competition Authority (NMa) is of importance as it may have affected the intensity of competition in the Dutch retail trade henceforth. Following practices in other European countries, the new Competition Act explicitly prohibits abuse of dominant positions and cartels, except for several exemptions such as franchising, purchasing combinations or cooperation in technical research. In addition, the NMa monitors mergers and take-overs in markets.

Specific regulatory changes

A wide range of regulatory restrictions affects the scope of the Dutch retail trade, including regulations related to health and safety of employees, urban planning and other environmental issues. Besides overall regulatory reforms, the Dutch government deployed specific reforms as part of a larger operation called the MDW (Competition, Deregulation, Legislation quality).

Three specific regulatory changes within the MDW-operation are directly related to the retail trade: (1) the liberalisation of opening hours, (2) PDV/GDV policy (policy on peripheral and large-scale retail outlets), and (3) the business licensing requirements or establishment law.

The liberalisation of opening hours is the most important MDW-operation concerning the retail trade. Until June 1996, Dutch retailers were not allowed to be open on evenings and on Sundays. The new regulation allows retailers to be open from 6 AM to 10 PM. Moreover, shops may be open 12 times a year on Sundays and public holidays (these days are assigned by municipalities). Under some conditions, retailers are allowed to be open after 10 PM and on more than 12 Sundays a year (for example in tourist regions).

Concerning the PDV/GDV policy the Netherlands apply a specific zoning planning policy similar to other European countries. That is, the freedom of establishment is restricted by

\[305\] The previous system was more permissive and allowed, for example, cartels unless they caused needless welfare costs.
local and urban planning laws, particularly for the retail trade. Since 1973, the Netherlands has pursued a specific policy regarding the establishment of large retailing formats. In essence, the aim of the policy is twofold, i.e. to maintain the function of shops in the inner city or centre of a town, and to strengthen competitive forces in this industry. As a result of this policy, it was hardly allowed to establish a retail enterprise on the outskirts of a town. This limits market entry and protects shops in town centres. During the 1990s this zoning and planning policy (in Dutch GDV/PDV-policy) has slightly been changed by extending the allowance of establishments on thirteen municipal junctions. More precisely, any type of retail firm is allowed to establish in these locations. Further, the zoning policy for the retail trade is decentralised to municipal and provincial authorities.

Finally, up to 1996, the conditions for entrepreneurs to start a new enterprise are constitutionalised in the ‘Vestigingswet Bedrijven 1954’ (Act on Business licensing requirements). This act protected consumers against non-capable entrepreneurs in terms of reliability, creditability and competencies. The law also protected incumbents against new competitors by evoking entry barriers. In 1996, the Dutch Act has been liberalised. In general entrepreneurs in the Dutch retail trade only have to fulfil general conditions on entrepreneurs’ requirements nowadays. Particularly, the regulations for new retailers became more favourable as the main aim of the deregulation was to enlarge market dynamics by simplifying entry.

Data and descriptive statistics

Data

Three sources of information, all obtained from Statistics Netherlands, are used to provide a overview of the development of competition, innovation and productivity, and the interactions between these three variables. We use firm-level data from the production statistics (PS, in Dutch “Productiestatistieken”), the General Firm Register (ABR, in Dutch: “Algemeen BedrijfsRegister”) as well as data from the Community Innovation Survey (CIS),

Production Statistics

The PS-data provide a complete coverage of firms with at least 20 employees. Firms with fewer than 20 employees are sampled. The accounting data in the PS include, among other variables, the following key variables: total sales, employment in full time equivalents and in persons, intermediate inputs, wages (including social security charges), and depreciation costs.

306 Only certain types of retail were allowed. These are retailing in dangerous or voluminous products (e.g., fuel, cars and caravans), large scaled furniture retail trade, and builder’s merchant.

307 In fact, in 1993 the government already allowed firms to enter the market under these less restrictive rules.

308 I.e. the value added by trade activities, calculated as the gross sales of traded goods minus the purchasing costs of traded goods.

309 Excluding purchasing costs of traded goods.
The PS-data cover the period 1993–2002 and contain information on five per cent of the total population of firms in the Dutch retail trade. Table 21–3 presents some statistics based on these PS-data. Comparing the firms in the PS-dataset with the population, we see that the PS contain on average firms with more employees and slightly higher productivity levels than the average of the total population.\textsuperscript{310}

**General Firm Register**

Information on the number of firms active in the retail trade is derived from the ABR data set. This set contains information for each firm on its SIC-code, its date of birth and its date of death (if relevant). From these figures we can determine the total number of firms in the retail sector, as well as the entry and exit rate.\textsuperscript{311}

**CIS**

We further employ three consecutive waves of the CIS, i.e. the CIS 2, CIS 2.5 and CIS 3 survey. These surveys cover, respectively, the periods 1994–1996, 1996–1998 and 1998–2000. The CIS provides firm-level data and consists of a sample of firms, which is smaller than the sample of the PS. Furthermore, the sample covers only firms with 5 or more employees. Consequently, this censoring omits a substantial part of small-sized firms. In particular, a large fraction of just started new firms are not included, even though these firms may be very important sources of innovation.\textsuperscript{312}

Statistics Netherlands collects the CIS-data every two years, but the survey spans a three year period. Several variables in this survey provide information on the total three year survey period. Due to this construction of the survey, variables cover information in overlapping years as the survey is conducted each two years. However, our variables of interest are only available for the last (third) year of each wave of the survey. This implies that the information on innovation is discontinuous and that this will hamper the analysis of taking account of dynamic effects.

**Merging of datasets reduces coverage**

To make assertions on the relationship between competition, innovation, and productivity we merge the PS-data and CIS-data into one data set. This merging, however, reduces the number of observations.\textsuperscript{313} In total the merged data set covers yearly 0.5 per cent of the total

\textsuperscript{310} To obtain estimates of the inputs and sales at an aggregated level such as an industry, sampled firms are multiplied with a raising factor. This factor is a ratio of the number of sampled firms to the total of firms in the same stratum of the population. This raising factor is provided by Statistics Netherlands.

\textsuperscript{311} I.e. the number of firms that entered and/or exited during some year as a percentage of the total number of firms at the beginning of that year.

\textsuperscript{312} Although the sample is continuously updated with young firms, those firms will pop up with a certain delay.

\textsuperscript{313} This loss of information arises due to sampling of firms. Only firms present in both sets can be used for our analysis.
population. Yet, more than 1000 observations remain for the analysis. The low coverage of firms in the CIS-dataset could underestimate the importance of innovation in the retail trade. In table 21–3 we provide several statistics which reveal that, when compared to the population or the PS-data, this merged set consists of very large firms. However, their productivity levels are in line with those of the PS-data.

Seen from an international perspective the number of observable firms is still large. Additionally, an international comparison of innovation activities is unfortunately not possible for the retail trade, as this sector is frequently missing in CIS-data for other countries. Despite both shortcomings, CIS-data remain imperative for assessing the role of innovation and the interaction between competition, innovation and productivity.

**Descriptive statistics competition, innovation and productivity**

The (merged) datasets discussed above provide several indicators on the extent of competition and innovation in the Dutch retail trade. In this section we present two indicators, together with the average productivity growth of the Dutch retail trade derived from the Production Statistics. These indicators will be used to determine the relations between competition, innovation and productivity growth in the next chapter.

**Competition 1993–2002**

In this study, the developments in competition are mapped by the relative profits measure (RPM, see Boone, 2000). The RPM is a measure on the performance of firms, and rests on the assumption that firms in an industry mutually differ in their marginal costs. Fiercer competition can be observed by a steeper slope of the relation between firms’ relative profits and relative levels of productivity. In fact, rising competition induces firms to exploit their

### T21–3 Characteristics of PS-data, PS-CIS-data compared to total population, 1996 and 2000 (a)

<table>
<thead>
<tr>
<th></th>
<th>Survey-PS</th>
<th>PS-CIS</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2000</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average firms size in full time equivalents</td>
<td>48.4 x 1000</td>
<td>300.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Number of firms</td>
<td>3.9</td>
<td>0.3</td>
<td>85.7</td>
</tr>
<tr>
<td>Labour productivity per full-time equivalent</td>
<td>32.5</td>
<td>34.6</td>
<td>30.4</td>
</tr>
<tr>
<td><strong>1996</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average firms size in full time equivalents</td>
<td>46.0 x 1000</td>
<td>180.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Number of firms</td>
<td>4.0</td>
<td>0.4</td>
<td>86.0</td>
</tr>
<tr>
<td>Labour productivity per full-time equivalent</td>
<td>31.7</td>
<td>30.5</td>
<td>26.8</td>
</tr>
</tbody>
</table>

(a) Survey PS are data derived from the PS, PS-CIS are matched data from PS and CIS, Population data are derived from Statline Statistics Netherlands.
efficiency advantage as much as possible. Then, efficient firms are more rewarded and attain relatively higher profits at the expense of less efficient firms. The RPM signals this as an increase in competition.\textsuperscript{314}

We calculate the RPM for each industry in the Dutch retail trade at the SIC 5-digit level by using the PS-data. Graph 21–3 ranks all industries within the Dutch retail trade according to their trend growth. The figure reveals that the changes in competition are rather heterogeneous. About 40% of these industries demonstrate a decline in competition, and the other 60% an increase. In addition, changes in the intensity of competition are of a different magnitude. Note also that in graph 21–3 the industries have different sizes, and vary for example from small cheese stores to large supermarkets.

<table>
<thead>
<tr>
<th>Changes in RPM across SIC 5-digit industries within the Dutch retail trade, 1993–2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Graph 21–3: Changes in RPM across SIC 5-digit industries within the Dutch retail trade, 1993–2002" /></td>
</tr>
</tbody>
</table>

To obtain an indication of competition development for the whole retail trade, we aggregate the RPM of all industries, each weighed by its industry’s market share in the total sales of the Dutch retail trade.

Graph 21–4 presents the average RPM and its trend for the period 1993–2002. As can be seen, competition is not constant over time. Overall, the trend of the average RPM suggests that competition in the retail trade demonstrated a small decline over the whole period. Moreover, the level of competition appears to be relatively low compared to other Dutch industries (see Creusen et al., 2006a)

\textsuperscript{314} Literature provides other competition indicators like the traditional price-cost margin (PCM). The PCM denotes firms’ ability to set prices above marginal costs. In this study we focus on the RPM. Results using the PCM can be found in Creusen et al., 2006b. These are largely similar as the one in this study.
Innovation 1994–2000

Table 21–4 presents some key statistics on innovation. It points out that the number of firms with innovation expenditures is relatively low in the retail trade. Only a sixth to a third of the firms indicated to invest in innovations. The average innovation expenditure for all firms in the sample demonstrates an increase between CIS 2 and CIS 2.5, but remains stable between CIS 2.5 and CIS 3. In contrast, the average innovation expenditure for the innovating firms increased during the three consecutive periods.

### T 21 – 4 Statistics on innovation CIS 2, 2.5 and 3

<table>
<thead>
<tr>
<th></th>
<th>CIS 2</th>
<th>CIS 2.5</th>
<th>CIS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of firms in sample</td>
<td>425</td>
<td>447</td>
<td>275</td>
</tr>
<tr>
<td>Share of innovating firms</td>
<td>24%</td>
<td>31%</td>
<td>15%</td>
</tr>
<tr>
<td>Average innovation expenditures for all firms in sample</td>
<td>122×1000 euro</td>
<td>190×1000 euro</td>
<td>196×1000 euro</td>
</tr>
<tr>
<td>Average innovation expenditures for innovating firms</td>
<td>507×1000 euro</td>
<td>608×1000 euro</td>
<td>1350×1000 euro</td>
</tr>
</tbody>
</table>

Source: own calculations based on CIS data.

Note, these aggregated firm-level statistics may differ from the total population due to sampling of firms and the merging of the CIS and PS data, as discussed in Section before...
Box 21-1 Innovations in retail trade mostly on processing

One may divide innovation into two types, process and product innovations. Concerning the retail trade product innovations affect the store concept, for example switching to self-service, or selling on the Internet. Process innovations, with the objective of increasing efficiency, include for instance a new cash-register system and an automated supply-management and stock system.

Unfortunately, the CIS-innovation survey among firms in services does not make a distinction between product and process innovations. Retailers however were asked to provide descriptions on their innovation activities. An analysis of these innovation examples revealed that innovations in the retail trade mostly consist of process innovations.

Productivity 1995–2002

Earlier we already discussed productivity levels of the Dutch retail trade for several periods in a national and international perspective. Graph 21–5 plots the average labour productivity levels per full-time equivalent for the retail trade between the years 1995 and 2002, based on the PS-data. In this period, labour productivity hardly improved. Until 1998 productivity significantly increased, thereafter productivity considerably declined. Productivity recovered again in 2002.

Average labour productivity per full-time equivalents for the whole Dutch retail trade, 1995–2002

Source: own calculation based on PS-data.
Productivity levels deflated by price mutations derived from the input-output tables of the national accounts (1992=100).
Competition, Innovation and Productivity

Theoretically, both competition and innovation are important drivers of productivity (growth). Graph 21–6 presents our conceptual framework, which captures the mutual relation between competition, innovation and productivity. This framework includes the direct impact of competition and innovation on productivity as well as the impact of competition on innovation.

An increase in competition may force firms to achieve the highest level of efficiency in production and management, given available technologies. This is often referred to as *static efficiency*. That is, increasing competition may reduce X-inefficiencies and subsequently enhance the level of static efficiency in the market (see, e.g. Nickell, 1996). Weak competition makes managers and employees lax, or even seduces managers and employees to shirk. In addition, innovations may affect efficiency levels in the (near) future and stimulate the level of *dynamic efficiency* of the market (see, e.g. Baumol, 2003).

Competition and innovation are also interrelated. Aghion et al. (2001 and 2002) illustrate that this relationship include two counteracting effects and combining those effects may result in an inverted U-relationship. However, no consensus exists in the theoretical or empirical literature on the relationship between innovation and competition (see Canton et al., 2005). Therefore our analysis of this relationship is of an explorative type and assesses whether the Dutch retail trade is characterised by an inverted U-relationship or a linear relationship between competition and innovation.

Our conceptual model neglects two (feedback) mechanisms as we do not apply a simultaneous model explaining competition, innovation and productivity at once. First, we assume that innovation does not affect competition directly in the short term. If innovation affects competition, this will be in the long term via productivity increases or product differentiation. Second, we ignore a direct effect from productivity on competition. Our measure of competition, the RPM, is based on relative marginal costs. In a special case these relative marginal costs are the reverse ratio of labour productivity. This implies that changes in productivity are captured by our measure of competition.
**Explanation competition development**

**Theoretical assertions on competition**

Policy frequently considers more competition as a stimulus of economic growth. In that sense, policy has taken various measures to enhance competitive forces on the product markets, also in the Dutch retail trade.

However, we cannot directly identify effects of regulatory reforms on competition in the Dutch retail trade. Still, we may obtain indications for such effects by investigating possible shifts in the level of competition after a reform occurred. For example, such a shift may occur after the reforms on opening hours and business licensing in 1996 and after the introduction of the competition act in 1998.

In addition to regulatory reforms, other determinants may affect competition as well. Therefore, in line with Creusen et al. (2006a) we include five additional explanatory variables to explain competition development: entry, exit, market demand, strategic interaction and advertising.

More entry is expected to have a positive impact on competition and more exit a negative impact. The decision to enter or to exit the market is not exogenous but depends on other determinants.

An increase in market demand due to economic growth reduces competition (and vice versa). Then all firms can set higher prices without being impeded by competitors’ price cutting.

In contrast, competition may increase if strategic interaction intensifies, i.e. when firms react more aggressively to their opponents in using their competitive advantages. Finally, advertising has an ambiguous impact on competition. In fact, advertising can raise competition if it increases market transparency, but may also reduce competition if it lowers product substitutability and effectively raises an entry barrier.

To investigate the effects of the explanatory variables on competition, we apply the two stage model from Creusen et al. (2006a, see also the box above). Using PS-data, we estimate this model at the SIC 5-digit level.

**Empirical findings on competition**

Table 21–5 presents the regression results and shows that the signs of most coefficients of the explanatory variables fit well with the theoretical assertions. Increases in strategic interaction and advertising have a significant positive impact on competition in the Dutch retail trade. The positive impact of advertising suggests that advertising is used to inform consumers in order to enhance market transparency and hence to intensify competition. A larger market demand reduces competition, which was the case during the booming economy in the late 1990s. In addition, the significant and positive parameter of the lagged competition indicator suggests that effects of changes in determinants and entry/exit rates last for multiple periods.

---

316 We ignore the impact of import on competition because import by the retail trade is not present according to the National Accounts.

317 I.e. including capital intensity as an indicator of the level of economies of scale. In fact, the contestability theory suggests that higher capital intensity and more economies of scale induce fewer firms on the market.

318 We approximate changes in market demand by adjusting the total sales for supply-side effects, such as changes in productivity and the number of firms. These changes are computed at the SIC 2-digit level due to data limitations.
Box 21–2 Formal model for explaining competition

The competition model exists of two steps. The second step is the subject of this section: explanation of competition. The first step concerns the pre-determination of entry and exit.

After taking logarithms of each variable, the regression equation for the relative profits measure (RPM) of industry \( j \) in period \( t \) reads as follows:

\[
RPM_{jt} = \beta_0 + \beta_1 \text{Entry}_{jt} + \beta_2 \text{Exit}_{jt} + \beta_3 RPM_{t-1,j} + \beta_4 MD_{jt} + \beta_5 ADV_{jt} + \beta_6 SI_{jt} + \beta_7 Dob_{jt} + \beta_8 Dca_{jt} + \epsilon_{jt}
\]

With 

- \( \text{Entry} \) estimated number of entrants as percentage of total number of firms
- \( \text{Exit} \) estimated number of exiting firms as percentage of the total number of firms
- \( MD \) market demand, i.e. total sales adjusted for supply-side effects
- \( ADV \) advertising rate, i.e. advertising costs as percentage of total sales
- \( SI \) dummy on strategic interaction
- \( Dob \) dummy on the liberalization of shop opening hours and business licence requirements (1996 and later)
- \( Dca \) dummy on the new Competition Act (1998 and later)

The lagged RPM may capture the slack of incumbents’ response to previous changes in the determinants. The fitted values of entry and exit (\( \text{Entry} \) and \( \text{Exit} \)) capture the joint effects of all other determinants on competition that go through entry and exit. These predicted values are obtained from two other equations, which are used to solve for the issue of endogeneity. In fact, we also regressed the entry rate (\( \text{Entry} \)) and exit rate (\( \text{Exit} \)) on all the other lagged determinants. In these equations we used a one year lag, because it is likely that entry and exit only take place if the change in the determinant becomes more settled and definite. Stated formally, we estimated:

\[
\text{Entry}_{jt} = \gamma_0 + \gamma_1 \text{Entry}_{t-1,j} + \gamma_2 \text{DEP}_{t-1,j} + \gamma_3 TS_{t-1,j} + \gamma_4 ADV_{t-1,j} + \gamma_5 Dob_{t-1,j} + \gamma_6 Dca_{t-1,j} + \gamma_7 RPM_{t-1,j} + \epsilon_{jt}
\]

\[
\text{Exit}_{jt} = \delta_0 + \delta_1 \text{Exit}_{t-1,j} + \delta_2 \text{DEP}_{t-1,j} + \delta_3 TS_{t-1,j} + \delta_4 ADV_{t-1,j} + \delta_5 Dob_{t-1,j} + \delta_6 Dca_{t-1,j} + \delta_7 RPM_{t-1,j} + \nu_{jt}
\]

With,

- \( TS \) \( (\text{deflated}) \) total sales of the Dutch market
- \( DEP \) capital intensity, measured by depreciation costs as percentage of total sales

The equations can be estimated in two sequential steps by the Ordinary Least Squares-technique. This procedure is known as the 2-Stage Least Squares-technique to correct for endogeneity problems (see for example Verbeek, 2004).\(^a\)

\(^a\) A positive and significant correlation between the RPM and the price-cost margin points to the existence of reallocation effects, i.e. when changes in competition also induce shifts in market shares.
These reallocation effects, however, typically emerge if competition is altered by changes in strategic interaction. So, simultaneous increases (decreases) in the RPM and the price-cost margin point to an increase (decrease) in firm’s strategic interaction.

Note that serial correlation may occur in the cross-sections of the SIC 5-digit sectors. This could mainly bias the significance of the parameters.

T21 – 5  Estimation results for determinants of competition in the Dutch retail trade, 1993-2002

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Expected sign</th>
<th>Estimated parameter</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory reforms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy 1996 on opening hours/business licensing</td>
<td>+</td>
<td>0.12</td>
<td>2.66</td>
</tr>
<tr>
<td>Dummy 1998 on Competition Act</td>
<td>+</td>
<td>-0.01</td>
<td>-0.30</td>
</tr>
<tr>
<td>(Fitted) entry rate</td>
<td>+</td>
<td>0.06</td>
<td>1.54</td>
</tr>
<tr>
<td>(Fitted) exit rate</td>
<td>-</td>
<td>-0.05</td>
<td>-0.68</td>
</tr>
<tr>
<td>Market demand</td>
<td>-</td>
<td>-6.94</td>
<td>-3.72</td>
</tr>
<tr>
<td>Strategic interaction</td>
<td>+</td>
<td>0.05</td>
<td>3.90</td>
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<tr>
<td>Advertising rate</td>
<td>?</td>
<td>0.13</td>
<td>2.61</td>
</tr>
<tr>
<td>Lagged RPM</td>
<td>+</td>
<td>0.42</td>
<td>11.55</td>
</tr>
<tr>
<td>Intercept</td>
<td></td>
<td>0.40</td>
<td>2.46</td>
</tr>
<tr>
<td>R-squared</td>
<td></td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td></td>
<td>563</td>
<td></td>
</tr>
</tbody>
</table>

* Positive sign indicates positive effect on competition, and visa versa.

In addition, our findings indicate that some regulatory reforms might have affected competition positively in the Dutch retail trade.\(^{319}\) The dummy variable for the period following the reforms on opening hours and business licensing, demonstrates that a significant upward shift in the level of competition occurred. However, such a shift is not identified after the introduction of the competition act in 1998. Further research is required to identify the effect of both regulatory reforms on the level of competition in the Dutch retail trade.

\(^{319}\) One can also combine the separate reforms in an overall indicator on regulatory reform (see Creusen et al., 2006b). Doing this, the results suggest that the regulatory reforms had a positive and significant impact on competition.
Relation innovation and competition

Theoretical assertions on innovation

Recent theory suggests that the incentive to innovate depends on the level of competition and the differences in efficiency level between competing firms (see Aghion et al., 2001 and 2002, Boone, 2001). It particularly shows that two countervailing effects determine the relation between competition and innovation. On the one hand, an increase in competition enhances the innovative effort of leading firms, because in this way these firms can escape from fierce competition (escape competition effect). On the other hand, increases in competition forces lagging firms to refrain from innovation, because those innovations become non-profitable (Schumpeter effect). The escape competition effect therefore points to a positive relation between competition and innovation. However, the Schumpeter effect points to a negative relation.

Aghion et al. suggest however, that combining these two effects in a dynamic model results in an inverted U-relationship between competition and innovation (see Aghion et al., 2001 and 2002). In fact, an initial rise in competition will first enhance total innovation efforts by the escape competition effect, but beyond some point it will reduce total innovative efforts as the Schumpeter effect becomes larger. To test whether an inverted U-relationship exists, we run two variants of the innovation expenditure equation (see the box below for more details).

When estimating the relationship between competition and innovation, one should be aware of the various steps firms have to go through in deciding to innovate. Recall that more than 70 percent of the retailers in our sample indicated that they had no innovation expenditures at all. Ignoring this group of non-innovative retailers and only focussing on the 30 percent of the retailers that do innovate may bias our empirical results on the relation between competition and innovation. So to capture all relevant innovation decision of all retailers, we employ the Tobit-I procedure and implicitly combine the decision to innovate in the first step with the decision on expenditures in the second step. As a result, the parameter estimates have now two interpretations. First they demonstrate an effect on the probability of innovation and second an effect on the relative innovation expenditures. Consequently, the impact of competition and market share on those expenditures, that is the marginal effects, are dependent on the probability of innovation.

320 These effects denoted by Aghion et al. resemble the famous Schumpeter’s mark I and mark II, in the sense that there are two countervailing effects of competition on innovation. Schumpeter’s mark I argues that more competition stimulates (all) firms to innovate (see Schumpeter, 1934). Schumpeter’s mark II, however, argues that too much competition may reduce innovation, because firms must have sufficient size and financial sources to benefit from innovation (see Schumpeter, 1942).
Box 21–3 Formal equation explaining innovation

To determine the dominant effect (escape competition or Schumpeter), the linear relation between competition and innovation for each firm $i$ in industry $j$ in period $t$ reads as:

$$ IS_{ijt} = q_0 + q_1 RPM_j + q_2 W_{ijt} $$

with

- $IS_{ijt}$: innovation rate, i.e. the firm’s innovation expenditures as a percentage of its total sales
- $RPM_j$: relative profits measure of the industry
- $W_{ijt}$: market share, i.e. total sales of each firm as a percentage of the total sales of the industry

This equation includes the firm’s market share as an explaining variable as firms may have exploit economies of scale from innovation. It is expected that larger firms have more opportunities to conduct research, such as financial funds or risk-sharing, or can better exploit economies of scale after implementing the innovation. Therefore, firms with a higher market share may also have more innovation expenditures in comparison to their sales.

Following Aghion et al. (2002) the relation between competition and innovative effort can be estimated by regressing the innovation rate of each firm on a quadratic function of the RPM of the respective industry.

The regression equation for the innovation rate becomes:

$$ IS_{ijt} = q_0 + q_1 RPM_j + q_2 RPM_j^2 + q_3 W_{ijt} $$

Note that innovation outlays as an indicator of innovation are left censored, which means that these variables can only take values larger than or equal to zero. In estimating all the equations we have to take account of this censoring and therefore apply the so-called censored regression technique (Tobit-I model, see Verbeek, 2004).

Empirical findings on innovation

We use firm’s innovation expenditures as a percentage of total sales as an indicator of innovation activities in the Dutch retail trade. Although, for example, the decision to exit...

---

Note that our approach differs with the one of Aghion et al. (2002) on two main elements. We use innovation expenditures as an indicator of innovation whereas they use patents. The latter is to our opinion a more limited indicator of innovation. The second main difference is that we apply a new indicator of competition,
the market is also a decision not to innovate, we will not analyse the impact of such effects separately. Furthermore, we assume that effects of legislation, strategic interaction, entry and exit are all captured by changes in the RPM as our indicator of competition.

The analysis of innovation partly consists of firm-level data (i.e. innovation expenditures and market share) as well as industry-level data (i.e. RPM). In addition, the RPM and are predetermined on PS-data at the industry level (5-digit).

Table 21–6 presents the results of the estimated linear relation between innovations expenditures and competition. Remember that the coefficients of a Tobit-I model have two interpretations. So these estimations results indicate that higher competition induces a higher probability of innovation as well as a higher ratio of innovation expenditures relative to the sales levels of firm $i$ (positive sign of competition). Then in terms of the theory, these results suggest that the escape competition effect dominates in the Dutch retail trade, i.e. some (leading) firms innovate to escape fierce competition. Further, the empirical results also point out that firms with a higher market share spend relatively more on innovation than firms with a lower market share.

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Estimate</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.14</td>
<td>9.08</td>
</tr>
<tr>
<td>RPM</td>
<td>0.02</td>
<td>4.31</td>
</tr>
<tr>
<td>Market share</td>
<td>0.24</td>
<td>5.14</td>
</tr>
<tr>
<td>Scale parameter$^a$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td></td>
<td>1147</td>
</tr>
<tr>
<td>Left-censored observations</td>
<td></td>
<td>864</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-72.90</td>
<td></td>
</tr>
</tbody>
</table>

$^a$ Scale parameter in the distribution used to normalise the underlying variable.

Source: own calculations based on PS- and CIS-data.

Additionally, we test the existence of an inverted U-relationship. The results do not support the theoretical notions of this relationship. Table 21–7 presents the results of a regression of the innovation rate on a quadratic function of competition and the firm’s market

322 Parameters of the Tobit-I model cannot directly be interpreted as the marginal effect on innovation because the probability of having a positive outcome should also be taken into account. We therefore focus on the sign of the effect estimates and not on the magnitude.

323 Although it can be argued that there is a relationship between market shares and the relative profit measure, the correlation between both explanatory variables is low. Therefore, multicollinearity is not a serious issue in this respect.
share. These results suggest that there is no inverted U-relationship between competition and innovation. The estimated coefficient of competition squared, i.e. $\varphi_2$, is positive and significant, and thus contrasts with the theory of Aghion et al. (2002).

### T21 – 7 Estimation of quadratic model (Tobit I-model)

Dependant variable: innovation rate (at firm level)

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Estimate</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.07</td>
<td>-1.76</td>
</tr>
<tr>
<td>RPM</td>
<td>-0.05</td>
<td>-1.50</td>
</tr>
<tr>
<td>RPM squared</td>
<td>0.02</td>
<td>2.22</td>
</tr>
<tr>
<td>Market share</td>
<td>0.24</td>
<td>4.59</td>
</tr>
<tr>
<td>Scale parameter*</td>
<td></td>
<td>21.65</td>
</tr>
<tr>
<td>Number of observations</td>
<td></td>
<td>1147</td>
</tr>
<tr>
<td>Left-censored observations</td>
<td></td>
<td>864</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td></td>
<td>-70.46</td>
</tr>
</tbody>
</table>

* Scale parameter in the distribution used to normalise the underlying variable.

Source: own calculations based on PS- and CIS-data.

Some cautious remarks as the results for innovation are not without problems. First, although innovation data from CIS is imperative and indispensable for this kind of research, still innovation is a difficult concept in services. Second, innovation expenditures do not measure the success of an innovation. The latter is not available at the firm level. Finally, due to data availability, we had to use the same explanatory variables for both the decision to innovate and for innovation expenditures of innovating firms.

### Impact competition and innovation on productivity

#### Theoretical assertions on productivity

In general firms’ labour productivity depends amongst others on total factor productivity (TFP), capital intensity, use of economies of scale, and on cyclical fluctuations. In this study, the first determinant, TFP, is most crucial. In fact, we assume that firms may enhance their TFP-level by innovation, that is, by conducting research to develop new technologies and/or new products.

Furthermore, theory suggests that fierce competition forces firms to reduce X-inefficiency as much as possible, and consequently affects TFP-growth in the short term (see for instance Nickel, 1996, for an overview). Therefore, in our model we assume that TFP-growth in the short term is not only related to innovation, but to competition as well.

These relations described above are transformed in a formal model (see box), and can be estimated empirically. As labour productivity is highly correlated with the business cycle due to labour hoarding, we added two year dummies (i.e. for the year 1997 respectively 1999) to control for incidental effects, including business cyclical effects.
Empirical findings on productivity
Estimation of the productivity equation is based on the merged data set of PS and CIS-data at the firm level. The set of the RPM are pre-determined from the PS-data at the 5 digit industry level. Due to the restrictive availability of the innovation data and the assumed lagged effect of innovation, these merged data concern the years 1997, 1999 and 2001.

The positive and significant coefficients for competition and innovation reveal that they both enhance TFP-growth, as can be seen in table 21–8. The positive effect of competition on the productivity growth is in line with the findings of Nickell (1996), and indicates that the market attains higher static efficiency with increasing competition. The positive effect of innovation on productivity growth is supported as well (dynamic efficiency). The insignificance of the coefficient on labour indicates that the Dutch retail trade as a whole is characterised by constant returns to scale.

Finally, combining the positive impact of innovation on productivity with the positive impact of competition on innovation suggests that competition has a second indirect effect on productivity growth via innovation. As competition stimulates innovation, the initial effect of competition on productivity becomes even stronger in the long term.

Table 21–8 Estimation results labour productivity growth, 1997-2001 (a)
Dependent variable: productivity growth (at firm level)

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Estimate</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.02</td>
<td>-0.61</td>
</tr>
<tr>
<td>Change RPM</td>
<td>0.07</td>
<td>1.91</td>
</tr>
<tr>
<td>Lagged innovation rateb</td>
<td>0.01</td>
<td>2.19</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>0.22</td>
<td>12.95</td>
</tr>
<tr>
<td>Labour</td>
<td>0.00</td>
<td>-0.45</td>
</tr>
<tr>
<td>Dummy 1999</td>
<td>-0.04</td>
<td>-0.93</td>
</tr>
<tr>
<td>Dummy 2001</td>
<td>0.05</td>
<td>1.09</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>877</td>
<td></td>
</tr>
</tbody>
</table>

*a* Note that only the growth rates of the years 1997, 1999, and 2001 can be used due to the CIS-data.

b Relative to (lagged) value added.

Source: own calculations based on PS- and CIS-data. Productivity levels deflated by price indices derived from the input-output tables of the national accounts (1992=100).

Concluding remarks

This study analyses the relationship between competition, innovation and productivity. It focuses on the Dutch retail trade as this industry accounts for a large part of the negative gap in productivity growth compared with the US since the mid-1990s.
In general, shopping with friends give more fun compared to shopping alone. This is also the case with competition and innovation. We show that both competition and innovation may speed up productivity in the Dutch retail trade. But, competition also stimulates innovation, and therefore the initial effect of fiercer competition on productivity becomes even larger in the long term. However, we show that on average competition hardly increased in the Dutch retail trade in the period 1993–2002.

This study contains two renewing features in empirical research. First, it combines two effects of competition on productivity. Higher competitive pressure reduces X-inefficiencies in the short-term and it stimulates innovation in the long term. Second, using firm-level data, this study also contains an empirical test on the existence of an inverted U-relation between competition and innovation, as introduced by Aghion et al. 2001 and 2002. This test rejects the hypothesis of an inverted U-relationship for the Dutch retail trade. Still, these features are first steps towards an extensive empirical model that relates competition, innovation and productivity, and thus require further investigation.

The findings of our study are relevant for policy as we find indications that both the intensity of competition and innovation expenditures appear to be low in the Dutch retail trade. Policy measures aiming at stimulation competition such as longer openings hours in 1996 may already have had an effect. Following that track is, therefore, a policy option that needs further consideration.
References


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TABLE OF CONTENTS

Introduction 7

1. OECD Workshops on Productivity Analysis and Measurement: Conclusions and Future Directions; Erwin Dievert 13

PART 1: PRODUCTIVITY GROWTH IN SPAIN AND IN SWITZERLAND 39

2. Productivity Growth and Innovation in OECD; Dominique Guellec and Dirk Pilat 41

3. The Role of ICT on the Spanish Productivity Slowdown; Matilde Mas and Javier Quesada 61

4. Multi-factor Productivity Measurement: from Data Pitfalls to Problem Solving – the Swiss Way; Gregory Rais and Pierre Sollberger 81

5. Innovation and Labour Productivity Growth in Switzerland: An Analysis Based on Firm Level Data; Spyros Arvanitis and Jan-Egbert Sturm 101

PART 2: THE MEASURE OF LABOUR INPUT 113

6. On the Importance of Using Comparable Labour Input to Make International Comparison of Productivity Levels: Canada-U.S., A Case Study; Jean-Pierre Maynard 115

7. Labour Productivity Based on Integrated Labour Accounts – Does It Make Any Difference?; Kamilla Heurlén and Henrik Sejerbo Sørensen 145


PART 3: THE MEASURE OF THE COMPOSITION OF LABOUR INPUT 211

9. Main Sources of Quarterly Labour Productivity Data for the Euro Area; Wim Haine and Andrew Kanutin 213


11. Labour Input Productivity: Comparative Measures and Quality Issues; Antonella Baldassarini and Nadia Di Veroli 239
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>PART 4: THE MEASURE OF CAPITAL INPUT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>International Comparisons of Levels of Capital Input and Multi-factor Productivity</td>
<td>Paul Schreyer</td>
<td>283</td>
</tr>
<tr>
<td>14.</td>
<td>Research and Development as a Value Creating Asset</td>
<td>Emma Edworthy and Gavin Wallis</td>
<td>303</td>
</tr>
<tr>
<td>15.</td>
<td>Empirical Analysis of the Effects of R&amp;D on Productivity: Implications for productivity measurement?</td>
<td>Dean Parham</td>
<td>337</td>
</tr>
<tr>
<td>16.</td>
<td>Infrastructures and New Technologies as Sources of Spanish Economic Growth</td>
<td>Matilde Mas</td>
<td>357</td>
</tr>
<tr>
<td><strong>PART 5: THE MEASURE OF INDUSTRY LEVEL MULTI-FACTOR PRODUCTIVITY</strong></td>
<td></td>
<td>395</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Productivity Measurement at Statistics Netherlands</td>
<td>Dirk van den Bergen, Myriam van Rooijen-Horsten, Mark de Haan and Bert M. Balk</td>
<td>397</td>
</tr>
<tr>
<td>19.</td>
<td>Sectoral Productivity in the United States: Recent Developments and the Role of IT</td>
<td>Carol Corrado, Paul Lengermann, Eric J. Bartelsman and J. Joseph Beaulieu</td>
<td>435</td>
</tr>
<tr>
<td>21.</td>
<td>Shopping with Friends gives more Fun; How Competition, Innovation and Productivity Relate in Dutch Retail Trade</td>
<td>Harold Creusen, Björn Vroomen and Henry van der Wiel</td>
<td>479</td>
</tr>
<tr>
<td>22.</td>
<td>Economic Growth in Sweden, New Measurements</td>
<td>Tomas Skytesvall and Hans-Olof Hagén</td>
<td>505</td>
</tr>
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