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Economics Department
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What Do We Know about Productivity Gaps and Convergence in EMU Economies?

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Abstract

This paper examines labour productivity levels and growth rates in 10 EMU economies: Germany, France, Belgium, Netherlands, Italy, Spain, Austria, Finland, Ireland and Portugal.

In general, European economies still lag behind the United States in terms of productivity level. Available estimates indicate that in the *tradables sector* (mainly manufacturing) Belgium, France, the Netherlands and (perhaps more recently) Finland are the top performers among the European countries. There seems to be more room for catch-up growth in Portugal and Spain. For Ireland, relevant sectoral data were not available. As for the *nontradables sector* (mainly services), one can only draw tentative conclusions. European economies seem to have improved their performance relative to the US, but there is considerable heterogeneity across the different industrial sectors within each country. Hence there is probably room for sectoral catch-up growth in each of these economies, especially so in Portugal and Ireland, with the least room in Belgium, France and the Netherlands.

A "stylized fact" indicates that labour productivity tends to grow faster in the tradables sector. On the other hand, the well-established Balassa-Samuelson hypothesis states that higher sectoral differences in productivity growth tend to generate higher sectoral inflation differentials and these, in turn, induce higher aggregate inflation. Against this backround, it is interesting to note that differentials in sectoral productivity growth rates seem to have been surprisingly similar among the countries studied: they have varied between 2 and 3 percentage points on average during the period studied. The overall view of the paper is that, due to the structural heterogeneity of countries concerned and measurement problems, caution should be exercised in classifying the EMU-countries into high- and low-productivity economies. A fairly certain conclusion of this study is that relative to the US there is still room for catch-up growth in productivity in all the countries, perhaps more so in Ireland, Portugal and Spain.

Keywords: EMU, convergence, productivity, Balassa-Samuelson hypothesis

Tuottavuuserot ja konvergenssi EMU-maissa

Suomen Pankin keskustelualoitteita 31/98

Timo Tyrväinen
Kansantalouden osasto

Tiivistelmä

Tässä tutkimuksessa selvitetään työn tuottavuuden tasoa ja kasvuvauhtia kymmenessä EMU-maassa, jotka ovat Saksa, Ranska, Belgia, Hollanti, Italia, Espanja, Itävalta, Irlanti, Suomi ja Portugali.

Euroopan maissa työn tuottavuuden taso on yleisesti edelleen heikompi kuin Yhdysvalloissa. Luotettavina pidettävät arviot viittaavat siihen, että kansainvälistä kauppaa käyvässä eli avoimessa sektorissa (lähinnä teollisuutta) työn tuottavuus on paras Belgiassa, Ranskassa ja Hollannissa. Viime vuosina myös Suomen teollisuus on noussut tähän ryhmään. Tuottavuuserojen kiinni kuromisen eli "catch-up-kasvun" näkökulmasta tuottavuuden kasvun voisi odottaa olevan tulevaisuudessa nopeinta Portugalissa ja Espanjassa. Irlannin sektorikohtaisia tietoja ei ollut käytössä. *Kotimarkkina- eli suljettua sektoria* (lähinnä palveluita) koskevat tuottavuusvertailut ovat erityisen epävarmoja. Useimmat Euroopan maat näyttävät vahvistaneen asemiaan Yhdysvaltoihin nähden. Kunkin maan sisällä toimialoittaiset erot ovat kuitenkin suuret. Alakohtaiseen "catch-up-kasvuun" lienee siis mahdollisuuksia kaikissa maissa. Eniten niitä on Portugalissa ja Irlannissa ja vähiten Ranskassa, Belgiassa ja Hollannissa.

Yleensä ajatellaan, että työn tuottavuuden kasvu on avoimessa sektorissa nopeampaa kuin suljetussa sektorissa. *Balassan-Samuelson*in hypoteesi puolestaan väittää, että mitä suurempi on ero sektoreittaisissa tuottavuusmuutoksissa – eli mitä nopeammin avoimen sektorin työn tuottavuus kasvaa suhteessa suljetun sektorin vastaavaan – sitä suuremmat ovat sektoreiden väliset inflaatioerot ja sitä nopeampi koko talouden inflaatiovauhti. Tätä taustaa vasten on mielenkiintoista havaita, että tuottavuusmuutosten sektoreittaiset erot ovat yllättävän samanlaisia eri maissa: ne ovat yleensä vaihdelleet kahden ja kolmen prosenttiyksikön välillä vuosittain. Kaiken kaikkiaan tutkimuksessa päädytään näkemykseen, että suurien maakohtaisten rakenteellisten erojen ja tuottavuuden mittaamiseen liittyvien epävarmuuksien vuoksi ei liene järkevää jakaa EMU-maita hyvän ja heikon tuottavuuden maihin. Suhteessa Yhdysvaltoihin eurooppalaisen tuottavuuden "catch-up-kasvu" on kuitenkin mahdollista kaikissa tutkimuksessa mukana olevissa maissa. Eniten lienee kiinni kurottavaa Irlannissa, Portugalissa ja Espanjassa.

Asiasanat: EMU, tuottavuus, konvergenssi, Balassan-Samuelsonin hypoteesi

Contents

1 Introduction

There are many aspects involved in cross-country comparisons of productivity. Different measures may be more useful depending on the purpose of the comparison. The three commonly used measures are 1) value added *per capita*, 2) labour productivity, and 3) total factor productivity.

As a measure of a nation's material wellbeing, *per capita* GDP is usually appropriate. Regarding disposable income, it is desirable that as many citizens as possible are working as many hours as possible, with hourly productivity as high as possible.

For many purposes, labour productivity is the most useful productivity measure, being more robust than most of the alternatives. It also obviates biases in cross-country productivity comparisons due to differences in participation rates etc. Labour productivity can be measured on the basis of *number of persons employed* or *number of hours worked*.

For studying international competitiveness, hourly labour productivity is the most relevant measure because, in most cases, wages are paid according to hours worked. In order to maintain competitiveness and profitability, hourly wages must be geared to the level of the hourly productivity. Unfortunately, hours worked are not available for all countries, particularly on a sectoral basis. Thus most studies – including the present one – examine labour productivity on a per employee basis. As will be shown below, this may bias productivity comparisons if normal annual working hours differ across countries.

Total factor productivity is a weighted sum of the labour productivity and capital productivity. In sectoral analysis, measurement problems related to total factor productivity are significant because appropriate data on sectoral capital stock are difficult to obtain (see Pilat 1996). Hence we ignore this particular productivity concept.

The purpose of this paper is two-fold. First, we examine whether there are considerable gaps between levels of labour productivity across the EMU countries. Secondly, we look at whether past productivity trends suggest that the gaps are about to narrow.

Differences in aggregate productivity may be due to differences in sectoral mix, in level of technology and/or in capital intensity. Although the relative price of labour is an important driving force behind the relevant processes, issues related to the sources of labour productivity differences are not on our agenda. Here we simply attempt to evaluate whether productivity gaps are of such magnitude as to be likely to generate catch-up growth in some economies.

If productivity gaps are due to structural differences (in production, labour market etc), they may be persistent and hence one may not detect any tendency for them to vanish. However, if the gaps do *not* represent a steady state, this implies that error correcting adjustment, or catching up, is to be expected.

Our study is motivated by the Balassa-Samuelson model, which suggests that inflation tends to be higher in catch-up economies. This issue may also turn out to be highly relevant for the economic evaluations that will have to carry out by the European Central Bank (ECB).

In the Balassa-Samuelson model, inflation is exacerbated by differentials in productivity growth as between the tradables and nontradables sectors. A

systematic tendency for productivity to grow faster in the former has the status of stylized fact in most countries. Dual productivity growth is to be expected to continue in the future.

Another feature of the Balassa-Samuelson model is that a rise in productivity in the tradables sector will bid up nominal wages throughout the economy; producers in the nontradables sector can pay the higher wages only if there is a rise in the relative price of nontradables. Thus *dual productivity growth* generates *dual inflation*, which tends to increase *aggregate inflation*.

Our analysis also allows us to scrutinize, in the present country setting, an assertion made by Bernard and Jones (1996, p. 1216): 'manufacturing shows little evidence of either labour productivity or multi factor productivity convergence, while other sectors, especially services, are driving the aggregate convergence result.'

The rest of the paper is organized as follows. We first examine aggregate labour productivity in terms of levels and trends. In section 3, sectoral data for the tradables and nontradables sectors are discussed. In section 4, sectoral trends in productivity growth will are tackled, while section 5 examines sectoral productivity gaps in terms of two sets of productivity estimates. The final section summarizes the paper and presents our concluding remarks.

2 Aggregate Productivity: Levels and Trends

A country will strive for higher levels of productivity because this enables its citizen's real income – ie GDP per capita – to grow.

At the level of total GDP, comparisons of labour productivity levels are fairly straightforward. Estimates of GDP, population and employment are available for most countries, and purchasing power parities (PPPs) at the GDP level are suitable for conversion of total GDPs into a common currency.

Table 1 reports the income and labour productivity levels with Germany normalized at 100. Of the EMU countries, income *per capita* is highest in Austria and Belgium. The gap is however marginal vs Germany, France, Netherlands and Italy. On the other hand, GDP *per capita* is considerably lower in Finland and Ireland and even lower in Spain and Portugal.

A country's level of income can be de-composed into a factor indicating how many persons in each country work (employment/population ratio) and a labour productivity factor. As indicated by the second column of table 1, the first ratio differs substantially across the countries compared. The share of employed in the population is highest in Germany, Austria and Portugal; very low in Spain; and fairly low in Ireland, Italy and Belgium. France, Netherlands and Finland comprise a middle group.

When these differences are accounted for, GDP *per person employed* appears to be highest in Belgium, France and Italy. This is because less people are working in these countries. Quite strikingly, this measure indicates that overall productivity in Spain is at a level comparable to Germany. Portugal looks very much like an outlier.

Adjusting for hours worked changes the cross-country comparisons somewhat. This is particularly the case for Spain, where the few who are employed work

many more hours per year than those employed in the other countries. In the Netherlands annual hours are by far the lowest in this comparison. In Spain employees work 44 per cent more annual hours than in the Netherlands. This obviously reflects in part the exceptionally large share of part time jobs in the Netherlands. Interestingly, in all the continental countries annual hours are below the average for the countries studied (= 1597 hours p.a.) whereas Finland, Ireland, Portugal and Spain come in above the average.

The final column of table 1 gives GDP *per hour worked*. These figures look quite similar for Spain, Ireland and Finland, Portugal again being an outlier. The rest of the countries seem to form a fairly homogenous, and high, productivity group, with Germany at the weak end. Aggregate productivity per hour seems to be highest in Netherlands, Italy and Belgium, ie some 20 per cent above the German level.

Table 1. **Income and Labour Productivity Levels in EMU Member States, 1994**

	GDP *per capita* (GER = 100)	Employment/ population ratio, 1994	GDP per person employed (GER = 100)	Annual hours worked per person	GDP per hour worked (GER = 100)
Germany	100	42.9	100	1,529	100
France	98	38.5	109	1,524	109
Italy	95	35.2	116	1,482	120
Austria	103	43.0	103	1,576*	100
Belgium	103	36.4	121	1,581*	117
Finland	82	39.8	89	1,654	82
Ireland	77	34.3	97	1,700*	87
Netherlands	95	38.5	105	1,321	122
Portugal	63	42.6	63	1,704	57
Spain	69	30.0	99	1,903	80

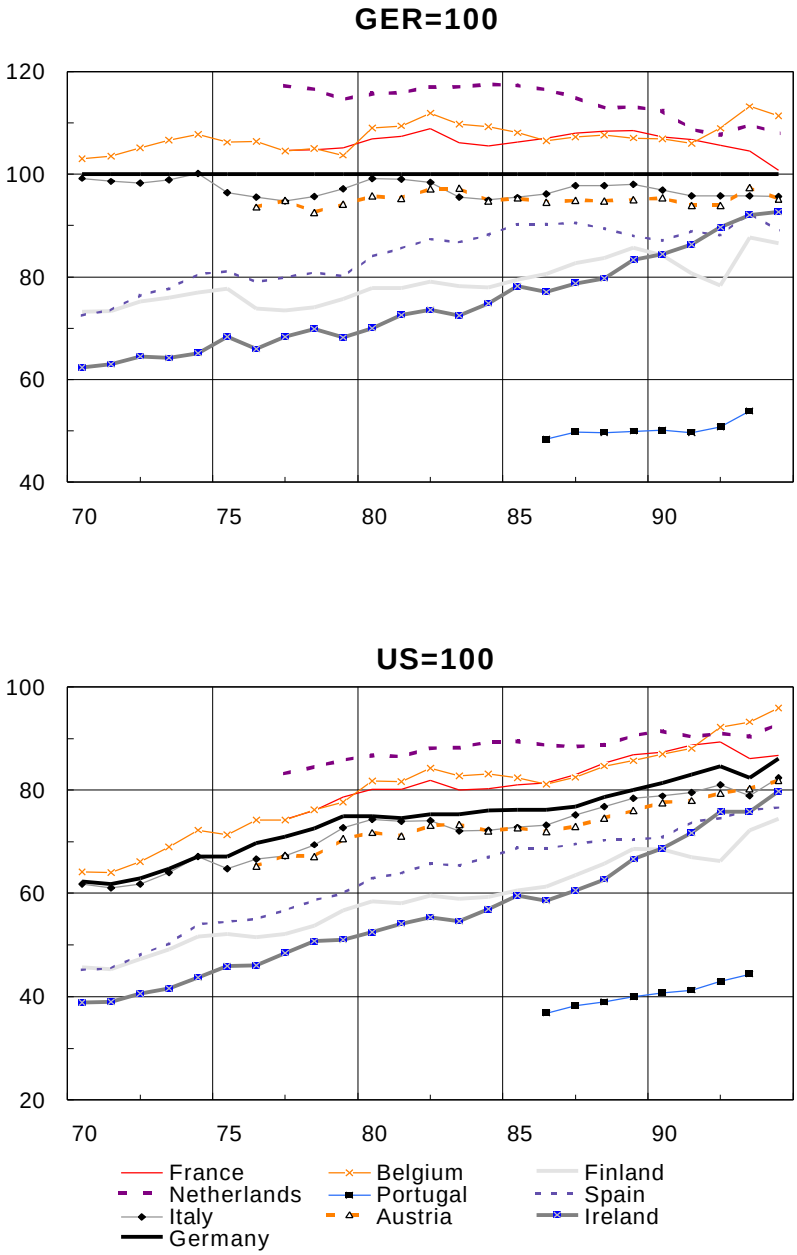
* Hours worked are for 1992

Source: Table 1 has been calculated using the information in Pilat, D. (1996): Labour Productivity Levels in OECD Countries: Estimates for Manufacturing and Selected Service Sectors, OECD, Economics Department Working Papers No 169. For Luxembourg, the data is not available. Figures for Germany refer to West Germany.

Chart 1 shows relative labour productivities (GDP per person employed) for a period starting in 1970 and ending in 1994. For each of the countries, the period is determined by the availability of data from the OECD Statistical Compendium 97/2. In each case, the annual GDP in national currency is converted using annual PPP estimates. As can be seen, relative positions in chart 1 are not exactly identical to those in table 1 for 1994. In most cases, however, the differences are minor.

Our main conclusions are as follows. The lower panel in chart 1 confirms that overall labour productivity in Europe is below that in the US despite clearcut convergence in this respect. At the end of the observation period, the gap is more than 50 percent for Portugal. For the rest of the EMU countries, the gap ranges from 5 per cent to about 25 per cent.

Chart 1. **Relative Labour Productivity Levels**



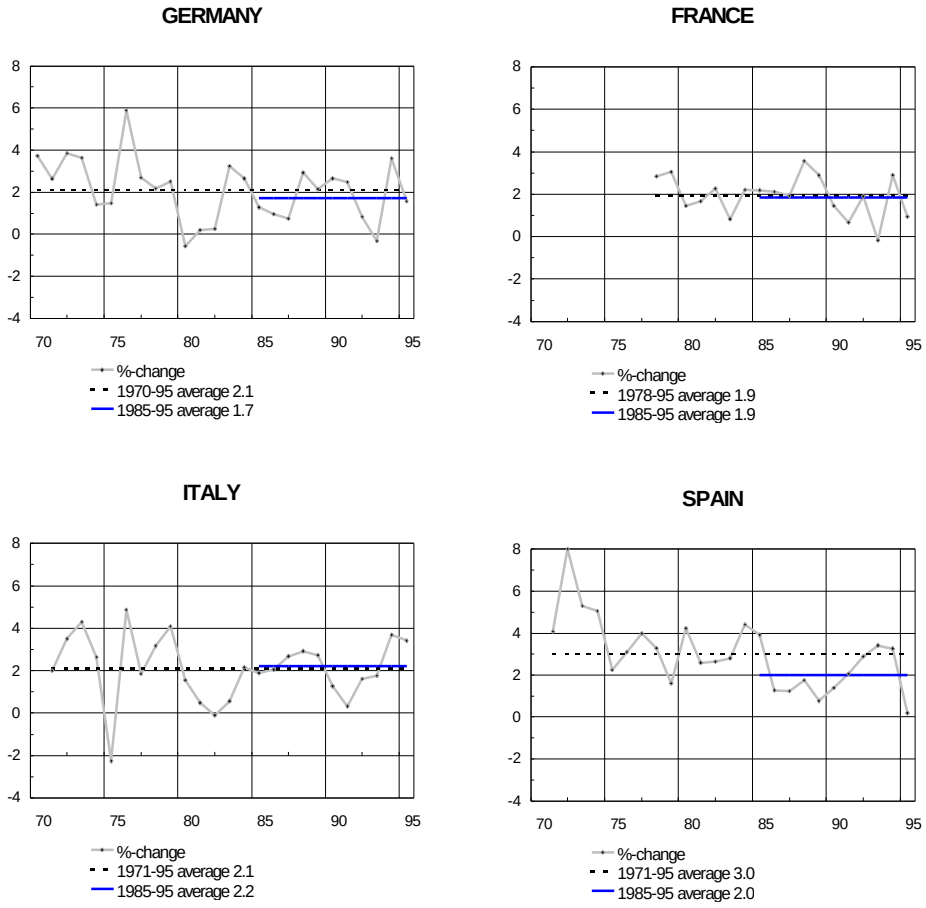
Labour productivity = Value added per person eployed at annual PPP.

The upper panel shows that for Germany, Austria and Italy relative labour productivity (per capita) has been very stable. France and Belgium can be similarly described with the exception of recent years. In the 1990s, France has lost some relative strength and Belgium has gained some. Since the mid-1980s, the Netherlands have systematically given up their positive edge vs Germany. Catch-up growth has obviously occurred in Spain, Ireland and Finland.This is also true of Portugal where labour productivity, however, still seems to be on a very low level.

Chart 2 gives further evidence on past productivity trends. Notice first that, in most countries, the average rate of productivity growth has been fairly stable. However, in the post-1985 period there was a more pronounced decline in productivity growth in Germany, Belgium and, most strikingly, in Spain. Secondly, with few exceptions, the average growth rate has been very similar across the countries. In Germany, France, Belgium, Italy, Spain and Austria, growth has been about 2 per cent p.a. in the past 10 years. In the Netherlands, growth has been slower. In Ireland, Finland and Portugal, labour productivity has improved at a faster rate although here the cross-country variability has been particularly large.[1]

To sum up, chart 2 contains signs of some catching up in Ireland, Finland and Portugal. This also is also true of Spain for the pre-1985 period but, somewhat surprisingly, not thereafter.

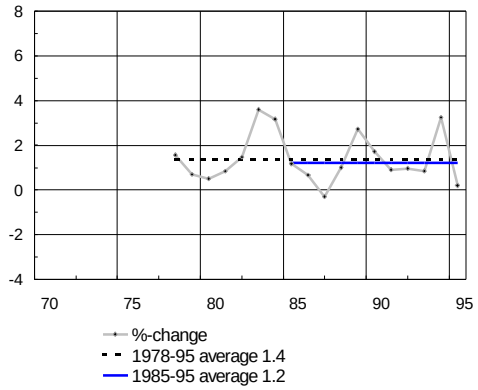
Chart 2. **Productivity Growth, %-change**
(= GDP at constant prices / number of employees)



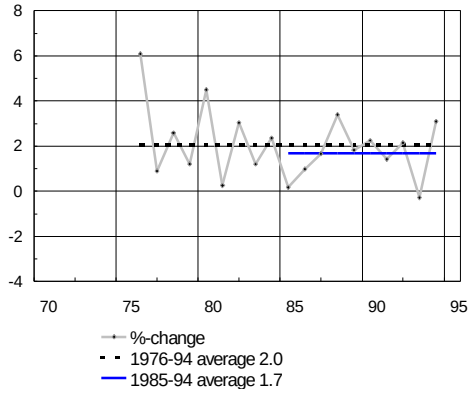
[1] In Finland in the early 1990s, the level of GDP fell by 13 per cent within two years time. At the same time, the unemployment rate rose from 3 per cent to 20 per cent. As employment, particularly in manufacturing, declined much more than production, Finnish manufacturing experienced a few years with productivity growth in excess of 10 per cent annually (see chart 2 below). This was in the middle of the extraordinary recession in the overall economy.

Chart 2. (cont.) **Productivity Growth, %-change**
(= GDP at constant prices / number of employees)

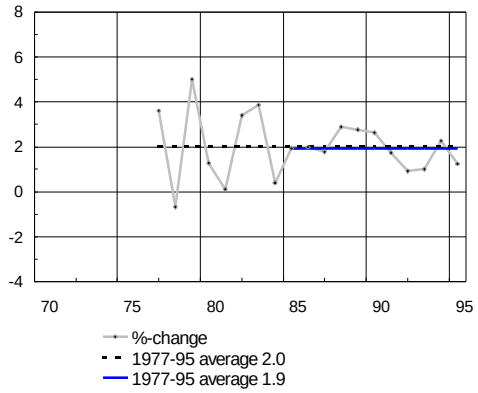
NETHERLANDS



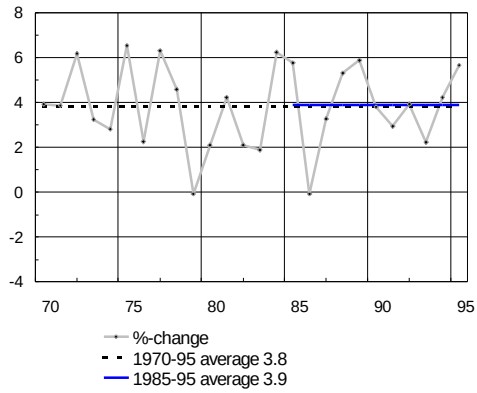
BELGIUM



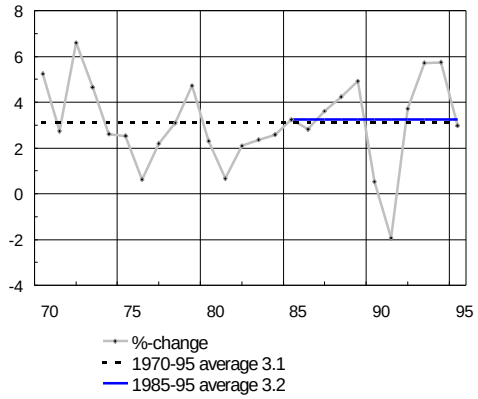
AUSTRIA



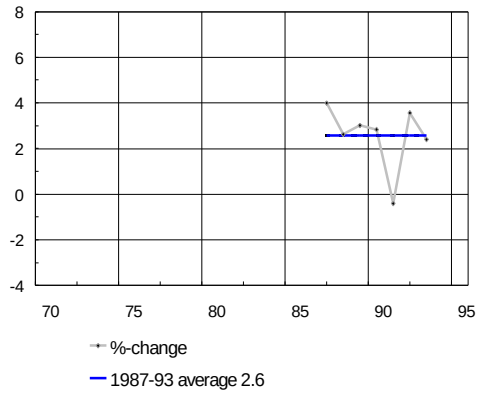
IRELAND



FINLAND



PORTUGAL



3 Sectoral Disaggregation and Data

We now turn to the sectoral analysis of labour productivity. This is necessary because in the Balassa-Samuelson model the driving force of dual productivity growth and dual inflation is the existence of two fundamentally different sectors in the economy: the tradables sector and the nontradables sector.[2] Let us first set out the background.

3.1 Sectoral Disaggregation

In empirical applications of the Balassa-Samuelson model, it has been commonplace to operationalize the tradables sector (= open sector) as the manufacturing industry, though in some studies, agriculture has been also included.

De Gregorio, Giovannini and Wolf (1994) examine the ratio of exports to production. They calculate, for 14 OECD economies, the average share of exports in total output for each industry in 1970–1985 and consider a share of more than 10 per cent as the minimum for tradables. Their results show that all industries experienced substantial increases during the period in the relative importance of tradables, with a particularly pronounced increase for the manufacturing industry. They conclude that the inclusion of the manufacturing industry – and mining as well – in the tradables sector is a plausible choice. Of the services, only transportation has an export share qualifying it as a tradable.

De Gregorio et al also include agriculture in the tradables sector because of its large export share. In spite of its well-known tradability, the treatment of agriculture is far from straightforward. In many countries, agricultural production has been heavily subsidized and prices administratively determined. As the number of self-employed dominates in agricultural employment, the measurement of agricultural labour productivity in the System of National Accounts (SNA) is particularly problematic, and differences in the related bias may induce differences in estimates across countries.

Finally, in all countries the output share of agriculture has diminished drastically in recent decades. In some countries the decline took place earlier and in some others later. Because changes in the size of the agriculture industry have been so large, the inclusion of agriculture in either of the two main sectors could dominate the examination of relative output shares. For example, De Gregorio et al report a considerable increase in the relative output share of the nontradables sector. As they include agriculture in the tradables sector, it is difficult to judge whether the reported trends simply mirror the collapse of the share of agriculture.

In the public sector, measurement of productivity in the SNA is also far from straightforward and the data-generating process differs considerably from that in the private sector of the economy.

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[2] The *Scandinavian Model of Inflation* also has the two-sector property. Here, the *open sector* is the leader and the *sheltered sector* is the follower. Production in the former is subject to foreign competition whereas in the latter it is not. This is in full accordance with the Balassa-Samuelson set-up. So is much of the rest of the Scandinavian inflation model as well. For details, see eg Lindbeck (1979).

Due to the above factors, our analysis concerns only the private sectorand excludes agriculture. The sectoral breakdown applied below is as follows:

Tradables sector:
manufacturing industry + transportation
Nontradables sector:
the rest of the economy excluding agriculture and the public sector

3.2 Data

The productivity measure used is value added per worker. The annual data come from the OECD[3] and cover nine countries: Germany, France, Italy, Spain, Belgium, Netherlands, Austria, Portugal and Finland. Adequate sectoral data was not available for Ireland. The lengths of the series vary from country to country. For Germany, there are observations for 1960–1993. For most of the countries, however, the data only begin in the mid-1970s and end in 1993–1995. For Spain, the sectoral OECD data starts at 1985 but it was augmented with data from the Bank of Spain as from 1965. For Portugal we only have data for 1987–1993.

In the present context, four points are worth stressing. First, labour productivity is the productivity measure used in most of the other studies as well.[4] Secondly, employment is measured by the number of employed persons since data on working hours were not available. This also means that labour productivity here is output per person, not per hour, which would be a more appropriate measure. As far as differences in sectoral productivity growth rates are concerned, the matter may cause problems particularly in countries where the share of part-time work has increased considerably and also unevenly across sectors. Of the countries studied, this is a major concern only for the Netherlands.

[3] OECD, Statistical Compendium 97/2, Paris 1997. The data has been prepared by Ulla Sjöblom at the Bank of Finland. The data for Spain has been constructed from national sources by Paco de Castro at the Bank of Spain.

[4] For some countries, we considered at the outset the development of total factor productivity (TFP) in the two sectors. We gave up this approach because some of the results seemed to be highly unconvincing. One example is as follows. In Spain, the growth of labour productivity in the nontradables sector has been sluggish – although positive in the long run – as can be seen in chart 2 below. A series for TFP indicates a steady and permanent decline in the *level* of TFP in the sector concerned. Because TFP is a product of labour productivity, Y/L, and capital productivity, Y/K, this result is obviously due to arbitrary measurement of the level of capital stock in the nontradables sector.

4 Sectoral Trends

Sectoral productivity growth rates and their differences can be seen in charts 3–5.

The first point to note is that, over the whole sample period, productivity in the tradables sector has grown more than in the nontradables sector (see chart 5). This holds for every single country and accords with the priors of the Balassa-Samuelson productivity hypothesis.

Tradables sector

Chart 3 introduces the growth rates of labour productivity in each of the nine countries for which the data was available. In addition, average annual growth rates are indicated for a period that starts with 1970 – in all cases where the data exists – and for a period that starts with 1985. For each country, the dotted line shows the average for the longer observation period, whereas the solid line gives the growth rate for the post-1985 period. These averages are also shown as numbers below each graph.

Two general conclusions are as follows. First, in most countries, longer-term productivity growth has been relatively stable despite considerable short-term swings. Second, there have been important differences in growth rates across countries. In the post-1985 period, productivity growth in manufacturing was fastest in Finland, 5.8 per cent p.a. This is a result of the exceptionally deep recession of 1991–1994, during which an incredible number of manufacturing employees were laid off and as a result labour productivity increased 6–10 per cent p.a. for three recession years in a row. This should be taken into account in evaluating future growth prospects for labour productivity in Finland. In particular, recent growth rates should not be extrapolated to the future.

In Portugal, average productivity growth in 1987–1993 was 4.5 per cent. In West Germany in the post-1985 period, manufacturing productivity grew by only 1.2 per cent p.a. on average. In Spain the growth rate was 2.3 per cent p.a. and in Netherlands somewhat higher at 2.8 per cent p.a. In the rest of the countries, the corresponding figures are between 3 and 4 per cent.

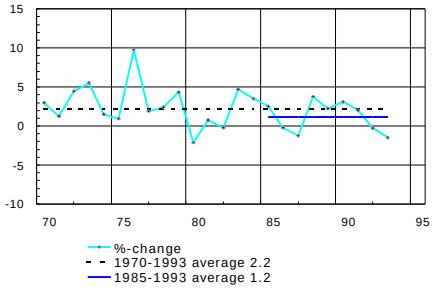
The most remarkable slowdown in productivity growth has occurred in Germany, Belgium and Spain. In Germany, annual average growth was 2.2 per cent for 1970–1993 and 1.2 per cent for 1985–1993. In Belgium, the figures are 4.2 for 1976–1994 and 3.0 per cent for 1985–1994. In Spain, the figures are 3.3 for 1976–1993 and 2.3 for 1985–1993. A marginal deceleration can also be detected for the Netherlands.

Finland is the only country in which a considerable acceleration took place. Average growth there was 4.2 per cent in 1970–1995 and 5.8 in 1985–1995. A marginal acceleration can also be detected for France.

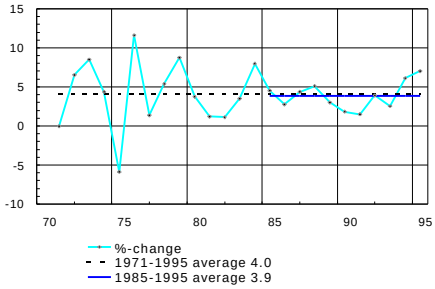
With respect to relative performance of different economies, the major differences as compared to Canzoneri et al (1996) are as follows. In our analysis, labour productivity in the Spanish tradables sector has not been growing at a particularly high rate. Perhaps the high productivity growth in agriculture – which Canzoneri et al include in the tradables sector – have led the authors to that conclusion. On the contrary, in France the corresponding growth, according to our data, has not been particularly slow – as Canzoneri et al indicate – but rather fairly robust.

Chart 3. **Productivity growth, %-change,** Tradables sector

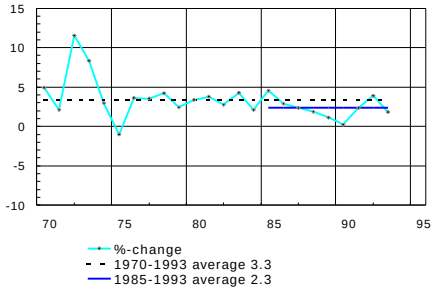
GERMANY



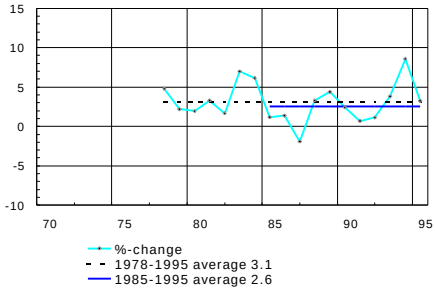
ITALY



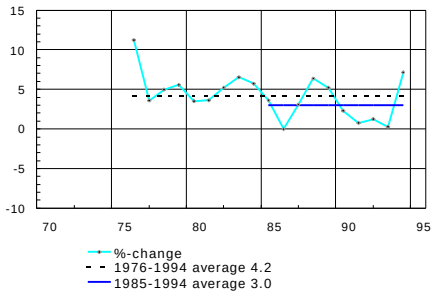
SPAIN



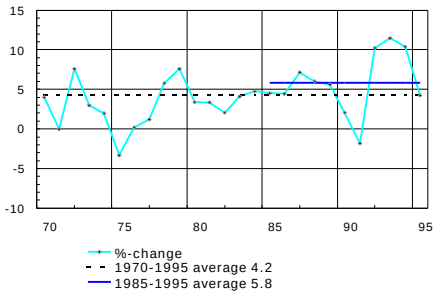
NETHERLANDS



BELGIUM



FINLAND



Nontradables sector

In the nontradables sector in the post-1985 period, the average annual growth of labour productivity has varied from nill in Spain, Portugal and the Netherlands to 2½ per cent in Finland. In Germany, France and Italy nontradables sector productivity growth averaged 1¼–1½ per cent and in Austria and Belgium somewhat less.

In general, growth rates look very stable over the observation period (chart 4). Spain is the only country in which there has been a notable slowing of the growth of labour productivity in the nontradables sector.

All in all, it seems doubtful that our data on labour productivity in the nontradables sector is due to a data-generating process in which catch-up convergence is taking place in the service industries.

As far as the nontradables sector is concerned, our results differ from those in Canzoneri et al (1996) in the following respects. In our study, France and Germany are not among the 'low growth' countries but are instead 'high growth' countries. Furthermore, Belgium and Spain are not among the 'fast growth' countries but are instead 'low growth' countries. The most obvious possible explanation for this contradiction is that Canzoneri et al (1996) include the public sector in their analysis and we do not. This may be an important difference since, in the System of National Accounts (SNA), public sector productivity growth is by definition nearly nill.

Productivity growth differentials across sectors

In this section we examine the difference between labour productivity growth in the tradables and nontradables sectors. Changes in these differentials can be seen chart 5.

Somewhat surprisingly, in spite of considerable differences in sectoral productivity growth rates, the growth differentials are quite homogenous across the countries, with two exceptions: Germany and Portugal.

Because of the slow growth in tradables productivity and relatively fast growth in the nontradables productivity, there has been a 'negative' average growth differential between sectoral growth rates in Germany. That is, in Germany nontradables productivity has grown more than tradables productivity in the post-1985 period. In Portugal, for the opposite reason, the growth differential was 4½ per cent. Of course, the data available for Portugal covers such a short period that this result must be considered with particular caution.

Chart 4. **Productivity Growth, %-change,** Nontradables sector

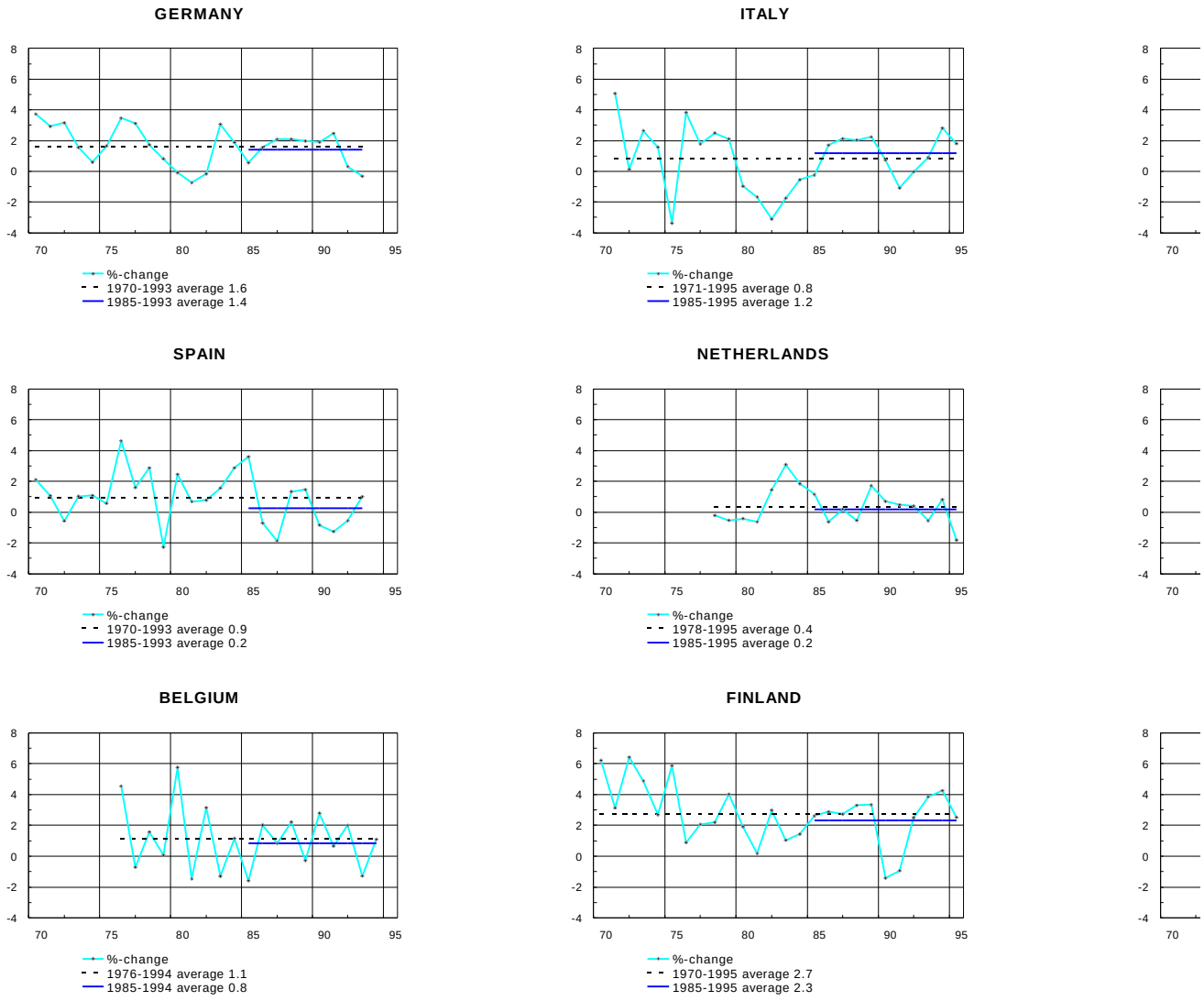
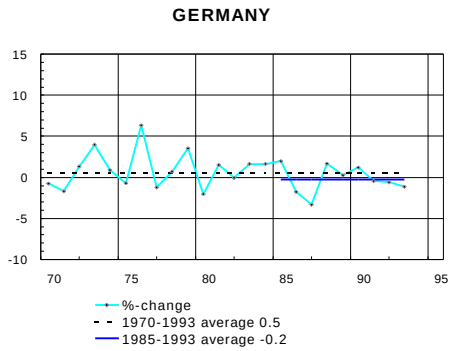
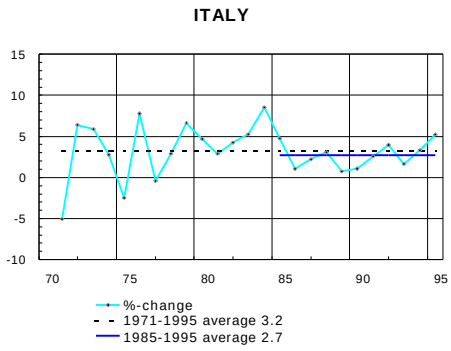
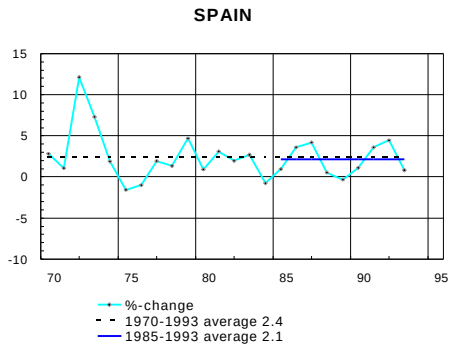
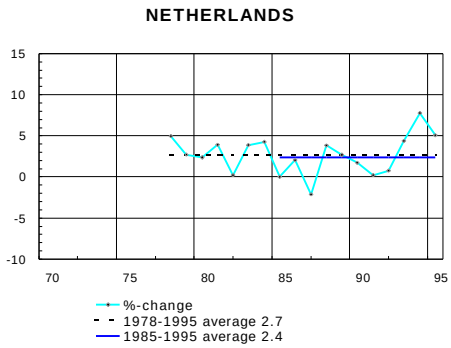


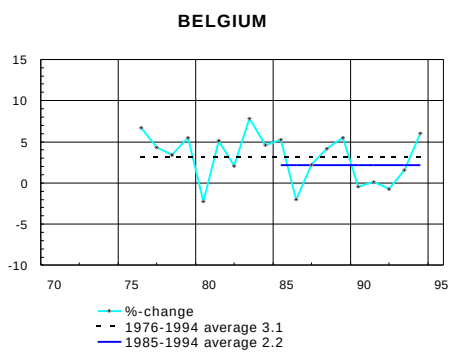
Chart 5. **Productivity Growth Differential, %-points,** Tradables sector – Nontra

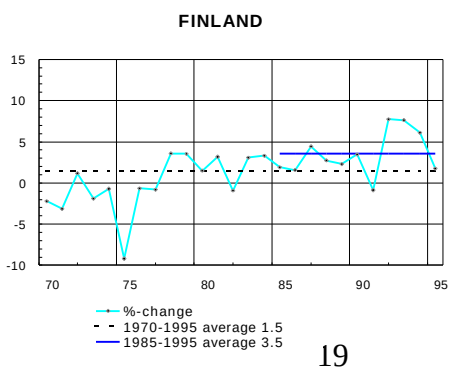












In all other countries the growth differential is 'positive' and surprisingly homogeneous across countries. Relevant measures probably vary between 2 and 3 per cent p.a. on average.

In Finland, due to the exceptionally rapid growth of manufacturing productivity during and after the recession of the 1990s, the growth differential of 3.5 per cent can be considered as an exceptional phenomenon. Because of this, we report in table 5 two measures for the growth differential for Finland. A more plausible estimate, which lies between these two figures, is the above-specified range for the other countries.

The most important differences as compared to Canzoneri et al (1996) are as follows. Both studies find that in Germany the duality in productivity growth is particularly weak. Canzoneri et al indicate that in France the differential is somewhat larger, with which we agree. Finally, Canzoneriet al conclude that in Belgium, Italy and Spain the relevant growth differential is particularly large. Our data do not confirm this but instread indicate that the difference between these countries and France is fairly small, as can be seen in table 2.

Table 2 summarizes the information presented in charts 3–5 for the period 1985–1993. For this period there are data available for all the countries. On the other hand, for evaluating trends in the years to come, more recent past may well be more indicative.

The most important conclusions of the discussion in this section are as follows. In the longer term, labour productivity has grown faster in the tradables sector. However, in Germany the opposite has been true in the post-1985 period. Second, Spain, which is one of the potential catch-up countries, has displayed low productivity growth in both the tradables and nontradables sectors. This challenges the view that productivity growth should be higher in countries with lower per capita income. Third, in addition to the Netherlands, productivity performance in the nontradables sector has been particularly poor in Spain and Portugal. This challenges, in the present country setting, the view of Bernard and Jones (1996) according to which the catch-up process is presently led by the service sector.

Table 2. **Average Annual Growth Rate of Labour Productivity in the Period Concerned, per cent**

	Period	Tradables sector (A)	Nontradables sector (B)	Growth differential (A)–(B)
Germany	1985–93	1.2	1.4	-0.2
France	1985–95	3.3	1.4	1.9
Italy	1985–95	3.9	1.2	2.7
Austria	1985–95	3.6	0.8	2.9
Belgium	1985–94	3.0	0.8	2.2
Finland:1	1985–95	5.8	2.3	3.5
Finland:2	1970–95	4.2	2.7	1.5
Netherlands	1985–95	2.6	0.2	2.4
Portugal	1987–93	4.5	-0.2	4.6
Spain	1985–93	2.3	0.2	2.1
Average		3.4	1.1	2.3

5 Sectoral Levels

5.1 Problems Related to Conversion

In section 2, value added for each country was converted using PPPs published by the OECD. PPPs calculated for the total value added may however be seriously biased if used for disaggregated data. Pilat (1996) suggests that there are two basic methods for solving this problem. The first one is called the 'production approach'. The other is an extension of the PPP approach. Sources of problems related to each of the methods are as follows (for a more detailed discussion, see Pilat, 1996).

When the so-called *production approach* is used, the appropriate conversion factors for productivity comparisons at the sectoral level need to be derived from comparisons of *producer prices* for specific goods. This data is usually not available. When 'unit values' are used instead, quality differences between countries are not properly accounted for. Furthermore, many industries are not covered in data on unit values. Finally, in an analysis based on value added by industry, conversion measures for both output and intermediate input are required. In practice, conversion factors for intermediate input are very difficult to derive in a cross-country context.

Although the production approach is theoretically the correct approach, authors have generally used the more widely available *price information on the expenditure side*. Extensive data sets are however available only for selected years.

There are five problems in using *expenditure PPPs* for sectoral productivity comparisons. First, PPPs include also distribution and transport margins because they are based on price comparisons at the retail level (for most consumer goods) or wholesale level (for most investment goods).

For the same reason, differences in VAT and other indirect taxes (and subsidies) across countries affect the measurement. Third, imported goods are taken into account in expenditure comparisons but should be excluded from producer price comparisons. Fourth, expenditure comparisons only cover final consumption. Intermediate goods, which comprise the bulk of output in many sectors, are not covered. Finally, no information is available on prices of intermediate goods, which would be needed for the double deflation.

The magnitude of potential errors due to the choice of measures becomes obvious from table 3, which presents alternative conversion factors for manufacturing output. The countries concerned are those EMU coutries for which Pilat (1996) provides information. For example, the upper part of table 3 indicates that the productivity of manufacturing in the Netherlands is 9 percentage points higher than that of Germany when based on the industry-of-origin approach instead of 3 percentage points according to the measure based on expenditure PPP for total GDP. The lower part of the table indicates that the choice of method is a matter of importance in each country considered.

Table 3. **Alternative Conversion Factors for Manufacturing Output, 1990**

(national currency units per DEM, converted by different methods)

	Expenditure PPP for total GDP	Expenditure PPP, adjusted for margins and imports/exports	Industry-of-origin PPP[1)]	PPP from mixed approach [1)]	Exchange rate
Germany	1.00	1.00	1.00	1.00	1.00
France	3.16	3.42	3.37	3.32	3.34
Italy	679.9	848.8	n.a.	n.a.	735.0
Netherlands	1.03	n.a.	1.09	1.10	1.12

(national currency units vis-á-vis own currency in PPPs for total GDP when converted with different methods)

	Expenditure PPP for total GDP	Expenditure PPP, adjusted for margins and imports/exports	Industry-of-origin PPP[1)]	PPP from mixed approach [1)]	Exchange rate
Germany	1.00	1.13	1.01	1.06	.78
France	1.00	1.22	1.07	1.11	.83
Italy	1.00	1.41	n.a.	n.a.	.84
Netherlands	1.00	n.a.	1.06	1.14	.84

[1)] Industry of origin PPPs and PPPs using mixed approach are originally for 1987 but were updated to 1990 using deflators for manufacturing value added so as to make them comparable with the other conversion factors.

Source: Data used in the table is from Pilat (1996).

In spite of the problems, most studies have used expenditure PPP's, often making crude adjustments for some of the problems. We discuss below two sets of data. First, we calculate sectoral labour productivity levels using annual expenditure PPPs for total GDP. Because of the fact that potential errors in this comparison may be of considerable magnitude, we also provide – although for a limited country settings – productivity levels with conversion carried out using the industry-of-origin approach. These data come from Pilat (1996) and are available only for selected years and seven of the eleven EMU countries. Here, data are missing for Italy, Austria, Ireland and Luxembourg.

5.2 Sectoral Levels – First View

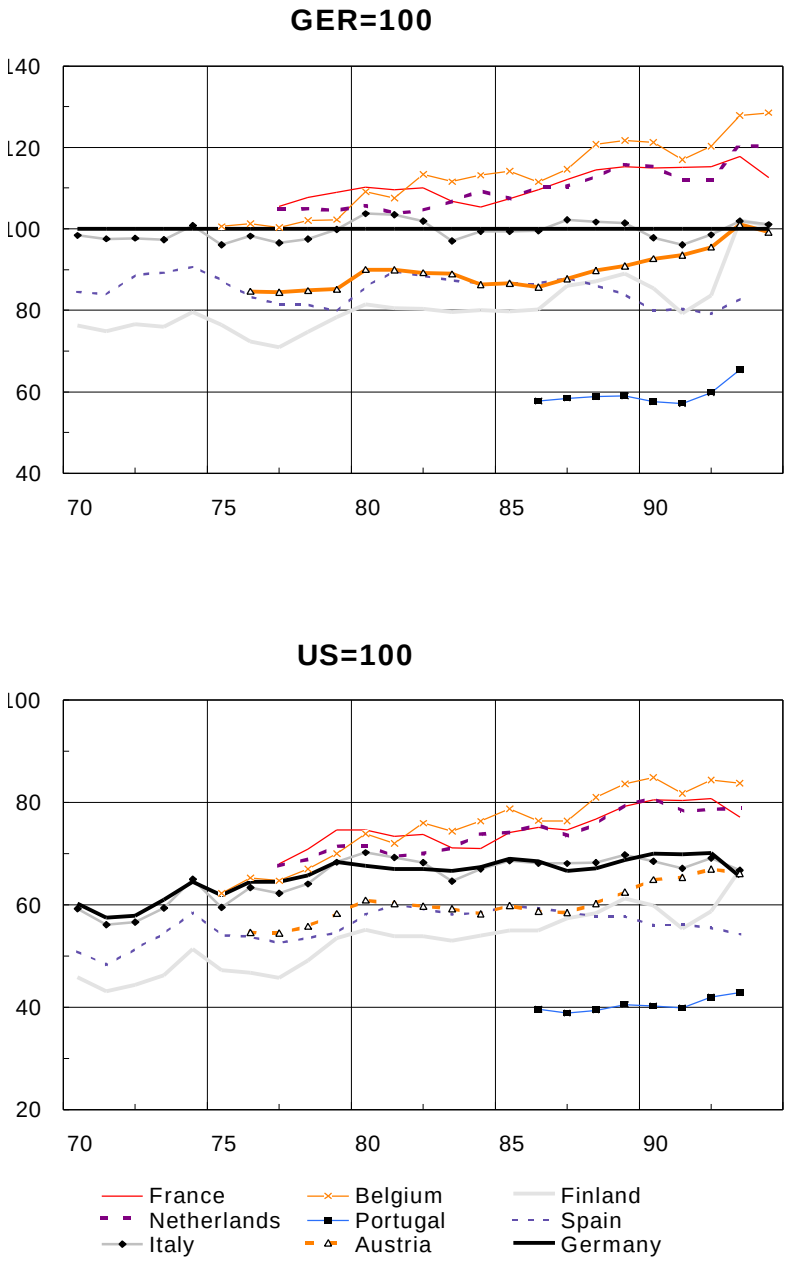
Chart 6 reports, for the tradables sector, annual labour productivity levels using aggregate PPP's for convertion. In the upper panel, the data has been normalized vis-á-vis Germany and in the lower panel vis-á-vis the United States.

Most countries seem to have improved their productivity performance relative to Germany. In this respect, Italy and Spain are the only exceptions. In the present comparison, the level (per person employed) of labour productivity has been very similar to that in Germany. For Spain, the negative gap has been considerable and – somewhat surprisingly – it has even been growing in more recent years. Finland and Austria have succeeded in catching up with Germany while Belgium, France and the Netherlands have been able to widen their productivity edge. As can be seen from the lower panel, in all EMU countries labour productivity in manufacturing is still considerably below the US level.

As far as the nontradables sector is concerned, the outcome is different in many respects. The lower panel of chart 7 indicates that labour productivity has improved more quickly in the European countries. France, Belgium and Spain have even surpassed US labour productivity. The other surprising outcome is that Germany seems to have improved its relative position among the European economies in the post-1985 period. The same holds for Finland for the whole observation period. For time being, the best performers among the European countries in this comparison seem to be France, Belgium – and Spain. The relative position of the Netherlands has been on a downward trend since the mid-1980s.

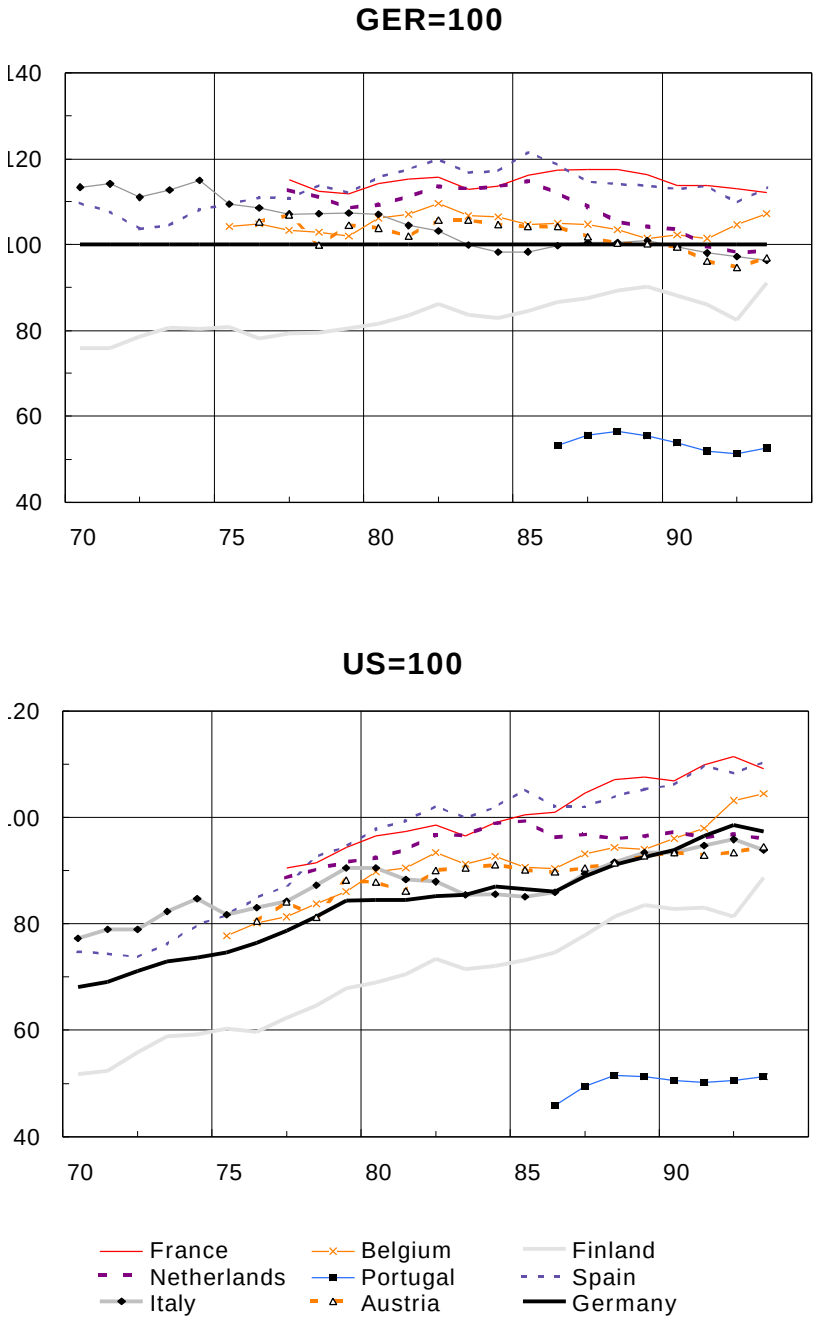
Because of imprecision of the conversion method, the above results must be viewed with caution. In order to consider the issue from another angle, we present another set of data below.

Chart 6. **Relative Labour Productivity Levels in Tradables Sector**



Labour productivity = Value added per person employed at annual PPP.

Chart 7. **Relative Labour Productivity Levels in Nontradables Sector**



Labour productivity = Value added per person employed at annual PPP.

5.3 Sectoral Levels – Second View

Pilat (1996) presents sectoral information on productivity levels with estimates of sectoral PPPs used for conversion. Although the sectoral breakdown is different from ours, for comparitive purposes, it may be useful to consider these data as well.

Manufacturing

Chart 8 presents relative levels of labour productivity in manufacturing in some EMU countries. The productivity level in the US is used as a benchmark. The data are from Pilat (1996) and they include information on productivity, not only per person employed but also per hour.

Above, we considered US manufacturing as the world leader in labour productivity. We also presented some evidence in chart 6 on the weakness of the catching-up vs the US.

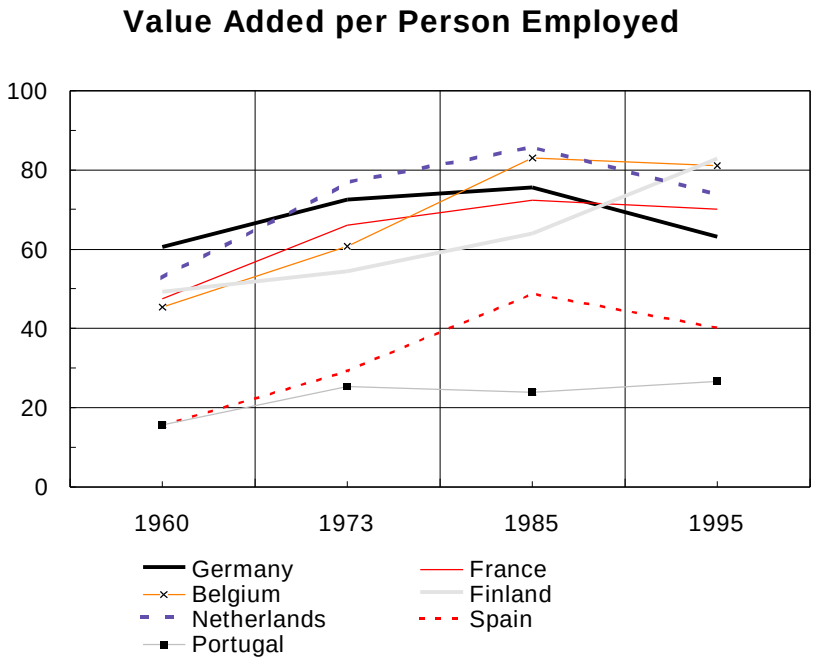
Chart 8[5] confirms the validity of both of these *a priori* views. Value added *per person* employed is still considerably lower in Europe than it is in the US. However, because of longer working hours in the US, the gap in the value added *per hour worked* is of much smalller. As a matter of fact, this measure even indicates that some European economies (Belgium, Finland and the Netherlands) have reached the US hourly productivity level in manufacturing.

The other interesting point is about the catch-up process. First, a considerable amount of catching up has already taken place and the gaps between EMU countries vs the US are now much smaller than they were in 1960. Second, the catch-up process, which proceeded quite smoothly, more or less came to a halt in the mid-1980s. In this respect, Finland is the only exception. The buoyancy of the US economy and the sluggish growth in Europe during the last decade is the likely explanation for the halting of the catch-up process. In the post-1985 period, the relative performances of Germany and Spain have been particularly poor.

What about value added per hour worked? In general, the halt in the catch-up process can be seen here as well. Finland's exceptional progress is even more striking in the lower panel of chart 8. Another spectacular success is the progress of the Spanish manufacturing industry between 1973 and 1985. Since then however, this favourable trend has been reversed.

[5] There were no reliable data on productivity in manufacturing for Austria, Ireland, Italy and Luxemburg (see Pilat, 1996).

Chart 8. **Relative Labour Productivity Levels in Manufacturing, 1960–95, US = 100**



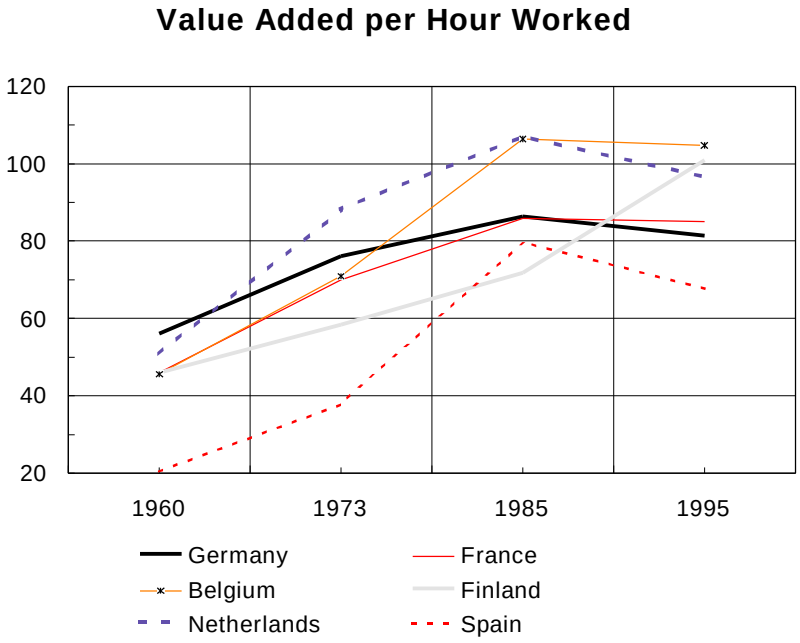


Table 4 contains the data used in Chart 8 but normalized by setting the productivity level in Germany at 100. This makes comparisons between the European countries more straightforward. The most important conclusions are as follows.

Of the seven countries concerned, the highest productivity levels in manufacturing in 1995 were achieved in Belgium, Finland and the Netherlands. The levels in France and Germany were somewhat lower. In this comparison, Germany ranks only fifth among the seven countries studied. Labour productivity in Spanish manufacturing is considerably below the average for the countries concerned[6]. Finally, Portugal is clearly an outlier. There the level of labour productivity in manufacturing is less than half the level achieved in the more advanced EMU countries.

In the present context, it is also of interest that the qualitative view related to the catch-up process in *manufacturing* is not dependent on the productivity measure chosen (per employee or hour). Second, developments reported for *manufacturing* here and the *tradables sector* above yield similar relative performances. In sum, neither the choice of productivity measure nor sectoral breakdown leads to qualitatively different implications.

Table 4. **Relative Labour Productivity Levels in Manufacturing, 1960–95, GER = 100**

	1960		1973		1985		1995*	
	Value added per person employed	Value added per hour worked	Value added per person employed	Value added per hour worked	Value added per person employed	Value added per hour worked	Value added per person employed	Value added per hour worked
Germany	100	100	100	100	100	100	100	100
France	78	82	91	92	96	99	111	105
Belgium	75	81	84	93	110	123	129	129
Finland	81	82	75	77	85	83	131	124
Netherlands	87	91	106	116	113	124	117	119
Portugal	26	n.a.	35	n.a.	32	n.a.	42	n.a.
Spain	25	36	40	50	65	92	64	83

* Or latest available year.

Source: The table has been calculated using the information in Pilat, D. (1996): Labour Productivity Levels in OECD Countries: Estimates for Manufacturing and Selected Service Sectors, OECD, Economics Department Working Papers No 169.

[6] A case study by McKinsey (1994) examines the productivity level in the motor vehicles & equipment industry in 1992, covering four of the countries studied in this paper. If the productivity level is defined as 100 in the US, Germany scored 59, France 57, and Spain and Italy each 40.

Services

Measurement of productivity levels in the service sector is a very complicated task (for a thorough discussion, see Pilat, 1996) and any estimates must be considered with caution. This also holds for the information in chart 7 above.
However, for some service industries, plausible productivity measures are available. Table 5 reports a selection of those for the eleven countries of interest.

Obviously there is considerable cross-country variation in sectoral productivity levels. This implies a substantial potential for further productivity growth in many countries. As stressed by Pilat (1996), the wide variation in productivity levels may also suggest that country-specific structural factors, such as regulation or lack of openness to international competition, inhibit productivity growth in some sectors.

In order to achieve a more general view, we proceed by studying country rankings. That is, we consider whether some countries should be considered 'high-productivity countries' and others 'low-productivity countries' in respect of service sector productivity.

Table 5 specifies nine productivity measures for seven sectors. It is straightforward to calculate the number of sectors in which a country is among the 3 best performers. Correspondingly, we can look at the three weakest performers (for which data are available). In table 5 the three highest productivity levels are in **bold** and the three lowest in *cursive.*

Columns 1 and 2 in table 5 give the sectoral rankings. Column 3 reports the arithmetical average of all seven to nine rankings for each country. This has been done despite at least three caveats that attach to the summary statistics. First, no attention has been paid to the relative sizes of different industries. Secondly, no account is taken of relative magnitudes of the productivity differentials that generate the ranking within an industry. Thirdly, for distribution and telecommunications, there are two alternative productivity measures, both of which enter the summary statistic. In spite of all these caveats, we think that the average rankings shed light on questions of interest.

The highest number of rankings *among the three best* is 5 for France and Luxembourg, 4 for Netherlands and 3 for Belgium and Finland. The highest number of rankings *among the three weakest* is 6 for Portugal, 5 for Ireland and 3 for Germany, Austria and Finland. Strikingly, Germany has only one ranking among the three best and 3 rankings among the three weakest.

Finally, table 6 reports the average rankings based on table 5. The numbers, although crude, seem to indicate that on average the highest overall level of service sector productivity has probably been achieved in France, Luxembourg and Netherlands. Belgium, Finland, Italy, Germany, Austria and Spain form the next group. Ireland and Portugal appear to have the lowest average level of productivity in services.

Table 5. **Productivity and Efficiency in Selected Service Industries**

	Electricity	*Distribution*		*Construc-tion*	*Airlines*	*Telecommunications*		*Postal Services*	*Railways*
	Gigawatt-hour per person employed, 1993	Distribution GDP per person employed, 1990 (GER=100)	Retail sales per employee, 1990 (GER=100)	Construction GDP per person employed, 1990 (GER=100)	Operating expense per available tonne kilometre, 1993 (US$)	Revenue per employee, 1992 (GER=100)	Mainlines per 100 inhabitants, 1992	Average technical efficiency, 1975–88(a)	Average technical efficiency, 1986–88(b)
Germany	*2.2*	100	**100**	100	0.71	100	44	*0.46*	*0.62*
France	**3.8**	**123**	**94**	110	0.88	108	**52**	0.72	**0.73**
Italy	*1.6*	121	72	112	0.72	**142**	41	**0.72**	0.64
Austria	*1.8*	111	73	**132**	*1.08*	123	44	n.a.	*0.59*
Belgium	**3.2**	**134**	93	**119**	*1.04*	*93*	43	0.60	0.63
Finland	3.1	*72*	85	**125**	**0.44**	*76*	**54**	*0.20*	0.65
Ireland	n.a.	*88*	60	n.a.	*1.46*	*84*	*31*	*0.36*	**0.73**
Luxembourg	n.a.	**129**	**129**	*82*	n.a.	**210**	**61**	**0.79**	*0.56*
Netherlands	3.1	121	*54*	*93*	**0.48**	**139**	49	**0.92**	**0.80**
Portugal	*1.2*	58	*52*	*51*	0.83	*93*	*31*	n.a.	0.69
Spain	**3.3**	*99*	*45*	115	**0.66**	118	*40*	n.a.	0.65

Note: Productivity leves among the three highest in the industry concerned appear in **bold** type; those among three weakest in *cursive.*

a) Defined as output relative to inputs, where output is the sum of the number of letters delivered and the financial operations performed, and inputs include employees, number of motor vehicles and number of postal offices used.

b) See note (a). Output is the combination of gross hauled tonne-kilometres by freight trains and gross hauled tonne-kilometres by passenger trains. The inputs are: engines and railcars, employment, and electrified and nonelectrified lines

Source: The table has been calculated using the information in Pilat, D. (1996): Labour Productivity Levels in OECD Countries: Estimates for Manufacturing and Selected Service Sectors, OECD, Economics Department Working Papers No 169.

There are two final points to be made. First, concerning European countries, the qualitative implications due to table 6 are very similar to those based on the upper panel of chart 7 above. In sum, this implies that the scope for catch-up productivity growth is probably greatest in the Irish and the Portuguese service sectors. Table 5 implies that there is also room for this kind of adjustment in several service industries in Belgium, Finland, Italy, Germany, Austria and Spain.

As far as the relative strength of the US service sector is concerned, the picture differs in the two comparisons. If the US were included in the comparisons in table 6, its score were by far better than that of any European economy. Of the seven measures for which data is available, the US service sector is among the three best in all of them. It has two number 1 positions, three number 2 positions and two number 3 positions. These rankings produce a summary statistic of 2, which is far below that of any individual European economy.

The picture one gets in the lower panel of chart 7 is different. As a result of strong catching up, labour productivity in the nontradables sector seems to have reached the US level in most EMU countries and to even exceed it in France, Belgium and the Netherlands. This confusion underlines the need for caution in the analysis.

Table 6. **Rankings of Productivity Levels in Selected Service Industries**

	Number of rankings among three best	Number of rankings among three weakest	Arithmetical average of rankings in various services*
Germany	1	3	5.9
France	5	0	3.9
Italy	2	1	5.4
Austria	1	3	5.9
Belgium	3	2	5.2
Finland	3	3	5.3
Ireland	1	5	8.0
Luxembourg	5	2	3.9
Netherlands	4	2	4.0
Portugal	0	6	8.5
Spain	2	2	6.0

* The smaller the statistic, the more efficient theservice sector in the country comparison.

6 Summary

This paper examines levels and growth rates of labour productivity in ten EMU economies: Germany, France, Belgium, Netherlands, Austria, Finland, Ireland, Spain, Portugal and Italy.

In general, European economies still lag behind the US productivity level. As far as the *tradables sector* (mainly manufacturing) is concerned, most reliable estimates indicate that Belgium, France, the Netherlands, and more recently perhaps also Finland, are the best performers among the European countries. The room for catch-up growth seems to be great in Spain and even more so in Portugal. For Ireland, relevant sectoral data were not available.

In the *nontradables sector* (mainly services), particular caution as to conclusions is well advised. Most European economies seem to have improved their performance relative to the US. However, outcomes in different branches are highly heterogenous. This also implies that there is probably room for sectoral catch-up growth in all the economies studied. This room seems to be the largest in Portugal and Ireland, and the smallest in France, Belgium, Luxembourg and the Netherlands. The rest of the countries are in between. For Spain and Finland different comparisons give mixed results.

According to the standard results of many studies, productivity growth tends to be faster in the tradables sector than in the nontradables sector. In the well-established Balassa-Samuelson model this is the driving force of dual inflation.

In our sample of countries, this finding holds with one exception. In Germany, productivity in the nontradables sector has grown more than that in the tradables sector in the post-1985 period. The other extreeme is Portugal where the annual growth of labour productivity in the tradables sector exceeded by 4½ percentage points the growth in the nontradables sector in the post-1985 period.

In the rest of the countries, the magnitude of the growth differential seems to have been surprisingly homogeneous. It has varied between 2 and 3 percentage points p.a. on average.

Summing up, labour productivity in Portugal is considerably lower than the EMU average. Because of uncertainties related to any measuring of productivity levels and the fact that the industrial composition is different in each country, we are hesitant to classify the rest of the countries as ’high-productivity countries’ or ’low-productivity countries’. This also implies that the hypothesis that Germany is a productivity leader among the EMU countries can be firmly rejected. At the level of total GDP, labour productivity is above the German level in Belgium and the Netherlands. It is below it in Portugal and to a lesser extent in Finland, Spain and Ireland. In France, Italy and Austria the level of GDP per person employed is very similar to that in Germany.

With respect to overall labour productivity, all EMU economies lag behind the US. It is probably safe to say that Ireland, Portugal and Spain have the largest scope for catch-up productivity gains in the future. In the tradables sector, there is scope for a strengthening of the catch-up in most EMU countries. This conlusion also holds for the nontradables sector, although here the relative performances of various branches are highly heterogenous across the countries.

Regarding economic and structural policy, two questions are straightforward. First, how could the productivity gap vs the US be narrowed more quickly? Such a narrowing would support international competitiveness of enterprises in the euro area and contribute to a reduction of EMU unemployment. Second, how could productivity growth be enhanced in the nontradables sector? This would help to avoid inflationary tendencies generated by behaviour in accord with the Balassa-Samuelson hypothesis.[7]

[7] On this issue, see Alberola and Tyrväinen (1998).

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