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Catching-up, then Falling Behind: Comparative Productivity Growth between Spain and the United Kingdom, 1950-2004

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Catching-up, then falling behind: Comparative productivity growth between Spain and the United Kingdom, 1950-2004*

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Abstract

The pattern of Spanish comparative labor productivity performance in the period 1950-2004 is underpinned by distinctive sectoral trends. From 1950 until the mid-1970s, Spain narrowed the aggregate labor productivity gap with Britain by shifting resources out of agriculture and by improving its comparative labor productivity position across most sectors, out of which manufacturing plays a central role. Significant improvements in comparative efficiency and the dynamic pace of comparative capital intensity characterize the catch-up phase. In the period 1975-1990 convergence stagnates. In spite of the continual shift of resources out of agriculture and the good comparative performance of small sectors, such as utilities, transport and communication, and agriculture itself, comparative labor productivity was adversely affected by the catching-up exhaustion of manufacturing and construction and by the deterioration of comparative labor productivity in services. A dramatic slowdown in efficiency gains characterizes the plateau phase. Lastly, Spain has widened the aggregate labor productivity gap since the early 1990s. The deterioration of Spain's relative productivity position with Britain has affected all sectors except agriculture. Efficiency stagnation characterizes the divergence phase.

Keywords: Labor productivity; Total factor productivity; Sectoral disaggregation; International comparison; Spain.

JEL Classification: N10; N30; O14; O47; O57.

1. Introduction

Spain is often considered a very good example of the European catching-up experience in the second half of the twentieth century (Caselli and Tenreyro, 2004). Indeed, in 1950, Spain was an impoverished country with relative income per capita at 23 and 31 percent of the United States and the United Kingdom levels, respectively, while in 2005 these figures had climbed to 55 and 75 percent.[1] However, such outstanding economic performance, a sort of textbook success on convergence, masks a distinctive failure, pervasive over several decades, and which shows its consequences in full strength in what observers witness today, i.e. from the lack of competitiveness of domestically produced goods and services to high unemployment. As early as the mid-1970s, Spain entered a period of underachievement in labor productivity terms that embarked her into a path of productivity *divergence* with respect to the world leading economies. This pervasive productivity failure casts serious doubts on the permanent nature of the per capita income gains that Spain has already achieved, as a sustainable high rate of per capita income growth will necessitate of an established culture of technological enterpreneurship and continued improvement in educational attaintment, it outlines the natural limits that employment expansion places to per capita income growth over the long-term, and it serves as a historical lesson to newly converging countries of the Eastern European periphery that may be reflecting upon the kind of institutional reforms to implement in order lead their economies into an era of high long-term productivity growth.

In order to document the "catching-up, then falling behind" productivity thesis, the paper presents new evidence on the comparative labor productivity performance of the Spanish economy over the period 1950-2004. In particular, the paper uses sectoral data on quantities, prices, and employment to construct a complete benchmark of comparative labor productivity levels between Spain and the United Kingdom dated as far back as 1968 and covering a total of nine sectors that divide the economy (Rostas, 1948; Pilat, 1994; Broadberry, 1997a). Broadly speaking, the construction of the benchmark estimates involves cross-country match-

[1] The gross domestic product (G.D.P.) data is expressed in 1990 U.S. dollars converted at Geary-Khamis P.P.P., from The Conference Board, Total Economy Database, January 2009.

ing of quantities and prices of products in each sector in order to obtain a conversion factor or unit value ratio that can then be applied to convert value added into a common currency and hence to calculate a figure of comparative sectoral labor productivity. Subsequently, the 1968 benchmark estimates are extrapolated to derive long-run series of comparative labor productivity by sector of the economy and for the aggregate economy (van Ark, 1993). More particularly, we apply value added and employment data from the newly released, internationally comparable EU-KLEMS database (1970-2004) and from the sectoral database in van Ark (1996). Once sectoral trends of comparative labor productivity are studied, the paper also explores the patterns of structural change in an attempt to draw a better informed view on the relative contribution of each sector to aggregate comparative productivity performance. Furthermore, the last analytical part of the paper constructs sectoral estimates of comparative total factor productivity (T.F.P.). In a growth accounting framework, the T.F.P. estimates are applied to quantify the contributions of comparative T.F.P. growth and comparative capital intensity growth to comparative labor productivity growth, both by major sector of the economy and for the economy as a whole.

Recently, the Spanish economic history literature has made significant advances in understanding the transformation of the economy during the last one and a half centuries. Prados de la Escosura (2003, 2007) shows that income per capita rose by fifteen times over the period 1850-2000, at trend growth rate of 1.9 percent per annum. According to Prados de la Escosura (2007), the long-run underperformance of the Spanish economy, measured in per capita income terms, can be ascribed to the slow growth rate recorded in the period 1850-1950. Income per capita grew, however modestly, in the hundred years up to 1950, thus rendering the division of a failed nineteenth century versus a successful twentieth one obsolete (Tortella, 1994a). Prados de la Escosura (2007) casts the second half of the twentieth century under a much more favourable light, as the historical evolution of per capita output data undoubtedly tells a story of success for that period. Close in spirit, the analysis in Prados de la Escosura and Rosés (2007) constitutes the largest effort to date to identify

the proximate sources of long-run growth in Spain. In a growth accounting framework à la Jorgenson applied over the period 1850-2000, Prados de la Escosura and Rosés (2007) explore whether G.D.P. growth has been mainly driven by factor accumulation or by T.F.P. growth. In the hundred years up to 1950, Prados de la Escosura and Rosés (2007) show that growth was mainly driven by capital accumulation. With regard to the second half of the twentieth century, Prados de la Escosura and Rosés (2007) identify T.F.P. growth as the driving force behind G.D.P. growth in the years 1951-1986, while Spain's accession to the European Union coincided with the beginning of a period characterized by a dramatic T.F.P. slowdown and by a return to capital accumulation, and to a lesser extent labor accumulation, as the main engine of G.D.P. growth.

This paper differs from, and thus intends to contribute to, this flourishing literature in a variety of ways. First of all, the focus of attention is on labor productivity. While acknowledging their respective role in explaining convergence, the presence of favourable demographic developments, the catching-up of labor market participation rates, and employment expansion, all place an upper-bound on per capita income growth. Thus, the evolution of labor productivity becomes the factor that guards the key for high long-term growth. Second, the paper places emphasis on the measurement and analysis of sectoral productivity trends as a way to identify the contribution of each sector to real economic convergence. And third, the paper adopts an international comparative perspective, which is thought necessary to properly document any story of convergence, thus it devotes substantial effort to construct disaggregated conversion factors between currencies in order to ensure cross-country comparability of labor productivity measures back in time. It is worth noting that the choice of reference country is not a straightforward matter, as any comparative study is shaped by the absolute performance of each country in the comparison. Yet, there is an obvious point of departure since, in order to document catching-up and convergence, the appropriate benchmark country must be a world leading economy. The United Kingdom was the European productivity leader in 1950. More particularly, by 1950, the U.K. employment structure

was already close to the structure that any catching-up country would aim at converging to, i.e. a low employment share in agriculture in favor of a high share in manufacturing and, increasingly so, in services. Furthermore, and in contrast to the United States - the other obvious candidate to compare with -, the United Kingdom was part of the *European core* towards which Spain would aim to integrate over the years. For these reasons, the choice of Britain appears somewhat superior to the choice of the United States as the reference country in this study.

In addition to the Spanish economic history literature, several recent accounts of European postwar economic growth find the Spanish experience of particular relevance. In Temin (2002), the unusually rapid economic growth experienced in Western Europe from 1950, the different growth rates achieved by different countries, and the end of this exceptional historical episode in the mid-1970s, can be largely ascribed to the excessively high share of labor in agriculture that Europe inherited after thirty disruptive years of wars and depression. The growth benefits of the *delayed* transition from agriculture are noticeable in the Spanish case. In Temin's (2002) empirical analysis, Spain starts with the highest share of agricultural labor in Western Europe and subsequently experiences the fastest growth rate in output per capita during the period 1950-1970. Close in spirit, Caselli and Tenreyro (2004) also find that the critical mechanism underpinning the convergence process of the European South (Greece, Portugal, Spain) to the European average (France) is associated with the vast labor shift out of low-productivity agriculture into high-productivity manufacturing and services, yet sectoral catch-up growth appears to have played a nontrivial role for Spain. In Caselli and Tenreyro (2004), Spain's experience in the second half of the twentieth century serves as an inspiring benchmark to the convergence prospects of the new member states of the European Union.

Overall, the relevant literature to date has placed emphasis on the analysis of aggregate macroeconomic data. Yet, macroeconomic aggregates contain limited information when it comes to consider the sources of catch-up growth and convergence. Sectoral data, both

within and outside manufacturing, have much higher information content and are therefore an essential factor to the proposed task. With this caveat in mind and drawing from the pioneering work of Rostas (1948) and Paige and Bombach (1959), a number of studies on comparative productivity performance have constructed benchmark estimates of comparative labor productivity at the aggregate level following a 'bottom-up' or sectoral approach (Pilat, 1994; Broadberry, 1997a; Broadberry, 1998). The benchmark estimates are then extrapolated in order to obtain long-run series of comparative labor productivity levels by sector of the economy and for the economy as a whole. This phenomenal exercise of constructing and assembling the comparative labor productivity series intends to provide the economic historian with valuable information on sectoral productivity trends, that can then be used to track down the mechanisms of catching-up. To date, the available studies have largely focused on the convergence experience of the world leading economies over the last one hundred and fifty years or so. As a result, we have a better understanding of the comparative labor productivity record of Britain, Germany, and the United States (Broadberry, 1998; Broadberry and Irwin, 2006) or, in other words, of the productivity race unleashed at the top. This paper is also a first attempt to contribute to this literature with a comprehensive study of the comparative labor productivity performance of a country in the *European periphery* (Spain) relative to a country in the *European core* (Britain) during the second half of the twentieth century. Thus, in the spirit of Paige and Bombach (1959), Smith et al. (1982) and Broadberry (1993, 1998), the paper uses sectoral analysis of comparative labor productivity to shed light to the productivity record of Spain and to identify the mechanisms behind the Spanish catch-up growth.

The results suggest that the period 1950-2004 witnessed three distinct phases of Spanish performance in comparative labor productivity. The first phase, from 1950 to 1975, is characterized by a fast convergence process. Convergence was driven by the significant contribution of manufacturing, both in terms of catch-up growth and structural change, and by the good comparative performance of smaller sectors, such as construction, utilities, and transport

and communication. Service sectors also contributed to Spain narrowing the aggregate labor productivity gap, certainly so in the last stage of the catch-up phase.[2] The convergence process stagnated during the period 1975-1990. Three sectoral trends underpin the aggregate stagnation: first, sectoral convergence in manufacturing and construction slowed down substantially and reversed towards the end of the 1980s, second, in the mid-1970s services entered a period of steady deterioration in comparative labor productivity performance, and third, the good performance of utilities and transport and communication, together with a revival in the comparative productivity performance of agriculture, were instrumental factors in keeping aggregate comparative productivity at a stationary level. The third phase spans from 1990 up to 2004 and, with the exception of agriculture, is characterized by generalized sectoral divergence. The importance of the service economy at this stage of Spanish development indicates that the declining trend in service sector comparative labor productivity has much to account for divergence at the aggregate level.

The sectoral growth accounting disaggregation of comparative labor productivity provides valuable explanatory insights on the phases identified above. The aggregate evidence for the three phases of comparative performance indicates, firstly, that comparative capital intensity has always contributed positively to comparative labor productivity growth, although its contribution has diminished over time, secondly, that a surge in comparative T.F.P. growth explains, to a significant extent, the catch-up growth of the first phase, and finally, that the persistent deterioration in comparative T.F.P. performance recorded in both manufacturing and services since the mid-1970s has eroded a significant part of the gains in comparative labor productivity previously achieved.

Spain experienced a dictatorial system up to 1975, a transition to democracy period in the years 1975-1986, and an era of full-fledged Western European integration that started with the membership of the European Union in 1986. Tortella (1994b), Prados de la Escosura and Sanz (1996) and Fusi and Palafox (1997), among others, document the institutional develop-

[2] In this study, services include three categories: finance and distribution; community, personal and social services (including hotel and restaurants); and government services.

ments and the macroeconomic policies adopted in Spain over the second half of the twentieth century. Regarding the main sectoral developments, it is worth pointing out that the good comparative performance of manufacturing during the catch-up years can be ascribed to the wave of (partial) economic liberalization that started in the early 1960s in conjunction with the favourable external economic environment (Carreras, 1987). Yet, despite noticeable improvements, the Spanish manufacturing sector remained highly regulated, subsidized, specialized in low-technology labor-intensive goods and shielded from international competition (Tortella, 1994b). The industrial restructuring that took place in the early 1980s as a consequence of the two Oil Shocks proved inadequate to set up the basis for a new era of catch-up growth. The service sector suffered from not very dissimilar problems. Traditionally, it has been dominated by labor-intensive low-value added per employee services, largely structured around small or very small scale firms that have tended to favour investment in infrastructure and construction rather than in capital goods (Gordo, Jareño and Urtasun, 2006). The evolution of agriculture is a noticeable case of sectoral development in Spain. Throughout the 1960s, the large labor shift out of agriculture was accompanied by high agricultural labor productivity growth. The latter can be explained by a rapid process of capital deepening, facilitated through the entry of machinery and equipment that resulted from the partial economic liberalization plan of the early 1960s (Tortella, 1994b). However, at the same time, the agricultural sector in the United Kigdom was enjoying large efficiency gains. Substantial improvements in T.F.P remained unseen in Spain until the mid-1980s. For the period 1985-1999, the average annual growth rate of comparative labor productivity stood at 4.8 percent while comparative T.F.P. growth surged to 3.6 percent annually. Interestingly, this surge in comparative efficiency occurred at the time of Spanish accession to the European Economic Community, which points towards a positive effect of European integration on agricultural productivity.

Overall, the comparative analysis carried out in this paper dates the mid-1970s as the beginning of the persistent productivity failure of the Spanish economy and the turning point

in the "catching-up, then falling behind" productivity thesis. The end of the dictatorship in 1975 brought to surface the distortions that had prevented the market from playing its role as the efficient mechanism to allocate resources in the economy. Amid a myriad of political and economic changes, from the draft of a new Constitution to the legalization of trade unions, we may tentatively argue that the 'transition to democracy years, 1975-1986' (Prados de la Escosura and Rosés, 2007) were a lost opportunity to devise the structural reforms that would have led the economy into an era of sustained, high productivity growth. On hindsight, these reforms might have addressed the development of an incentive structure to encourage private scientific research and development investment and to promote educational attaintment and excellence as the basis for long-lasting productivity gains.[3]

The remainder of the paper is organized as follows. Section 2 examines the sources of growth in living standards in postwar Spain and compares them to the United Kingdom. Section 3 presents the benchmark estimates of comparative labor productivity levels constructed for 1968, by sector of the economy and for the aggregate economy; it also studies the long-term series obtained by extrapolation. In Section 4, we assess the role of structural change by shift share analysis. Section 5 presents postwar estimates of comparative T.F.P. and carries out the growth accounting decomposition of comparative labor productivity growth. Section 6 concludes.

2. Comparative living standards in the second half of the XXth century

This section accounts for the sources of growth in living standards in postwar Spain and places them in comparison to those of the advanced British economy. The decomposition of output per capita is as follows:

$$\frac{Y}{N} = \frac{Y}{H} \cdot \frac{H}{E} \cdot \frac{E}{N_{15-64}} \cdot \frac{N_{15-64}}{N} \tag{1}$$

[3] In a study that focuses on the post-1995 productivity performance of the Spanish economy, Doménech (2008) outlines the quantity and quality of human capital, the level of research and development investment, the regulatory environment around private enterprise, and the average size of firms, as the most relevant ultimate explanations of the productivity gap.

where Y denotes output, N population, H total hours of work, E employment, and N_{15-64} denotes population from 15 to 64 years of age. Taking logs and time derivatives to expression (1) yields the above decomposition expressed in growth rates:

$$g_{\frac{Y}{N}} = g_{\frac{Y}{H}} + g_{\frac{H}{E}} + g_{\frac{E}{N_{15-64}}} + g_{\frac{N_{15-64}}{N}} \tag{2}$$

where the growth rate of output per capita ($g_{\frac{Y}{N}}$) equals the sum of the growth rate of output per hour ($g_{\frac{Y}{H}}$), the growth rate of average hours of work ($g_{\frac{H}{E}}$), the growth rate of the employment rate ($g_{\frac{E}{N_{15-64}}}$), and the demographic rate ($g_{\frac{N_{15-64}}{N}}$). Note that the sum $g_{\frac{H}{E}} + g_{\frac{E}{N_{15-64}}}$ is the growth rate of the volume of labor input. Table 1 reports the results of the accounting exercise laid out in expression (2) for the Spanish economy during the period 1960-2005.

*** INSERT TABLE 1 HERE ***

The following findings are worth highlighting. From 1960 onwards, Spain experienced substantial growth in living standards, largely underpinned by the good performance of labor productivity growth. After an exceptionally high growth record during the 1960s, Spain deccelerates in the following two decades. The diminishing growth pace during the 1970s and 1980s rests upon both, a slowdown in labor productivity growth and negative growth in the volume of labor input. For the period 1990-2005, the contribution of these components reverses: labor productivity growth embarks on a fifteen-year long period of poor performance and the volume of labor input experiences the highest growth seen in the second half of the twentieth century. Towards the end of our sample period, the growth rate in living standards is clearly sustained by more work. Given that the current employment rate in Spain remains among the lowest across the OECD (Faggio and Nickell, 2007), there is still certain scope for future growth in living standards through employment expansion.

Table 1 also reports the growth accounting components of expression (2) for the United Kingdom. The growth rate of living standards in the United Kingdom has been remarkably

stable. For the period under consideration, output per capita grew at an annual average rate within the band of 1.8 to 2.4 percentage points. In terms of its components, labor productivity growth gradually deccelerated from a figure of 3.4 percent in the 1960s to a figure of 2 percent in the first five years of the new century. The volume of labor input has continuously recorded negative growth, largely driven by lower hours of work per employee. Throughout the period, the proceeds of Britain's labor productivity growth have been spread among those employed in the form of lower average working hours.

*** INSERT TABLE 2 HERE ***

Table 2 reports the differences between Spain and the United Kingdom in the growth accounting components of expression (2). Thus, it provides the evidence of a process of convergence in labor productivity between Spain and the United Kingdom. The convergence process was intense during the 1960s and 1970s, and continued, albeit at a much slower rate, during the 1980s. After such remarkable convergence path, the Spanish economy entered a period of divergence in labor productivity that accelerated around the turn of the century. Since the mid-1990s, the United Kingdom has experienced the fastest labor productivity growth among the large European Union states, while Spain is placed at the lower end of the productivity race (Timmer, O'Mahony and van Ark, 2007).

Further evidence on comparative labor productivity performance is reported in Table 3. It broadly confirms the long-term pattern described above, in particular, the remarkable catch-up period of the Spanish economy. Yet, it suggests that convergence in labor productivity stagnated as early as the mid-1970s.

*** INSERT TABLE 3 HERE ***

The rise in living standards that the Spanish economy has experienced since the early 1950s is truly remarkable. Such exceptional episode can be largely ascribed to the good performance of labor productivity growth. However, the comparative evidence available

unmasks an uneven record and indicates the mid-1970s as the possible start date of the failing productivity performance of the Spanish economy. The aim of the next sections is to shed light to the comparative labor productivity performance of Spain relative to the United Kingdom and place it in historical perspective. In Section 3 next, we provide a comprehensive sectoral breakdown of comparative labor productivity levels and trends in an attempt to identify the mechanisms behind the Spanish postwar catch-up, plateau, and divergence.

3. Postwar sectoral trends in comparative labor productivity: The Spain/U.K. comparison

3.1. The comparative performance of manufacturing

In this section we present an estimate of comparative labor productivity in manufacturing for Spain relative to the United Kingdom for the benchmark year of 1968. In the construction of the benchmark estimate we follow the industry of origin approach, thus the aim is to obtain a conversion factor between currencies that reflects the average relative ex-factory price of a unit of manufacturing output in 1968.[4] The conversion factor or unit value ratio (U.V.R.) for manufacturing as a whole is constructed following a stagewise aggregation procedure that, to start with, calculates unit values of matched products across the manufacturing industries of each country. The unit value of a product is obtained as the ratio of total ex-factory sales value over quantity produced. The industry-specific unit values of both countries are then combined using quantity weights in order to derive an industry U.V.R. Further reweightings of industry U.V.Rs. make use of gross value added shares to produce an estimate of the U.V.R. for total manufacturing. The manufacturing U.V.R. can be applied to convert value added into a common currency and hence to obtain a figure of comparative labor productivity.

Reliable information on ex-factory sales and quantity at such level of dissagregation is

[4] The industry of origin approach has been extensively used in the literature of comparative labor productivity in manufacturing since the early work of Rostas (1948) and Paige and Bombach (1959). A detailed discussion of the methodology and its applications can be found in, for example, van Ark (1993) and Maddison and van Ark (1994).

drawn from the British *Census of Production* and the Spanish *Estadística Industrial*, both publications compiled by national statistical bodies since the early XXth century in the case of Britain and the early post-war period in the case of Spain. We obtain an average conversion factor for manufacturing output in 1968 of 181.7 pts/£ while the official exchange rate stood at 166.46 pts/£. Table 4 reports the comparative level of value added per employee in manufacturing for the benchmark year of 1968. We also present disaggregated figures of comparative productivity at the branch level and a figure of comparative value added per hour worked for total manufacturing.[5]

*** INSERT TABLE 4 HERE ***

On average, valued added per employee in manufacturing was 56.6 per cent of the U.K. level. Spain fared better in terms of value added per hour with a comparative figure of 61.2 in 1968. The comparative evidence suggests that the best performing sectors were chemicals and ferrous and non-ferrous metals.

Long-term estimates of comparative labor productivity in manufacturing can be constructed by extrapolating backwards and forwards the 1968 benchmark figure with time series on manufacturing output and labor input for Spain and the United Kingdom. More particularly, the extrapolated estimate of comparative labor productivity for year $t+1$ is the result of combining the 1968 benchmark figure with a ratio of labor productivity indexes of both countries, as shown in the following expression:

$$(3) \qquad \frac{(VA/E)_{t+1}^{Sp(£)}}{(VA/E)_{t+1}^{UK(£)}} = \frac{(VA/E)_{1968}^{Sp(£)}}{(VA/E)_{1968}^{UK(£)}} \times \left[\frac{(VA/E)_{t+1}^{Sp(pts)}/(VA/E)_{1968}^{Sp(pts)}}{(VA/E)_{t+1}^{UK(£)}/(VA/E)_{1968}^{UK(£)}} \right],$$

where VA denotes value added, E is employment, and superscripts $\{Sp, UK\}$ denote country with, between parentheses, the prices of the country at which the value added figure is

[5] Reweighting involves that U.V.Rs. can be derived at different stages of aggregation. Estimates of branch U.V.Rs. underpin the figures of comparative labor productivity by manufacturing branch presented in Table 4. Appendix A reports the branch level U.V.Rs. constructed for 1968 and provides further details on the calculations.

expressed. In practice, the term in brackets on the right-hand-side of expression (3) is constructed as the ratio of real value added per employee indexes.[6]

In our extrapolations, we use manufacturing data on real value added, employment, and total hours from the EU-KLEMS database 2007 vintage which spans uninterruptedly from 1970 to 2004. The EU-KLEMS database has been constructed on the basis of cross-country harmonisation of data provided by national statistical offices. Harmonisation encompasses, among other things, the adoption of a common industrial classification, the construction of standardised measures of factor inputs, and the development of a common linking methodology for different vintages of national accounts data. For the purposes of this article, the EU-KLEMS database has improved cross-country comparability of basic variables such as value added, employment, and hours (Timmer, O'Mahony and van Ark, 2007). The value added and employment series are extrapolated backwards to 1956 using van Ark's (1996) sectoral database, and the average hours per employee series is extrapolated back to 1968 using the index on hours worked per person from the ICOP industrial database, as in Table 4. The 10-sector database constructed in van Ark (1996) can be considered an early attempt at improving cross-country comparability of value added and employment data from national accounts sources. Fig. 1 plots the time paths of comparative labor productivity levels in manufacturing.

*** INSERT FIGURE 1 HERE ***

The trends shown in Fig. 1 suggest that Spain faced a large productivity gap in the late 1950s that narrowed substantially in the following fifteen years. From the second half of the 1970s until the mid-1980s, comparative labor productivity recorded, if anything, just a very mild improvement. In the mid-1980s, comparative labor productivity entered a phase of dramatic and sustained decline that has taken the estimate of comparative value added

[6] A second extrapolation method consists of updating or backdating the benchmark $U.V.R.$ estimate with a ratio of national price indexes. See van Ark (1993) for a discussion on the alternative methods to extrapolate benchmark estimates of comparative value added and productivity.

per employee in 2004 back to its 1967 level. Identical trends are obtained regardless of the choice of labor input unit.

The literature acknowledges a number of factors underpinning the catch-up performance of Spanish manufacturing. During the 1940s and well into the 1950s, Spain was led by autarkic policies geared towards state interventionism of industry and import substitution, with restrictions on the inflow of foreign capital and new technology (Prados de la Escosura, 2007). Strong catch-up started in the early 1960s coinciding with a wave of (partial) economic liberalization brought about by the Stabilization Plan of 1959 (Carreras, 1987; Tortella, 1994b). Note that, in the period 1950-1959, the average growth rate of total exports stood at 1.1 percent per annum, while they surged to an annual average rate of growth of 12.5 percent in the catch-up years of 1959-1973. Similarly, the average growth rate of total imports accelerated from 5.7 percent per annum in the period 1950-1959 to 11.4 percent during the 1959-1973 catch-up episode (Tena, 2005). For those industries whose main focus was the domestic market (e.g. ferrous and non-ferrous metals, chemicals, automobiles), the Stabilization Plan eased the entry of capital goods and new technology, which prompted the modernization of production methods and allowed significant efficiency gains. Thus, by 1968, Spanish labor productivity in ferrous and non-ferrous metals had reached 79 percent of the U.K. level while chemicals had narrowed the gap to above two-thirds of the U.K. level. In addition, equipment goods industries as well as more traditional manufacturing industries, namely consumption goods industries such as footwear and furniture, expanded due to an export-led surge favoured by the external economic environment (Tortella, 1994b; Tena, 2005).[7] However, in spite of the improvements of the 1960s and early 1970s, the Spanish manufacturing sector remained significantly regulated, too specialized in low-technology labor-intensive goods (e.g. textiles, ferrous metals), highly subsidized, and shielded from international competition (Tortella, 1994b). The lack of competitiveness, together with the widespread effects of the two Oil Shocks, called for the restructuring of the sector. A plan

[7]The composition of Spanish exports had been traditionally dominated by agriculture, with an export share of 61.5 percent in 1959. It is not until the late 1960s that manufacturing managed to reverse this trend: the export share of agriculture fell from 48.3 percent in 1967 to 27.9 percent in 1973 (Tena, 2005).

for industrial restructuring was implemented in the early 1980s and the sector experienced a mild recovery in the second half (van Ark and Serrano, 2001). Yet, as Fig. 1. shows, the Spanish manufacturing sector did not embark on a further catch-up episode: the late 1980s witnessed the widening of the labor productivity gap.

A useful cross-check of the reliability of both, the benchmark estimate and the time series extrapolations, is found in the direct benchmark comparison constructed in van Ark (1995). For the benchmark year of 1984, van Ark (1995) finds that, on average, value added per employee in Spanish manufacturing was 88 per cent of the U.K. level, while comparative value added per hour was 89 per cent. Our respective estimates are 82.2 and 89.3, which are reassuringly similar to van Ark's (1995) and in line with the variation reported for the bilateral comparisons of other countries (Broadberry, 1993).

Bearing in mind the relative significance of manufacturing output and employment in total output and employment, one can safely argue that the aggregate pattern of comparative labor productivity between Spain and the United Kingdom is at least partly driven by the catching-up, stationarity, and divergence experienced by the manufacturing sector. Naturally, one needs to draw upon evidence from other sectors, this is to which we now turn.

3.2. A sectoral breakdown of comparative productivity trends

This section presents sectoral estimates of comparative value added per employee for the Spain/U.K. comparison. The construction of the estimates involves the time series extrapolation of a cross-sectional benchmark for each sector. The cross-sectional benchmark is located in 1968 and covers a total of nine sectors that divide the economy. In addition to the manufacturing estimate constructed in the previous section, cross-sectional estimates of comparative labor productivity for 1968 are obtained in agriculture, mining, utilities, construction, transport and communication, finance and distribution, community, social and personal services (including hotels and restaurants), and government services (public administration and defense). The sectoral breakdown is in accordance with the European industrial classification NACE revision 1 adopted in the EU-KLEMS database, which is our

main source for the time series data on output and employment applied to extrapolate the benchmark values.[8]

Following convention, the methodology used to construct the 1968 benchmark estimates varies across sectors. Thus, we apply the industry of origin approach in agriculture and mining, we use quantity indicators of sectoral output to derive an implicit relative price or conversion factor in utilities and transport and communication, and we make a direct comparison of physical output per employee for the rest (Pilat, 1994). Census estimates covering agriculture, mining, and utilities are available for both countries in the postwar period. The 1968 statistics on construction have been well documented by census data in Britain and by the builders' confederation in Spain. Reliable estimates are also available for transport and communications, drawing mainly from annual abstracts and sector specific reports. Disaggregated quantitative evidence for services in 1968 is harder to piece together. Yet, firm evidence can be extracted from annual statistical abstracts and, as in Broadberry (1997b), we have chosen to amalgamate finance and distribution, on the one hand, and community, personal and social services, on the other. A final sector that is necessary to complete the benchmarking exercise is government services. To the extent that output is proxied by employment, as it is common in the system of national accounts, comparative labor productivity equals one. Thus, we apply the convention, commonly found in the literature (Broadberry, 1997a; Broadberry, 1997b; Broadberry, 1998), to our benchmark estimate of comparative labor productivity in government services and we set it equal to one hundred. Note that, inevitably and particularly when the benchmark is established back in time, quality adjustments which could influence the comparative figure are not accounted for (O'Mahony and de Boer, 2002). A detailed description of the construction of the 1968 benchmark estimates is given in Appendix A.

Table 5 reports sectoral estimates of comparative labor productivity for Spain relative to the United Kingdom. The aggregate comparative figure for the benchmark year is obtained

[8] As in the case of manufacturing, the value added and employment series from EU-KLEMS database are extrapolated backwards using van Ark's (1996) sectoral database for agriculture, utilities, construction, and transport and communication.

following the methodology in Rostas (1948).

*** INSERT TABLE 5 HERE ***

The time path of the aggregate estimate presented in Table 5 suggests three phases of comparative productivity performance of the Spanish economy. First, there is a fast convergence process up to 1975, in particular convergence accelerates after 1959. Second, the convergence process stagnates during the period 1975-1990. And third, there is a reversal of convergence from 1990 up to 2004.

The sectoral level evidence indicates that the prominent catch-up of manufacturing, together with the good comparative performance of smaller sectors such as construction, utilities, and transport and communication, determined aggregate comparative productivity in the first phase. Notice that services contributed positively to the catching-up experience in the years between 1968 and 1973.[9] In the second phase, sectoral convergence in manufacturing and construction slowed down substantially and then reversed towards the end of the 1980s. As early as the mid-1970s, services entered a period of sustained erosion of comparative labor productivity, while agriculture experienced a revival. Thus, the improved comparative productivity performance of agriculture, together with the continuous good performance of utilities and transport and communication, kept aggregate comparative productivity at a stationary level. Finally, the third phase is characterized by generalized sectoral divergence, with the exception of the good comparative performance recorded in agriculture. The importance of the service economy at this stage of Spanish development would suggest that the declining trend in service sector comparative labor productivity has much to account for aggregate divergence in the last phase. Yet, the service sector is by no means the only underperformer. Mas and Quesada (2007) conclude that the Spanish productivity problem, at least in the period 1995-2004, can be ascribed to the negative productivity

[9] The disaggregation we use in services is not fully consistent with the disaggregation in van Ark (1996). Hence, we could not extrapolate backwards certain service categories. For those cases, we extrapolate EU-KLEMS data with a linear trend back to 1968. This applies to community & personal services and government services (public administration and defense).

growth recorded in construction, some traditional manufacturing industries, such as textiles and wood, and almost all market service sectors, with the main exception of financial market intermediation. Regarding the contribution of services, Gordo, Jareño and Urtasun (2006) explore the productivity record that has shadowed the expansion of the Spanish service economy since 1980. According to the authors, the explanation beneath such a poor record lies on the relatively larger weight that labor-intensive low-value added per employee services (e.g. tourism) have in shaping the service aggregate for Spain. Furthermore, the atomization of Spanish services, greatly dominated by small or very small enterprises, has hindered the scope for efficiency gains through the exploitation of scale economies. In addition, Gordo, Jareño and Urtasun (2006) point out two persistent elements of service sector retardation in Spain, namely the low emphasis on technological innovation and the tendency of Spanish service sector firms to favour investment on infrastructure and construction rather than on capital goods.

The next section attempts to obtain a better informed view on the relative contribution of the sectoral trends identified above to the aggregate performance of comparative labor productivity. We do so by exploring the patterns of structural change.

4. The role of structural change

The cross-sectoral trends in comparative labor productivity levels identified in the previous section constitute one piece of the explanatory evidence underpinning the performance of aggregate comparative labor productivity. Next, we explore the time evolution of sectoral employment shares in order to qualify the presence, or absence, of a convergence process in the structure of employment across countries (Caselli and Tenreyro, 2004). In 1960 the shares of British labor employed in agriculture and in manufacturing were, respectively, 4.1 and 36.3 percent, while the corresponding shares for Spain stood at 39.8 and 19.5 percent. Thus, a labor shift out of agriculture and into manufacturing, that is from a low value added per employee sector to a high value added per employee sector, would contribute to Spain narrowing the gap in overall comparative labor productivity.

The structural convergence experienced by Spain is shown in the sectoral shares of employment reported in Table 6.

*** INSERT TABLE 6 HERE ***

From 1950 through to 2004, both countries witnessed a fall in the share of employment in agriculture. In the Spanish case, the decline was substantial and the largest labor shift took place in the period 1950-1975. Britain, on the other hand, had already reallocated labor from agriculture by the 1950s. Notice that, in 1975, the manufacturing employment shares of Spain and the United Kingdom were already close. The latter was partly due to the continuous increase of the Spanish share in the previous two decades and partly due to the fall of the U.K. share. Thereafter, the employment share in manufacturing declined steadily in both countries, though the fall in the U.K. share was larger showing the absorption capacity of its tertiary sector. Overall, the coarse evidence suggests that, from 1950 until the mid-1970s, at least part of the Spanish catch-up in aggregate terms can be ascribed to labor reallocation from the low productivity agricultural sector to the high productivity manufacturing and service sectors. In the mid-1970s, however, Spanish manufacturing entered a contractionary period and the decline in the shares of employment in agriculture and manufacturing was matched by the expansion in the share of service sector employment and, more recently, construction.

Next, we apply the basic shift share analysis to gauge quantitatively the relative contribution to aggregate labor productivity growth of internal labor productivity growth and structural change.[10] In an economy composed of $i = 1, ..., n$ sectors, define the overall economy labor productivity level at time T as the weighted sum of sectoral productivities:

$$\frac{Y_T}{E_T} = \sum_{i=1}^{n} \frac{Y_{iT}}{E_{iT}} \frac{E_{iT}}{E_T}, \tag{4}$$

[10]For an overview of the shift share methodology and for further applications see, for example, Syrquin (1984), Paci and Pigliaru (1997), Timmer and Szirmai (2000).

where Y denotes output, E employment, and the weights are sectoral employment shares. For convenience, expression (4) is rewritten as:

$$y_T = \sum_{i=1}^{n} y_{iT} s_{iT}, \tag{5}$$

where y_{iT} is labor productivity in sector i at time T and s_{iT} is the corresponding sectoral employment share at time T. Define $[t, T]$ as the time interval under consideration, thus the difference in aggregate labor productivity levels between time t and time T can be decomposed as follows:

$$y_T - y_t = \sum_{i=1}^{n} \left(\frac{y_{iT} - y_{it}}{y_{it}} \right) y_{it} s_{it} + \sum_{i=1}^{n} (s_{iT} - s_{it}) y_{it} + \sum_{i=1}^{n} \left(\frac{y_{iT} - y_{it}}{y_{it}} \right) (s_{iT} - s_{it}) y_{it}. \tag{6}$$

Dividing expression (6) through by y_t yields the decomposition of aggregate labor productivity growth as:

$$\frac{y_T - y_t}{y_t} = \sum_{i=1}^{n} \left(\frac{y_{iT} - y_{it}}{y_{it}} \right) \frac{y_{it}}{y_t} s_{it} + \sum_{i=1}^{n} (s_{iT} - s_{it}) \frac{y_{it}}{y_t} + \sum_{i=1}^{n} \left(\frac{y_{iT} - y_{it}}{y_{it}} \right) (s_{iT} - s_{it}) \frac{y_{it}}{y_t}, \tag{7}$$

where y_{it}/y_t is sector i's labor productivity level relative to the aggregate level at the beginning of the period.

As conventional nomenclature in shift share analysis dictates, the first term on the right hand side of expression (7) is the intrasectoral effect, the second term is the net shift effect (or static shift effect), and the third term is the interaction effect (or dynamic shift effect). The intrasectoral effect captures the contribution of within-sector labor productivity growth to aggregate labor productivity growth. The net shift effect measures the effect of changes in the structural composition of employment on aggregate labor productivity growth. If positive, it shows that, in net terms, labor reallocation among sectors is dominated by labor influxes to sectors with a relatively high level of relative labor productivity at the beginning of the period. And vice versa, if negative, it shows that, in net terms, labor reallocation

among sectors is dominated by labor influxes to sectors with a relatively low level of relative labor productivity at the beginning of the period. Finally, the interaction effect augments the net shift effect by taking into account the labor productivity growth of the relevant sector in the period of interest. Overall, the sum of the net-shift and interaction effects captures the contribution of structural change to aggregate labor productivity growth (Maddison, 1996).

Table 7 reports the results of the decomposition of the growth rate of aggregate labor productivity for Spain and the United Kingdom. The decomposition in expression (7) is applied to the nine-sector disaggregation introduced in Table 5. The period of analysis is 1968-2004 and we focus on the three subperiods that broadly define the phases marking Spanish productivity performance in comparative terms.

*** INSERT TABLE 7 HERE ***

The evidence in Table 7 shows that, on balance, sectoral labor productivity growth has been the main force behind aggregate labor productivity growth in both countries, yet structural change effects are important too. The role of structural change differs from country to country and it is worth pointing out certain identifiable aspects. For the case of Spain, the structural change effect is larger, in absolute terms, in the first of the three subperiods. More particularly, in 1968-1975, the structural change effect was determined exclusively by the net shift effect, that is the pure effect of labor reallocation from a sector with a low value added per employee level (namely, agriculture) to a sector with a high value added per employee level (namely, manufacturing, construction, and services). The distribution of labor out of agriculture tended to favour the expansion of sectors that experienced substantially lower average productivity growth than agriculture itself (e.g. finance and distribution, community and personal services, construction), which explains a null estimate of the interaction effect for the years 1968-1975. In contributive terms however, the structural change effect is larger in the second subperiod as it explains 43 percent of aggregate labor productivity growth. This subperiod witnessed a positive net shift effect, to a large extent driven by labor reallocation from agriculture to services and to a lesser extent driven by labor reallocation from

manufacturing and construction to services, and a negative interaction effect. The latter captures that the labor releasing sectors experienced higher labor productivity growth than the recipient ones, in particular, certain labor absorbing service sector categories, such as community and personal services, recorded mild negative productivity growth over the second phase. Finally, in 1990-2004, aggregate labor productivity growth was fully explained by intrasectoral productivity growth as structural change had no significant explanatory role. The last phase is characterized by the labor transfer from agriculture and manufacturing into services and construction, by the modest productivity growth recorded in manufacturing and, especially, in services, and by the negative productivity growth registered in construction.[11] For the case of Britain, it is worth noting the negative impact of structural change throughout the period 1975-2004. This negative contribution of structural change was partly due to labor reallocation from British manufacturing to service sectors with lower levels of value added per employee and partly due to lower labor productivity growth in the recipient sectors.

Overall, the evidence presented thus far reinforces the view of the significant contribution of manufacturing to Spain narrowing the aggregate productivity gap up to the mid-1970s, both in terms of catch-up performance and structural change. It also reinforces the view of the increasing importance of the service sector which, in comparative labor productivity terms, has underperformed with respect to the United Kingdom since the mid-1970s.

In this section, we have assessed the potential importance of structural change in explaining aggregate labor productivity growth for Spain and the United Kingdom over the three phases of comparative economic performance previously established. Next, we address the proximate sources of sectoral labor productivity growth, the main contributive factor in

[11] Applying the *modified* shift share analysis introduced in Broadberry (1998) to the Spanish data assembled in Prados de la Escosura (2003), Prados de la Escosura (2007) finds that structural change explains about one-third and one-fourth of aggregate labor productivity growth over the periods 1958-1974 and 1975-2000, respectively. Using a growth accounting framework, Temple (2001) presents evidence on the importance of structural change in explaining the growth experience of Europe and the United States over the years 1950-1990. Temple (2001) obtains cross-sectoral bounds on the marginal product differential, or wage gap, in order to derive estimates of the *direct* effect of labor reallocation on aggregate T.F.P. growth. The *direct* reallocation effect is particularly strong in the Spanish case. It accounts for roughly one-seventh of aggregate labor productivity growth for the period 1960-1990.

explaining aggregate labor productivity growth for both countries.

5. Comparative capital intensity and comparative T.F.P: Evidence from sectoral trends

This section explores the underlying determinants of the main sectoral trends in comparative labor productivity identified above. In particular, we decompose comparative labor productivity into two components: comparative capital intensity and comparative total factor productivity. The standard decomposition can be written as:

$$\frac{y_{Sp}}{y_{UK}} = \frac{A_{Sp}}{A_{UK}} \left(\frac{k_{Sp}}{k_{UK}} \right)^{\alpha}, \tag{8}$$

where the first term on the right hand side is comparative T.F.P. and the second term measures the contribution of comparative capital intensity to comparative labor productivity. Parameter α is the share of capital in total output. Re-writing the above decomposition in terms of growth rates yields:

$$g_{\frac{y_{SP}}{y_{UK}}} = g_{\frac{A_{SP}}{A_{UK}}} + \alpha g_{\frac{k_{SP}}{k_{UK}}}, \tag{9}$$

where the growth rate of comparative labor productivity is explained by the contribution of comparative T.F.P. growth and the contribution of comparative capital intensity growth.

Before applying the growth accounting decomposition, we need to extract a series of comparative T.F.P. from equation (8). In order to do so, we first construct a series of comparative capital deepening (van Ark, 1990; Broadberry, 1993; Broadberry, 1998). Standardized series of sectoral capital stock have recently become available for Spain (Mas et al., 2005) while the United Kingdom has already produced various vintages of disaggregated capital stock series (O'Mahony and de Boer, 2002).[12] In this study, we use the net definition of capital stocks to ensure consistency between sources. The cross-country capital stock series are expressed in

[12] The capital stocks series in O'Mahony and de Boer (2002) are part of the National Institute Sectoral Productivity Dataset (NISEC02).

the same currency by converting the estimates in Mas et al. (2005) into 1996 U.S. $ on the basis of a purchasing power parity for expenditure on capital goods (OECD, 1999).[13] Sectoral capital shares are averaged over time and across countries. Table 8 reports comparative T.F.P. estimates for agriculture, manufacturing, services, and the aggregate economy.

*** INSERT TABLE 8 HERE ***

The pattern of aggregate comparative efficiency that emerges from the evidence presented in Table 8 resembles the profile of aggregate comparative labor productivity. Thus, for the second half of the twentieth century, the evidence available suggests that Spain did not achieve complete convergence to the British efficiency level. The stagnation of the mid-1970s was followed by the widening of the efficiency gap in the early 1990s.

The growth accounting decomposition specified in equation (9) is applied to sectoral data of manufacturing, services, and agriculture. A number of results and features are highlighted next and summarized in Table 9.

*** INSERT TABLE 9 HERE ***

For the period 1964-1975, the average annual growth rate of comparative labor productivity in manufacturing was 5.2 percent while comparative T.F.P. grew at an annual rate of 4.3 percent. Thus, comparative T.F.P. growth accounted for most of the comparative labor productivity growth during the catch-up phase of the manufacturing sector. Capital accumulation had a role to play, in particular, capital stock per worker in Spanish manufacturing grew at an annual rate of 7.2 percent while its British counterpart grew at an annual rate of 4.5 percent. As a result, Spanish manufacturing became more capital intensive than British manufacturing in the second half of the 1960s, yet the gains in comparative labor productivity came mostly from improvements in T.F.P. performance. From the mid-1970s to the second half of the 1980s, the trends in the manufacturing sector changed considerably. In

[13] In particular, we use the 1996 P.P.P. for expenditure on machinery and equipment. Note also that we exclude residential construction from the estimates in Mas et al. (2005)

particular, comparative labor productivity virtually flattened as a result of a mild decline in comparative T.F.P. just made up by the positive contribution of comparative capital intensity. Finally, from the late 1980s through to the late 1990s, comparative labor productivity recorded a negative annual growth rate of 1.5 percent which was more than accounted for by a negative annual growth rate of 1.7 percent in comparative total factor productivity.

The profile of comparative productivity performance in services is different from that of manufacturing. For the period 1968-1975, the average annual growth rate of comparative labor productivity in services was 2.8 percent while comparative T.F.P. grew at an annual rate of 2.2 percent.[14] Yet, in the Spain/U.K. comparison, the salient feature of the service sector is the steady and sustained decline in comparative labor productivity recorded since the mid-1970s. For the period 1975-1999 as a whole, comparative labor productivity in services shows a negative average annual growth rate of 1.3 percent. The growth accounting disaggregation suggests that this poor record is underpinned by a negative annual growth rate of 1.6 percent in comparative T.F.P. Thus, comparative capital intensity made up for some of the negative T.F.P. contribution, but by no means it did offset it.

In comparative labor productivity terms, the Spanish agricultural sector remained roughly stagnant for well over thirty years. Even though in absolute labor productivity terms Spanish agriculture performed well, as labor productivity grew at an average annual rate of 5.5 percent over the period 1964-1985, Spanish agriculture just about qualified as a catching-up sector since the respective U.K. figure stood at 4.7 percent. It is worth noting that Spanish agriculture was much less capital intensive than British agriculture for most of the post-war period, although the large capital intensity gap has steadily narrowed since the late 1960s. The remarkable episode of Spanish agricultural performance in comparative terms commences in the mid-1980s. For the period 1985-1999, the average annual growth rate of comparative labor productivity was 4.8 percent while comparative T.F.P. growth surged to 3.6 percent annually. These figures are underpinned by 6.8 percent annual growth in labor

[14] These figures compare to 5.4 percent and 4 percent, respectively, recorded by manufacturing in the same period.

productivity in Spain while the U.K. slowed down its growth rate to 2 percent. Thus, the comparative analysis carried out here indicates that the postwar development of Spanish agriculture fits well the *Lewis model* (Lewis, 1955). Namely, fast labor productivity growth in Spain was firstly driven by capital deepening, a process of capital accumulation that gave way to modern agriculture and ended subsistence practices, to then be shaped by large efficiency gains. Interestingly, the surge in comparative efficiency occurred at the time of Spanish accession to the European Economic Community, which points towards a positive effect of European integration on agricultural productivity.

Overall, the first symptoms of a failing productivity performance in Spain appear with the loss of efficiency dynamism that manufacturing and services experienced in the mid-1970s. Table 10 reports the results of the growth accounting disaggregation for the aggregate economy. Notice that, while Spain has registered diminishing T.F.P. gains over the period, the U.K. economy has progressively improved its efficiency record.

*** INSERT TABLE 10 HERE ***

The aggregate evidence for the three phases of comparative performance indicates, firstly, that comparative capital intensity has always contributed positively to comparative labor productivity growth, although its contribution has diminished over time, secondly, that a surge in comparative T.F.P. growth explains, to a significant extent, the catch-up growth of the first phase, and finally, that the persistent deterioration in comparative T.F.P. performance that started in the mid-1970s has eroded a significant part of the gains in comparative labor productivity previously achieved.

Using different data sources, a surge in aggregate T.F.P gains has been identified as the relevant proximate cause of the Spanish catch-up growth episode in Suárez (1992), Cebrián (2001) and Prados de la Escosura and Rosés (2007). Sanchís (2006) documents a large contribution of T.F.P to output growth over the catch-up years of 1958-1975 by following a disaggregated sectoral approach. Similarly, a substantial deceleration in aggregate T.F.P.

growth has been reported by several authors for various subperiods within the years 1975-2000 (e.g., Mas and Quesada, 2005; Timmer and van Ark, 2005; Prados de la Escosura and Rosés, 2007). The comparative perspective adopted here dates the mid-1970s as the beginning of the persistent productivity failure of the Spanish economy, which indicates that the 'transition to democracy years, 1975-1986' were a lost chance to devise the necessary structural reforms that would have led the economy into an era of sustained, high productivity growth.

6. Conclusions

The catch-up, plateau, and divergence pattern of Spanish comparative labor productivity performance in the period 1950-2004 is underpinned by distinctive sectoral trends. Spain narrowed the aggregate labor productivity gap with Britain by shifting resources out of agriculture and by improving its comparative labor productivity position across most sectors, out of which manufacturing plays a central role. Significant improvements in efficiency and the dynamic pace of capital intensity characterize the catch-up phase. In the period 1975-1990 convergence stagnates. In spite of the shift of resources out of agriculture and the good comparative performance of certain sectors, such as utilities, transport and communication, and agriculture itself, comparative labor productivity was adversely affected by the catching-up exhaustion of manufacturing and construction and by the deterioration of comparative labor productivity in services. A dramatic slowdown in efficiency gains characterizes the plateau phase. Lastly, since 1990 the aggregate labor productivity gap has been widening. The deterioration of Spain's relative productivity position with Britain affected all sectors except agriculture. The stagnation of efficiency characterizes the divergence phase.

Appendix A: Benchmark estimates of comparative labor productivity levels

This appendix reports the sources and methods used to construct the sectoral estimates of comparative labor productivity for the benchmark year of 1968.

1. Manufacturing

Table A.1 presents the results of the industry-of-origin comparison in manufacturing.

*** INSERT TABLE A.1 HERE ***

The total number of matched products is 207, which represents a coverage ratio of 40.1 percent for Spain and 21.4 percent for the United Kingdom. The majority of matched products belong to 'lower' technology sectors, namely food, textiles and chemicals. More homogeneous matches have been done in those sectors, hence the product mix problem has been minimized, however note that a relatively high degree of grouping was needed in some industries, e.g. clothing. On the other hand, following van Ark (1995), the matching of products in high-technology branches, namely machinery and equipment, has required some adjustments in order to account for quality differences. Value added and employment data are also taken from the sources reported in Table A.1.

2. Agriculture, Forestry and Fishing

For the United Kingdom, value added is taken from *National Income and Expenditure* (CSO, London) and employment is taken from O'Mahony (1999). For Spain, value added is taken from *Contabilidad Nacional de España-Base 70* (INE, Madrid) and employment is taken from Mas et al. (2002). The Spain value added per employee figure is converted into a common currency using a purchasing power parity (P.P.P.) based on 19 commodities. The P.P.P. was constructed using quantities and producer prices from *Agricultural Statistics 1969-1971* (HMSO, London) and *La Agricultura Española en 1968* (Ministerio de Agricultura, Madrid). The matched commodities include: wheat, barley, oats, sugar beet, potatoes, apples, pears, plums, cherries, onions, brussel sprout, asparagus, broad beans, runner beans, beef, mutton and lamb, pork, milk, eggs in shell.

U.K. value added per employee (£)	1264
Spain value added per employee (pts)	64585
P.P.P. (pts per £)	193.91

3. Mining and Quarrying

Table A.2 presents the results of the industry-of-origin comparison for the mining sector. The coverage ratio is 65 percent for Spain and 79 percent for the United Kingdom. Value added and employment data are also taken from the sources reported in Table A.2.

*** INSERT TABLE A.2 HERE ***

4. Utilities

British quantity and employment data for electricity and manufactured gas are taken from the *Census of Production, 1968*. Spanish quantity and employment data for electricity and manufactured gas are taken from *Estadística Industrial 1968*. The value added aggregate for the United Kingdom is from *National Income and Expenditure* (CSO, London) and the Spanish value added aggregate is from *Contabilidad Nacional de España-Base 70* (INE, Madrid). An industry P.P.P. of 193.8 pts/£ is obtained and applied to convert value added per employee figures into a common currency.

5. Construction

As a rough indicator of productivity, we use the number of houses built per employee (Broadberry, 1997a). Spanish figures on the number of permanent houses completed is taken from *Informe sobre la construcción 1969* (SEOPAN) and employment data is taken from Mas et al. (2002). British figures on the number of permanent houses completed is taken from the *Annual Abstract of Statistics* (HMSO, London) and employment is taken from the *Census of Production, 1968.* The calculated figures of houses per employee for Spain and the United Kingdom are, respectively, 0.23 and 0.27.

6. Transport and Communication

For the United Kingdom, quantity and revenue data on freight and passenger transport by rail, mail handled, telegrams, and telephone calls, are from the *Annual Abstract of Statistics* (HMSO, London) and *The Post Office, Report and Accounts* (HMSO, London). For Spain, quantity and revenue data on freight and passenger transport by rail, mail handled, telegrams, and telephone calls, are from *Anuario Estadístico de España* (Madrid, INE) and *Estadísticas Históricas de España* (2005). The calculated industry P.P.P. is 111.7 pts/£ which is applied to aggregate value added and employment data. For the United Kingdom, value added is from *National Income and Expenditure* (CSO, London) and employment is from van Ark (1996). For Spain, value added is from *Contabilidad Nacional de España-Base 70* (INE, Madrid) and employment is from van Ark (1996).

U.K. value added per employee (£)	2034
Spain value added per employee (pts)	166844
P.P.P. (pts per £)	111.7

7. Finance/Distribution

We have assumed that comparative labor productivity in Distribution equals comparative labor productivity in Finance (Broadberry, 1997a). Output in finance is related to the volume of transactions which is proxied by the money supply. Money supply data (cash and coins in circulation plus current account deposits) are taken from the *Annual Abstract of Statistics* (HMSO, London) and from *Anuario Estadístico de España* (Madrid, INE). The money supply data is expressed in common currency by using the exchange rate. British employment data in financial services is from *Annual Abstract of Statistics* (HMSO, London). Spanish employment data in financial services is estimated from *Renta Nacional de España y su Distribución Provincial* (Fundación BBV) with value added shares from *Contabilidad Nacional de España-Base 70* (INE, Madrid). Quantity of financial services per employee in the United Kingdom is 33.3 while quantity of financial services per employee in Spain is 28.8.

8. Community, Social and Personal Services

Comparative labor productivity is proxied by education sector productivity. The latter is measured by pupils per teacher in primary education. For 1968, British data from the *Annual Abstract of Statistics* (HMSO, London) and Spanish data from *Estadísticas Históricas de España* (2005). The figures are 35.5 for the United Kingdom and 35.2 for Spain.

9. Government Services (Public Administration and Defense)

Comparative labor productivity equals one by construction as real output is proxied by employment in the system of national accounts.

10. Aggregate economy

We follow the aggregation method in Rostas (1948) where sectoral figures on comparative labor productivity are weighted by the sectoral employment shares of each country. We take the geometric average of the two resulting aggregates. Employment shares are taken from the EU-KLEMS database extrapolated backwards with van Ark (1996).

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Table 1.
Accounting for growth in living standards, Spain and U.K., 1960-2005

	Annual compound growth rates (in percentage points)					*Total compound growth* (in percentage points)
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	1960-2005
Spain						
Output per capita ($g_{\frac{Y}{N}}$)	7.21	3.76	2.70	2.59	3.02	178
Output per hour ($g_{\frac{Y}{H}}$)	6.97	5.92	3.37	1.14	-0.30	173
Average hours ($g_{\frac{H}{E}}$)	0.51	-0.64	-0.94	-0.06	-0.45	-13.6
Employment rate ($g_{\frac{E}{N_{15-64}}}$)	0.03	-1.56	-0.30	1.24	3.66	12.3
Demographic rate ($g_{\frac{N_{15-64}}{N}}$)	-0.30	0.04	0.57	0.28	0.10	6.45
U.K.						
Output per capita ($g_{\frac{Y}{N}}$)	2.20	1.83	2.39	2.09	2.04	95.3
Output per hour ($g_{\frac{Y}{H}}$)	3.38	2.85	2.34	2.63	1.96	121.7
Average hours ($g_{\frac{H}{E}}$)	-0.81	-1.12	-0.35	-0.27	-0.34	-27.3
Employment rate ($g_{\frac{E}{N_{15-64}}}$)	-0.04	-0.08	0.22	-0.25	0.16	-0.68
Demographic rate ($g_{\frac{N_{15-64}}{N}}$)	-0.32	0.19	0.19	-0.02	0.25	1.61

Sources: Series on G.D.P., total population, employment and hours are from the The Conference Board and Groningen Growth and Development Centre, Total Economy Database, January 2007, http://www.ggdc.net. Labor force from OECD Labour Force Statistics, Summary Tables, Volume 2006, Release 3. Population 15-64 calculated by applying the demographic rate, that is the ratio of working age population over total population, to the total population series. The demographic rate is derived from the OECD source cited above.

Note: The G.D.P. series is expressed in 1990 U.S. dollars converted at Geary-Khamis P.P.P.

Table 2.
Differences in the growth accounting components, Spain *minus* U.K. 1960-2005

	Differences in annual compound growth rates (in percentage points)					*Difference in total compound growth* (in percentage points)
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2005	1960-2005
Output per capita ($g_{\frac{Y}{N}}$)	5.01	1.93	0.31	0.50	0.98	82.7
Output per hour ($g_{\frac{Y}{H}}$)	3.59	3.07	1.03	-1.49	-2.26	51.3
Average hours ($g_{\frac{H}{E}}$)	1.32	0.48	-0.59	0.21	-0.11	13.7
Employment rate ($g_{\frac{E}{N_{15-64}}}$)	0.07	-1.48	-0.52	1.49	3.5	12.9
Demographic rate ($g_{\frac{N_{15-64}}{N}}$)	0.02	-0.15	0.38	0.30	-0.15	4.84

Sources: As specified in Table 1 for both countries.
Note: Spain and U.K. G.D.P. series are expressed in 1990 U.S. dollars converted at Geary-Khamis P.P.Ps.

Table 3.
Comparative labor productivity, Spain/U.K. aggregate economy 1950-2000

(U.K.=100)	1950	1960	1973	1979	1985	1990	1995	2000
Comparative G.D.P. per worker	43	56	95	96	93	95	90	90

Source: A. Heston, R. Summers and B. Aten, Penn World Table Version 6.2, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006.

Table 4.
Comparative levels of labor productivity in manufacturing, Spain relative to the U.K. 1968

	Census value added per employee (U.K.=100)	Census value added per hour (U.K.=100)
Branches		
Cement, stone, clay, pottery and glass products	64.4	
Chemicals and allied products, plastics, fuel and mineral oil refining	70	
Food products, beverages and tobacco	48	
Textiles, wearing apparel, footwear, rubber and synthetic fibres	62.6	
Mechanical and electrical machinery and equipment, metal goods and transport equipment[1]	47.8	
Ferrous and non-ferrous metals	78.7	
Paper, board, printing and publishing, timber and manufactured stationary	57.8	
Total manufacturing	56.6	61.2

Sources: BSO, Report on the Census of Production for 1968, various volumes, London 1973; INE, Estadística Industrial 1968, Madrid 1971. Hours of work in manufacturing are from EU-KLEMS Database 1970-2004 March 2007 Release extrapolated backwards to 1968 with ICOP Industrial Database, Benchmark 1987, GGDC.

Notes: Estimates calculated at geometric average of U.V.Rs. for each manufacturing branch and for total manufacturing; U.V.Rs. are reported in Appendix A. [1]Military transport is included for the U.K. however excluded for Spain.

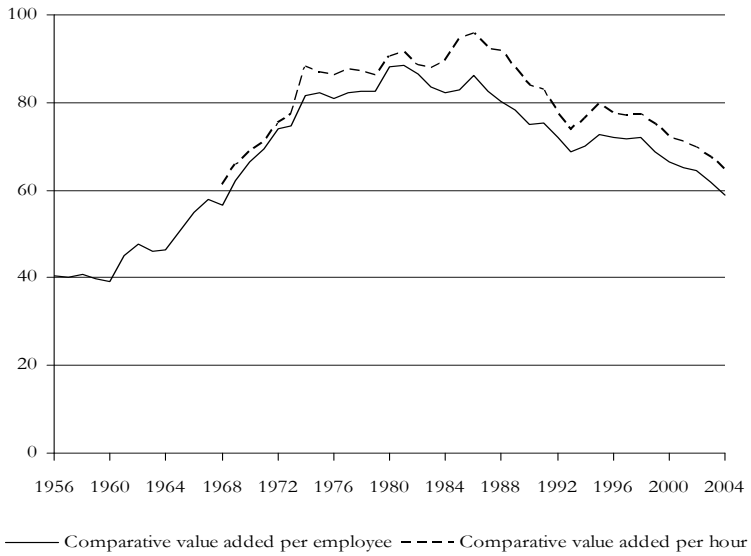

Fig 1. Comparative labor productivity in manufacturing, U.K.=100

Table 5.
Sectoral estimates of comparative labor productivity, Spain/U.K. 1950-2004

(U.K.=100)	1950	1960	1968	1973	1979	1986	1990	1995	2004
Agriculture	30.7	30.3	26.4	23.6	32.6	39.3	49.7	62.3	56
Mining			67.8	98.4	177.8	93.7	105.2	39.6	38.4
Manufacturing	34.6	39.2	56.6	74.6	82.7	86.1	75.1	72.8	59
Utilities	51	59.1	81.5	81.5	89.2	92	101.8	66.5	70
Construction	54.8	59.6	85.3	97.2	98.1	105.5	100.7	95.3	72.3
Transport & Commun.	56	57.4	73.4	87	109.8	107.8	115.4	104.5	81.8
Services			93.7	110.7	106.4	94.7	93.7	88.9	78.6
of which:									
Finance & Distribution			86.6	99.2	96.5	87.1	83.6	76.7	61.5
Community & Personal			99.3	122.6	113.9	109	110	107	104.7
Government services			100	103.4	94.2	66.7	64.3	62.5	68
Aggregate	37	48.6	70.8	86.7	94.2	94.7	95.8	93	81.3

Sources: See the main text and Appendix A.
Note: The 1950 and 1960 estimates for the aggregate economy are extrapolations of the 1968 benchmark figure using real G.D.P. per worker series from Heston, Summers and Aten (2006), Penn World Table 6.2.

Table 6.
Sectoral employment shares, 1960-2004

(in percentage points)	1950	1960	1970	1975	1980	1990	2000	2004
Spain:								
Agriculture	*47*	*39.8*	25.4	20.4	16.9	10.6	6.3	5.7
Mining			0.7	0.7	0.7	0.5	0.3	0.2
Manufacturing	*15.6*	*19.5*	22.2	23.3	23.1	19.7	18.1	16.1
Utilities			0.6	0.6	0.6	0.5	0.5	0.4
Construction			10	10.9	9.4	9.8	11.1	13.2
Transport & Commun.			5.1	5.2	5.4	5.1	5.3	5.3
Finance & Distribution			14.2	16	17.6	21.5	24.5	24.7
Community & Personal			18.4	19	21.1	25	26.8	27.5
Government			3.4	4.1	5.2	7.3	7.3	6.9
U.K.:								
Agriculture	*5.1*	*4.1*	2.9	2.5	2.3	2.1	1.7	1.3
Mining			2.4	2	1.6	0.6	0.3	0.2
Manufacturing	*34.9*	*36.3*	31.7	28	25.6	18.5	14.9	11.9
Utilities			1.4	1.2	1.1	0.8	0.5	0.4
Construction			7.2	7.3	7.4	8.1	6.5	6.8
Transport & Commun.			6.7	6.3	6.3	5.9	5.9	5.9
Finance & Distribution			23.9	25.7	27.8	32.7	36	36.8
Community & Personal			18.4	20.7	21.6	25.8	29.4	31.5
Government			5.6	6.3	6.3	5.4	4.9	5.2

Sources: The 1950 and 1960 estimates for Spain and the U.K. are, respectively, from van Ark (1996) and Broadberry (1997); the 1970-2004 estimates are calculated from EU-KLEMS Database March 2007.

Table 7.
Structural change and labor productivity growth, 1968-2004

(in percentage per annum)

	Aggregate labor productivity growth*	Intrasectoral effect	Structural change effect	*Net shift effect*	*Interaction effect*
Spain:					
1968-1975	5	3.69	1.31	1.31	0.00
1975-1990	1.81	1.03	0.78	1.05	-0.27
1990-2004	0.81	0.81	0.00	0.11	-0.11
U.K.:					
1968-1975	0.92	0.83	0.09	0.13	-0.04
1975-1990	1.7	2.03	-0.32	-0.09	-0.23
1990-2004	1.98	2.41	-0.43	-0.33	-0.1

Sources: The EU-KLEMS Database 1970-2004 March 2007 Release extrapolated backwards with van Ark (1996).

Notes: *Annual compound growth rates. The interaction effect is calculated as a residual.

Table 8.
Sectoral trends in comparative TFP levels, Spain/UK, 1964-1999

(UK=100)	1964	1968	1973	1979	1986	1990	1995	1999
Agriculture	59.6	51	42.4	52	52	62.5	73.5	79.1
Manufacturing	46	55.9	69.1	72.3	75.1	66.3	61.4	59
Services		95.9	110.9	102.4	88.9	88.9	81.7	76.1
Aggregate		78.8	90.8	92.2	89	90.5	85.7	80.6

Sources: See text. The capital share is calculated as one minus the labor share. Aggregate economy labor shares are from Bernanke and Gürkaynak (2001). Sectoral labor shares for the UK and Spain are obtained from, respectively, the NISEC02 Dataset (O'Mahony and de Boer (2002)) and from Garrido-Ruiz (2005).
Note: The aggregate estimates are whole economy estimates, in the interest of brevity the estimates for small sectors are omitted.

Table 9.
Comparative sectoral labor productivity growth

(in percentage per annum)

	Comparative labor productivity growth	Contribution of comparative T.F.P. growth	Contribution of comparative capital per worker growth
Manufacturing			
1964-1975	5.2	4.3	0.9
1975-1987	0.0	-0.2	0.2
1987-1999	-1.5	-1.7	0.2
Services			
1968-1975	2.8	2.3	0.5
1975-1999	-1.3	-1.6	0.3
Agriculture			
1964-1985	0.8	-1.1	1.9
1985-1999	4.8	3.6	1.2

Sources: The EU-KLEMS Database 1970-2004 March 2007 Release is extrapolated backwards with van Ark (1996). The capital stock data and sectoral labor shares are from the sources in Table 8.
Note: Annual compound growth rates.

Table 10.
Capital and T.F.P. contributions to aggregate labor productivity growth, 1968-1999

(in percentage per annum)

	Labor productivity growth	Contribution of T.F.P. growth	Contribution of capital per worker growth
Spain, 1968-1975	5	2.6	2.4
U.K., 1968-1975	0.92	0.05	0.87
Spain-U.K., 1968-1975	4.08	2.55	1.53
Spain, 1975-1990	1.81	0.53	1.28
U.K., 1975-1990	1.7	1.07	0.63
Spain-U.K., 1975-1990	0.11	-0.54	0.65
Spain, 1990-1999	1.21	0.17	1.04
U.K., 1990-1999	2.32	1.6	0.72
Spain-U.K., 1990-1999	-1.11	-1.43	0.32

Sources: The EU-KLEMS Database 1970-2004 March 2007 Release is extrapolated backwards with van Ark (1996). Capital stock data and country-specific capital shares from the sources in Table 8.
Note: Annual compound growth rates.

Table A.1.
Unit Value Ratios in manufacturing, Spain/U.K. 1968

	Unit Value Ratios (pts/£)		
	at Spanish C.V.A. shares, quantity weights	at U.K. C.V.A. shares, quantity weights	Geometric Average (Fisher index)
Branches:			
Cement, stone, clay, pottery and glass	129.9	140	134.8
Chemicals and allied products, plastics, fuel and mineral oil refining	179.6	190.1	184.8
Food products, beverages and tobacco	138.7	151.6	145
Textiles, wearing apparel, footwear, rubber and synthetic fibres	181.6	203	192
Mechanical and electrical machinery and equipment, metal goods and transport[1]	216.5	217.4	217
Ferrous and non-ferrous metals	202.7	205.8	204.2
Paper, board, printing and publishing, timber and manufactured stationary	126.7	143.8	135
Total manufacturing	170.7	193.4	181.7
Exchange Rate			166.46

Sources: BSO, Report on the Census of Production for 1968, various volumes, London 1973; INE, Estadística Industrial 1968, Madrid 1971; IMF, International Financial Statistics 1969.
Notes: C.V.A. is census value added. [1]Military transport is included for the U.K. and excluded for Spain.

Table A.2.
Unit Value Ratios in mining, Spain/U.K. 1968

	Unit Value Ratios (pts/£)		
	at Spanish C.V.A. shares, quantity weights	at U.K. C.V.A. shares, quantity weights	Geometric Average (Fisher index)
Branches:			
Coal mining	150.4	150.4	150.4
Stone, sand, clay and sand extraction	101.8	98.8	100.3
Metalliferous mining	385.5	275.9	326.1
Non-metalliferous mining, petroleum and natural gas	104.7	106.5	105.6
Total mining	165.1	140.1	152.1

Sources: BSO, Report on the Census of Production for 1968, various volumes, London 1973; INE, Estadística Industrial 1968, Madrid 1971.
Note: C.V.A. is census value added.