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New growth regimes, but still institutional diversity

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Whereas the American case may hint that product and labour market deregulation, venture capital and NASDAQ are necessary for the success of technologically led growth, international comparison suggests the coexistence of at least three successful configurations. Deregulated economies explore a science-pushed innovation, along with external labour flexibility and significant inequality in terms of competences. However, social democratic countries develop a cooperative approach to the knowledge-based economy: rather homogeneous educational level, lifelong learning, negotiation by social partners of the consequence of innovation and collectively organized labour mobility. There is a third configuration for some catching-up economies that use information technology as a method of leapfrogging: labour markets remain largely institutionalized and regulated, without exerting adverse impact upon macroeconomic performance.

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JEL classification: G14 information and market efficiency; event studies, O33 technological change: choices and consequences, O47 measurement of economic growth; aggregate productivity

1. Introduction

In retrospect, the 1990s represent a turning point in the sources of growth and the transformation of the institutional architecture in most OECD countries. From the early 1970s, economists had tried to explain the productivity slow-down and its consequences upon long-term growth and employment. In spite of more competition and waves of innovation in emerging sectors, productivity was not recovering during the 1980s. By contrast, the next decade has experienced a clear shift with respect to the previous trends. First, total factor productivity increased, especially in the USA and some other industrialized countries. Second, the typical mass

production industries of the Golden Age have been restructuring and a dynamic sector associated with the production of information and communication technologies (ICT) has emerged. Third, a new configuration for industrial organization can be observed in Silicon Valley. The flexibility of networking and mobility of professionals seem to replace the vertically integrated firm and the strict dichotomy between design and manufacturing, management and production.

This paper proposes an analysis of these phenomena using an international comparison that relates macroeconomic indexes of performance to qualitative data on basic economic and financial institutions. A first section analyses the emergence of a new growth regime based upon the intensity of research and development and innovation strategies. The purpose is then to set out the economic factors that differentiate the successful economies that seem to build such a growth regime from those lagging behind and still trapped in the previous productive and institutional model. Intensity of ICT use appears to be a discriminating factor. The next question to be addressed is clear enough: is there a typical institutional architecture that would best promote the adoption of this growth regime? The conventional answer is positive and states that the benchmark should be the American configuration, based upon highly flexible labour markets, excellence of academic research and close links with business, a permissive tax system and last but not least, sophisticated new financial markets. However, if one adopts a comparative qualitative methodology, the American configuration turns out to be only one of the three possible institutional architectures capable of sustaining the emerging technology-led growth regime. Small social democratic countries, and some 'catching-up' countries with no Fordist legacy, are able to enter the virtuous circles associated with the leading role of ICT. The same methodology enables us to discriminate between product market deregulation and labour market and social deregulation: the first appears as a condition, whereas the second is not necessary. A short conclusion summarizes the main findings: within the emerging productive paradigm there exist several different configurations for firm organization and domestic institutions.

2. The changing pattern of the 1990s

2.1 A new growth regime

The basis for this new regime is none other than the renewed effectiveness of corporate research and development spending in raising total factor productivity. The OECD (Scarpetta *et al.*, 2000) has analysed the foundations of the type(s) of growth that took place during the 1990s. This study establishes a classification in which the world's industrialized nations are divided according to two distinct criteria (Figure 1). They are the increasing intensity of R&D after 1990, along the horizontal axis, and the acceleration of total factor productivity, on the vertical axis.

We would expect to find the United States in the far north-east corner of the graph, given the frequency with which the new growth regime is associated with the

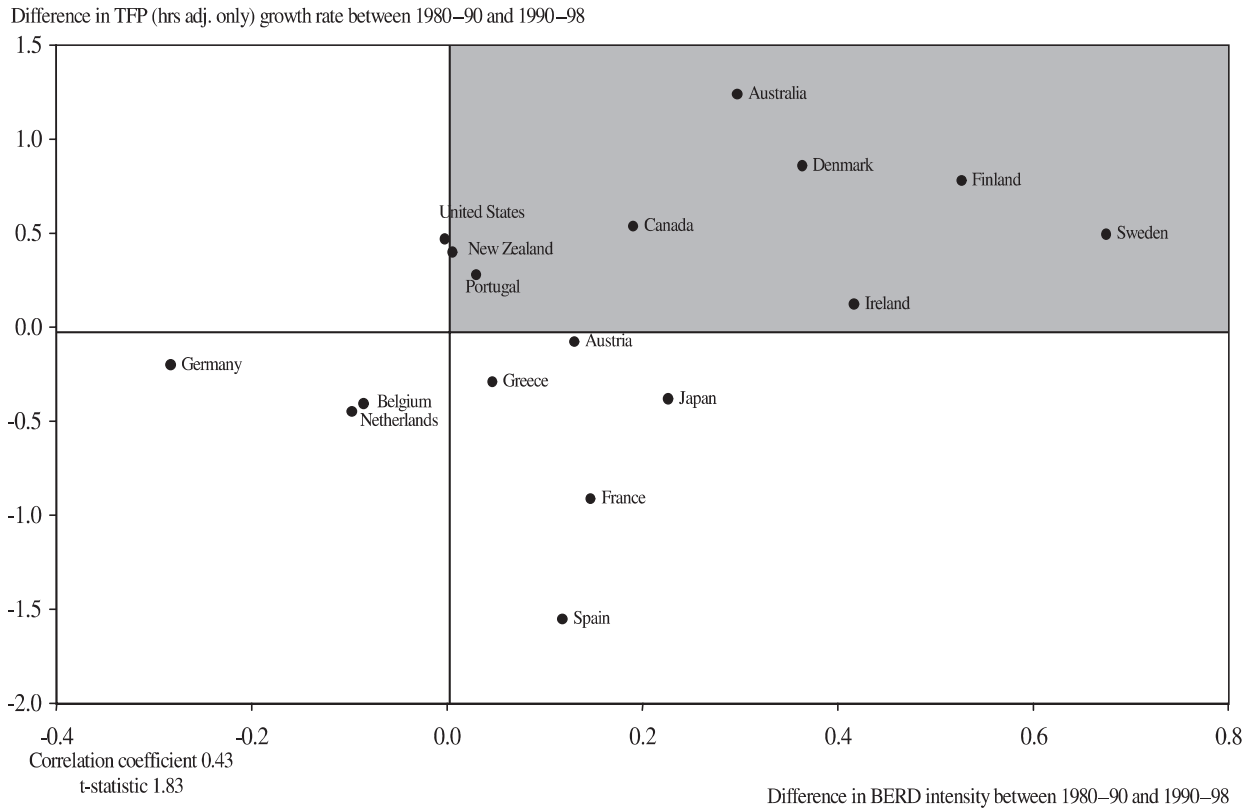

Figure 1 Detecting technology-led regimes among OECD countries.

American economy. In actual fact, it is interesting to note that the performances of a whole group of Scandinavian (Denmark, Finland, Sweden) and Anglo-Saxon (Australia, Ireland, Canada, New Zealand) countries, plus, to everyone's surprise, a southern European one (Portugal), are just as good, if not a lot better, than that of the United States.

This raises the following question: are all of these different countries pursuing the same economic strategy, and do they belong to the same institutional configuration? If so, it is crucial that the United States should not become the sole focus of analysis, and that a systematic international comparative analysis be carried out. It is in these two directions that the present article will continue.

It is important to check whether, and to what extent, ICT are the cause of this polarization between the 'top performing' countries and all the others. Traditional methods in this type of research involve the use of accounting methodologies that can break the total factor productivity index down into its components. Depending on whether raw data are being used (Oliner and Sichel, 2000, p. 19), or else data that have been smoothed out to cover the entire economic cycle (Gordon, 2000, p. 53), assessments of American performances can vary widely. As it is, the OECD's international comparisons (Scarpetta *et al.*, 2000) suggest that the contribution of information system-related capital equipment to overall growth has only been 0.2% higher in the United States than in the European countries, at least for the (already distant) period between 1990 and 1996. This makes it difficult to ascertain the causes of the much wider gap in growth rates on each side of the Atlantic between 1991 and 2000.

2.2 Choosing between three main interpretations

What mechanisms could explain the rapid rise in total factor productivity? Three main mechanisms may be at work here (Table 1).

Many of the countries that lag behind in economic and industrial modernization might continue to experience faster growth than other already industrialized countries, particularly when the former belong to a zone of economic integration (i.e. Europe). This is a reference to a *catching up phenomenon* that the new ICT paradigm has not necessarily eliminated. This catching up can be particularly rapid where *initial productivity levels* are low. Portugal belongs to this category.

Questions remain as to whether the mass production-related mechanisms that had been so central to the post-war boom years continue to apply in certain sectors and/or countries. Traditionally, the intensity of this mechanism can be apprehended through the overall *rate of investment*, long considered to be the explanation for many Asian countries' rapid rate of growth before the 1997 crisis. Japan embodies this mechanism, followed by Portugal, Germany and Austria.

Of course, the central hypothesis remaining to be verified is whether a third mechanism, based on *ICT diffusion*, has now become the dominant one. The

Table 1 Three sources of growth: catching up, investment intensity, use of ICT (in percent, except columns 1, 2 and 5)

Variables	Catching up		Investment		Implementation of ICT			
							Demand	
Countries	GDP/ inhabitant 1990 (EU = 100)	GDP/ employment 1990 (EU = 100)	Average share of 1990–2000	Annual increase 1990–2000	Index of national telecom price (EU = 100)	Investment in knowledge 1995 Share of GDP	ICT intensity 1995 Share of GDP	Δ ICT (acceleration after 1990)
Austria	109.6	99.0	23.5	−2.1	156	7.2	3.5	1.8
Australia	101.9	91.0	–	–	–	6,8	–	–
Belgium	103.0	121.7	20.8	1.4	114	7.1	3.8	1.5
Canada	115.7	100.4	–	–	–	8.8	–	–
Denmark	135.0	87.2	19.1	−1.1	44	9.7	4.8	1.5
Finland	142.7	84.7	18.5	−8.1	60	9.6	4.5	3.1
France	111.5	114.0	19.3	−2.1	104	10.2	4.3	1.5
Ireland	70.0	96.2	19.6	−0.6	86	–	5.1	0.5
Italy	101.1	110.4	18.8	−3.4	114	6	3.9	2.3
Japan	121.1	91.5	28.3	−0.8	169	6.6	4.2	0.7
Germany	123.5	107.7	22.3	2.2	125	7.1	4.2	0.3
Greece	43.3	71.3	21.1	−1.8	197		3.5	2.6
Netherlands	102.8	100.3	21.1	−0.2	44	7.9	4.8	1.6
New Zealand	85.5	79.8	–	–	–	–	–	–
Norway	112.5	98.4		–	–	8.9	–	–
Portugal	37.1	55.4	25.6	−3.4	145	–	4.3	2.6
Spain	68.8	98.8	22.9	0.3	179	–	3.3	2.8
Sweden	144.2	83.2	16.5	−4.5	34	10.6	6.2	3.1
United States	119.4	123.0	18.2	−0.8	112	8.4	6.4	1.5
United Kingdom	89.2	86.7	17.0	−1.8	81	8.4	5.6	1.6
Average EU	100	100	22.0	−1.6	100	8.0	4.3	1.8

Source: Columns 1 and 2: Scarpetta *et al.* (2000, p. 80); Columns 3 and following: Commission of the European Communities (2000, p. 31).

significance of this third factor can be measured by the intensity of ICT utilization; its growth during the 1990s; and the low price of telecommunications services. This is because the core of the 'New Economy' is supposed to be built upon the contrast between the large initial fixed costs and the low costs of transmission and duplication of the information (Shapiro and Varian, 1999). Sunk costs, which are characteristic of informational goods and intellectual property, also play a role in the transformation of competition (Boldrin and Levine, 2002, 2003). For other analysts, ICT are nothing less than the precursor of an even more radical transformation that will be characterized by the advent of a knowledge-based economy—an outcome that the OECD has been purposefully predicting, basing diagnosis on current investments in education, software and copyrights (OECD, 1999).

The main issue is therefore to determine which of the methods available can best explain to what extent each of these mechanisms, evaluated on its own or in conjunction with all of the others, best accounts for recent macroeconomic developments.

2.3 Boolean analytical methods

Economists traditionally rely on econometric analyses, testing growth, labour or multi-factor productivity equations in which explanatory variables encompass the various indicators that were mentioned in the preceding section. However, for at least two reasons, this methodology may not suffice for the requirements of the present article.

First of all, there is the supposition that *one and the same structural equation* covers the many different countries that make up the OECD. This is a questionable hypothesis. Research on modes of 'regulation' has demonstrated time and again that there is a great deal of differentiation (including during the 1990s) between the various types of social innovation systems (Amable *et al.*, 1997*a*, *b*); and more generally, between the various forms of capitalism (Boyer, 1999). Using a single structural equation to test all of these situations is all the more problematic because some analysts consider certain economies to be already operating within an ICT-driven productive paradigm even as other economies continue to pursue a Fordist logic. The findings of such a method will generally indicate the mediocre quality of the econometric adjustments that are being done in tests involving the use of an equation which fuses two otherwise heterogeneous regimes.

Moreover, this approach allows only a single, predetermined configuration to emerge, inasmuch as the only factor that is used to account for the concept of a regime is the relative intensity of its parameters. If, for example, we wanted to focus on the *complementarity* that exists between investments in machines or in ICT, we would need to use a composite term that multiplies these two variables. However, the findings obtained from those available econometric studies that have adopted

this type of model in the name of institutional complementarity have all been extremely disappointing, as few composite terms have turned out to possess any real significance. This is because they focus on second order effects—even though the first order effects have not yet been sufficiently accounted for (Carlin and Mayer, 1999; Fitoussi and Passet, 2000; Ernst, 2001). All in all, the method is too fragile to provide for a regime that combines a range of varied mechanisms.

The ideal solution would be to have a method that does not postulate the existence of a single regime but would reveal them. This method would make it possible to discover *inductively* which associations of characteristics might lead to a given result—in the present example, to an outcome in which economies are part of a virtuous growth regime that combines renewed total productivity gains, and more research and development. It would also be better if this method simply revealed the existence of a given effect, and did not delve into its intensity. Once the salient configurations are revealed, it then becomes possible to carry out a conventional time series econometric analysis incorporating the factors that explain the price nature of the regimes. This will fine-tune the overall analysis and deliver estimations that are more relevant than the ones that the conventional econometric practices have been able to come up with.

Other social sciences, outside economics, often resort to this type of qualitative analysis whenever immediate quantification is impossible. Hence, the idea of bringing into the framework of economic analysis a methodology that was first introduced and illustrated by Charles Ragin (1987, 1994). The irony is that the quantitative data from Table 1 will have to be converted into qualitative data via a binary separation of variables: if the country concerned is well endowed with the corresponding characteristic, it will receive (in a Boolean notational scheme) a value of 1 for that particular variable or of 0 if the opposite prevails. The threshold is set by the average of the variable over the whole sample. Since such a dichotomy is a quite drastic simplification, various sensitivity analyses shift this threshold and test the outcome for the configurations and complementarities previously detected. The same approach is applied to variables that measure macroeconomic performance (total productivity, growth, employment, etc.). What is interesting with this simplification is that it enables Boolean algebraic tools to be used to reveal the entire set of configurations that can possibly lead to a given macroeconomic performance (and conceivably the way in which several of the component indexes can be combined to achieve this result). For the purposes of the present study, Table 2 is built in such a way as to test to what extent the first column, which captures the presence of the technology-led regime (TLR) (revealed by the north-east quadrant of Figure 1), is the outcome of a combination of the six explanatory variables that measure, respectively, catching up, Fordist legacy and intensity of ICT use (derived from Table 1).

Table 2 A test of three sources of technology-led growth by Boolean algebra

Variables		Catching up		The old Fordist paradigm	The information-led paradigm		
Countries	A TLR Acceleration total factor productivity after 1990 and more business RD/GDP	Low productivity level in 1990	High total investment/GDP during the 1990s	Increased investment/GDP after 1990	Low price of telecom.	High investment in information goods	Faster investment in ICTs after 1990
Austria	0	0	1	0	0	0	1
Australia	1	0	–	–	–	–	–
Belgium	0	0	1	1	0	0	0
Canada	1	0	–	–	–	–	–
Denmark	1	0	0	0	1	1	0
Finland	1	0	0	0	1	1	1
France	0	0	0	0	1	1	0
Ireland	1	1	0	0	1	1	0
Italy	0	0	0	0	0	0	1
Japan	0	0	1	0	0	0	0
Germany	0	0	1	1	0	0	0
Greece	0	1	0	0	0	0	1
Netherlands	0	0	0	0	1	1	0
New Zealand	1	1	–	–	–	–	–
Norway	–	0	–	–	–	–	–
Portugal	1	1	1	0	0	1	1
Spain	0	1	1	1	0	0	1
Sweden	1	0	0	0	1	1	1
United States	0	0	0	0	1	1	0
United Kingdom	0	0	0	0	1	1	0
Labelling of the variables	tlr	r	i	di	te	ict	dict
	To be explained		Explaining economic factors				

Source: Derived from Table 1 and Figure 1. Original data from Scarpetta et al. (2000, pp. 33–8).

2.4 ICT implementation as the precondition for a new regime of growth

Following Charles Ragin's method let us write the equation of all the configurations that lead to a successful TLR. Wherever the condition is satisfied (i.e. 1 appears in the first column of Table 2) we adopt capital letters (here TLR) and conversely, lower-case letters denote the absence of the related property. Another convention is to replace the logical operator AND by • and the operator OR by +. Looking at the first column of Table 2, we find that the economies of Australia, Canada, Denmark, Finland, Ireland, New Zealand, Portugal and Sweden can be characterized as TLRs, the property to be explained. Unfortunately, owing to lack of data, Australia, Canada and New Zealand cannot be included in the Boolean analysis. It is then possible to write down the following equation:

$$\mathrm{TLR} = \underbrace{\mathrm{r}\bullet\mathrm{i}\bullet\mathrm{di}\bullet\mathrm{TE}\bullet\mathrm{ICT}\bullet\mathrm{dict}}_{\text{Denmark}} + \underbrace{\mathrm{r}\bullet\mathrm{i}\bullet\mathrm{di}\bullet\mathrm{TE}\bullet\mathrm{ICT}\bullet\mathrm{DICT}}_{\text{Finland, Sweden}} + \underbrace{\mathrm{R}\bullet\mathrm{I}\bullet\mathrm{di}\bullet\mathrm{te}\bullet\mathrm{ICT}\bullet\mathrm{DICT}}_{\text{Portugal}} + \underbrace{\mathrm{R}\bullet\mathrm{i}\bullet\mathrm{di}\bullet\mathrm{TE}\bullet\mathrm{ICT}\bullet\mathrm{dict}}_{\text{Ireland}}$$

The two first terms in the equation, which relate to Denmark, and Finland and Sweden, are identical except for the variable dict/DICT which represents the acceleration of ICT investment after 1990. We conclude that the latter factor plays no role and can therefore be removed from the equation. Comparison of the first term with the fourth shows a similarity of all the factors except for the catching-up effect, represented by the variable *r*, initial productivity in 1990. Therefore, the four configurations can be summarized by the following equation:

$$\mathrm{TLR} = \underbrace{\mathrm{i}\bullet\mathrm{di}\bullet\mathrm{TE}\bullet\mathrm{ICT}}_{\text{Denmark, Finland, Ireland, Sweden}} + \underbrace{\mathrm{R}\bullet\mathrm{I}\bullet\mathrm{di}\bullet\mathrm{te}\bullet\mathrm{ICT}\bullet\mathrm{DICT}}_{\text{Portugal}} \qquad (1)$$

First result R1 The typical configuration for a TLR is related to information and telecommunication. A low price for telecommunication is necessary for industrialized countries but not for those *catching up*.

More precisely, it would seem that the four countries (Denmark, Finland, Ireland, Sweden) which combine low *telecommunications prices* with highly intensive *ICT utilization* have succeeded in becoming members of the new growth regime—without this necessarily having implied any increase in their overall rate of investment. This is a first indication supporting a widely held hypothesis concerning the *generic* nature of the ICT (Soete, 2001). However, this is not the only configuration. Indeed, Portugal provides an example of an *economy that is catching up*. It features a well above average rate of investment and has been making significant (and ever increasing) efforts in the area of *ICT utilization*. It is a country where higher than average telecommunications prices are not prejudicial to economic dynamism.

By contrast, let us look at the three countries that have been increasing the share of total investment and invested more than average but have not developed intensively ICT. They have not experienced an increase in total factor productivity (see Figure 1 and Table 2, column 1). These economies are Belgium, Germany and Spain. Note that the presence of Belgium suggests that the size of the country is not the discriminating factor.

Second result R2 The economies that still follow the previous 'Fordist' pattern governed by high capital accumulation, without implementing ICT, have been *unable* to speed up technical change and adopt a technologically led growth regime.

How robust are these results? Imagine that there is a measurement error, for example, in the estimation of business research development expenditure in the USA in such a way that this country could then belong to the sample of the successful one. It is necessary to add to equation (1) the following term representing the USA:

r • i • di • TE • ICT • dict i.e. the exact configuration of Denmark

The first result is thus confirmed.

Third result R3 The USA is not unique in terms of ICT implementation. The Scandinavian countries and Ireland belong to the same configuration and display even better macroeconomic performance.

It is not necessarily so if, for example, we consider that Portugal is below and not above the average ICT intensity demand (see Table 1). Then, a high investment in ICT is no longer a necessary condition but the coexistence of two configurations remains: low telecom costs and high use of ICT for developed countries, increasing use of ICT for catching-up countries.

To sum up, this could be the explanation for the *diverging trajectories* followed by OECD countries. Germany and Japan's success from the mid-1970s onwards had been based on a strategy that revolved around a marginal amendment of existing mass production methods. In the 1990s however, the macroeconomic success of another group of countries became predicated on their implementing the new ICT-driven productive paradigm. Paradoxically, the Scandinavian countries and Ireland were touched by this phenomenon, but not the United States, where the total factor productivity growth rate was below the OECD average. This demonstrates the usefulness of a truly comparative approach, which does not rely on the American economy as the benchmark. The example of Portugal also demonstrates how this new productive paradigm can create *new possibilities* for countries that were lagging behind in the preceding growth regime. This means that under certain conditions the old and the new paradigms can be combined to produce beneficial macroeconomic effects.

It therefore behoves us to look into the institutional configurations that gave birth to these success stories.

3. What institutional configurations for the new growth regimes?

While it would be tempting to benchmark OECD countries with respect to the USA, it might be more enlightening to keep open the determination of the institutional configurations. The issue is then for theory to interpret the rationale behind the observed configurations. The hypothesis of 'institutional complementarity' helps us to interpret the diversity of these configurations.

3.1 The USA: universal model or exception?

If we were to take the American economy as the benchmark, the emergence of rapid growth would require the combination of a number of structural characteristics. First of all, there would need to be an abundance of venture capital, and new financial markets would have to be created to enable a public listing of the securities of firms implementing the new technologies—these factors being considered indispensable if radical ICT-related innovations are to be funded. Secondly, the stimulation of competition through product market deregulation and through the easing of labour market constraints would be considered as the necessary conditions for any redeployment of demand and input factors from the old to the 'new economy'. Moreover, given that ICT would reinforce the idea that work has an increasing intellectual content, the quality of the initial education and lifelong learning programmes would be seen as a precondition for the knowledge economy's success. In this new regime, priority would be given to *radical* innovations, in contrast to the preceding era of mass production, when innovations were *incremental* and focused, for example, on product quality or differentiation. As such, the quality of the research system and the density of its ties to business become essential factors. In all of these areas, the American economy comes out as a 'one best way'.

Consequently, many studies of the new economy postulate, implicitly or explicitly, the following equation:

> The 'New Economy' = venture capital + new market + deregulation + flexibility of labour + modern and highly developed universities + a dynamic research system + dense links to the business world + a tax system that encourages entrepreneurship

This is an invitation to investigate how widely diffused are these various economic and financial institutions. In fact, a recent OECD research programme was devoted to the characteristics of the knowledge economy (OECD, 1999), seen as the key emerging growth regime (Scarpetta *et al.*, 2000), and has compiled a whole set of statistical indicators on research, innovation (see Table A1), education (Table A2), finance (Table A3) and macroeconomic performance. These statistical

indexes capture the many components of OECD countries' innovation systems (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Amable *et al.*, 1997*a*, *b*).

One could adopt the methodology that contrasts innovation and diffusion, and then compute a diffusion index which takes the more advanced economy, the United States, as its base. The originality of this article is to try to detect the various institutional architectures that have been shown to sustain the emerging growth regime of the 1990s. This hypothesis derives from a series of contemporary studies. Both *Regulation* theory (Boyer and Saillard, 2002) and the *Varieties of Capitalism* school (Hall and Soskice, 2001) stress that there are institutional foundations of comparative advantage. Therefore, from a purely logical point of view, various institutional configurations may coexist and sustain a coherent growth regime.

According to the aforementioned approach (i.e. by asking which institutional conditions lend themselves to a particular macroeconomic outcome), it is possible to establish the mix of institutions that founded the technology-led growth regime during the 1990s. Thus Table 3 converts the available statistical data (from Tables A1, A2 and A3) into Boolean variables. Its objective is to detect which combination of these institutions represents a dynamic growth regime in the 1990s.

3.2 Three configurations: knowledge-based, deregulated and catching-up economies

Which traits are shared by those countries that simultaneously recorded a post-1990 acceleration in total factor productivity and an increase in the share of business R&D in GDP, that is, the countries that have been exploring a technology-led growth regime? Seven countries are thus detected: Australia, Denmark, Finland, Ireland, Norway, Portugal and Sweden (see the fifth column, Table 3, labelled TLR) . The following Boolean equation gives the mix of variables that have delivered such an outcome, noted TLR.

TLR = X • X • pmr • ep • X X • edu • SCPHD • kno • X	Australia
+	
vc, X, pmr • ep • LLL • COM • EDU • scphd • KNO • CO	Denmark
+	
VC • nm • PMR • ep • LLL • COM • EDU • scphd • KNO • CO	Finland
+	
vc • nm • pmr • ep • lll • COM • edu • SCPHD • KNO • co	Ireland
+	
X • X • X • X • X • X • EDU • scphd • X • X •	Norway
+	
R • vc • nm • pmr • EP • lll • com • edu • scphd • X • X •	Portugal
+	
VC • NM • PMR • EP • LLL • COM • EDU • scphd • KNO • CO	Sweden

'X' denotes missing data.

Table 3 Searching for possible institutional determinants for the improvement of macroeconomic performance in the 1990s

Variables	Better macroeconomic performance after 1990				Finance			Labour market		Education			Research	
Countries	Increase in total factor productivity	Faster growth	More employment growth	TLR	Abundant venture capital	Important 'New market'	Product market extended regulation	Extended employment protection	Intensive lifelong learning	High use of computers in secondary school	High secondary degree	High scientific degree in population	High investment in knowledge	Good cooperation University/Firms
Austria	0	0	1	0	0	0	0	1	1	–	1	0	0	0
Australia	1	1	0	1	–	–	0	0	–	–	0	1	0	–
Belgium	0	0	1	0	1	0	1	1	1	0	0	0	0	0
Canada	1	0	0	1	–	–	0	0	–	–	1	1	1	–
Denmark	1	1	0	1	0	–	0	0	1	1	1	0	1	1
Finland	1	0	0	1	1	0	1	0	1	1	1	0	1	1
France	0	0	1	0	0	1	1	1	0	1	1	1	1	0
Ireland	1	1	1	1	0	0	0	0	0	1	0	1	1	0
Italy	0	0	0	0	0	0	1	1	0	0	0	–	0	–
Japan	0	0	0	0	–	–	1	1	–	–	–	0	0	–
Germany	0	0	0	0	1	1	1	1	0	–	1	0	0	0
Greece	0	0	0	0	0	1	1	1	0	–	0	0	–	–

Table 3 Continued

Variables	Better macroeconomic performance after 1990				Finance			Labour market		Education			Research	
Countries	Increase in total factor productivity	Faster growth	More employment growth	TLR	Abundant venture capital	Important 'New market'	Product market extended regulation	Extended employment protection	Intensive lifelong learning	High use of computers in secondary school	High secondary degree	High scientific degree in population	High investment in knowledge	Good cooperation University/Firms
Netherlands	0	1	1	0	1	0	0	1	1	0	1	–	0	0
New Zealand	1	0	1	0	–	–	0	0	–	–	0	1	–	–
Norway	1	1	1	1	–	–	–	–	–	–	1	0	–	–
Portugal	1	0	1	1	0	0	0	1	0	0	0	0	–	0
Spain	0	0	1	0	0	–	1	1	0	–	0	1	–	–
Sweden	1	0	0	1	1	1	1	1	1	1	1	0	1	1
United States	1	1	0	0	1	1	0	0	–	–	1	1	1	–
United Kingdom	0	0	0	0	1	0	0	0	1	1	1	1	1	0
Labelling of the variables	dtfp	dg	dn	tlr	vc	nm	pmr	ep	lll	com	edu	Scphd	kno	co
	Macroeconomic outcomes				Explaining institutional factors									

Given the paucity of explanatory variables for Norway, this country will be removed from the sample. The use of Boolean algebra delivers the following regrouping:

$$\begin{aligned} TLR = {} & LLL \bullet COM \bullet EDU \bullet scphd \bullet KNO \bullet CO \\ & \bullet [\underbrace{vc \bullet X \bullet pmr \bullet ep}_{\text{Denmark}} + \underbrace{VC \bullet nm \bullet PMR \bullet ep}_{\text{Finland}} + \underbrace{VC \bullet NM \bullet PMR \bullet EP}_{\text{Sweden}}] \\ & + \underbrace{pmr \bullet ep \bullet edu \bullet SCPHD}_{\text{Australia}} \bullet [\underbrace{kno \bullet X + vc \bullet nm}_{\text{Ireland}} \bullet COM \bullet KNO \bullet co] \\ & + \underbrace{vc \bullet nm \bullet pmr \bullet EP}_{\text{Portugal}} \bullet lll \bullet com \bullet edu \bullet scphd \end{aligned}$$

The first set of parentheses might seem to imply that venture capital institutions need to be present (Sweden and Finland); however, Denmark has achieved a TLR without them. The same reasoning applies for employment protection (Denmark versus Finland) and for product market liberalization (Denmark versus Sweden). The second term shows that venture capital and new markets are not necessary for Ireland to successfully join the TLR. Nor does the third configuration require the sophisticated financial tools observed in the USA.

Therefore, if one neglects the variants of the first group, the equation can be simplified into:

$$\begin{aligned} \underset{\substack{\text{Technology-}\\ \text{led regime}}}{TLR} = {} & \underbrace{LLL \bullet COM \bullet EDU \bullet scphd \bullet KNO \bullet CO}_{\text{Knowledge-based economy}} + \underbrace{pmr \bullet ep \bullet edu \bullet SCPHD}_{\substack{\text{Deregulated}\\ \text{science-pushed}\\ \text{economies}}} \\ & + \underbrace{EP \bullet R}_{\substack{\text{Employment}\\ \text{protection and}\\ \text{catching up}}} \end{aligned} \qquad (2)$$

Three configurations emerge as permissive for a TLR:

Configuration 1 *A knowledge-based economy* (KBE) combines good general educational level of the working population (EDU), lifelong learning (LLL) and a high investment in knowledge acquisition through education and research (KNO). Furthermore, modern schools use computers intensively (COM) and there is good cooperation between universities and firms in terms of research and innovation. It is to be noted that the regulatory environment is quite diverse: few regulations in Denmark, but many in Sweden, Finland being an intermediate case. Similarly these Scandinavian economies may or may not have any pro-innovation financial tools. The common feature is clearly the *systemic complementarity* between the coordination mechanisms governing the creation and diffusion of knowledge. The institutions of a *social democratic society* seem rather instrumental in providing a coherence and efficiency to the system. Since Denmark, Finland and Sweden belong

to this model, but not Belgium, this may suggest that small size and large international openness are not sufficient conditions for a knowledge-based economy.

Configuration 2 *Pro-market orientation and reliance upon scientific research*, and not so much investment in primary and secondary education are the key features of a second group of countries, here represented by Australia and Ireland. One recognizes *some*, but not all, of the ingredients that are supposed to define the 'New Economy'. The key institutions are totally different from that observed for Configuration 1.

Configuration 3 Portugal belongs to a third category featuring low achievement in knowledge, but starting from a low productivity level, the country does not need the same institutions as Configurations 1 and 2. Employment protection does not seem detrimental within this third configuration.

This interpretation in terms of different institutional architectures is at odds with the conventional vision of a progressive diffusion of the same institutional arrangements.

Fourth result R4 *Three institutional configurations* allow economies to enter a TLR: the knowledge-based economy, the pro-market and pro-science architecture and finally a less defined configuration based on catching up by the accelerated adoption of information technologies.

3.3 How robust is this taxonomy?

What happens to the aforementioned findings when the only focus becomes the recovery in total factor productivity growth rates after 1990? The purpose is then to explain the second column of Table 3 (increase in total factor productivity, DTFP) by the same institutional variables as previously. Two other countries, Canada and the United States, are then added to the list of seven economies analysed above. The Boolean equation corresponding to the term DTFP is obtained by completing previous equation (1) by two new terms:

$$\begin{aligned}\mathrm{DTFP} = {} & \{\text{Countries displaying TLR}\} + \mathrm{pmr} \bullet \mathrm{ep} \bullet \mathrm{SCPHD}\,(\mathrm{EDU} \bullet \mathrm{KNO} \bullet \mathrm{X} \\ & + \mathrm{edu} \bullet \mathrm{X} + \mathrm{VC} \bullet \mathrm{NM} \bullet \mathrm{EDU} \bullet \mathrm{KNO})\end{aligned}$$

This can be rearranged into the following grouping, using the previous results

$$\begin{aligned}\mathrm{DTFP} = {} & \mathrm{LLL} \bullet \mathrm{COM} \bullet \underset{\text{Denmark, Finland, Sweden}}{\mathrm{EDU}} \bullet \mathrm{scphd} \bullet \mathrm{KNO} \bullet \mathrm{CO} \\ & + \mathrm{pmr} \bullet \mathrm{ep} \bullet \mathrm{SCPHD}\,[\underset{\text{Australia}}{\mathrm{edu}} \bullet \mathrm{kno} + \mathrm{KNO}\,(\underset{\text{Ireland}}{\mathrm{vc}} \bullet \mathrm{nm} \bullet \underset{\text{Canada}}{\mathrm{co}} + \mathrm{X} \\ & + \underset{\text{USA}}{\mathrm{VC} \bullet \mathrm{NM} \bullet \mathrm{EDU}})] + \mathrm{R} \bullet \mathrm{EP} \bullet \mathrm{vc} \bullet \mathrm{nm} \bullet \underset{\text{Portugal}}{\mathrm{pmr}} \bullet \mathrm{lll} \bullet \mathrm{com} \bullet \mathrm{edu} \bullet \mathrm{scphd}\end{aligned}$$

The second term can be reduced too: VC • NM is not a necessary condition for total factor productivity increase after 1990, as shown by the comparison of Ireland and

the USA. But then the comparison of Australia (edu • kno) with the USA (EDU • KNO) shows that this term also is not a necessary condition for a speeding up of technical change. Hence the condensed result

$$\text{DTFP} = \underbrace{\text{LLL} \bullet \text{COM} \bullet \text{EDU} \bullet \text{scphd} \bullet \text{KNO} \bullet \text{CO}}_{\text{Knowledge-based economy}} + \underbrace{\text{pmr} \bullet \text{ep} \bullet \text{SCPHD}}_{\text{Deregulated science-pushed economies}} + \underbrace{\text{R} \bullet \text{EP} \bullet \ldots}_{\text{Employment protection and catching up}} \qquad (3)$$

Acceleration of total factor productivity

Hence three other results:

Fifth result R5 A looser definition of a TLR confirms the previous taxonomy, that is, the existence of three configurations: first, the typical institutions of a knowledge-based economy—good education, lifelong learning, cooperation between universities and firms—typical of *social democratic economies*; second, *deregulated economies* that emphasize scientific research, now extended to nearly all English-speaking countries; third, some *catching-up countries* with a regulated labour market, typical of southern Europe.

Sixth result R6 The so-called 'New Economy' that was supposed to be typical of, if not exclusive to, the United States, is in fact shared by Canada and Ireland and may persist even after the bursting of the American internet bubble. It would be more exact to label this configuration as 'deregulated and science led'.

Seventh result R7 The much celebrated venture capital and new markets, which seem so crucial for the American trajectory, are *neither sufficient nor necessary* conditions for the adhesion to a TLR, even within a 'deregulated science-led regime'.

3.4 Various forms of institutional complementarity

This method finally exhibits the complementarities or at least compatibilities between various institutional arrangements (Amable *et al.*, 2002). Nevertheless, they do not derive from a canonical supermodularity originating in technology (Milgrom and Roberts, 1990): just-in-time, total quality control, are not considered here. Furthermore, these configurations differ from those investigated previously. Comparative institutional analysis (Aoki, 2001) contrasts the hierarchical and vertically integrated mass-production firm with the flexibility associated with modular production and the mobility of competences typical of Silicon Valley. The 'Varieties of capitalism' theory stresses a dichotomy between non-coordinated and coordinated market economies, with the USA on one side, and Germany on that of a social market economy (Hall and Soskice, 2001). In fact, different configurations emerge from the present analysis (Figure 2).

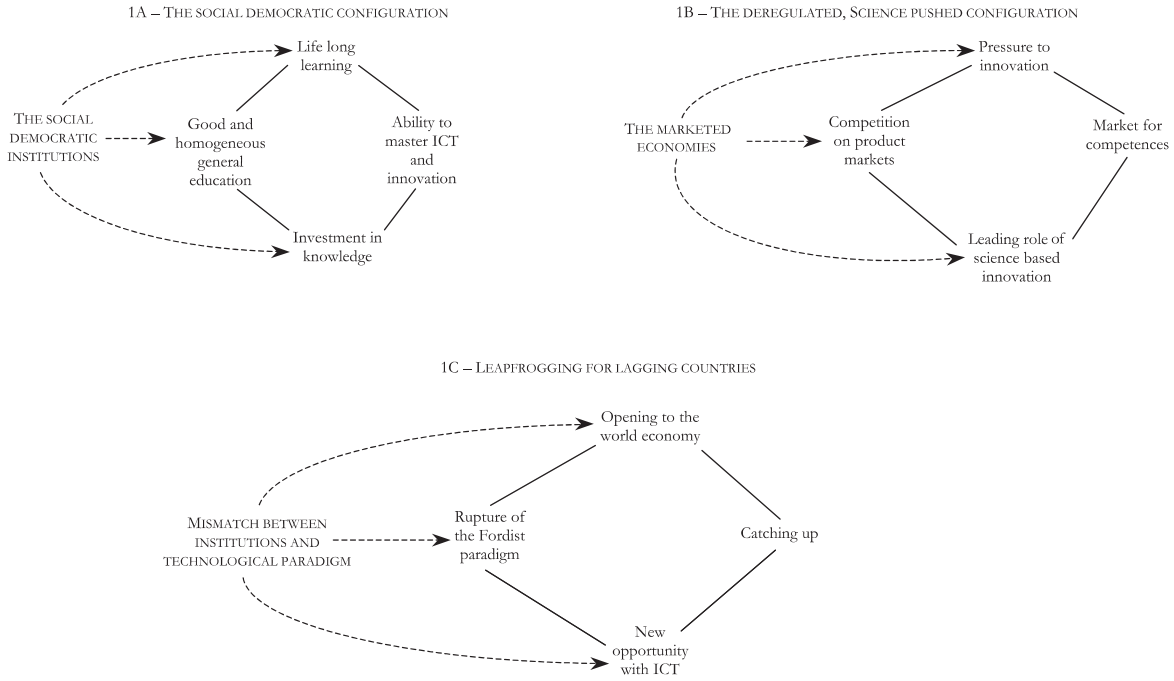

Figure 2 Three different institutional complementarities for a technology-led regime.

The knowledge economy relies on the complementarity between the high general educational levels that permit intensive job training and institutionalized cooperation between, on the one hand, the academic system and the research centres, and on the other, business. On average, a large proportion of total output is devoted to education, to software and to other vehicles for the transmission of knowledge. ICT are used intensively, but they are simply a channel that favours *widespread socialization* of knowledge by means of collective investments. Basically this model is different from the so-called 'New Economy' and its leading firms such as Intel and Microsoft, since Linux may well become the emblem of this type of knowledge economy. Here the market is not the dominant form of coordination—instead *cooperation* is, in this instance, institutionalized and organized on a national basis. Thus, this configuration does not bring major inequalities since the rather even distribution of education endows individuals with good skills. This feature is good both on the production side with the dynamism of innovation, and on the demand side, for diffusion of new products with a large informational content.

The deregulated economy on the other hand allows for a *private appropriation* of advances in knowledge inasmuch as patents and the defence of intellectual property rights become the tools that enable those who have the highest diplomas and/or the most talent to keep most of the innovation rents for themselves. A very active external labour market is given the task of evaluating at all times how much everyone is to be remunerated, depending on his/her competence and on the demands of the market. This capture of the rents associated with innovation is mitigated by the fact that competition on the product markets tends to cause a considerable drop in the price of information goods, allowing consumers to benefit ultimately from innovation-driven advances. In this configuration the unequal distribution of competences is a key ingredient of the very dynamism of growth.

The accelerated catch-up model is made possible by a shift in the technological paradigm. This is another configuration that is capable of triggering a virtuous circle, despite, or maybe because of, the initial lag that the country in question (Portugal) was experiencing during the old Fordist mass production model. A *heavily protected labour force* does not impede membership of this regime—unlike the second configuration, which is typical of countries that are characterized by their confidence in market mechanisms. The complementarity between institutional arrangements is not so clear but the structural changes in the international economy and innovation systems play a role since they remove the barriers to development that existed previously.

4. How important is deregulation?

Let us turn back to Table 3 and ask which institutional arrangements have triggered an acceleration of growth (i.e. DG in column 3) or alternatively a recovery in

employment trends during the 1990s by comparison with the previous decade (i.e DN in column 4). The purpose is to test a frequently held conviction that full market deregulation is a necessary condition during any shift of productive paradigm.

4.1 Product market deregulation, a necessary condition for growth recovery

The five countries that recorded accelerated growth after 1990 (Australia, Denmark, Ireland, Netherlands, United States) belong to two distinct configurations:

$$\begin{aligned} DG = {} & pmr \bullet LLL \bullet EDU \bullet [vc \bullet ep \bullet \underset{\text{Denmark}}{COM} \bullet scphd \bullet KNO \bullet CO \\ & + VC \bullet nm \bullet \underset{\text{Netherlands}}{EP} \bullet com \bullet kno \bullet co] + pmr \bullet ep \bullet SCPHD\,[\underset{\text{Australia}}{edu} \bullet kno \\ & + VC \bullet \underset{\text{United States}}{NM} \bullet lll \bullet EDU \bullet KNO + vc \bullet nm \bullet \underset{\text{Ireland}}{ll} \bullet COM \bullet EDU \bullet KNO \bullet co] \end{aligned}$$

Denmark and *the Netherlands* are characterized by high general educational levels and by above average efforts in the area of lifelong learning. These are two conditions for categorization as a knowledge economy, and more specifically, as its *social-democratic variant*. The labour market is not necessarily deregulated—it is in Denmark, but not in the Netherlands. Similarly, a strong venture capital is present in the Netherlands but not in Denmark but nevertheless both countries have enjoyed an acceleration of growth. This configuration is rather similar to the one observed for the TLR.

Australia, Ireland and the United States belong to another configuration, one in which the deregulation of the labour market coincides with an emphasis on the excellence of scientific personnel. In its market-oriented variant (wherein a market logic governs the reallocation of competences and capital to those areas where innovation breakthroughs have occurred), this model could be entitled a *Schumpeterian* one (c.f. the role of radical innovations in economic dynamics). This is another name for a deregulated science-push configuration. But again, the comparison of Ireland with the USA shows that sophisticated financial markets are not a necessary condition for growth renewal.

Nevertheless, both groups of countries share a common feature: a large product market deregulation, as made explicit by the final equation:

$$DG = \underset{\substack{\text{Deregulation}\\ \text{of product}\\ \text{market}}}{pmr} \bullet [\underset{\substack{\text{Training and}\\ \text{education}}}{LLL \bullet EDU} + \underset{\substack{\text{Deregulation of labour}\\ \text{market and scientific}\\ \text{research-led technical change}}}{ep \bullet SCPHD}] \qquad (4)$$

Eighth result R8 Higher growth rates after 1990 are associated with product market deregulation but not necessarily labour market deregulation. This is only the case for market-led and science-pushed regimes.

This trend is consistent with efforts by international organizations, both at a worldwide level (WTO, OECD) and at a European one. After all, the deepening of the Single Market has been associated with repeated attempts to reinforce competition through deregulation. This outcome would appear to validate one of the hypotheses advanced by regulationist inspired research concerning the knock-on effects of *forms of competition* in the growth regimes that emerged during the 1980s and 1990s (Petit, 1998).

On the other hand, *the deregulation of labour is not a necessary precondition.* This negative finding can be explained by the fact that analyses by international organizations tend to stress external flexibility, in that this factor is associated with an attenuation of the regulatory and negotiated constraints that usually weigh upon labour. Yet an innovation-driven redeployment of employment can be organized collectively, either through internal mobility within a large firm (one example being the Japanese economy during its 'golden years') or else by various public agency actions, including workforce retraining (the policy pursued by the small open Scandinavian economies).

4.2 Labour market regulation is not necessarily bad for employment

One observes a polarization between the New World and the Old Continent: the dynamism of job creation that marks the former, versus the stagnation (and lower rates of activity) that characterizes the latter. This divergence is frequently attributed to strong differences in labour market institutions and regulations. Thus, more flexibility, that is, social deregulation is often presented as a *necessary precondition* for any reduction in this gap, and for Europe's return to a full employment regime. The aforementioned Boolean analytical method comes up with a surprising finding.

Looking back to Table 3, fourth column, nine countries exhibit a speeding up of employment in the 1990s compared with the 1980s. The related Boolean equation can be written and then simplified into the following equation:

$$DN = EP \bullet co\ [LLL \bullet EDU + R + PRM] + pmr \bullet ep \bullet SCPHD \bullet edu \quad (5)$$

Acceleration of employment	Extended labour regulation + weak cooperation universities–firms	Education and training	Catching up	Product Market regulation	Deregulated economics/ Science-pushed technology and relatively low education
		Austria, Netherlands	Spain, Portugal	France, Belgium	New Zealand, Ireland

Six of the eight countries that share the attribute of good employment performance have two traits in common: relatively restrictive labour regulations; and little cooperation between the research and business spheres. This is clearly a paradoxical finding, given that most international institutions (the OECD, IMF, European

Commission, etc.) and central bankers continue to argue that increased labour market flexibility is the essential condition for a return to full employment. First, because they feel that this strategy enables, amongst others, a more accommodating type of monetary policy. Second, if radical innovations drastically transform the productive system, the renewal of competences and job or employment mobility are conditions for the redeployment of economic activity into profitable, sunrise sectors. However, Boolean analysis suggests that employment protection is not necessarily bad for employment but needs to be associated with one or the other of the following three characteristics.

A first condition is that *the country's level of education, and the intensity of its vocational training, must be high*. Here the sort of flexibility that can be achieved by a North American style of external workforce mobility is replaced by a type of general education and continuous training that ensures a wide spectrum of competences via polyvalence and/or the periodic adaptation of qualifications to the imperatives of the productive paradigms that happen to be emerging (Boyer and Durand, 1997). Austria and the Netherlands belong to this configuration, which has turned out to be a knowledge economy variant in which the labour factor is still being moulded by strong institutions and rules—even though the labour market and welfare institutions have been reformed in order to reflect the new nature of international competition (Fitoussi and Passet, 2000; Freyssinet, 2000) as well as the opportunities that the new technologies offer.

An entirely different condition relates to the *level of development*. Changes in the Spanish and Portuguese employment situations during the 1990s show that labour regulation-based control is not an obstacle for *economies that are catching up*. Of course, in these countries too, some labour market reforms have been implemented but the institutional configuration is still different from a typical market-led one.

It is even more surprising to discover the existence of an *institutional complementarity* between continued *product market regulation* and the heavy labour market constraints—this being a configuration to which both France and Belgium belong. As such, measures that would be detrimental in a deregulated product market can be beneficial in an economy that is still being subjected to large-scale public intervention. But with European integration and the pressure of international competition enforced by the WTO, for how much longer will this configuration prevail?

Finally, note that the *deregulated economies* configuration (represented here by New Zealand and Ireland) places more trust in scientific research than in vocational training. It remains that these conditions are not sufficient in and of themselves, inasmuch as Canada, the United States and Australia have not recorded any equivalent acceleration in their employment levels, even though they share in these very same characteristics. In accordance with a strict Boolean logic, this observation would call for research into *other* indicators that could discriminate amongst this

group of countries. The size of the present article restricts our ability to explore this question any further.

Ninth result R9 Two contrasted configurations delivered faster employment growth after 1990: *some deregulated economics* with low education on the one hand, and on the other, a form of employment protection associated with one of the three features: good education and training, catching-up or product market regulations.

Of course, the long-term viability of these configurations is an open question, but conventional wisdom should be challenged concerning the interpretation of the 1990s. At this stage of the analysis, the most noteworthy finding is probably that the configurations that encouraged a recovery in employment levels are not the same as those that characterized the growth regime that emerged during the 1990s. An equivalent finding was made in an earlier study, one that was based on a different sample of 12 OECD countries, and which analysed data and used an automatic ranking procedure (Amable *et al.*, 1997*a*). Here, the mastering of information technologies appeared to have no relationship to the degree of proximity to full employment.

4.3 Novelty and product differentiation are as important as higher productivity

How can we explain that a virtuous circle of employment has not gone hand in hand with a virtuous circle of productivity and growth? *Different interpretations* can be advanced, depending on the methodology being adopted. Growth accounting methods generally show that the unequal diffusion of ICT in Europe and in the United States does not finally explain the two regions' differential growth rates, even though this gap tended to increase from the mid-1990s onwards (Cohen and Debonneuil, 2000).

On the other hand, if the sample of OECD countries is divided into two groups, basing this division on a panoply of indicators that cross innovation-related and macroeconomic variables; and if one estimates a cumulative growth model for each of these two samples—then the virtuous circle does appear, but only for the most dynamic group of countries, and not for the others. This could explain the negative findings that had been reached for the whole of the sample (Scarpetta *et al.*, 2000).

Still, a third interpretation remains. Creating a continuity with the mass consumption-driven growth regime, certain macroeconomists continue to assert that the total factor productivity growth rate is the single criterion that makes it possible to assess whether a new regime has emerged or not. Now, it may well be that the primary usefulness of ICT is that they allow for a better fit between the production possibilities and the changing demands of the market, thanks to increased responsiveness, a more fine-tuned and relevant product differentiation, and improvements in the quality of services. Consumer satisfaction rises without any accompanying improvement in productivity, since the crucial factor has now become profit rate optimization. In passing, note that changes in gross profit margins in the

United States, which had become exceptionally stable and strong during the 1990s (Zarnowitz, 2000: Appendix, Chart 6), tend to substantiate this hypothesis. If so, ICT, an instrument of rationalized management for most large private sector firms (and even more so in the public sector), does not feature a strong potential for enhancing productivity, with the exception of the information goods-producing sector itself.

5. Strength and limits of this approach

Since these results are somehow surprising and the methodology not so familiar to economists, the reader may raise many objections to the previous findings. Let us try to answer some of them.

First, the nature of the exercise is not so much to deliver a general taxonomy for the various countries but to detect clustering of variables and *institutional and technological configurations* that deliver a given macroeconomic outcome. The method is essentially *inductive* and has therefore to be complemented by a comparison with current theorizing of the same issues. This is a reply to the possible impression that the sample opposes small open economies to large ones. It should be stressed that the knowledge-based economies group is typically associated with social democratic institutions and not small size *per se*. Clearly, Belgium, Portugal and the Netherlands belong to different configurations.

Second, the selection of the representative variables might seem *ad hoc* or worse, selected in order to sustain a given interpretation. Actually, the method is quite the opposite. Tables 1, A1, A2 and A3 gather all the relevant variables characterizing social system of innovation, for which international comparative data have been assembled by OECD. The approach is *an intermediate strategy* between the econometric tests of a single theory and the juxtaposition of national case studies, out of which it is difficult to draw general results (Lundvall, 1992; Nelson, 1993). The list of variables is sufficiently rich to sustain *ex ante* a large series of institutional configurations. Actually, only a few of them emerged out of the analysis and they did not necessarily fit with the *ex ante* interpretation of the author.

Third, the configurations emerging out of the inductive method are useful only if *ex post* they can be interpreted according to some theoretical framework. The general hypothesis of institutional complementarity is enlightening (see above, Figure 2). Both the knowledge-based social democratic configuration and the deregulated science-pushed one exhibits quite contrasted institutions, but in each configuration, they do fit one with another in fostering innovation and growth. The next step would be to build a formal model in order to analytically derive the precise features that make coherent these configurations.

How robust are the results? *A priori*, given the crude reduction of continuous variables to dichotomous ones (0 or 1), the relatively small number of observations, one could fear totally unstable and therefore irrelevant taxonomies. Surprisingly,

the picture that emerges is quite consistent with previous findings on social systems of innovation. The social democratic and market-led configurations have recurrently been found by various methods: automatic data clustering (Amable *et al.*, 1997*a*; Amable, 2003), econometric analyses of growth (Amable and Petit, 2002) or out of the properties of theoretical models (Amable *et al.*, 2002). The catching up configuration is more uncertain.

Last question: how does this approach relate to the *Varieties of Capitalism* (VOC) theory (Hall and Soskice, 2001) or the vast literature on the diversity of capitalisms (Berger and Dore, 1996; Whitley, 2000, 2002; Coates, 2002; Schmidt, 2002)? The objective is the same but the tools and the results differ significantly. First, VOC contrasts two types of capitalism according to the degree of non-market coordinating mechanisms, whereas this article leaves open the number of configurations as well as the precise nature of the institutional arrangements that complement market adjustments. Second difference, this article studies the 1990s, i.e. a period of significant structural changes whereas VOC stresses the permanence of the same institutional complementarities in the long run. Third distinction: this approach is exclusively concerned with macro-institutional configurations, whereas VOC aims at a micro-foundation at the firm level of the basic institutions of capitalism (Boyer, 2002).

To sum up, the present methodology leaves open the possibility of a plurality of configurations and does not immediately attempt to estimate an econometric model that assumes that there is a single universal institutional configuration. The impact of a given characteristic can be unfavourable in one instance, beneficial in another, without this implying the existence of some 'outliers', to use a terminology that is customary in econometric analysts. Actually, these outliers may well define coherent configurations that remain unnoticed by theoreticians.

6. Conclusion

Keeping in mind the experimental nature of the present exercise, one could propose the following provisional conclusions.

(a) The 1990s correspond to an epochal change in terms of growth regime. A massive investment by itself is no longer capable of fostering a process of cumulative growth, along the previous line of mass production and consumption. *Fordism is dead—long live the information and communications technologies*! Actually, the intensity of ICT utilization seems to be a prerequisite for a country's inclusion in a regime driven by technological innovation.

(b) Faster growth is observed only if a country has undertaken a *deregulation of the product markets* (particularly *telecommunications*). This is the second prerequisite for the renewed growth that was observed during the 1990s. Nevertheless, deregulation of the labour market is not a necessary condition, even if it is observed within a market-led configuration. Similarly, and quite

surprisingly, financial innovations such as abundant *venture capital* or the creation of '*new* financial *markets*' are not at all required in order to sustain a technological-led regime.

(c) However impressive the American new economy of the 1990s, the US configuration should not be taken as the benchmark, and the unique reference in order to assess the diffusion of a single one best way model. *De facto* the USA is a member of a group of market-led economies that includes Australia, Ireland and Canada. All have in common the fact that they have started to deregulate both their product and labour markets, and rely on the impetus of scientific advances to develop new technologies.

(d) At least, *three institutional configurations* support a technology-led growth regime. Social democratic institutions favour a knowledge-based economy, whereas deregulated market economies rely more on science push for growth. Last but not least, the new opportunities associated with globalization and ICT give some opportunities for lagging economy to catch-up or even leapfrog other economies.

(e) The erosion and demise of the post-Second World War Fordist growth regime might give the *impression of a convergence* towards a new model. Nevertheless, a closer look at institutional configurations shows still *contrasted paths* for labour institutions, state intervention, social systems of innovation. Furthermore, the collapse of the Internet bubble has already shown the limits of ICT-driven growth and probably gives the chance for a more promising and general model, that of a knowledge economy and society.

(f) It is important to stress that all these results are quite or rather tentative. This article is an invitation to economists and social scientists to *combine two distinctive methods* in order to assess the diversity of brands of capitalism. Qualitative comparative analysis is quite essential in order to detect discrete technological and institutional configurations. But they are not sufficient since they should be the first step toward an econometric analysis of time series, with endogenous selection of contrasted regimes. This could reconcile two objectives: to detect a historical change and nevertheless keep open the existence of distinctive trajectories. It is an agenda for future research.

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Appendix

Table A1 Some institutional factors governing innovation

Variables / Countries	Firms–university cooperation (1994–96)	Customer orientation of innovation (by rank: 1 maximum 12 minimum)	Venture capital in early stage/GDP		Administrative regulation	Employment protection
			1995 (%)	1999 (%)		
Austria	13	–	0.002	0.018	1.65	2.4
Australia	–	–	–	–	1.10	1.1
Belgium	14	2	0.052	0.107	3.10	2.55
Canada	–	–	–	0.165	0.85	0.6
Denmark	17	1	0.009	0.023	1.15	1.9
Finland	53	–	0.035	0.10	2.20	2.1
France	11	3	0.030	0.065	3.2	2.90
Ireland	14	–	0.048	0.055	1.45	1
Italy	–	2	0.0225	0.0485	3.0	3.75
Japan	–	–	0.003	0.001	2.75	2.6
Germany	10	1	0.035	0.070	2.65	3.25
Greece	–	–	–	–	1.90	3.55
Netherlands	8	1	0.08	0.16	1.50	2.75
New Zealand	–	–	–	–	1.40	1
Portugal	10	–	0.06	0.05	1.55	3.85
Spain	–	–	0.030	0.0375	2.225	3.45
Sweden	28	–	0.012	0.058	2.00	2.90
United States	–	–	0.058	0.165	1.25	0.2
United Kingdom	12	2	0.080	0.130	–	–
Average EU	17	–	0.037	0.078	1.95	2.32

Source: Column 2: Petit Pascal (2000, p. 33); Column 3: Bassani and Scarpetta (2000, p. 30); Column 4: Bassani and Scarpetta (2000, p. 31).

Table A2 The role of competence formation

Variables / Countries	Fraction of population with secondary education 1966 (%)	Fraction of population with scientific or engineering PhD (flow) 1996 (%)	Student per computer		Lifelong learning fraction of the population involved 1999
			Primary	Secondary	
Austria	72	0.05			8.0
Australia	59	0.22			
Belgium	53	0.06	25	13	7.5
Canada	76	0.13			
Denmark	66	0.04	14	9	19.5
Finland	66	0.085	11	7	17.5
France	61	0.16	31	10	3
Ireland	50	0.25	18	8	4.2[a]
Italy	39		51	14	5.5
Japan		0.035			
Germany	86	0.09			5.5

Greece	44	0.065			1.5
Netherlands	62		13	16	14
New Zealand	60	0.18			
Norway	82	0.04			
Portugal	20	0.03	150	65	3
Spain	30	0.14			4.9
Sweden	73	0.07	13	6	26.5
United States	86	0.13			
United Kingdom	76	0.19	16	9	19
Average EU	61	0.095	34.2/21.3[b]	15.7/10.2[b]	7.0

Source: Column 1: Commission of the European Communities (2000, p. 31).

[a] For 1995.

[b] Without Portugal.

Table A3 The role of the financial system

Countries	Venture capital/GDP 1999 (%)	New market capital/GDP 1999 (%)
Austria	0.04	0.5
Australia	–	–
Belgium	0.26	0.1
Canada	–	–
Denmark	0.05	–
Finland	0.14	2.3
France	0.13	4.7
Ireland	0.09	0.4
Italy	0.06	1.1
Japan	–	–
Germany	0.13	3.7
Greece	0.06	17.5
Netherlands	0.32	0.3
New Zealand	–	–
Norway	–	–
Portugal	0.04	0.2
Spain	0.1	–
Sweden	0.2	31.2
United States	0.37	57.3
United Kingdom	0.2	1.5
Average EU	0.14	3.4

Source: Commission of the European Communities (2000, p. 31).