

Centre Piece

The Magazine of The Centre for Economic Performance



Volume 9 Issue 2 Summer 2004

Women not working



THE QUEEN'S
ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2002



computer assistance

Editor Hugh Stephenson
Design Raphael Whittle
Print VIP Print

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Editorial and Subscriptions Office
Centre for Economic Performance
London School of Economics
Houghton Street
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Annual subscriptions for one year (3 issues):
Individuals £13.00
Students £8.00
Organisations (UK and Europe) £30.00
Rest of world £39.00
Visa and Mastercard accepted
Cheques payable to *London School of Economics*

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Volume 9 Issue 2
(ISSN 1362-3761) All rights reserved.

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CENTRE *for* ECONOMIC
P E R F O R M A N C E

THE LONDON SCHOOL OF ECONOMICS
AND POLITICAL SCIENCE
HOUGHTON STREET LONDON, WC2A 2AE
Tel: 020 7955 7798 Fax: 020 7955 7671
Homepage: www.centrepiece-magazine.com
Email: centrepiece@lse.ac.uk



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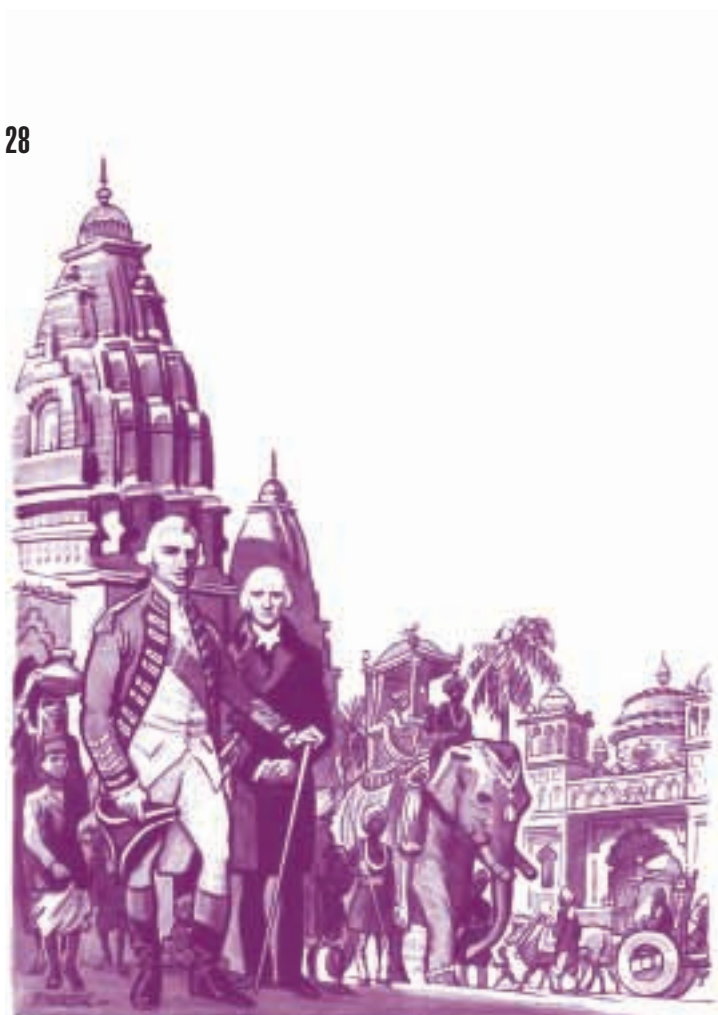
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Working better

John Van Reenen finds that British labour productivity still suffers from low investment in capital, basic skills and innovation.

For economists, labour productivity is the key indicator of economic health. This is because over the long haul real income growth must follow labour productivity growth. If money wages run ahead of labour productivity, prices eventually have to rise in order to bring real wages back into line.

Material wellbeing, of course, must come from earnings. This is as true whether our spending is financed from current wages, or by drawing on savings out of past wages, or by borrowing based on our (perhaps over-optimistic) expectations of future wages. Government revenue for transfers, or for services like health and education, ultimately comes from taxing productivity. So despite the popular attention on other "proximate" indicators of economic wellbeing, such as inflation, unemployment or stock market values, these are largely sideshows in the long run. Labour productivity has to be where the action is.

Some critics attack this emphasis on the primacy of

productivity. They argue that faster productivity growth can only be accompanied by greater disparities of wealth and that the costs of greater inequality are too high to bear. In my view this is completely wrong, both in politics and in economics. If we can achieve faster economic growth through productivity improvements, the fruits of this growth can be used in many different ways. There is nothing to prevent the additional growth being spent primarily on benefiting the worst off in our society through greater redistribution or on better public services. Indeed, it may be easier to get the wealthy to accept such redistributive measures in the context of faster growth than of slower growth. When average incomes are stagnating, redistribution requires an absolute reduction in the income of the better off to finance transfers to the less well off. It is no surprise that taxes, always unpopular, are least welcome during a recession.

As for the economics, there is no obvious relationship (either in theory or in practice) between the level of unequal-

Joe Doe could take Thursday and Friday off and produce as much as John Bull

ity in a country and its level of productivity growth. Although economists tend to emphasise the need for some degree of inequality to provide incentives, very high levels of inequality can undermine productivity growth. For example, it is well recognised that excluding the poor from getting good levels of schooling can be a fundamental brake on growth through squandering a country's talents.

My reading of the empirical research is that there is no robust statistical relationship between the degree of inequality and productivity growth. It is true that the United States has a high level of productivity *and* a high level of inequality. But it is equally true that many European countries with much lower degrees of inequality are able to match the US productivity performance.

So the idea that there is inevitably a rigid trade off between equity and efficiency is profoundly mistaken. We can all share the goal of increasing the size of the economic cake through higher productivity. The disagreements will be on how to divide it up.

If productivity – and more specifically labour productivity – is the key economic goal, how should we measure it? GDP growth itself is not a good indicator. For example, a good part of the faster GDP growth of the US compared with Europe has been due to faster US population growth. The best single measure of labour productivity is real output per hour worked. This measure links most closely to hourly wages, which is the market return for labour. So what are the facts on this indicator?

First, output per hour worked is significantly lower in the UK than in our main competitors. On the latest data from the market sector, output per hour in Britain was almost 40% below that in the United States. In other words, Joe Doe in the US could take Thursday and Friday off and still produce as much as poor John Bull in the UK toiling away throughout the working week.

Figure 1: Relative output per hour worked, 1999



Source: O'Mahony and de Boer, 2002, market economy data

The gap with major European economies is also striking. Despite some recent improvement, output per hour in the market sector in the UK is around 20% below that of France and Germany. This may seem to conflict with recent headlines announcing that Britain now matches Germany in productivity. This is only true for output per worker, not for output per hour worked. German output per worker is similar to that in the UK, but the Germans work less long hours. The average German employee has the equivalent of two months' more holiday a year than the average British worker and still manages to produce the same output. The "output per worker" gap widens even further when we compare ourselves with the US, because Americans work an average of about 10 hours a month more than we do.

Does this mean that Germans are lazy or that Americans are workaholics? There should be no presumption that working longer or shorter hours is any better or worse for productivity, because it is output per hour worked that matters. In principle, each society can make its own free choice as to whether it wants to work longer or shorter hours.

Figure 2: Average annual hours per worker, 2002



Source: OECD Employment Outlook, 2003



It is not clear why Europe is lagging behind

This is the context in which the data on British performance need to be analysed. On the surface, Britain's output per person is satisfactory. Although we still remain a way behind the US, we are pretty close to the French and Germans.

The main reason for this is simple. In recent decades Britain has had a much more successful record in getting people into jobs than other main European countries. The proportion of working age people in jobs is 73% in the UK, compared with 65% in Germany and 61% in France.

It is hard to argue that these lower employment rates in Europe are the result of benign social choices. The large numbers of young people, older people and women who are not working in Germany and France might have chosen to do so, if their national institutions had been different. The higher measured productivity of Continental Europe compared with the UK may well in part reflect the fact that so many low productivity Germans and French are excluded from the employment numbers. It is easy to improve your measured productivity by keeping the least skilled workers out of a job. However, this is unlikely to be the full story, as British productivity was lower than the French or German even in the 1980s when the UK had much higher unemployment than they did.

Figure 3: Employment rate of working age population, 2002



Source: OECD Employment Outlook, 2003

If the latest data do point to a continuing UK labour productivity gap, is it bigger or smaller than it used to be? It is useful to distinguish between three key periods.

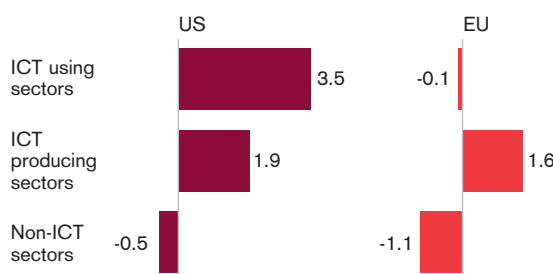
■ First, after 1945 Britain and the other Western European countries enjoyed a "golden age" of economic growth. Europeans were chasing the US productivity frontier. This catching up was driven by the spread of new ideas from the US to the rest of what now constitutes the OECD. Because catching up is easier than innovating at the technological frontier, US productivity growth was generally slower than in Western Europe. However, the catch-up process was much slower for the UK than for France and Germany and we slipped down the productivity rankings. Research at the CEP has shown that part of the reason for slower UK catch up, historically, is due to relatively low levels of investment in R&D and human capital.



■ The second period is more of a mixed story. Following the oil shocks of the mid-1970s, the productivity growth rates in both the US and Europe slowed significantly. From about 1980 productivity began to rise in the UK, especially in manufacturing. The deregulation of product and labour markets helped to halt the UK's long relative productivity decline. But, though we started to do better in absolute terms, it was not enough to significantly improve our position in the productivity rankings.

■ Third, there appears to have been a structural shift in US productivity growth in the mid-1990s. It went from about 1.2% a year between 1977 and 1995 to 2.2% a year between 1995 and 2001. Information and Communication Technologies (ICTs) were an important part of the explanation of faster US productivity growth in the late 1990s. The falls in quality-adjusted computer prices accelerated after 1994 and led to big productivity growth in sectors like semiconductors and retailing. These growth rates were not matched in European countries and the previous long convergence between US and Europe productivity staggered to a halt.

Figure 4: Change in annual growth in output from 1990-95 to 1995-2001



Source: O'Mahony and Van Ark, 2003

More capital per worker means more output per worker

From an accounting point of view, the main reason for this third period was the slower productivity growth in those European sectors using ICT intensively like retail, wholesaling and finance. Productivity in the ICT-using sectors in the US grew during the late 1990s at around 5% a year, more than twice as fast as its rate of growth in the first half of the 1990s. The same sectors in Europe only saw growth of 2% a year, slightly less than in the early 1990s. Since it is likely that ICT is available at about the same price in Europe as in the US, it is not clear why Europe is lagging behind. It is a fact, however, that as the IT revolution introduced new forms of capital European economies failed to exploit its benefits in terms of enhanced productivity and prosperity as fully as did the US.

This does not appear to be due to measurement error or to the “bubble economy” of the late 1990s, since US productivity growth continued to roar ahead in the 21st century despite the hi-tech crash in 2001 and despite the impact of 9/11.

What was happening to UK productivity during this period? The most recent data seem to show that here the UK has in fact held its own with US since 1995 – a remarkable achievement given the strong showing of the US. There has also been some narrowing of the UK productivity gap with France and Germany since the beginning of the 1990s. However, as we have seen, the UK still carries a significant labour productivity deficit and it is unclear whether the momentum of recent years will close the gap there with France and Germany.

In formal terms, the productivity gap between Britain and another country can be broken down into two parts: first, the quantity of the inputs and, second, how they are used. There are two key types of input. One relates to capital. Giving workers more and better equipment to use should enable them to produce more output from a given hour

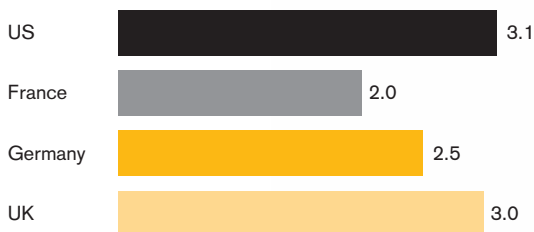
worked. Economists call this “capital deepening”: more capital per worker means higher output per worker.

The other type of input relates to skills. Here, improving the human capital of an economy by increasing the supply of education should also raise productivity. But inputs do not explain the whole story, which is where different ways of working come in. After we have deducted the contributions of capital and skills from output per hour we are usually left with an explained residual element that goes under the rather inelegant name of “total factor productivity”. Differences in total factor productivity relate to different ways of working, for example through better ways of organising firms or using better technology. They help explain what we do with our fixed capital and our human capital. How does the UK compare on these measures?

If labour productivity is about the amount of capital and how it is used, we have a substantial gap with France, Germany and the US. Britain has much lower capital invested per hour worked than other major countries and this accounts for around 80% of our labour productivity gap with France and Germany. Add in the UK’s skill deficit and this explains just about the whole productivity gap with Continental Europe.

However, this is not true of our productivity gap in relation to the US. Increasing the proportion of machines to workers to American levels would only make up about half of the gap. Nor would higher skill levels close the gap. Around half the gap between UK and US labour productivity is due to higher US total factor productivity – in other words, to different ways of working.

Figure 5: Annual growth rates in output per hour, market economy, 1995-2001



Source: O'Mahony. Groningen



This leaves us two key questions. First, why is there less capital per hour worked in Britain? And, second, what is the secret of the US productivity story if it is not in fixed or human capital?

Part of the story on capital is government failure. Government investment in roads, houses, schools and hospitals historically has been low in the UK compared with other countries. Basic numeracy and literacy skills amongst the adult population in Britain – key components of our human capital – are also notoriously poor. This may be slowly changing with educational reform, but low adult skills may be a factor behind low investment.

Another important part of the capital story, however, may be that UK managers choose to invest less than their foreign counterparts because the return is lower. Why invest in new plant or IT that will not deliver a significant return?

This leads us to the second question. Why do US workers create so much more output for their fixed and human capital inputs? What is it that they do to work more effectively that makes such a significant difference on a macro-economic level? The answers must address both of these questions by digging below the figures to understanding what drives productivity – at the business level.

To tackle these questions the CEP has launched a new programme on Innovation and Productivity. One stream of this work will be to rigorously investigate whether managerial practices are a cause of the productivity gap through collecting primary data at the firm level across countries. Initial results suggest that different management practices are critical in accounting for productivity differences between countries and within countries. We also find that the return to ICT use is much higher in organisations with management best practice – which may be why the US has benefited the most from the recent technological upheavals.

The research is at an early stage but Watch This Space for more results...

John Van Reenen is Director of the CEP and Professor of Economics at the LSE.

This article is an edited version of a speech he made at a seminar on productivity in London on 15 March this year, jointly hosted by McKinsey & Co and the LSE.

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Computer assisted exam results

John Schmitt and Jonathan Wadsworth look at 10 years' data on GCSE and A level results and conclude that access to a PC at home has a significant impact on outcomes.

A large body of research has documented the "digital divide" in household ownership of personal computers (PCs) in the United States, Britain and elsewhere. PC ownership is concentrated in richer households and the ownership gap between rich and poor has widened over the last decade.

One important question is whether unequal access to computers matters in itself, or whether PC ownership inequality is just a manifestation of the widening income inequality that has pervaded the UK for the last 20 years. Research attempting to link PC ownership directly to economic or social outcomes has tended to focus on the effect on the earnings of adults. Our study is concerned as

to whether there is any link between PC ownership and children's educational attainment.

Increased familiarity with a computer, increased frequency of Internet use and access to computer-based learning programs could all help to boost educational attainment and examination performance. A simple search of the World Wide Web, for example, shows that many commercial study guides specific to British school examinations are available in CD format in shops or can be downloaded directly from the Internet. Access to the many on-line exam preparation sites, which provide details and interactive tests, could also have a positive effect on examination performance. Many examinations now require coursework, which can be completed in a student's own time and are,

PC ownership is concentrated in richer households

therefore, open to the influence of all the resources provided by ownership of a computer. The BBC, for example, has an on-line revision site for schools (<http://www.bbc.co.uk/schools/revision/>). In this way, home computers may complement any effects of PCs used in schools.

Our starting hypothesis was simple: if personal computers (PCs) are widely used to enhance learning and information gathering across a variety of subjects, then a computer at home might well be a way of enhancing educational attainment.

To test this notion, we used data on British youths from the British Household Panel Survey between 1991 and 2001. We found a significant positive association between PC ownership at home and both the number of GCSEs obtained and the probability of passing five or more GCSEs. Home computer ownership was also associated with a significant increase in the probability of passing at least one A level and of getting three A levels or more.

Our findings appear robust to a set of controls for individ-

ual, household and area characteristics, including household wealth proxies and, for A levels, prior educational attainment of the student. When we use the panel nature of the data set to control, additionally, for *future* ownership of a PC (as a proxy for unobservable household characteristics), the "PC" effects remain and are statistically significant (though reduced for the sample of A level results). These findings suggest that the observed PC effects may have a direct role for PCs in the educational "production function" for teenagers, though we would welcome further research on this issue.

GCSE (at age 16) and A level (at age 18) are the principal school examinations taken in Britain and getting five or more GCSE passes (at Grade C or higher) is an important gateway to A level courses, with three or more A level passes being the standard requirement for university admission. We used data from the British Household Panel Survey (BHPS) to compare the educational achievement of 16- and 18-year-olds living in households with and without a PC. The same data also allow for a large range of household and individual controls that are necessary to attempt to separate out any true "PC" effects from those simply

Our data

The BHPS is a longitudinal survey of all the occupants living in a sample of some 5,000 randomly selected, nationally representative British households. It is conducted each autumn, beginning in 1991 and currently available to 2001. It was designed originally as an annual survey of *each* adult (aged 16 and over) member of a household, a total of approximately 10,000 individual interviews in each wave. Individual adults who left their original households are followed and interviewed. Thus the sample should have remained broadly representative of the population as it changed. In addition to detailed information on each occupant aged 16 and over, including all examination results, each wave monitored the age and gender of any children in the household. Around 150 individuals turn 16 in each wave of the survey. We pooled all 16- and 18-year-olds across the last 10 waves of the survey to create our sample data sets. (Those in the first wave in 1991 were omitted, since there is no information

for these individuals on their circumstances one year earlier.)

The data sets contain information for each individual on the number of GCSE passes at grade C and above (but not the actual grade obtained) and the number of any A levels passed (but not the grade). Since the level of educational attainment was asked in each year of the survey, we can identify those who took their GCSE exams at age 15 and at age 16. It is common for an individual getting a GCSE grade lower than C to repeat the examination the following year, particularly in the key subjects of Mathematics and English. These additional measures of examination success, while recorded in subsequent waves of the data, do not appear in our dependent variables. For most individuals in the data, therefore, we essentially observe a "one-off" experiment.

We used a similar method for 18-year-olds and their A levels. Because the data are longitudinal, about 70% of individuals appear in both our "16-year-old" and our

"18-year-old" samples. (The data set contains no other information on children's ability, such as the nationally administered aptitude tests taken by all 14-year-olds in Britain.) Month of birth also determines in which third of the school year the child begins school. This influences the total amount of time spent in school and, potentially, future earnings. We, therefore, include relevant controls for month of birth.

The BHPS asks whether "the household owns or rents a personal computer, even if used only for games, but only if it has a keyboard". It includes in this definition computers used for business purposes by the self-employed, but excludes those provided by employers for work at home. We can, therefore, determine whether or not the household owned a personal computer in the year(s) before the child sat GCSE or A level examinations. This enabled us to construct dummy variables with the value 1 for households owning a computer in the year

correlated with PC ownership, such as household income or parental background, which could also influence the educational outcomes for children in the household.

We used our sample of youths from the BHPS to estimate the impact of PC ownership on six educational outcomes: (1) successful completion of any GCSE at grade C or higher; (2) the total number of GCSE passes; (3) success-

ful completion of five or more GCSEs at grade C or higher; (4) successful completion of one or more A levels; (5) the number of A levels; and (6) successful completion of three or more A levels. The basic equation we considered is set out in our CEP Discussion Paper No. 625.

Table 1 provides a summary of the overall trends in educational attainment and PC ownership in our data set.

Table 1. Sample means of key variables, pooled sample

All	Sample of 16 year old individuals				Sample of 18-year-old individuals			
	% with PC	% with PC	% with GCSE A*-C	mean no. GCSEs A*-C passes	% with 5+ GCSEs A*-C	% with PC	% with A Level	mean no. A Level passes
Year								
1991	29.4	52.1	62.4	3.6	38.7	35.9	33.9	0.6
1994	34.4	52.3	64.2	4.1	45.1	46.3	48.8	1.1
1997	37.4	51.2	67.6	4.5	47.7	55.4	48.2	1.2
2001	57.1	73.2	76.9	5.2	56.1	66.7	48.5	1.3

Source: Authors' calculations using BHPS, 1991-2001. Individual PC count is percentage of individuals living in a household with a home computer present. Mean number of passes includes those coded as zero who did not take A level examination. Age cohort refers to first sample observation taken after examination.

before the relevant examination took place and 0 for the rest. (Since each BHPS wave asked about PC ownership, "recall bias" should not be a problem. If, though, a respondent wrongly claimed ownership of a PC at the time of a survey, for example, this would bias the results toward zero in the usual way.) The annual survey also tells us the age of the youth when the household first owned a PC and hence gives us a "years of PC ownership" variable, which could help to measure any effect of cumulative PC experience on subsequent performance.

Beginning with the fourth wave (1995), the BHPS also asked a separate set of questions of all 11- to 15-year-old household members. In 1997, this additional survey includes a specific question on the frequency of home computer use among 11- to 15-year-olds, excluding time spent on computer games. We can match the answers to these questions at age 15 to around one third of our 16-year-old sample. For this sub-

sample we constructed five dummy variables, splitting 16-year-olds according to whether they: (a) made no use of a PC in a household that had one; (b) used a PC 1-2 days a week; (c) 3-4 days a week; (d) most days; or (e) did not have a computer at age 15. We can then test whether frequency of use, as well as ownership, is associated with educational attainment. For this sub-sample, we also have information on individuals' attitude to school work and whether they were bullied at school at age 15, which we included as additional controls to try to account for some aspects of individual heterogeneity.

The potential control variables were measured for the year before the relevant examination took place and then mapped onto the individual. We matched information relating to household and local area characteristics to each child, using the household and local authority identifiers in the data. The survey allows us to follow any child leaving the parental

home to his or her new household.

Since Scotland has its own examination system, which differs in important ways from that in England and Wales, we dropped all Scottish observations from the sample. When indicated, the regressions also contain a set of control variables for household and parental background, as well as for the characteristics of our 16- and 18-year-olds.

In all, we have around 1,450 observations with a full set of control variables on 16-year-olds, of which 78% come from different households and around 1,500 complete observations on 18-year-olds.

Many exams now require coursework, which can be completed at home

Over the 10-year sample period, PC ownership rates for the population as a whole virtually doubled, from about 29% of all individuals living in a household with a PC in 1991 to about 57% in 2001. In households containing 16-year-olds, the incidence of PC ownership is higher than in the rest of the population and ownership rates for this group of households also rose steadily, from just over half (52%) in 1991 to almost three fourths (73%) in 2001. PC ownership is slightly less common among households with an 18-year-old, but showed the same strong upward trend in ownership between 1991 and 2001. Over the same period, the overall level of GCSE and A-level attainment also rose. By 2001, over 75% of the sample of 16-year-olds had at least one GCSE at grade C or higher, over 55% had

managed five or more GCSEs passes and just under 50% of the 18-year-olds had at least one A level.

Panel (a) of Table 2 presents our first set of results on the impact of PC ownership on obtaining any GCSEs at grade C or higher. Column 1 reports the marginal effects from a probit equation of GCSE attainment at age 16 conditional on PC ownership at age 15, with controls only for the wave of the BHPS in which the individual was observed at age 16. In this simple equation, PC ownership at 15 raises the likelihood of receiving GCSEs at 16 by 15.1 percentage points (statistically significant at the 1% level using robust standard errors). Column 2 adds a quadratic for real household income, equalised by the square root of the number

Table 2. Effect of PC ownership at age 15 on educational attainment at age 16

	(1)	(2)	(3)	(4)	(5)	(6)
(a) Any GCSE grade A*-C						
PC at 15	0.151**	0.099**	0.029	0.034	0.032	0.018
Controls						
Panel wave	Yes	Yes	Yes	Yes	Yes	Yes
Income	No	Yes	Yes	Yes	Yes	Yes
Household	No	No	Yes	Yes	Yes	Yes
Individual	No	No	No	Yes	Yes	Yes
Area	No	No	No	No	Yes	Yes
Area 2	No	No	No	No	No	Yes
Pseudo R ²	0.032	0.069	0.139	0.172	0.237	0.252
N	1453	1453	1453	1453	1453	1305
(b) Number of GCSEs grade A*-C						
PC at 15	1.218**	0.981**	0.567**	0.667**	0.548*	0.536*
Controls						
Panel wave	Yes	Yes	Yes	Yes	Yes	Yes
Income	No	Yes	Yes	Yes	Yes	Yes
Household	No	No	Yes	Yes	Yes	Yes
Individual	No	No	No	Yes	Yes	Yes
Area	No	No	No	No	Yes	Yes
Area 2	No	No	No	No	No	Yes
Adjusted R ²	0.035	0.054	0.154	0.191	0.205	0.192
N	1005	1005	1005	1005	1005	887
(c) 5 + GCSEs grade A*-C						
PC at 15	0.151**	0.127**	0.084**	0.096**	0.086*	0.093*
Controls						
Panel wave	Yes	Yes	Yes	Yes	Yes	Yes
Income	No	Yes	Yes	Yes	Yes	Yes
Household	No	No	Yes	Yes	Yes	Yes
Individual	No	No	No	Yes	Yes	Yes
Area	No	No	No	No	Yes	Yes
Area 2	No	No	No	No	No	Yes
Pseudo R ²	0.025	0.033	0.099	0.136	0.167	0.172
N	1005	1005	1005	1005	1005	887

Source: BHPS 1991-2001.
 * = significant at 5%; ** = significant at 1%.
 Coefficients in panels (a) and (c) are marginal probabilities from probit equations. Coefficients in panel (b) are OLS estimates. Area 2 effects in Column 6 includes local authority level data and applies to England only.

We know the age of the youth when the household first owned a PC



of individuals in the household, which cuts the estimated PC effect to 9.9 percentage points. Column 3 adds other housing level controls, including additional possible household wealth proxies (number of rooms and housing tenure) and other controls for mother's and father's education, mother's and father's age, marital statuses of parents, number of dependent children living in household, whether household had moved in past 12 months, parental involvement in school parent-teacher association, and the religious outlook of parents. These variables reduce the size of the estimated PC effect considerably and it is no longer statistically significant. Column 4 adds individual-level controls for the trimester in which the child began school, gender, ethnicity, sibling order of the child, and health status of the child. Column 5 adds area level variables for region, school type and parental perception about whether the neighbourhood is "bad". These additional controls have little further effect on the magnitude or statistical significance of PC ownership. (The Appendix to Discussion Paper No. 625 gives the full set of estimates from this regression.)

Panel (b) of Table 2 repeats the exercise in panel (a), now using the number of GCSEs as the dependent variable conditional on obtaining at least one GCSE (and using ordinary least squares, rather than probit, given the change in the nature of the dependent variable).

The results of the simple equation shown in Column 1 indicate that having access at home to a PC at age 15 increases the number of GCSEs achieved on average by

over 1.2. Even after including the full set of individual, household and area controls (Column 5), PC ownership is associated with a positive, statistically significant increase in the number of GCSEs, equivalent to about half an additional GCSE. Adding variables to control for educational conditions in local authorities (Column 6), which lowers the sample size somewhat, has no impact on the size or significance of the estimate.

Panel (c) of Table 2 suggests that PC ownership may also have an important (and statistically significant) positive impact of 15.1 percentage points on the probability of attaining five or more GCSEs at grade C or higher, a current national educational goal. Adding successive levels of controls (Columns 2 to 5) reduces the economic impact to about 9 percentage points, but the effect remains statistically significant at the 5% level. Again, adding controls for local education authority characteristics (Column 6) does not alter the conclusions.

Even though the regressions in Column 5 of Table 2 control for a broad list of individual, household and local area characteristics, PC ownership may still simply be acting as a proxy for unobserved characteristics, such as household wealth, which may be positively correlated with both PC ownership and with higher educational attainment. So, as a robustness test, we substituted dishwasher, tumble drier and car ownership for the PC ownership variable. These alternative household durables may also proxy unobservable household effects, especially wealth effects that are not picked up in the comprehensive list of controls. At the same time, we might not expect these other consumer durables, in and of themselves, to be important inputs into an educational production function.

The results of these regressions are set out in detail in Discussion Paper No. 625. In summary, if you only apply basic controls, dishwasher or car ownership do indeed appear to have as large an impact on the number of GCSEs obtained as owning a PC, while owning a tumble drier appears only to have an insignificant negative impact. But, if you include our full set of controls, the apparent educational effects of dishwashers, driers and cars fall substantially and are no longer statistically significant. In fact with a regression that includes a full set of individual, household and area controls, together with all three of these other household assets and the original PC-ownership variable, PC ownership still raises the number of GCSE passes by an amount that is very close to the impact reported in Table 2, Column 5 (about half an extra GCSE, significant at the 1% level). Meanwhile, none of the other household durables is statistically significant.

The pattern of results for the attainment of five or more GCSE passes is similar. The inclusion of cars and the other household durables in the regression does not eliminate the large, well-defined effect of PC ownership at age 15. When the full set of individual, household and area controls is

Over the 10 years to 2001 students living in a household with a PC almost doubled to 57%

Table 3. Effect of PC ownership at age 17 on educational attainment at age 18

	any A Levels	any A levels / 5+ GCSEs	No. of A levels / has A level	3+ A Levels / has A level
Panel A				
PC at 17	0.123**	0.109*	0.278*	0.149**
Pseudo R ² / Adj. R ²	0.189	0.221	0.154	0.233
N	1512	513	471	471
Panel B				
PC at 17	0.083*	0.081	0.229*	0.161**
Pseudo R ² / Adj. R ²	0.302	0.253	0.328	0.233
N	1364	497	428	428

Source: BHPS 1991-2001.

* = significant at 5%;

** = significant at 1%.

Estimates in Columns 1, 2 and 4 are marginal probabilities from probit equations. Estimates in Column 3 are OLS regression coefficients. Sample size in Columns 3 and 4 are less than that in Column 2 because of missing values on dependent variable. Panel B is sub-set of panel with information on number of GCSE qualifications, which is included as an extra conditioning variable.

included, PC ownership is associated with about a 9 percentage point increase in the probability of obtaining five or more GCSEs, very close to the 9.3 points estimated effect shown in Column 6 of Table 2. All this strongly suggests that the "PC" effect is not simply acting as a proxy for unobserved household wealth.

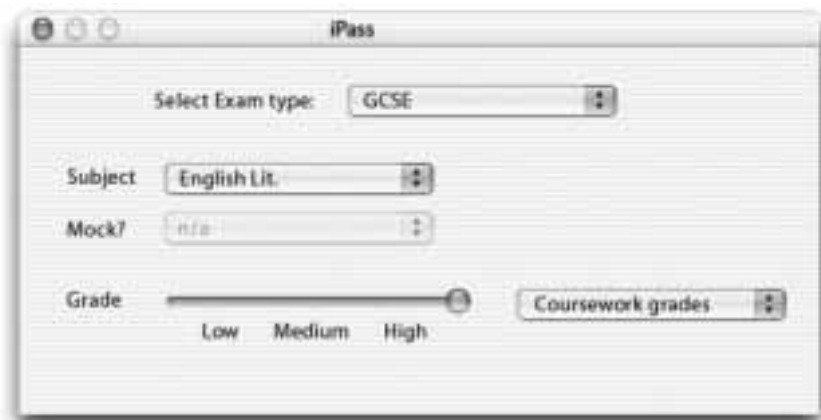
We performed one other test to try to distinguish between a true PC effect on educational outcomes and a spurious effect based on PC ownership acting as a proxy for unobserved household characteristics. Implicit in the analysis so far is the assumption the PC ownership is a good proxy for actual use of computers, which is presumably the channel through which computer ownership improves educational outcomes. Since 1997, the BHPS has asked all 15-year-olds about how many days each week they used a home computer, if one is present in the household. This gives us one way to test the effect of computer use at the intensive margin. Another way is to count the number of years of PC ownership, using the information in the data set.

We found that, while positive, the "years of experience" variable was not significant when added to any of our regressions. However, the intensity of computer use does appear to track educational outcomes closely. Children who live in houses with computers, but who never use them, are actually less likely (by about 20 percentage points) to complete at least one GCSE than children in houses without a computer; those who use computers "once or twice a week" have about the same probability as those in houses without a computer; children who report using a computer three to four times a week have a 10 percentage point advantage;

and those who say they use computers "most days" a 13 percentage point advantage.

The results are not quite as clear cut for our other two educational outcomes (the number of GCSEs at grade C and above and five or more GCSEs at grade C and above) and sample size for those with at least one GCSE for whom we had the "frequency of use" variable is smaller. Nevertheless, the results still suggest that more frequent PC use is associated with better educational outcomes. Taken together, the results in all three cases provide some support for the view that, *within* households that have computers, children who use computers more fare better. To the extent that this is true, these results, therefore, reinforce the findings PC ownership is *not* simply acting as a proxy for unobserved household characteristics.

The BHPS data also allow us to look separately at the impact of PC ownership at age 17 on the attainment of A levels, typically at age 18. Table 3 reports results for the ownership of a PC at age 17 on the probability of getting at least one A level, on the number of A levels obtained, and on the probability of gaining three more A levels. Again



PC ownership is associated with about a 9 point increase in the probability of getting five or more GCSEs



applying all our previous controls for 16-year-olds, including household ownership of cars, VCRs and dishwashers, Column 1 shows a strong, statistically significant, impact. PC ownership at age 17 raises the likelihood of attaining an A level pass among all 18-year-olds in our data set by just over 12 percentage points. For the smaller subset of youths (Column 2) who, in principle, are eligible to take A levels (i.e. those with five or more GCSEs) the PC effect falls to around 11 points, but remains significant. Among the third of 18-year-olds with at least one A level pass, household PC ownership at age 17 seems to be associated with around one quarter of an extra A level (Column 3). The probability for those in this sub-set of passing three or more A levels is estimated to be up almost 15 percentage points as a result of the PC effect (Column 4).

Data from household surveys are not ideal for measuring the impact of PCs on educational attainment, because unobservable factors at the household (and possibly even at the individual) level may cause problems. Random assignment of individuals to control and treatment groups could help to control for unobserved effects explicitly, though this is unlikely ever to happen in the nationally important examinations we study here. Moreover, the "one-off" nature of the examinations we study means that even an experiment would struggle to control for individual unobservable effects. So, until there is evidence to the contrary, the results here suggest that PC ownership may have important effects on significant educational outcomes.

John Schmitt is an Economist with 17th Street Economics, Washington, DC.

Jonathan Wadsworth is a member of the CEP and lectures at Royal Holloway College London.

This article is an edited version of their CEP Discussion Paper No. 625, which can be downloaded from <http://cep.lse.ac.uk/pubs>

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Ideas are not like other assets

Intellectual Property Rights (IPRs) are supposed to be a system to reward creative thinkers. But Danny Quah finds that all too often they fail both in theory and in practice. Here he explores other possibilities, particularly in relation to computers and software.

Creative people produce ideas. Let us call them *intellectual assets*. New knowledge, building layer upon layer on itself, has been the basis of the phenomenal change for the better in the human condition in the last 200 years, transforming the economically dismal world of the previous 12,000 years.

Kenneth Arrow, the Stanford University economist and 1972 economics Nobel laureate, liked to use the conundrum that hypothetical financial supporters of 17th-century scientific research might have confronted if faced by two grant applications: the first, proposing to study the properties of different woods and metals in constructing the hulls of ocean-going ships; the second, proposing to analyse the properties of the square root of -1. The first offered immediate benefits to society. But the second?

How could anyone have foreseen that the square root of -1 (which Descartes

referred to in a derogatory way as an imaginary number) would make intuitive the formulas in Einstein's theories of special and general relativity; would become an integral part of quantum mechanics; would enter Maxwell's theory of electromagnetism and thus be used by every electrical engineer, radar operator, signals analyst and telecommunications specialist in the coming four hundred years; and would be embedded in every electrical gadget, personal computer, Internet device, or mobile telephone that we use today?

Two features are central to this story. The first is the way in which economic growth draws at its most fundamental level from interaction with knowledge and ideas. The second, (described by Douglass North, the economic historian and 1993 Nobel laureate) is the intermediating system by which societies have figured out ways to reward innovators and agents of creativity by giving them property rights in ideas.

The story goes like this. Strong property rights legally identify an owner, including the owners of ideas. They transform mere assets into property specific to particular individuals. In doing this, those property rights sharpen the incentive to develop and put to productive use the resources owned. Society gains as well through the provision of worthwhile goods and services.

This is an extremely orthodox, neoclassical economic story of the kind that we teach to students in universities worldwide. Strong property rights and voluntary exchange, through markets or otherwise, lead to socially optimal outcomes. Such arrangements, almost magically, align the self-serving behaviour of individual property owners with the good of society at large. This proposition is not just a creed of conservative apologists for the capitalist system. It is an insight that serves well for a simple reason: it works.

Since economically worthwhile ideas

Ideas are nonrival and infinitely expandable



are productive assets, the seductive and easy parallel conclusion is that intellectual property rights (IPRs) should lead similarly to good social outcomes. Michael Eisner of Disney Corporation and Jack Valenti of the Motion Picture Association of America have indeed argued that strong intellectual property rights are absolutely fundamental to the efficient workings of economies.

This conclusion, unfortunately, is wrong.

To understand why, we need to dig a little bit into the nature of ideas and knowledge. Ideas are nonrival and infinitely expandable. Their use by someone does not detract from the usefulness in their nature to yet others. Trading ideas is not an exchange where ideas are handed over for something else; instead, trading ideas simply creates copies of the idea, each exact copy of the idea as much of an original as the original idea itself. In these characteristics, ideas have an intrinsic nature to them that distinguishes them from all other ordinary economic commodities.

Ordinary commodities *are* rival. Once someone has eaten an apple, that apple not only cannot satisfy anyone else's hunger; the apple is physically no more. Ordinary commodities do *not* carry infinite expansibility. Apples exchange for, say, oranges by being physically handed over. One party to the trade goes home bereft of apples but with pockets full of oranges. Apples do not reproduce freely and instantaneously on demand.

The upshot is that trade in ideas differs from trade in most other things economically valuable. The neoclassical reasoning on why voluntary exchange succeeds in delivering so much good to so many breaks down for ideas. When an idea-owner sells the good, he continues to have it. Both buyer and seller and all others in similar situations will see incentive to keep selling (and in the process making) copies of the idea as long as that idea's market price

remains positive, given that the opportunity cost to them of providing further copies of the idea is zero, for they continue to retain the idea to use or consume however they wish. The process ends only when the market is completely saturated. But a forward-looking, purposeful idea-maker – the creative knowledge-worker, the putative newly entitled intellectual asset owner – will realise this dynamic is in place long before the total saturation point is reached. He will move on to do something more financially rewarding (perhaps becoming a plumber in north London).

Societies can put in place some friction to that free competitive exchange and dissemination of ideas. Useful ideas could be kept as trade secrets, divulged only to specific individuals or to particular industry groups, forming trusted coalitions. Ideas could be handed over only with tight restrictions on what can be done with them. Laws could be set up that do no more than disallow competition between alternative idea-producers. Technologies might be built that slow down the transmission of ideas. Whatever it turns out to be, these arrangements work by disrupting markets. Through curtailing the distribution and dissemination of ideas, such arrangements raise the exchange price of ideas and thus incentivise creativity.

Intellectual property rights are one such disruption in markets. They are not ordinary property rights but they prevent perfectly competitive dissemination of ideas, so that ideas end up under-used in the world. Intellectual property rights restrict how ideas can be built on, sequentially refined and iteratively improved. They prevent development of socially desirable, closely competing ideas. They encourage applying creativity and ingenuity to circumvent their strictures through finding legal loopholes, but without improving the lot of humanity by pushing outwards the frontier of technology. They create monopolies in the market for ideas. But IPRs are also, if not a strictly

necessary evil, for now at least an evil that gets the job done of incentivising knowledge-creation.

The world would be a dire place were no new ideas being constantly created. But at the same time having so much of the creative output of humanity cordoned off cannot be a good thing either. Let us call this the essential, inherent tension in intellectual assets and let us reserve the term "intellectual property" for when the artificial construct of property rights are asserted over such assets.

This inherent tension, in one form or another, has been long recognised, even if not always openly acknowledged in contemporary policy debate. William Nordhaus analysed it in his economics PhD dissertation at Yale in the late 1960s. Two centuries before that, Thomas Jefferson, one of the drafters of the US Constitution, wrote powerfully on the nature of ideas, articulating the concepts of nonrivalry and infinite expansibility. While he founded the US Patent Office and provided in the US Constitution a clause that protects intellectual property, he considered the monopolies thus created a national embarrassment. (This particular founding father of the United States of America never thought it unAmerican to dispute the status of intellectual property.)

Remember this delicate trade-off: society-wide curtailment and underemployment of ideas (Jefferson's national embarrassment) set against the potential good that incentivising creativity ought to deliver. But is this trade-off for real? Does current IPR practice succeed at the second task of incentivising and rewarding? Some propositions in economic theory fail to hold in reality. Some empirical regularities from the real world pose puzzles for economic theory. But the current formal systems of intellectual property might have the singular distinction of failing not just in theory but in practice as well.



Patent infringement is a civil not a criminal offence

There is this powerful conceit of the lone inventor, puttering about in the garage or in the woodshed at the bottom of the garden, coming up with world-beating inventions at the weekend, but ending up with no financial gain. Without a social infrastructure of protection, these amateurs without business savvy are ripped off by some ruthless multinational corporation. (Even with IPR slapped around an idea, because patent infringement is a civil not a criminal offence, a patent-holder still has to take an offender to court, involving costly litigation way beyond the means of most people.)

Even when they work properly in theory, intellectual property rights confound the workings of markets and thus potentially inflict social damage. In practice, they sometimes do not even achieve their supposed good of rewarding the deserving and thus incentivising the creative originators of ideas. Indeed sometimes they perversely reward the undeserving.

At the turn of the 20th century, Thomas Edison built an empire around his creative output of inventions – the light bulb, electricity provision by networks, the phonograph, the modern dynamo and hundreds of others. Edison founded a company that went on to become the world's largest and most successful corporation. He accumulated personal wealth that placed him within the top 400 of the US's richest individuals.

By contrast, Nicholas Tesla, Edison's contemporary and great rival who held over 700 patents on radio, fluorescent

light, the alternating current motor, wireless communication and much else, died miserably poor, spending his last years feeding pigeons outside New York's Public Library. Yet it was Tesla's AC motor that allowed viable electricity transmission over Edison's networks, when Edison wrongly persisted in wishing to retain DC technology. In the event, Tesla's critical idea prevailed but went unrewarded, while Edison's wrong-headed one garnered the financial rewards. Public relations and entrepreneurial savvy trumped the raw intellectual idea.

This negative message echoes in example after example: Gary Kildall's operating system for personal computers, CP/M, developed a decade before Bill Gates's deal with IBM, did not give Kildall even a tiny fraction of Gates's hundred billion dollar wealth or save him from death in a barroom brawl with some bikers (as one colourful legend has it). Eli Whitney's 1792 patent on the cotton gin won him no part of the US's 900-fold increase in cotton exports over the ensuing 70 years (by which time cotton accounted for half the value of total US exports to the rest of the world). Xerox Corporation held patents on the laser printer, Ethernet, graphical-interface computer operating systems using multiple windows, mouse and keyboard, and WYSIWYG word processing. These concepts were successfully exploited by everyone else, but not by Xerox Corporation itself.

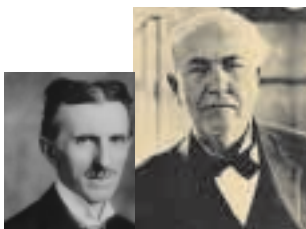
Just as intellectual property rights have not always protected an innovator, nor

does their strengthening necessarily generate greater innovation. The dramatic increase in strong intellectual property rights awarded in the US since 1975 reflects, in part, court decisions extending patent protection for software. However, this strengthening and extension of IP coverage did not obviously elicit greater innovation effort in the industry. Between 1987 and 1994 real R&D spending in the computer and software industry fell 20%, while the number of patents awarded increased 200% and real R&D spending in corporate America overall rose 25%.

What have we learnt from this experience? In theory, property rights on ideas inflict losses in social efficiency; humanity ends up under using ideas. Again, in theory, societies tolerate this because those property rights are needed to reward and incentivise the creators of ideas. In practice, however, we have just seen many cases where intellectual property rights don't do this last bit well at all, either through not providing enough reward to the right people or through providing too much to the wrong ones. In all those situations and many others like them, society has simply sacrificed economic value to no good purpose whatsoever. Our loss from current arrangements for managing intellectual assets is double.

But societies and economies are surprisingly adaptive organisms. When an itch manifests itself, a mechanism for scratching that itch eventually appears as well, without necessarily anyone consciously designing that scratcher. The process, however, can

IPRs prevent the competitive dissemination of ideas



IPRs do not necessarily generate greater innovation



Our loss from current arrangements for managing intellectual assets is double



be slow and there is nothing to stop us trying to speed things up.

Mechanisms that can circumvent the economic difficulties that ideas, creativity and knowledge introduce can be divided into two kinds: conscious intervention and hands-off (spontaneously emergent) social behavior.

The economic historian Paul David has noted how institutions such as patronage and procurement can provide substitute incentive mechanisms in place of intellectual property rights. Both of these are found in the real world – Research Council support for academic research, military or space exploration contracts and wealthy patron support for the arts are some prominent examples. These distance the incentive for creating an idea from the individual rewards arising in its dissemination.

Yet other suggested schemes work similarly, by separating dissemination reward from initiation incentive. Jenny Lanjouw, a former PhD student at the LSE, has proposed global market segmentation in intellectual property rights for pharmaceuticals that could potentially benefit the poor and disease-afflicted in the Third World, without disincentivising pharmaceutical innovation in the West. Michael Kremer at Harvard has suggested that patents be auctioned off generally, but with governments randomly buying some of the intellectual assets for release into the public domain, thereby freeing those intellectual assets into socially efficient usage.

Finally, perhaps an even crazier suggestion: divert what government and legal resources societies currently expend on determining and protecting intellectual property rights – patents, copyright, trademarks – into building instead mechanisms for providing an appropriate and reliable flow of intellectual services derived from the underlying intellectual assets. Unlike the intellectual assets

themselves, such services would be rival and finite and would show none of the market failures described above. Since we already have a Financial Services Authority, we might also have a parallel Intellectual Services Authority!

Interestingly, the computer software industry, so active in the intellectual land grab, is also the one that has seen greatest innovation in institutional mechanisms. Open Source Software is the most notable such example. The term describes software that is provided with the underlying code available for others to refine, develop and learn from.

SourceForge.net, the largest repository of Open Source code and applications, hosts over 71,000 software projects, all freely available for downloading over the Internet. Some of these are, admittedly, of interest primarily to the technical community, but significantly many others are of general consumer and end-user interest: office productivity, information management and database suites that rival those from commercial market leaders; messaging client systems that outgun any commercially sold; video and music applications providing functionality beyond any commercial software; and some truly remarkable computer games.

These ideas are given away, not sold. Worldwide communities of capable software engineers and hobbyists – better than money can buy – converge, metaphorically at least, on the Internet, to code and debug useful software, which is then released for the world to use and improve. Corporate backing from companies such as IBM, Intel, Nokia and Sun Microsystems and support services from companies like Red Hat have provided credibility and legitimacy to the Open Source movement.

As with markets, these developments show emergent behavior, with no strong, single central command, but

with global efficient out-comes spontaneously arising from uncoordinated individual actions and economists have begun to study the workings of this Open Source mechanism.

We might at this stage understand how, say, individual Open Source programmers could be doing this work only for its high profile apprenticeship signalling function; they are building reputations and lying in wait for transition to high-paying, IP-protected jobs. But we do not really understand why such spontaneous, emergent behaviour achieves the successes and social optimally outcomes that it has. Why are the resulting products so often better and more innovative than their commercial, IP-protected counterparts? We can only conjecture that, somehow, in separating the dissemination rewards from those accruing to innovation, the Open Source mechanism attempts, with no explicit guidance, to reinstate endogenously one socially efficient outcome.

Perhaps it is a model that we can use for other ideas than software. Ian Ayres and Barry Nalebuff at Yale University have attempted to initiate such a model in their recent book, "Why not? Using Everyday Ingenuity to Solve Problems Big and Small" and on its associated whynot.net website. It may all seem a bit crazy, but not obviously more so than the current system we have for managing intellectual property.

Danny Quah is a member of the CEP and Professor of Economics at the LSE.

This article is an edited version of his Clifford Barclay Memorial Lecture delivered at the LSE in November 2003.



Women looking for work

Female unemployment rates differ widely from country to country. Ghazala Azmat, Maia Güell and Alan Manning look for the reasons that might explain this particular gender gap.

Discussions of the disadvantage faced by women in the labour market tend to focus on the gender gap in pay. Yet in many countries there is another important gender gap that is virtually ignored, the gender gap in unemployment rates.

This is not true in all countries. In the UK the female unemployment rate among prime-age workers (those aged 25-54) is 1.1 percentage points *below* the male, but in some countries the gap is very large. In Spain the female unemployment rate is 11.8 percentage points above the male. Table 1 presents data on the gender gap in unemployment rates in all the OECD countries. These figures are computed using the standard ILO definition of unemployment, so are designed to be comparable across countries.

From Table 1 (overleaf) one can identify several distinct groups of countries. The largest gender gaps in unemployment rates are to be found in the Mediterranean countries (Spain, Greece, Italy and France). Next come the Benelux countries (Belgium, the Netherlands and Luxembourg); then the "Germanic" countries (Germany, Austria and Switzerland); then the "Nordic" countries (Sweden, Finland and Norway) and, finally, the "Anglo-Saxons" (US, UK, Ireland, Australia, Canada and New Zealand). In a number of the Mediterranean countries, the high unemployment rates that are the subject of much discussion in the media are largely a "female" problem, since unemployment rates among middle-aged male heads of households are not much higher than in the UK and the US. We will refer to those countries with a large gender gap in unemployment

The largest gender gaps are in the Mediterranean countries

Table 1. Gender gaps in unemployment rates among prime-age workers in the OECD countries

Country	Male	Female	Difference	Ratio
Spain	9.2	21	11.8	2.28
Greece	6.2	15.2	9	2.45
Italy	6.6	12.7	6.1	1.92
France	9	12.6	3.6	1.4
Belgium	6.1	9	2.9	1.48
Netherlands	2.1	3.8	1.7	1.81
Luxembourg	1.4	2.9	1.5	2.07
Germany	7.2	8.5	1.3	1.18
Denmark	3.7	4.9	1.2	1.32
Portugal	3.4	4.6	1.2	1.35
Finland	7.9	9	1.1	1.14
Switzerland	2.2	3.2	1	1.45
Japan	3.7	4.4	0.7	1.19
Sweden	5.2	5.9	0.7	1.13
USA	3	3.4	0.4	1.13
Austria	3.4	3.6	0.2	1.06
Australia	5.5	5.3	-0.2	0.96
Canada	6.5	6.3	-0.2	0.97
NZ	5.5	5.3	-0.2	0.96
Norway	2.6	2.2	-0.4	0.85
Ireland	5.7	4.8	-0.9	0.84
UK	5.4	4.3	-1.1	0.8
New OECD countries				
Hungary	6.7	5.6	-1.1	0.84
Turkey	5.9	5.5	-0.4	0.93
Mexico	1.6	2.1	0.5	1.31
Czech Rep	5.9	9.5	3.6	1.61

Source: OECD Labour Market Statistics (OECD Statistical Compendium), 1999.

rates as the “high gap” countries and those with a low gap as the “low gap” countries.

It should be emphasised that the ILO definition of unemployment is designed to measure those workers who want a job but do not have one. To be classified as unemployed on the ILO definition one must have been looking for work in the recent past and available to start work in the near future. So gender differences in unemployment rates do not reflect gender differences in how many people want a job but differences in the proportions of people who, wanting a job, are unable to find one.

The aggregate figures in Table 1 hide the fact that the gender gap in unemployment rates might be larger for some categories of women than others. There does seem to be some evidence for this. The gender gap in unemployment rates is largest among the young, the married and those with young children. But in the countries where there is a big overall gender gap, all categories of women are at a disadvantage. There is something here that needs to be explained.

The number of people who are unemployed can be thought of as being determined by the rate at which people become unemployed (what economists call the inflow rate) and the rate at which they leave unemployment (what economists call the outflow rate). The overall unemployment rate is increasing in the inflow rate and decreasing in the outflow rate. So a gender difference in the unemployment rate could be the result of a gender difference in the outflow rate and/or the inflow rate. Which of these is the most important can be expected to offer clues about the source of the gender gap in unemployment rates.

Table 2 presents some estimates of the gender differences in the flows between employment and unemployment and between unemployment and employment (controlling for a variety of other relevant characteristics). The countries are ordered with those with the largest overall gender gaps in unemployment rates at the top. One should interpret the numbers in the following way – for Spain the average employed woman is 27.5% more likely to enter unemployment than the average employed man and the average unemployed woman is 34.5% less likely than the average unemployed man to get a job. This pattern of employed women being more likely to leave jobs and unemployed women being less likely to get jobs is repeated in all the countries with a large gender gap in unemployment rates. So in these countries women are at a disadvantage both in keeping and in getting jobs. To understand the gender gap in unemployment rates we need to understand the gender gaps in both inflow and outflow rates.

Why are women in work more likely than men to leave their jobs in some countries? One hypothesis is that women are



Unemployment rates are highest for the young, the married and those with young children

Table 2. Gender gaps in flows between employment and unemployment

Country	E_U	U_E
Spain	0.275 **	-0.354 **
Greece	0.538 **	-0.47 **
Italy	0.394 **	-0.138 *
France	0.266 **	-0.341 **
Belgium	0.466 **	-0.49 **
Luxembourg	-0.189	-0.195
Germany	0.012	-0.425 **
Denmark	0.371 **	-0.432 **
Portugal	0.446 **	-0.3 **
Finland	0.344 **	-0.068
USA	-0.114 **	-0.012
Austria	-0.05	-0.511 **
Ireland	0.062	0.401 **
UK	-0.473 **	0.292 **

Notes: 1. Data for European countries are from retrospective monthly work history data in ECHPS. Retrospective monthly data from Sweden and the Netherlands are missing. US data are from successive monthly CPS. Sample restricted to those between 25 and 54. 2. For Hazard Rates methodology see DP 607. Controls are for age, education, marital status and number of children. 3. ** denotes 1% significance level and * denotes 5% significance level.

more likely than men to leave jobs to have children and/or to care for children and elderly relatives. It is true that women are more likely than men to leave jobs for this reason but this has little to do with gender gaps in unemployment rates as women leaving employment for these reasons end up out of the labour force and not in unemployment. In the four countries with the highest gender gaps in unemployment rates (Spain, Greece, Italy and France) fewer than 5% of women who are currently unemployed report “caring/childbirth” as the reason for why they left their previous job.

In all countries, most of the unemployed have ended up in that state because they have lost their previous jobs when they wanted to keep them rather than because they no longer wanted the job and quit. In many countries, men are more likely than women to be laid off. In countries like the UK this difference is extreme – 45% of male jobs end because the worker is laid off, compared with 23% of female. But in many of the countries with a big gender gap in unemployment rates the most striking feature is that there does not seem to be a large gender gap in the reasons why workers leave employment for unemployment. In addition, many of the southern European countries have high numbers of workers on temporary and short-

Table 3. Gender gaps in unemployment durations

Country	% of unemployed with duration >12mths		
	Men	Women	Gender gap
Spain	45.4	55.5	10.1
Greece	48.6	59.5	10.9
Italy	62.1	60.7	-1.4
France	39	41.7	2.7
Belgium	60.1	60.9	0.8
Netherlands	47.7	40.4	-7.3
Luxembourg	38.6	27.2	-11.4
Germany	49.9	54	4.1
Denmark	20.9	20.1	-0.8
Portugal	39.5	42.9	3.4
Finland	33.1	26.2	-6.9
Switzerland	40.6	38.7	-1.9
Japan	27.4	14.8	-12.6
Sweden	33.3	26.1	-7.2
USA	7.4	6.2	-1.2
Austria	32.7	24.1	-8.6
Australia	31.8	25.8	-6
Canada	12.8	10.2	-2.6
NZ	23	17.9	-5.1
Norway	7.3	6.3	-1
Ireland	59.5	47.5	-12
UK	34.5	21.5	-13

Source: OECD Employment Outlook 1999.

term contracts, which are very likely to end with a move into unemployment. One possible explanation for this is employment protection legislation, which makes it difficult to lay off workers that have been with the firm for a long time on permanent contracts. While such institutions protect the workers most covered by them, they also tend to place the burden of labour market adjustment on more marginal groups. Women are less likely than men to be in the heavily protected group and more likely to be in the marginal group.

We have pointed out that in the “high gap” countries unemployed women are less likely than unemployed men to get jobs. One consequence of this is that women in “high gap” countries are more vulnerable than men to long-term unemployment and all the adverse consequences that this brings. Table 3 presents information on the fraction of unemployed men and women who have been out of work for more than 12 months.

But why it is that unemployed women in the “high gap” countries are less likely than unemployed men to get a job? The actions of both individuals and employers could well affect the rate at which the unemployed find jobs. From the perspective of the individual unemployed person, greater



In Spain the average unemployed woman is 34.5% less likely to get a job

effort to find work is likely to be rewarded with a shorter duration of unemployment. But the attitudes of employers and the general availability of jobs will also affect how easy it is for the unemployed to get work.

If unemployed women in some countries are less likely to find a job than unemployed men, that might be because they are less "serious" about wanting a job and make fewer efforts to find work. We could find no evidence that this was the case. For the US, the UK and Spain we compared the number of methods of job search used by unemployed men and women. In all countries, men report using slightly more search methods than women, but this difference is similar in Spain (a "high gap" country) and in the US and the UK (both "low gap" countries). The limited evidence available provides no support for the view that unemployed women in "high gap" countries are less serious in their desire for work than men.

Another factor that is often argued to affect the seriousness with which the unemployed seek work is the availability of welfare benefits. But it is important to realise that many of the unemployed (and especially unemployed women) do not receive any welfare benefits at all. Table 4 presents some data on the fraction of unemployed men and women that report receiving any form of welfare

benefit. In most countries, women are less likely to receive welfare benefits than men, because their weaker employment history makes them less likely to have established entitlement and because unemployed women may be living with employed men and thus not eligible for means-tested benefits. From this table it is hard to see how it could possibly form the basis of an explanation as to why, in some countries, there is such a large gender gap in unemployment rates. For example, virtually no one unemployed in Italy (male or female) receives any benefits and the proportions of unemployed men and women receiving benefits in Spain and the UK are very similar, even though the two countries have a very different gender gap in unemployment rates.

It might also be true that there is a mismatch between the desires of the female unemployed in terms of jobs they like and the jobs that employers are offering. In particular, it is sometimes argued that many women want part-time work and that there is not much part-time work in the Mediterranean countries. But there is little evidence for this view. Table 5 shows that very few of the unemployed women in the "high gap" countries want part-time work. For example, in Spain the desire for part-time employment among the unemployed was lower than the incidence of part-time working in the employed population.

Table 4. Benefit receipt among the unemployed (%)

Country	Male	Female
Spain	34.5	15.9
Greece	13.6	9.4
Italy	4.3	3.3
France	51.0	40.6
Belgium	79.9	74.0
Luxembourg	22.2	17.9
Germany	68.7	69.4
Denmark	85.8	83.7
Portugal	26.9	23.4
Finland	79.7	75.4
Austria	59.5	43.5
Ireland	87.8	44.9
UK	33.3	17.2

Source: ECHPS.
The question asked is "Do you receive unemployment benefit or assistance?".

Table 5. Part-time employment (%)

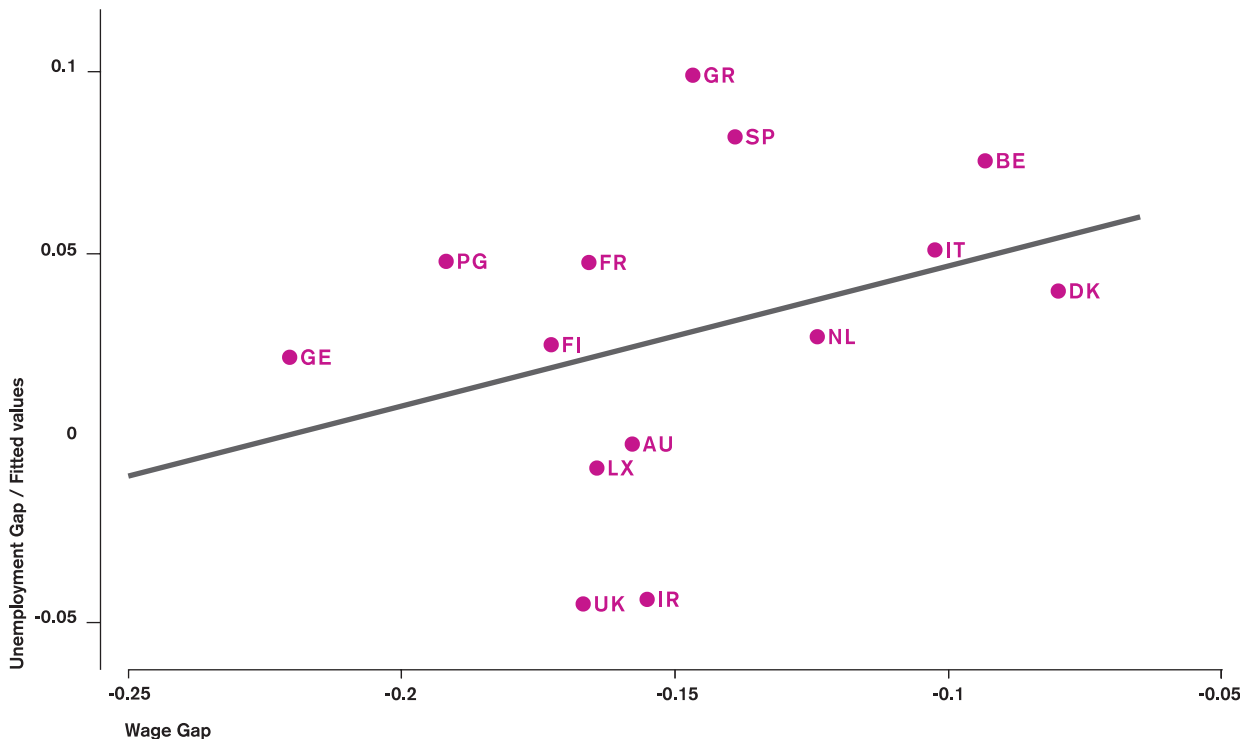
	Female		Male	
	Unemployed wanting part-time work	Employed working part-time	Unemployed wanting part-time work	Employed Working part-time
Spain	7.8	16.5	1.3	2.6
Greece	6.8	5.7	0	2.6
Italy	34.4	12.4	3.7	2.8
France	23.2	30	2.7	5.3
Belgium	20.1	34	2.1	3.2
Netherlands	72.4	68.7	15.3	16.7
Luxembourg	36.1	18.1	0	1.3
Germany	23.7	33.6	3.2	3.3
Denmark	16.3	35.1	0	11.4
Portugal	0	8.3	0	1.6
Finland	7.1	15.2	0	6.5
Sweden	19.4	42.6	2.9	8.3
Austria	44.8	28.7	3.8	3
Ireland	47.2	22.2	0	5.7
UK	55.1	44.2	5.2	7.5

Source: Eurostat Labour Force Survey, 1996.



In many countries men are more likely to be laid off than women

Figure 1. Gender gaps in unemployment rates and wages



If there are not big differences in the attitudes of unemployed men and women, perhaps the differences in the outflow rates can be accounted for by the behaviour of employers. Employers might be more favourably disposed towards employing men than women.

Work by Blau and Kahn has suggested that cross-country differences in the gender pay gap can be better explained by gender-unspecific labour market institutions, like the minimum wage and collective bargaining, and that countries with a small gender pay gap tend to be the countries with lower wage inequality in general. But it is sometimes argued that this reduced wage inequality is artificial and that one consequence of it is to raise the unemployment rates for those workers who would, in a free market, earn relatively low wages. This might be thought to include women. To investigate this hypothesis Figure 1 shows the relationship between the gender gap in unemployment rates and the gender gap in wages. There is a weak positive relationship between the two, indicating that countries in which women's pay is a lot below men's pay have lower gender gaps in unemployment rates, but the relationship is not statistically significant (the t-statistic is 1.2). For example, the gender pay gap in Spain and Greece is only marginally smaller than that in the UK but the gender gap in unemployment rates is enormous.

There are other reasons why employers might prefer to

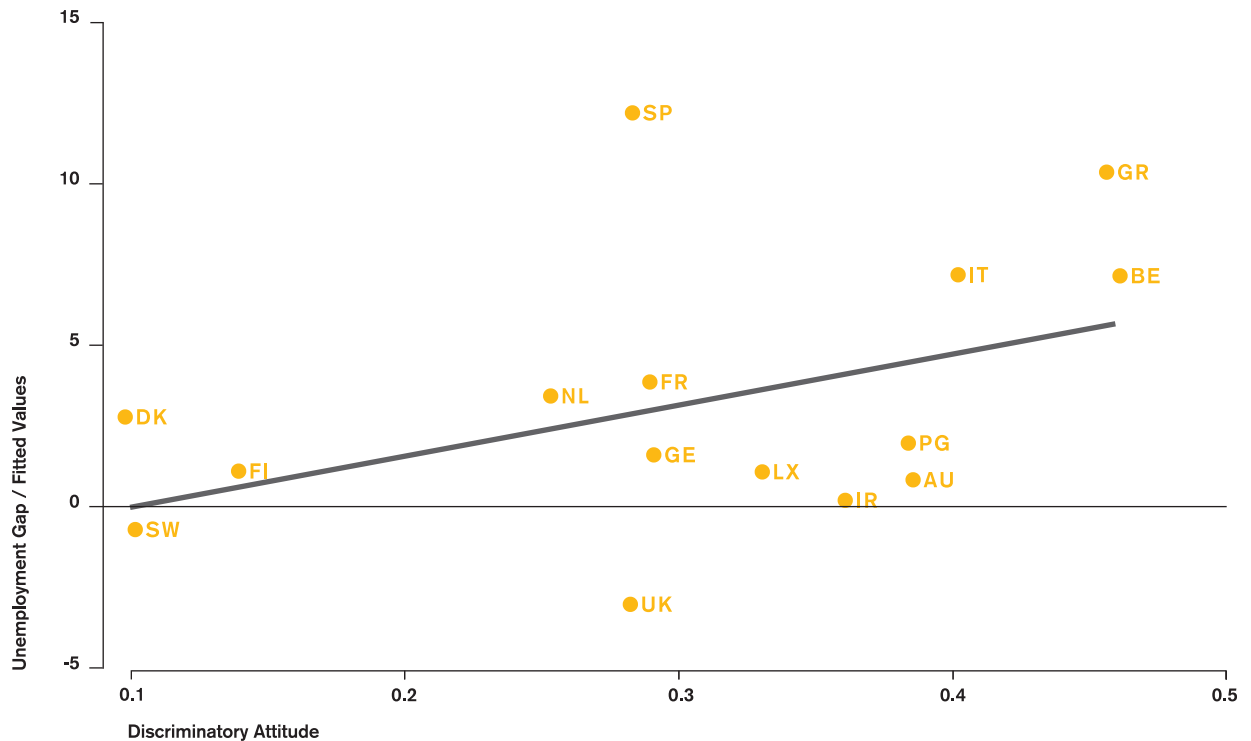
appoint men rather than women. For example, one sometimes hears the argument that employers prefer to appoint men because hiring is costly and men are more likely to stick in their jobs, or because women are more likely to take time off work because their children are sick. Even if this were true, it cannot really explain why there is a gender gap in unemployment rates in some countries but not others. An alternative hypothesis is that differences in maternity leave legislation make employers more favourably inclined towards men in some countries than in others. But in fact the differences in maternity leave regulations across EU countries are relatively small and the Nordic countries, which have generous maternity provisions, also have small gender gaps in unemployment rates.

Of course, it may not be legislation that makes men more attractive to employers than women. It could be lower levels of accumulated labour market experience among unemployed women. This might particularly be true in some of the "Mediterranean" countries where, until recently, female labour market participation was low. But our work (on admittedly rather poor quality data) suggests that this hypothesis has little explanatory power.

Employers may also simply feel that women are less deserving of employment than men and make their hiring decisions accordingly. We can get some idea as to how

Women are less likely to receive welfare benefits than men

Figure 2. Gender gaps in unemployment rates and discriminatory attitudes



widespread such discriminatory attitudes are from the 1996 Eurobarometer survey, which asked respondents whether they agreed with the statement “when jobs are scarce, men should have more right to a job than women”. In all countries, men seem more likely than women to think that women are less deserving of employment, but there are also substantial differences across countries. Crudely, the Nordic countries are less “discriminatory” and the Mediterranean countries more so. Figure 2 plots the gender gap in unemployment rates against a measure of discriminatory attitudes towards women (a higher number corresponds with more prejudice). The extent of discriminatory attitudes is positively correlated with the gender gap in unemployment rates, as the fitted regression line in Figure 2 shows.

There are other factors that might be responsible for these cross-country differences. But the remarkable thing is that we find that similar relationships hold within countries. The inhabitants of the southern parts of Italy and Spain have more discriminatory attitudes than those living in the northern parts of those countries and the gender gap in unemployment rates is also higher in those regions.

But there is one problem with the hypothesis that discriminatory attitudes can explain why employers hire men in preference to women. It is that the attitudes have been



Nordic countries, with generous maternity provisions, also have small gender gaps

around for a long time, but large gender gaps in unemployment rates are a relatively recent phenomenon. It seems plausible, though, when overall unemployment rates are high and there are many applicants for most jobs, that employers may be faced with a large number of job applicants who are more or less equivalently qualified. In this situation, employers are more or less free to indulge any slight discriminatory preferences they may have without suffering any loss from doing so. In contrast, in tight labour markets, waiting for a male job applicant rather than hiring a female one may be a much more costly strategy. Hence, putting prejudices into practice is easier when unemployment is high and there are long queues for jobs, which was the situation in most of the "high gap" countries in the 1980s and 1990s.

In some OECD countries male and female unemployment rates are very similar but in others (notably the Mediterranean countries) the female unemployment rate is much larger than the male. Our research indicates this comes about in part because of labour market institutions that protect certain groups of workers at the expense of others and because of persistent discriminatory attitudes that jobs are more valuable than men. This is what Algan and Cahuc have called the "male breadwinner" culture.

This outcome is bad for the women who are on the receiving end of the discrimination and bad for the economy as a whole, since it means that is not necessarily the most productive workers who are in jobs and may contribute to higher levels of wages among the protected workers. But

there is one other consequence which is arguably not so bad. Because these countries protect and value the employment of the male head of household, they tend to have a lesser problem with the phenomenon of workless households than countries like the UK, where employment decisions are more commonly made on individual grounds without consideration of the social consequences. In other work at the CEP, Gregg, Scutella and Wadsworth show, for example, that although the individual unemployment rate is much higher in Spain than the UK, the proportion of Spanish households with no one in work is similar in the two countries.

As in many parts of the economy, dealing with one sort of problem often has the effect of causing another. The real challenge is in delivering good outcomes in every dimension.

Ghazala Azmat is a Research Assistant at the CEP.

Maia Güell is a Research Associate at the CEP and Assistant Professor at the Universitat Pompeu Fabra, Barcelona.

Alan Manning is Professor of Economics at the LSE and a member of the CEP.

This article is based on their CEP Discussion Paper No. 607, which can be downloaded at <http://cep.lse.ac.uk/pubs>

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Understanding institutions

Daron Acemoglu delivered the 2004 Lionel Robbins Memorial Lectures at the LSE in February. His theme was that understanding the differences in the formal and informal rules governing economic and political interactions was the first step to explaining differences in long-run economic performance. This article summarises the three lectures.

Tremendous differences in incomes and standards of living exist today between the rich and the poor countries of the world. Average per capita income in sub-Saharan Africa, for example, is less than one twentieth that in the United States. Explanations for why the economic fortunes of countries have diverged so much abound. Poor countries, such as those in sub-Saharan Africa, Central America or South Asia, often lack functioning markets, their populations are poorly educated and their machinery and technology are outdated or nonexistent. These are, however, only *proximate* causes of poverty, begging the question of why these places do not have better markets, better human capital, more investments, better machinery and

better technology. There must be some *fundamental* causes leading to these outcomes and, via these channels, to dire poverty.

The two main candidates to explain such fundamental causes are geography and institutions. The *geography hypothesis*, which has a large following both in the popular imagination and in academia, maintains that the geography, climate and ecology of a society's location shape both its technology and the incentives of its inhabitants. The geography hypothesis emphasizes "forces of nature" as a primary factor in the poverty of nations. The alternative, the *institutions hypothesis*, is about "man-made" influences. According to this view, some societies are organised with "good institutions" that encourage

investment in machinery, in human capital, and in better technologies and, consequently, they achieve economic prosperity.

Three crucial elements comprise "good institutions": first, enforcement of property rights for a broad cross section of society, so that a variety of individuals have incentives to invest and take part in economic life; second, constraints on the actions of elites, politicians and other powerful groups so that these people cannot expropriate the incomes and investments of others in the society or create a highly uneven playing field; and, finally, some degree of equal opportunity for broad segments of the society, so that they can make investments, especially in human capital, and participate in productive economic activities. These good

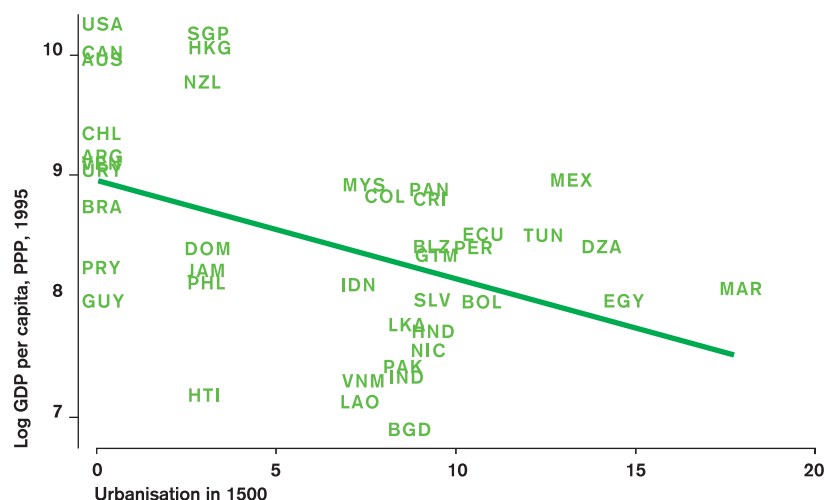
institutions contrast with conditions in many societies of the world throughout history and today, where the rule of law is selectively applied, property rights are nonexistent for the vast majority of the population, the political and economic power of elites is without bounds, and only a small fraction of citizens have access to education, investment and production opportunities.

If you want to believe that geography matters, look at a world map. Locate the poorest places in the world, with per capita income levels less than one twentieth of the United States. You will find almost all of them close to the equator, in very hot regions with periodic torrential rains, in places where, by definition, tropical diseases are widespread.

However, this evidence does not establish that geography is a first-order influence on prosperity. It is true there is a correlation between geography and prosperity. But correlation does not prove causation. Most important, there are often omitted factors driving the associations we observe in the data.

Similarly, if you look around the world, you will see that almost no wealthy country achieves this position without institutions protecting the property rights of investors and placing some degree of control over the government and elites. Once again, however, this

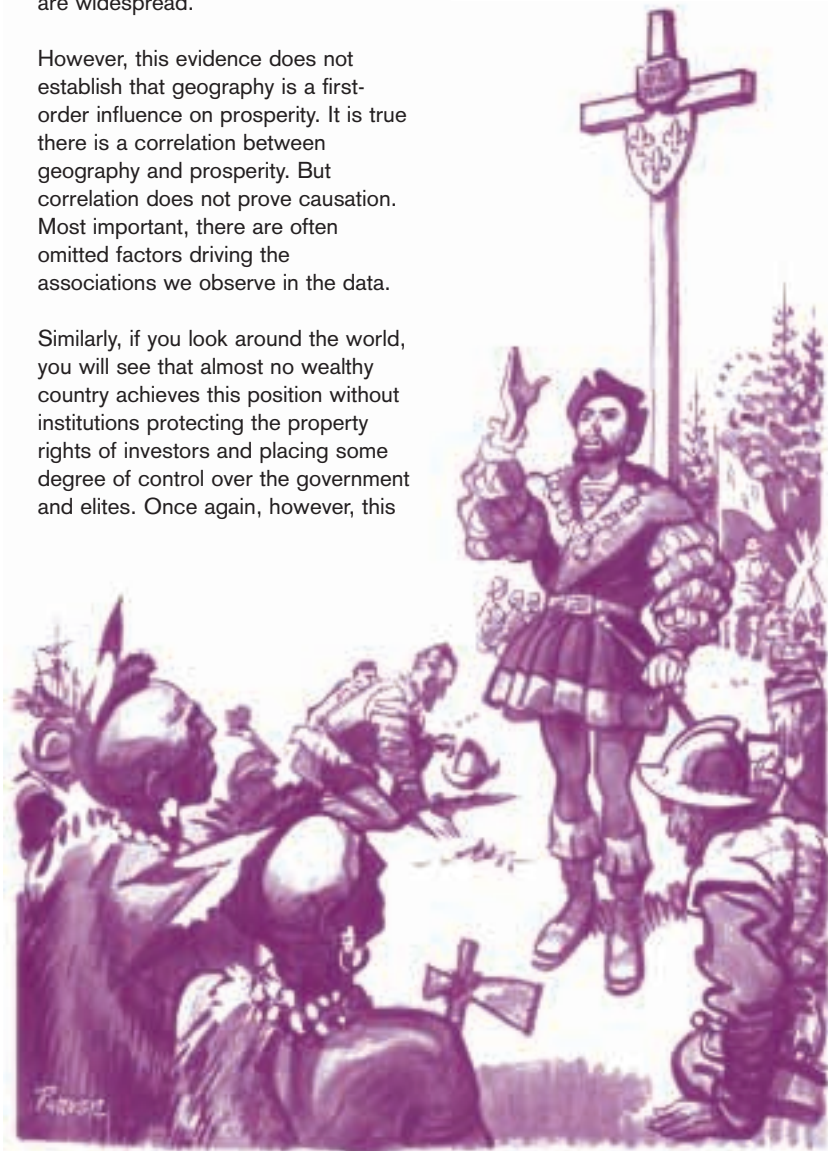
Figure 1. Shifting prosperity: 1500 versus 1995



correlation between institutions and economic development could reflect omitted factors. or reverse causality.

To make progress in understanding the relative roles of geographic and institutional factors, we need to find a source of "exogenous" variation in institutions: in other words, a "natural experiment" where institutions change for reasons unrelated to potential omitted factors (while geographic factors remain constant, as they almost always do).

The colonisation of much of the globe by Europeans starting in the 15th century provides such a natural experiment. This experience transformed the institutions in many lands conquered or controlled by Europeans, but by and large had no effect on their "geographies". Therefore, if geography is the key factor determining the economic potential of an area or a country, the places that were rich before the arrival of the Europeans should continue to be rich after the colonisation experience and, in fact, still be rich today. Since the key determinant of prosperity remains the same, we should see a high degree of *persistence* in economic outcomes. If, on the other hand, it is institutions that are central, then those places where

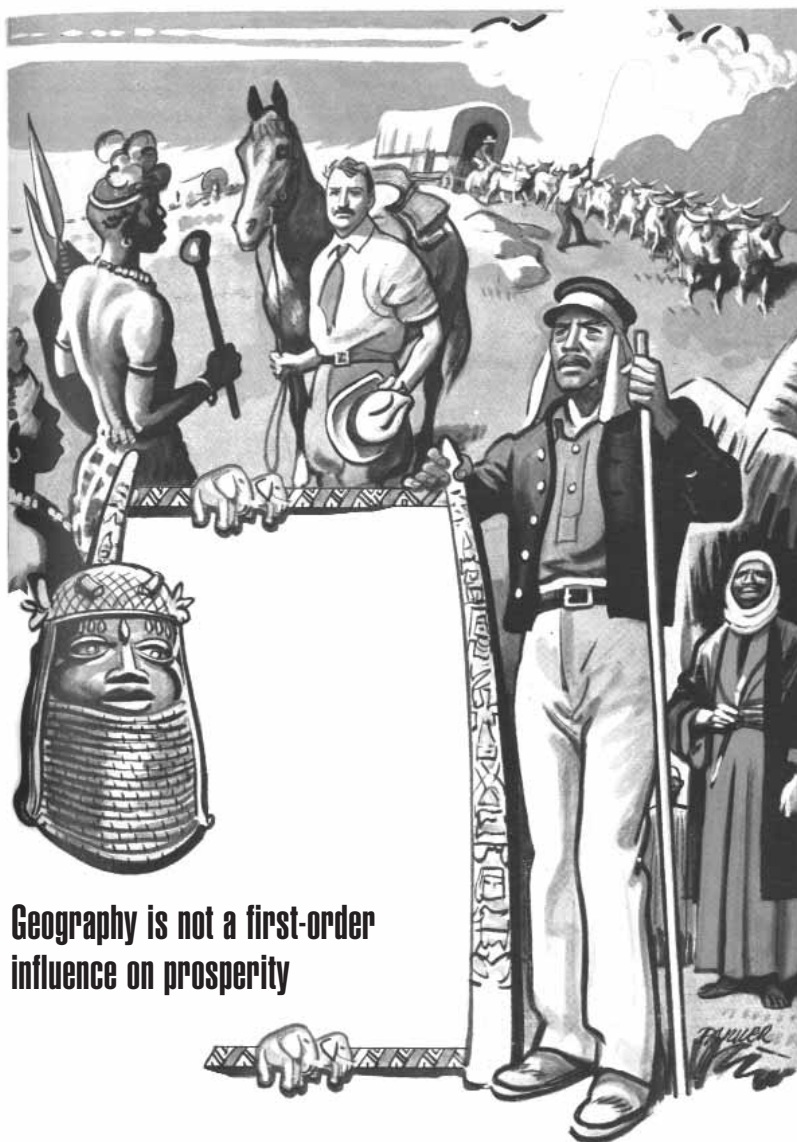


good institutions were introduced or developed should get richer, compared with those where Europeans introduced or maintained institutions to extract resources or exploit the non-European population.

Historical evidence suggests that Europeans indeed pursued very different colonisation strategies, with very different associated institutions, in various colonies. At one extreme, Europeans set up exclusively extractive institutions, exemplified by the Belgian colonisation of the Congo, slave plantations in the Caribbean or forced labour systems in the mines of Central America. These institutions introduced neither protection for the property rights of regular citizens nor constraints on the power of elites. At the other extreme, Europeans founded a number of colonies where they created settler societies, replicating – and often improving – the European form of institutions protecting private property. Primary examples of this mode of colonisation include Australia, New Zealand, Canada and the United States. The settlers in these societies also managed to place significant constraints on elites and politicians, even if they had to fight to achieve this objective.

So what happened to economic development after colonisation? Did places that were rich before colonization remain rich, as suggested by the geography hypothesis? Or was there a systematic change in economic fortunes associated with the changes in institutions?

The historical evidence shows no evidence of the persistence suggested by the geography hypothesis. On the contrary, there is a remarkable “reversal of fortune” in economic prosperity. Societies like the Moguls in India and the Aztecs and the Incas in America, which were among the richest civilizations in 1500, are among the poorer areas of the world today. In contrast, countries occupying the territories of the less-developed civilisations in North America, New Zealand and Australia



Geography is not a first-order influence on prosperity

are now much richer than those in the lands of the Moguls, Aztecs and Incas. Moreover, the reversal of fortune is not just confined to this comparison. Using various proxies for prosperity before modern times, we can show that the reversal is a much more widespread phenomenon. For example, before industrialisation only relatively developed societies could sustain significant urbanisation and high levels of population, so urbanisation rates and population density are relatively good proxies for prosperity before European colonisation. Figures 1 shows a strong negative relationship between urbanisation rates in 1500 and income per capita today and between population density in 1500 and income per capita today. The former European colonies that are relatively rich today are those that were poor and sparsely-settled before Europeans arrived.

This reversal is *prima facie* evidence against the most standard versions of the geography hypothesis. It cannot be that the climate, ecology or disease environments of the tropical areas condemn these countries to poverty today, since these areas with the same climate, ecology and disease environment were *richer* than the temperate areas 500 years ago. Although it is possible that the reversal may be related to geographic factors that have time-varying effects on economic prosperity, for example because certain characteristics that first cause prosperity then condemn nations to poverty, a more detailed look at the evidence shows that there is no evidence of any such factors, nor any support for “sophisticated” geography hypotheses of this sort.

But is the reversal of fortune consistent with the institutions hypothesis? The answer is yes. In

fact, once we look at the variation in colonisation strategies, we see that the reversal of fortune is exactly what the institutions hypothesis predicts. European colonialism made Europeans the politically powerful group with the capability to influence institutions more than any indigenous group was able to at the time. In places where Europeans did not settle (and thus did not care much about aggregate output or welfare), in places where there was a large population to be coerced and employed cheaply in mines or in agriculture (or simply taxed), in places where there was a lot to be extracted, Europeans pursued the strategy of setting up extractive institutions or taking over already existing extractive institutions and hierarchical structures. In those colonies, there were no constraints on the power of the elites (which were typically the Europeans themselves and their allies) and no civil or property rights for the majority of the population. In fact, many of them were forced labourers or slaves. Contrasting with this pattern, in other colonies where there was little to be extracted, where most of the land was empty, where the disease environment was favourable, Europeans settled in large numbers and developed laws and social institutions to ensure that they themselves were protected, both in their political and economic lives. In these colonies, the institutions were, therefore, much more conducive to investment and economic growth.

This evidence, however, does not mean that geography does not matter at all. Which places were rich and which were poor before Europeans arrived might have been determined by geographic factors. These geographic factors also probably influenced the institutions that Europeans introduced, as illustrated by the example of the climate and soil quality in the Caribbean, which made it productive to grow sugar, encouraging the development of the plantation system based on slavery. What the evidence shows instead is that geography neither condemns a nation to poverty nor guarantees its

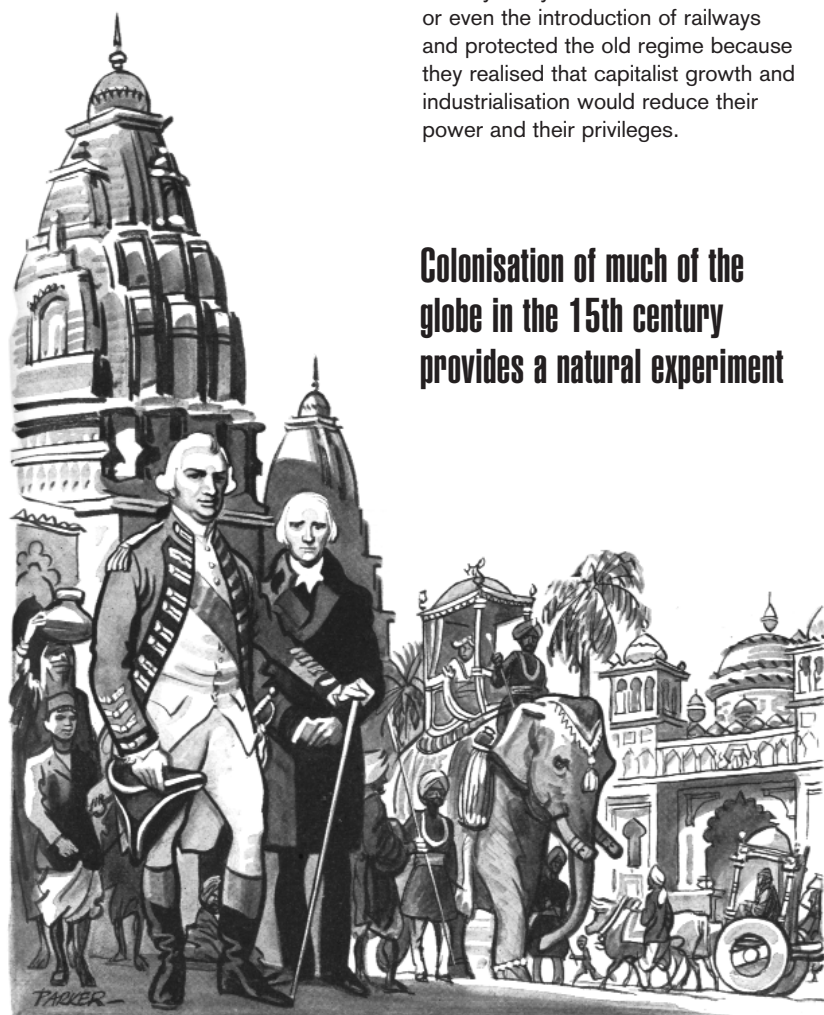
economic success. If you want to understand why a country is poor today, you have to look at its institutions, not at its geography.

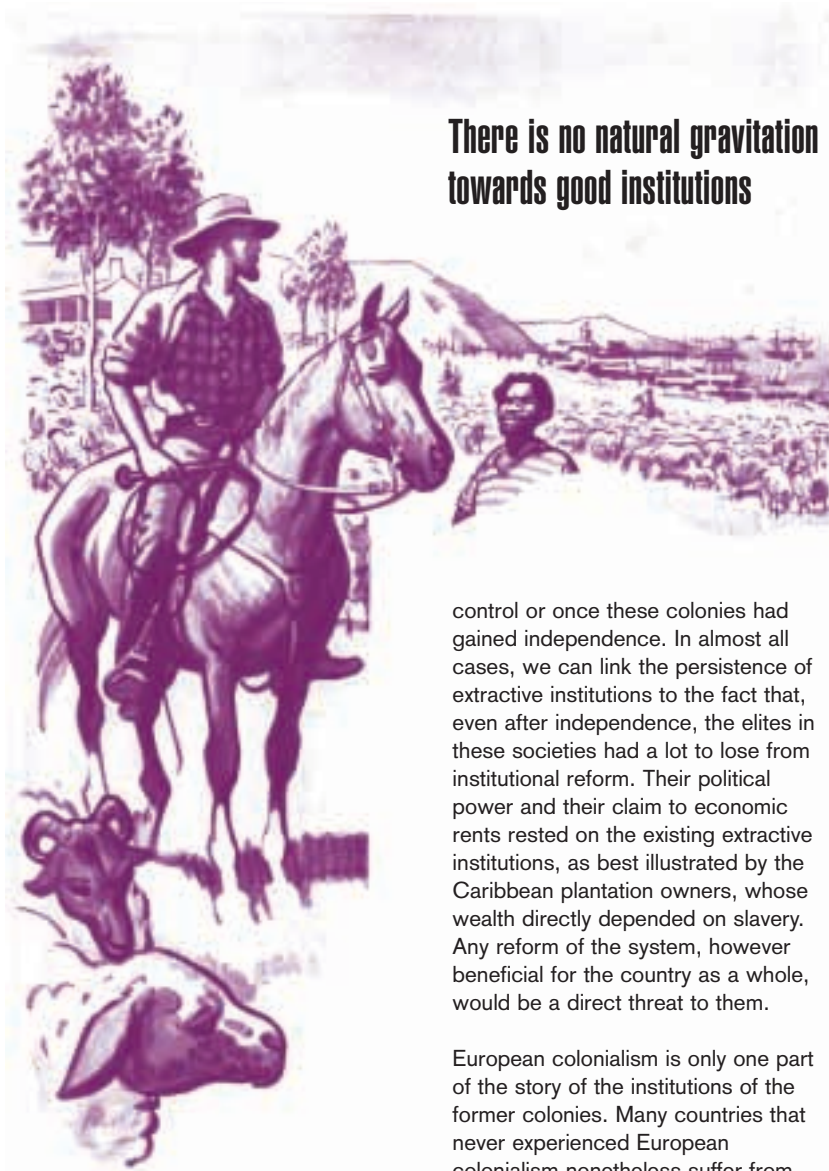
If institutions matter so much for economic prosperity, why do some societies choose or end up with bad ones? Moreover, why do these bad institutions persist even long after their disastrous consequences are apparent? Is it an accident of history, the result of some misconceptions, or mistakes by societies or their policy-makers? Recent empirical and theoretical research suggests that the answer is no: there are no compelling reasons to think that societies will naturally gravitate towards good institutions. Institutions not only affect the economic prospects of nations,

but are also central to the *distribution* of income among various individuals and groups in society. Institutions not only affect the size of the social pie, but also how it is distributed. This perspective implies that a potential change from dysfunctional and bad institutions toward better ones that will increase the size of the social pie may nonetheless be blocked when such a change significantly reduces the size of the slice that powerful groups receive from the pie and when they cannot be credibly compensated for this loss.

That there is no natural gravitation towards good institutions is illustrated by the attitudes of the landed elites and the emperors in Austria-Hungary and in Russia during the nineteenth century. They blocked industrialisation or even the introduction of railways and protected the old regime because they realised that capitalist growth and industrialisation would reduce their power and their privileges.

Colonisation of much of the globe in the 15th century provides a natural experiment





There is no natural gravitation towards good institutions

Similarly, European colonists did not set up the institutions to benefit society as a whole. They chose good institutions where it was in their interests, because they would be the ones living under the umbrella of these institutions as in much of the New World. In contrast, they introduced or maintained already-existing extractive institutions when it was in their interest to extract resources from the non-European populations of the colonies, as in much of Africa, Central America, the Caribbean and South Asia. Furthermore, these extractive institutions showed no sign of gravitating towards becoming better institutions, either under European

control or once these colonies had gained independence. In almost all cases, we can link the persistence of extractive institutions to the fact that, even after independence, the elites in these societies had a lot to lose from institutional reform. Their political power and their claim to economic rents rested on the existing extractive institutions, as best illustrated by the Caribbean plantation owners, whose wealth directly depended on slavery. Any reform of the system, however beneficial for the country as a whole, would be a direct threat to them.

European colonialism is only one part of the story of the institutions of the former colonies. Many countries that never experienced European colonialism nonetheless suffer from institutional problems (while certain other former European colonies have arguably some of the best institutions in the world today). Nevertheless, the perspective developed here applies to these instances as well: institutional problems are important in a variety of instances and, in most of these, the source of institutional problems and the difficulty of institutional reform, lie in the fact that any major change will create winners and losers. The potential losers are often powerful enough to resist change.

The persistence of institutions and potential resistance to reform do not mean that institutions are unchanging. They can show significant evolution and even highly dysfunctional

institutions can be successfully transformed, as demonstrated by Botswana, which managed to build a functioning democracy after its independence from Britain and become the fastest-growing country in the world. Institutional change will happen either when groups that favour change become powerful enough to impose it on the potential losers, or when societies can strike a bargain with potential losers so as to credibly compensate them after the change takes place, or perhaps to shield them from the most adverse consequences of these changes. Recognising the importance of institutions in economic development and the often formidable barriers to beneficial institutional reform is the first step towards significant progress in jump-starting rapid growth in many areas of the world today.

Daron Acemoglu is a Professor of Economics at the Massachusetts Institute of Technology

This article first appeared in the June 2003 issue of the IMF's magazine, *Finance & Development*.

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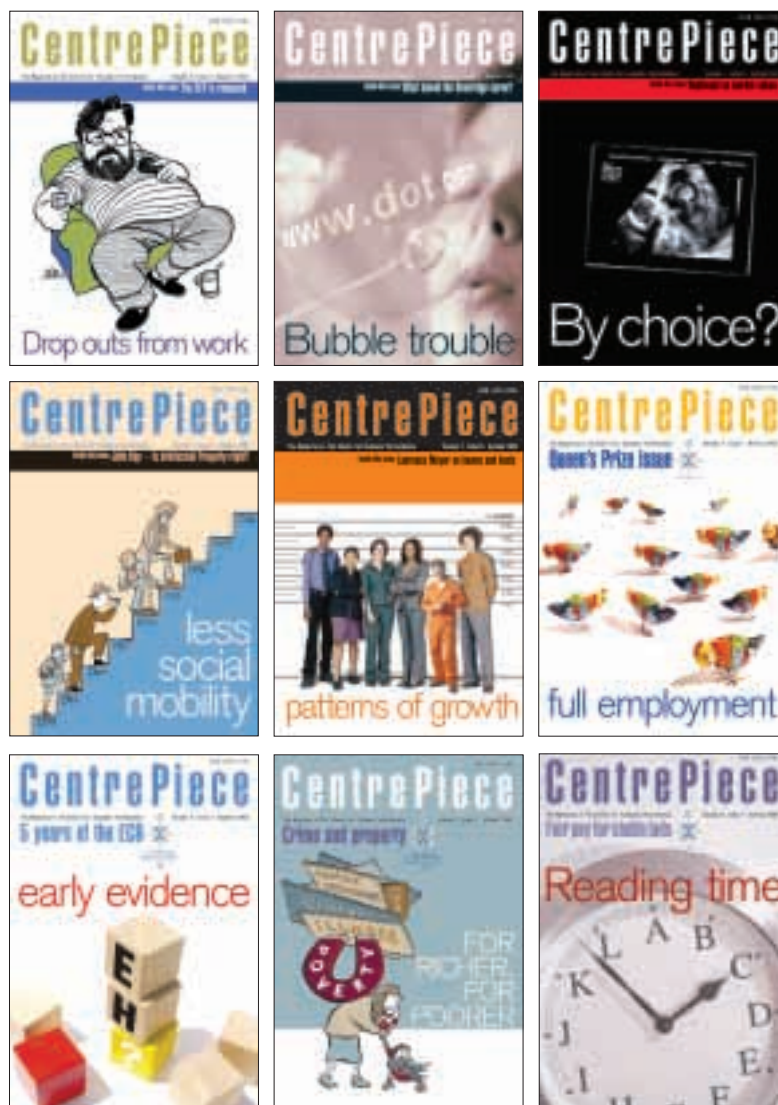
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