Flexibility and Inequality: Changes in Youth Labour Outcomes in Advanced Economies[*]

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Abstract: Since the mid-1970s, youth labour outcomes have worsened compared to those of adults across the OECD; with Anglo-Saxon countries experiencing declines mostly in relative pay and continental European countries mostly in relative employment. To explain the trends, this paper builds a structural disequilibrium labour market model and estimates it on an unbalanced panel of 10 OECD countries. The evidence reflects downward shifts in both youth relative demand and supply, with a significant endogenous contribution from educational participation. The shifts were combined with rigid pay-adjustment in continental Europe and more flexible pay-adjustment in Anglo-Saxon countries, thus linking labour market deregulation with higher efficiency.

1 Introduction

The situation of youths in advanced labour markets during the last three decades has caused a general concern: youth labour outcomes have worsened in comparison to those of adults in most advanced economies (OECD, 1982, 1996, 1999; Blanchflower & Freeman, 2000). This deterioration has materialised differently between countries, with Anglo-Saxon countries experiencing declines mostly in relative pay, continental European countries mostly in relative employment, and Germany and the Netherlands exempted from this rule, but largely due to limited data availability. To give a sense of size, relative declines for young male adults for the period 1977-1996 have been as high as 25 % points in terms of employment in France and as high as 14 % points in term of pay in the US (Ryan, 2001), rising to 30 and 16.4 respectively when longer periods are examined (Christopoulou, 2008). Adding increased school enrolment to the picture does not remove the concern, as it often happens that poor labour market conditions leave education as the only alternative for young people, especially at the tertiary level. All this has occurred despite the presence of forces that are favourable for youths; namely the positive demographic changes of the 1980s, the expansion of the service industries which traditionally employ many youths, and the strong computerization trends.

The widely-held view is that the evolution in youth labour outcomes is mostly demand-driven. Much of the focus has been on demand shifts caused by internationalisation and changing technology, under the assumption that these carry a "double-skill-bias", meaning simply that they are biased against both the education and the experience dimension of skill (Levy & Murnane, 1992; Ryan, 2001). Other literature puts emphasis on adverse macroeconomic conditions, supporting that the demand for young workers is "super-cyclical", i.e. more responsive to gen-

eral economic shocks than it is for older adults, as youths constitute the markets'
most common job-seekers (OECD, 1996; Blanchflower & Freeman, 2000; O' Higgins, 2001). Youth super-cyclicality may also occur as a quantity-side adjustment
if relative wages are slow to clear the market instead, or via the "last in, first out"
practices for youth labour in internally structured labour markets.

Valid though the aforementioned explanations may be, they are unable to stand
alone, as they lack considerations regarding institutional restrictions. The role of
labour market institutions is potentially crucial, given that after an economic shock
institutions stand in the way of the market's adjustment process. Pay-setting institutions, especially, are thought to determine the flexibility of the wage mechanism
and, thus, to direct the effect of demand shifts either on pay or on employment.
This rationale, traditionally used to explain aggregate labour outcomes (e.g. Freeman & Nickell, 1988; Layard, Nickell & Jackman, 1991; Siebert, 1997; Nickell, 1997;
Blanchard & Wolfers, 2000 etc.) and later linked specifically to skill-biased changes
to explain relative labour outcomes by education level (e.g. Krugman, 1994; Nickell
& Bell, 1995, 1996; Mortensen & Pissaridis, 1999 etc.), currently constitutes the
conventional view, despite aggregate empirical evidence being mixed (Baker et al,
2005). As a result, it has also proved popular in the youth-related literature. At
the same time policy makers have put youths at the centre of labour market deregulation attempts, opting for lower youth sub-minimum wages and more "flexible"
temporary contract legislation - with the latest French attempt failing memorably
after a series of massive protests (Howell & Schmitt, 2006).

In support of the conventional view, recent youth-specific empirical findings conclude in favour of the critical role of institutions for youth labour outcomes (OECD,
2004; Neumark & Wascher, 2004), especially when combined with economic shocks

(Bertola, Blau & Kahn, 2002; Jimeno & Rodriguez-Palenzuela, 2002). Some evidence is also suggestive of youth super-cyclicality (OECD, 1996; O'Higgins, 2001). However, the validity of these empirical findings is largely restricted by methodological shortfalls. Firstly, with the exception of a couple of early and rather basic structural studies on UK data (Merrilees & Wilson, 1979; Wells, 1983; Rice, 1986), the bulk of the empirical research has failed to provide the potentially critical link between trends in relative youth pay and employment, basing their findings in estimations of reduced-form-type equations of employment or unemployment outcomes only. Secondly, no study has formally accounted for the crucial possibility of an endogenous codetermination between labour market and education outcomes. Finally, in most cases, candidate causal forces have been assessed in separate frameworks independently from each other.

Given the diversity of the potential causes and the partial methods of their empirical appraisal to date, there remains the challenge of developing a more inclusive and methodologically more appropriate assessment mechanism. This paper takes up this challenge and, borrowing from the structural approach literature of the 1980s, it develops and estimates a disequilibrium empirical model for relative labour market outcomes by age-group based upon microeconomic foundations. The model consists of four simultaneous equations describing the structure of the labour market; namely, relative labour demand, relative labour supply, relative wage adjustment, and educational participation. In this way, pay, employment and education outcomes are allowed the possibility of endogenous co-determination and all candidate explanations of the youth labour market problem are assessed concurrently – the two major methodological contributions of this study to the field.

The model is specified in section 2 and a data description follows in section

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3. The model is then estimated for 20-24 year-old males in comparison to 25-54 year old-males in two stages: In section 4 the estimation explores the labour market situation of the typical economy in the sample, while section 5 explores cross-country heterogeneity in wage-adjustment. Section 6 concludes.

2   The model

The formulation of the model is based on the principles of the Supply-Demand-Institutions (SDI) framework, as described by Katz & Autor (1999). The SDI framework was chosen because it is simple and intuitive; it considers employment and wage outcomes to be simultaneously co-determined; and it can be easily extended.

In short, the SDI framework assumes imperfect substitutability between skill-groups in demand and no skill-group substitutability in supply and, thus, treats relative labour demand as moderately price elastic and relative labour supply as perfectly inelastic. Supply and demand are taken to interact in a competitive setting in order to determine labour outcomes, and any deviations from the competitive equilibrium point are attributed to institutional or non-competitive forces that restrict wage-adjustment (unions, minimum wages etc.). (Dis)Equilibrium outcomes can be altered by supply or demand shifts in different ways, depending on the existing institutional restrictions, or by institutional changes caused either exogenously or endogenously as responses to the shifts in demand and/or supply. Outcomes are taken to lie on the demand curve as assumed in monopoly union or "right-to-manage bargaining" microeconomic frameworks.

The model here is built as an algebraic version of the SDI conceptual framework, augmented to allow for some additional possibilities. Specifically, the model explic-

itly accounts for the endogenous interaction between employment/unemployment and wages, but also goes a step further to incorporate educational participation and test for its own potentially endogenous role. Moreover, age-group substitutability in demand is supplemented by the possibility of substitution on the supply-side, and it is under both these hypotheses that labour outcomes are modelled in relative terms between age-groups and that age-specific submarkets are induced to interact. Lastly, although it is through wages that the market adjusts to demand and supply changes, institutions are assumed to affect the market's flexibility both on the quantity-side and on the price-side. The model is as follows:

Relative demand:

$$\ln \left(\frac{E_i}{E_j} \right)^D_{ct} = a_{oc} + a_{0t} + a_1 \ln \left(\frac{W_i}{W_j} \right)_{ct} + \sum_{\kappa} a_{2\kappa} \ln X_{\kappa ct} + \sum_{\mu} a_{3\mu} \ln Z_{\mu ct} + \varepsilon_{1ct} \quad (1)$$

Relative supply:

$$\begin{aligned} \ln \left(\frac{E_i}{E_j} \right)^S_{ct} =\ & \beta_{oc} + \beta_{0t} + \beta_1 \ln \left(\frac{W_i}{W_j} \right)_{ct} + \beta_2 \ln \left(\frac{Y_i}{Y_j} \right)_{ct} \\ & + \sum_{\mu} \beta_{3\mu} \ln Z_{\mu ct} + \beta_4 \ln ED_i + \varepsilon_{2ct} \end{aligned} \quad (2)$$

Educational participation:

$$\ln ED_{ct} = \gamma_{0c} + \gamma_{0t} + \gamma_1 \ln \left(\frac{W_i}{W_j} \right)_{ct} + \gamma_2 \ln u_{ict-1} + \sum_{\mu} \gamma_{3\mu} \ln Z_{\mu ct} + \varepsilon_{3ct} \quad (3)$$

Disequilibrium condition:

$$\ln \left(\frac{u_i}{u_j} \right)_{ct} = \ln \left(\frac{E_i}{E_j} \right)^S_{ct} - \ln \left(\frac{E_i}{E_j} \right)^D_{ct} \quad (4)$$

Relative wage-adjustment equation:

$$\Delta \ln \left(\frac{W_i}{W_j} \right)_{ct} = \delta_{0c} + \delta_{0t} + \delta_1 \ln \left(\frac{u_i}{u_j} \right)_{ct} + \sum_{\mu} \delta_{2\mu} \ln Z_{\mu ct} + \varepsilon_{4ct} \qquad (5)$$

Where E is employment (D for demanded and S for supplied); W is monetary pay; X denotes economic variables; Z denotes institutional variables; Y denotes population size; ED is educational participation; u denotes unemployment rates; ε denotes stochastic errors. Indexes i and j stand for the youth group and the prime-age adult group respectively; c and t denote the country and time dimensions of the database respectively; and κ and μ denote economic shocks and institutions respectively.

The system (1)-(5) has been modelled aiming for overidentification. Specifically, different institutional and economic explanatory variables have been included in each equation in order to satisfy the order condition of identification. Next, each equation is discussed consecutively.

2.1   Relative labour demand

The relative demand equation can be derived by equating the wage ratio with the ratio of marginal products in a programme of output-constrained cost minimization, given a Constant Elasticity of Substitution (CES) production function, and is essentially:

$$\ln \left(\frac{E_i}{E_j} \right)^D = a_1 \ln \left(\frac{W_i}{W_j} \right) + a_2 \ln(\text{youth-biased shifters})$$

where the coefficient equals the elasticity of substitution $\sigma^D < 0$ between age-groups [1] and "youth-biased shifters" are any forces that affect the demand of the

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two groups disproportionately. Youth-biased demand shifters are represented in (1) by economic and institutional variables.

The inclusion of the economic variables in the demand equation will test the two main proposed explanations for the youth labour market problem. Specifically, economic variables that represent economic cycles will offer evidence in favour of or against the hypothesis of youth super-cyclicality, whereas coefficients on skilled-biased variables (trade and technical change indicators) will assess the possibility of any skill-bias in demand shifts - when present - falling both on the experience and the education dimension of skills.

The institutional influences could come either from school-to-work transition networks or from employment protection legislation or both. By accelerating the matching of employers and employees and by facilitating the adaptation of new technologies through on-the-job training, school-to-work institutions (if effective) are expected to have a positive influence on relative demand. On the other hand, the effect of employment protection legislation is expected to be negative. Strict employment protection legislation entails higher firing costs and increases the bargaining power of existing staff for wages. In consequence, it decreases overall inflows into employment and, thus, affects the demand for young employees more than that of prime-age adults, given that youths constitute a disproportionate share of the pool of job-seekers. This effect should be weaker when employment protection involves age-specific provisions - most often the case - and stronger when it is combined with adverse economic shocks on demand.

2.2 Relative labour supply

Studies that consider relative labour outcomes within the SDI framework normally allow no wage responsiveness or cross-group substitutability on the supply side. Instead, relative labour supply is taken as predetermined by past educational investment decisions and demographic changes; i.e. exogenous to current labour market conditions (e.g. Katz & Murphy, 1992; Murphy & Welch, 1992; Card & Lemiux, 2001; Angel-Urdinola & Wodon, 2003 etc.). However, this may not be the case when supply is defined in relative terms between age-groups. In fact, the wage responsiveness of youth labour supply is expected to be higher than that of older adults, as they are in those stages of their life-cycle that the alternative uses of time are highest (i.e. education). Moreover, youths and prime-age adults may be members of the same households and youth participation may be largely affected by the relative wages or participation decisions of prime-age adults. Equation (2) allows for these possibilities by modelling relative supply to depend on relative wages and educational participation as follows[2]:

$$\ln\left(\frac{E_i}{E_j}\right)^S \approx \beta_1 \ln\left(\frac{W_i}{W_j}\right) + \beta_2 \ln(\text{youth-biased shifters}) + \beta_3 \ln ED_i$$

Adding demographic and institutional factors as labour supply shifters then yields equation (2). [3]

Parameter $\beta_1 > 0$ can be taken to account for substitution possibilities in labour supply, but may also reflect the differences in the wage responsiveness of supply between age-groups. Thus, assuming different substitution possibilities between leisure and consumption by age-group, β_1 will be expected significant even if no cross-substitution takes place between age groups in supply.

Similar performance is expected by the institutional variables that measure opportunity costs; i.e, the indexes quantifying the generosity of the benefit system. If youths and older adults are not equally responsive to changes in income from alternative sources, the coefficients on these variables are expected to be negative and significant both in presence and in absence of cross-group substitution effects. However, there is more to consider here than differences in preferences. Benefit systems could influence relative supply in their own right, even if equal income-responsiveness is assumed between age-groups, since they often grant easier access and higher allowances to mature adults than youths. Then, relative supply is expected to be higher the lower the relative generosity of benefits, with any cross-group substitution effects and/or differences in income responsiveness reinforcing this effect.

Relative supply is also affected by active labour market policies. Like unemployment benefits, active labour market policies could be seen as alternative uses of time and have negative effects on relative supply, or alternatively they could promote labour force participation of the discouraged and idle population and, therefore, have a positive effect. Both are plausible and it is an empirical issue which prevails.

The influence of the remaining explanatory variables is straightforward. Relative supply is expected to change in the same direction with relative population sizes and in the opposite direction to educational participation.

2.3 Educational participation

Participation in education, as an alternative use of time for youths, should be wage-responsive itself, as part of the determination of labour supply. To account for this possibility equation (3) is added to the model, giving educational participation

an endogenous role. The equation is designed in line with human capital theory, with decisions of educational participation depending on the relative importance of current versus future labour market conditions: Given that W_j is the wage of an individual with an average level of experience and an average level of educational attainment, whereas W_i is the wage of an individual with low (if not zero) levels of experience and education, youth demand for education is modelled as responsive to a gross education-experience premium (i.e. to the increase in a young person's wage if s/he attains an average level of education and experience), with $\gamma_1 < 0$.[4]

By substituting (3) into the relative supply function and taking the institutional variables in both equations to be the same, one gets:

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\begin{aligned}
\ln \left(\frac{E_i}{E_j} \right)^S_{ct} = {} & (\beta_{oc} + \beta_4 \gamma_{0c}) + (\beta_{0t} + \beta_4 \gamma_{0t}) + (\beta_1 + \beta_4 \gamma_1) \ln \left(\frac{W_i}{W_j} \right)_{ct} \\
& + \beta_2 \ln \left(\frac{Y_i}{Y_j} \right)_{ct} + \sum_{\mu} (\beta_{3\mu} + \beta_4 \gamma_{3\mu}) \ln Z_{\mu ct} \\
& + \beta_4 \gamma_2 \ln u_{ict-1} + (\beta_4 \varepsilon_{3ct} + \varepsilon_{2ct})
\end{aligned}
$$

As before, β_1 captures the wage responsiveness of relative supply due to age-group substitution in labour force participation or differences in leisure-labour substitution between groups, and is net of any effects caused by the substitution between labour force and educational participation of youths. Any such effects are captured by $\beta_4 \gamma_1$. Thus, $\beta_1 + \beta_4 \gamma_1$ can be interpreted as the total or "gross" responsiveness of relative supply to wages.

The lagged level of youth unemployment rate appears in (3) to test youth super-cyclicality on the supply-side; that is, to test the role of adverse labour market conditions in the determination of educational participation if relative wages adjust at slow pace and are not representative of the situation in the labour market.[5]

Thus, if job shortages for youths in the previous year impel them to education in the current year, γ_2 is anticipated to bear a positive sign.[6]

Finally, as Z includes institutions representing the generosity of the benefit system, which constitute an opportunity cost of education; these are expected to affect educational participation in the same direction as relative supply.

2.4 Disequilibrium condition

Disequilibrium condition (4) determines how relative demand and supply variables will be quantified in the system and is modelled to imply a demand-constrained labour market; i.e, it restricts the relative labour outcomes on the relative demand curve.[7] This assumption is not implausible when one studies post-1975 labour trends. According to early structural empirical studies, the youth labour market in the UK switched from being supply constrained to being demand constrained in the late 1960s or early 1970s (Merrilees & Wilson, 1979; Wells, 1983; Rice, 1986). Similarly, for the rest of the countries the trends in group-specific unemployment rates (presented in Figure 1) are also suggestive of non-clearing labour markets.[8]

2.5 Adjustment of relative wage

Equation (5) determines the movement of the system in disequilibrium. It is essentially a typical short-term Phillips-type relationship expressed in relative term between age-groups $\Delta \ln(W_i/W_j)_{ct} \approx \delta \ln(u_i/u_j)$, augmented by a group of wage-setting institutions. According to (5), the rate of relative adjustment does not depend solely on the difference between relative supply and demand, but also on measures of relative minimum wages and labour union strength, such as union contract coverage, union membership and coordination/centralization levels in wage

bargaining. The effect of these institutions on relative wage-change is difficult to predict, as it depends on whether unions have or have not already attained their preferred wage-dispersion by age, as well as on the relative weight the interests of youths and prime-age adults are given by unions.

In particular, if unions have already attained their preferred wage-dispersion between age-groups, they may not want to allow the ratio to vary in response to relative unemployment and, thus, they should work against downward relative wage-flexibility, appearing with a positive coefficient. On the other hand, if they have not already attained their preferred wage-dispersion by age, then the determining role will be played by the relative weight they give to the interests of age-groups. Then, this depends on how well organized youths are in their representation within the union, how active and loyal they are, how sympathetic prime-age adult members are towards youths, how competitive are unions for youth membership and how important is the existence of the union in the long-term for the union leaders and members (Ryan, 1987).

Specifically, unions will pursue wage-compression by age if they give similar weight to the interests of youths and mature adults or if they give little weight to the interests of youths but the demand elasticity of substitution between age-groups is high enough to generate competition that can drive down the wages of mature members. Again, the variables that represent the strength of unions would appear in (5) with a positive sign, shifting the relative wage-adjustment curve upwards so that for a given level of relative unemployment the rate of decline in relative wage is smaller. On the other hand, if unions give the interests of youths less weight than those of prime-age adults but the demand elasticity of substitution between age-groups is not very high, the outcome pursued will be greater wage-dispersion by

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age. Then, indices of union strength will be expected with a negative sign.

Note that bargaining coordination/centralization may not always work in the same direction with the unions' goals. Specifically, even though high bargaining coordination and/or centralization increases the unions' power, it also increases the bargainers' awareness of the macro-level consequences of wage arrangements and, thus, facilitates the responsiveness of wage demands to macroeconomic conditions (Calmfors & Driffill, 1988; Soskice, 1990; Teulings & Hartog, 1998). Therefore, the coefficients on the coordination/centralization index and on the rest of the indicators of union strength are not necessarily expected to carry the same sign.

3   Data and method of estimation

The database is an unbalanced panel of annual observations for ten OECD countries over the period 1973-2000. This draws mainly from OECD published and unpublished statistics, and is also augmented with indicators from several different sources. The specific age-groups compared are young adult males (20-24 year olds) and prime-age adult males (25-54 year-olds).[9] The choice of the age-group of young adults was based on the availability of data on pay and educational participation, which are particularly scarce for teenage categories. Analysis of female relative labour is left aside, on the assumption of strict segregation between male and female labour markets.

The endogenous variables in the database are: relative employment as $(E_i/E_j)^D$; relative mean earnings as W_i/W_j; relative unemployment rates as u_i/u_j; and participation in tertiary education divided by the youth population size as ED_i. Relative labour supply is then calculated as the sum of relative demand and relative unemployment rates. The exogenous economic variables are: the output gap, as a cyclical

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proxy; openness (exports plus imports divided by GDP), as an indicator of internationalisation; and first differences in R&D expenditure per capita, as a proxy of the rate of technological change[10]. As Y_i/Y_j we use the relative population size by age group.

The institutional variables are indexes provided by Juan F. Jimeno (used for the paper by Jimeno & Rodriguez-Palenzuela, 2002), most of which originate from Nickell (1997) and have since been widely used in the aggregate literature. They cover the unemployment benefits system (replacement rates and benefit duration), the extent of active labour market policies (as instrumented measure of spending), wage determination (union membership, union contract coverage and the degree of bargaining coordination), employment protection (the pervasiveness of employment protection legislation and the strictness of legislation regarding the use of temporary contracts) and lastly, relative minimum wages. To these we add the number of apprentices as a percentage of the 20-24 year-old cohort by country in the late 1990s, as a measure of school-to-work institutions.

The database has several advantages over what has been used in youth cross-country analysis so far. Firstly, measuring youth cyclicality effects has mostly involved estimations of the responsiveness of youth unemployment to "result indicators" of economic cycles (mostly the adult unemployment rate), whereas the cyclical variable used here (i.e. output gap) is closer to a "cause-indicator". Secondly, an observable indicator - the R&D variable - is used along with a time trend (or time effects) to represent changes in technology, instead of the time-trend alone, as has been common practice to date. Finally, this is the first time that national time-series on trade, educational participation and apprenticeship have been collected and analysed in the youth-specific literature.

Despite the merits of the database, its dimensions remain unavoidably small: the countries are ten and the number of available observations per country ranges between 10 and 26. Moreover, the panel includes several time-invariant variables as well as variables that are potentially defective (e.g institutional indicators that do not account for age-specific provisions), while it omits variables that are relevant to the analysis (e.g. measures of computerisation). These restrictions, in combination with the relatively high number of regressors per equation, give rise to a trade-off between the level of sophistication of the model's specification and the validity of the available econometric methods of estimation. Bounded by this trade-off, the labour market model is kept in its static form and it is estimated on the pooled panel by Two Stage Least Squares with dummy variables (2SLSDV). 2SLS is selected because it has the advantage of confining a specification error to the particular equation in which it appears, unlike other full-information methods, such as Three Stage Least Squares (3SLS), which would propagage any such error throughout the system.

4 Results for advanced economies as a whole

Table 1 presents the 2SLS estimates of the simultaneous equations model when using the complete pooled sample and time-invariant institutions. Results from three alternative specifications are reported. Specification (1) includes all available variables and country-dummies, but uses a time-trend as an indicator of unobserved trend factors (e.g. of technological change in the demand equation) instead of time-dummies. Specification (2) is the same as (1), but excludes the institutional variables that do not allow for age-specific provisions and are, therefore, a source of misspecification. Finally, specification (3) is the same as (2), but replaces the time-trend with time-dummies.

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The results for each equation are discussed in turn.

4.1   Relative demand

Starting from relative demand, one observes that in the first two specifications the implied elasticity of substitution between age-groups, although carrying the correct sign, is weak and statistically insignificant. However, the inclusion of time-dummies in specification (3) increases the value of the coefficient as well as its statistical significance: the elasticity becomes -0.57 and very close to statistically significant at the 10% level. At first, -0.57 may seem rather low, especially when compared to the -1.13 or -2 (and higher) elasticities of substitutions between teenagers and prime-age adult males in the UK estimated by Merrilees & Wilson (1979) and Wells (1983), respectively. However, this requires more careful consideration. Given the numerous omitted variables in the estimations of Merriless & Wilson and Wells, and given that more recent and more valid estimates of elasticities of substitutions between education-groups in the US lie between 1 and 2 (Johnson, 1997; Autor, Katz & Krueger, 1998), then a short-run elasticity of substitution below unity between two groups with both an education and an experience skill gap is a plausible and an encouraging result.

The estimation also suggests that relative demand is responsive to aggregate economic shocks. The cyclical economic indicator used for that purpose is the output gap variable. A positive output gap indicates strains on productive resources and causes upward pressure on inflation, whereas a negative output gap indicates unused capacity which tends to exert downward pressure on inflation. The results in all specifications imply that a high level of output gap increases the demand for youth labour compared to that of adults, thus reflecting the presence of super-cyclicality.

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Some evidence of skill-biased demand shifts is also at hand. In all three speci-
fications the parameters on the openness variable appear negative and significant,
suggesting that globalisation favours the more experienced workers. The coefficients
entail a decrease of 0.4-0.5% in youth relative employment after a 1% increase in
openness.

On the other hand, though, the coefficient on the change of R&D spending per
capita in specifications (1) and (2) appears positive and statistically significant, im-
plying that R&D spending favours the less experienced workers. The result is more
plausible in specification (3), where the coefficient loses its statistical significance.
After all, R&D spending is only a partial indicator of technological change and
ignores other more important aspects of it, especially computerisation.

Given the poor performance of the R&D indicator in specifications (1) and (2),
it is tempting to perceive the linear time trend as a potential indicator of skill-biased
technological change. This, however, would involve the assumption that technolog-
ical change occurs at a constant rate, whereas, in fact, it may occur unevenly and
can even be endogenous (e.g. as a function of training and education of the work-
force). In reality, the time trend could be capturing the effects of any relevant trend
factor omitted, and, as Solow put it, it is essentially a measure of our ignorance.
Still, economists have traditionally used the time trend as a measure of technological
shifts, and provided that no other appropriate observable indicator is included in
the equation, it is unlikely that the trend is entirely independent from the effect of
changing technology. In specification (3) the time trend is redundant and, therefore,
omitted, as time-dummies are included instead.[11]

The institutional variables also provide implausible results. In particular, the
coefficient on the general employment protection index is positive and statistically

significant, while the coefficient on the temporary contracts indicator, which would be expected to have a more important effect as temporary contracts are more commonly used for youths, appears statistically insignificant. This however does not come as a surprise, as multicollinearity between the two indicators is high (correlation coefficient is 0.88), making it difficult to isolate the distinct association of each characteristic of employment protection with relative demand. Furthermore, the estimated effect is most likely to be misspecified. The employment protection variables typically refer to adults and make no allowance for youth-specific derogations, which are marked in some countries.[12] As a result, the employment protection variables are excluded from specifications (2) and (3), with their exclusion leaving the rest of the estimated coefficients roughly unaffected.

The apprenticeship index performs better. In particular, it appears consistently significant across specifications and even though in specification (1) it carries a negative sign, when the misspecified variables on employment protection are excluded in (2) and (3), the coefficient switches to positive. The result suggests a 0.15-0.2% increase in relative employment after a 1% increase in apprenticeship/youth population, adding credit to Ryan's (2001) emphasis on the youth-friendly role of school-to-work institutions.[13]

Interestingly, summing up the estimated effects of all the shift factors of relative demand (i.e. all factors excluding wages) from 1987 to 1996 (the ten-year period common to all countries) results in an average net demand shift of -6.8% specifications (1) and (2) and of -5.3% in (3). In other words, at a given level of relative wages, relative demand is estimated to have fallen by 5.3-6.8%. This confirms the initial prediction: demand-side forces in advanced labour markets have worked against youths in particular and have done so substantially.

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4.2 Relative supply

The findings from the relative supply equation are very close to what one would expect. To begin with, relative pay appears statistically insignificant in all specifications, implying that there are no substantial differences in preferences for labour and leisure by age, or on a secondary level, that youths are not substitutes for older adults in labour supply within households. However, unless educational participation is strictly exogenous and unresponsive to relative pay, this is not sufficient to suggest that the relative supply curve between young and prime-age male adults is vertical. In fact, here, participation in tertiary education appears to play an important and endogenous role in the determination of relative supply: it is correctly signed, it carries a fairly high coefficient, it is statistically significant, and the Hausman test offers evidence against the hypothesis of its exogeneity consistently across specifications. As a result, the wage-elasticity of relative supply depends solely on the wage-responsiveness of educational participation.

The relative population variable also performs as anticipated. Its coefficient is positively signed in all specifications, although it is statistically significant in specification (3) only. With a coefficient value of 0.81, the implied connection between relative population and relative supply is nearly one-to-one, as expected.

Once again, the performance of the institutional variables is poor. The variables representing the generosity of the benefit system, namely the benefit duration and the replacement rates indices, appear to have a positive and statistically significant effect on relative supply; that is, the opposite effect than anticipated. However, as before with employment protection, this effect could well be misspecified, given that the indices do not account for age-specific provisions. For this reason, the two variables are omitted from specifications (2) and (3), with no major consequences

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for the remaining estimates.

As for the estimated effect of active labour market policies, this appears more plausible. The respective coefficient is positive and significant in all specifications and in specifications (2) and (3) that exclude misspecified institutions, its value is larger. This suggests that participation in the respective programmes encourages participation in the labour force, with a 1% increase in ALMP spending entailing an increase in relative supply of 0.21%-0.23%.

Finally, a perplexing result is that the time-trend included in the relative supply equation in the first two specifications is statistically significant. This implies that there are unknown factors that increase relative supply steadily over time that have not been accounted for. However, this result may occur as a side-effect of the absence of time-dummies.[14]

4.3 Educational participation

For the educational participation equation, two points deserve emphasis. Firstly, the relative wage coefficient is negative and statistically significant in all specifications (in (1) and (2) it is significant at the 10% level). With the relative wage coefficient estimated to range between 0.7-1.6, the suggested gross relative supply wage-elasticity is between 1.0 and 1.8[15]; thus, it is substantially higher than the estimated relative demand elasticity.

Secondly, the coefficient of the lagged youth unemployment variable is positive and significant in all specifications. Given that, due to data limitations, educational participation has not been modelled as an option for prime-age adults (consistent with the fact that it is of secondary scale and more likely to be voluntary/uncyclical for adults[16]), the estimated coefficient suggests that the typical country in the sample

experiences youth super-cyclicality on the supply side as well.

Given these estimates, it is now possible to calculate how big a part of the change in educational participation during the period of interest comes as a reaction to labour market conditions. Taking the relative pay effect alone, this accounts for 9.8% of the increase in educational participation in the typical country between 1988 and 1996 according to estimations (1) and (2), and for 22.8% of the increase according to estimation (3). As relative pay is the only factor formally modelled as endogenous in the educational participation equation, these results suggest that the endogenous part of educational participation ranges from one tenth to a quarter. However, taking also into account the effect of the lagged youth unemployment rate, these proportions become significantly larger. Specifically, the sum of the relative pay and lagged unemployment effects accounts for the 23.2% of the increase in educational participation between 1988 and 1996 according to estimations (1) and (2), and for 44.5% of the increase according to (3). This latter result suggests that nearly half the students who have enrolled to education during the specified period have done so due to poor wages or due to the lack of employment opportunities in the labour market.

The rest of the estimates in the equation are as expected. The replacement rate and benefit duration indicators provide as implausible results as in the supply function - possibly for the same reasons - and are subsequently excluded from specifications (2) and (3), again with no substantial consequences for the rest of the estimates. The coefficient on the ALMP indicator is positive and significant in all specifications, implying that such policies encourage participation not only in the labour force but also in education. Finally, the time trend appears positive and significant; potentially capturing the effect of factors such as the level of tuition fees

for which no variables are available.[17]

Overall, on the supply-side, the net shift experienced by the typical advanced economy during 1978-1996 appears favourable for youths. Specifically, relative supply appears to shift inwards by -8% in specifications (1) and (2) and by -6% in (3).[18] This favourable supply shift dampens down the final decrease in relative employment and pay caused by adverse demand changes. Had supply-side factors not worked in this direction the youth labour market problem would have been considerably more severe.

4.4   Relative wage-adjustment

In the wage-adjustment equation, the immediate response of the relative pay change to relative unemployment appears weak, with the respective coefficient ranging from -0.06 to -0.1. Thus, the results suggest a picture of overall price rigidity in the system, as not only is the market's responsiveness to shocks limited by low relative demand and moderate supply wage flexibility, but also the rate of relative wage change is slow.

On this, the wage-setting institutions prove influential. To start with, the coefficient on union contract coverage is positive and statistically significant in all specifications. More importantly, it suggests a considerable effect on relative wage-change; i.e., that a one unit increase in the union coverage index (e.g. if union coverage moves from the 25-50% range to the over 70% range) is associated ceteris paribus with an upward shift of the relative wage curve such that for the same level of relative unemployment the corresponding wage-decrease is 14.4-21.5% lower. This could be due to two different possibilities. Firstly, it could reflect the fact that unions have already attained their preferred wage-dispersion by age and, therefore,

they want to preclude relative wages from responding to relative unemployment. Alternatively, if the preferred relative-wage ratio has not been attained, the result suggests that unions pursue wage-compression by age, in agreement with the mainstream empirical literature on aggregate outcomes (OECD, 1997; Blau & Kahn, 1999, 2002; Aidt & Tzannatos, 2002; etc.).

Interestingly enough, the indicator of union membership appears with the same sign as union coverage but insignificant and with a lower coefficient. The implication is that countries with high union contract coverage may show little decline in relative wages even if union membership is low. This is consistent with the fact that in France young adults have experienced a very modest decline in their relative pay (-2.9% from 1974-1998), while combining a very high percentage of employee coverage by union bargaining (more than 70%) with the lowest union membership percentage out of the 10 countries in the sample (11.8%).

Another interesting result is the negative and in the first two specifications statistically significant coefficient of the coordination index. This implies that higher employer and union coordination in wage bargaining facilitates flexibility in the youth labour market, shifting the relative wage curve downwards so that a given level of relative unemployment is associated with a higher decline in youth relative pay, in line with the Calmfors and Driffill (1988) hypothesis for aggregate wage-adjustment. Note though that the coefficient for bargaining coordination is hardly large enough to outweigh the effect of bargaining coverage.

Unfortunately, testing whether youth sub-minimum wages also contribute to the market's flexibility is not possible due to limited variation in the variable at hand.[19]

4.5 Goodness of fit

Overall, the model performs well, especially so considering limitations of the data. The sense of good performance is also supported by the Sargan test on the validity of the instruments. Two versions of the test have been reported in the result tables: one that uses the Sargan statistic in its usual form and one that controls for the number of regressors. Both versions yield a positive result in most specifications, except in the case of relative demand, which potentially lacks relevant variables (e.g. indicator of computerization).

Another way of assessing "goodness of fit" is to check whether the model adequately explains the differential evolution of the dependent variables across countries. For this we use specification (3), which is chosen here as the preferred specification, on the basis that it excludes misspecified institutional effects, it includes time-dummies and provides the most plausible estimates for the basic coefficients. Figure 2 plots the change in actual and fitted relative employment, relative supply, relative wage change and participation in tertiary education. The fit is satisfactory. The explanatory factors as modelled in the system can account for a significant part of the actual differences in the dependent variables across countries.

5 Cross-country heterogeneity in relative wage-adjustment

5.1 Rate of relative wage-adjustment by country-group

This section explores cross-country heterogeneity for the rate of relative wage-adjustment. The aim is to test the principal explanatory hypothesis of the youth

labour market problem - that differences in pay-setting institutions between countries cause differences in pay-flexibility and, therefore, direct the effects of shocks either onto relative employment or onto relative pay - which would link the comparatively more liberal wage-setting institutions with the significant relative pay losses in the Anglo-Saxon countries, and the more coordinated wage-setting institutions with the significant relative employment losses in continental Europe.

Countries have been grouped according to two stylised facts. First, youth relative employment and wage outcomes follow similar trends within two country-groups: the group of Anglo-Saxon countries and the group of continental European countries. Secondly, the countries in each of these groups share broadly similar institutional characteristics. Thus, Australia, Canada, the UK and the US form one group and Finland, France, Germany, the Netherlands and Sweden form another. Lastly, as Japan shares some features with both the Anglo-Saxon countries and the continental European countries, but it cannot be properly classified with any of the two, it forms a "group" in its own right.

Table 2 provides the estimation of the relative wage-adjustment equation in the preferred specification with the coefficient on the relative unemployment rate varying by country-group.[20]The results are encouraging for the shocks-institutions interpretation. The estimated coefficient on relative unemployment for the continental European group appears statistically insignificant , while for the Anglo-Saxon group it is both statistically significant and five times higher in value than the pooled coefficient in the equivalent estimation of Table 1 (column (3)). Furthermore, the effect of wage-setting institutions – especially of union contract coverage – to wage-adjustment is also more substantial than estimated for the typical country. Estimating the wage-adjustment equation without accounting for cross-country

heterogeneity can, therefore, be seriously misleading. The dichotomy between the country-groups is too substantial to justify the pooling of the coefficients.

A special note should be made for Japan. According to the respective coefficient estimate, Japan's wage-adjustment is as rigid as in the continental European group. In contrast, the Japanese level of union contract coverage is amongst the lowest in the sample. Therefore, the slow rate of wage-adjustment to relative unemployment may initially seem inexplicable. However, one should note that the Japanese pay data is problematic. As Ryan and Miyamoto (2005) point out, the pay data on Japan, which the OECD derives from the Japanese Basic Survey on Wage Structure (BSWS), excludes non-regular employment. Since non-regular employment is more common - and increasingly so - among youths than prime-age adults, and possibly less well paid than regular employment, the Japanese pay data underestimate the actual relative pay declines between age-groups. This could well be the reason for the odd result.

5.2   Simulating the movement to equilibrium

The evidence provided so far suffice for the terms "flexibility" or "rigidity" to be used only in comparative statements: "the Anglo-Saxon countries have a less rigid wage-structure than continental European countries" or "labour markets become more flexible in time as labour unions lose power". How sizeable is the "flexibility" or the "rigidity" in each case is not clear. To provide a rough idea, one can simulate the movement to equilibrium as suggested by the estimated coefficients on the relative unemployment rate for the typical Anglo-Saxon country in the sample versus the typical continental European country in the sample.

To characterize equilibrium in relative terms between age-groups, note that for

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$\delta_{0c} = -\delta_1 \ln(u_i/u_j)^*$ equation (5) takes the form:

$$\Delta \ln \left(\frac{W_i}{W_j} \right)_{ct} = \delta_{0t} + \delta_1 \left(\ln \left(\frac{u_i}{u_j} \right)_{ct} - \ln \left(\frac{u_i}{u_j} \right)^* \right) + \sum_\mu \delta_{2\mu} \ln Z_{\mu ct} + \varepsilon_{4ct}$$

where $(u_i/u_j)^*$ stands for the relative level of unemployment rates by age at the NAIRU, reflecting relative labour market frictions (i.e. how well the labour market matches workers and jobs in relative terms between age-groups).

This means that the intercept can provide an estimate of the equilibrium level of relative unemployment. Then, under the assumption that all else remains equal, one can proceed in calculating the time (years) the system would require in order to reach that equilibrium (i.e. for relative unemployment to reach its level at the NAIRU).

Note, though, that according to (5) the system can only reach equilibrium when institutional and economic influences (as captured by the time-effects) are zero. Otherwise, relative wages will stop adjusting at the point where the gap between actual and equilibrium relative unemployment equals the sum of institutional and economic influences. Thus, for simplicity of calculation, the simulations here are performed on a shorter version of (5) that excludes time-dummies (which were statistically insignificant in Table 2) and institutional variables. Any time-invariant institutional effects are now captured by the country-specific dummies and are, thus, allowed to influence the NAIRU level of relative unemployment rates. Moreover, given the strange coefficient, Japan is removed from the sample.

The results are presented in Table 3. The estimated rates of wage adjustment are now lower in value. However, the Anglo-Saxon rate remains 20 times faster than the one for the continental European group. The estimated equilibrium relative unemployment rates are of similar scale for both groups. [21]

Given these estimates, the deviation of the actual relative unemployment rate of each group from the relative unemployment rate at the NAIRU is depicted in Figure 3. Evidently, the two lines never cross, with the typical Anglo-Saxon market being consistently closer to equilibrium (for several years even lower than the equilibrium level) than the typical continental European market.

The simulation is generated taking 1991 as a starting point[22] and holding all exogenous and predetermined variables in the system constant. The resulting time-paths of relative unemployment are illustrated in Figure 4. (The reader should mind the difference in the scale of the y-axes). The difference in the speed of adjustment, as reflected by the coefficients on relative unemployment in the wage-adjustment equation, is also reflected by the slopes of the two projected unemployment lines. However, the simulations give a better sense of how important these differences are. Specifically, to make a relative unemployment adjustment as small as -0.055 (in logs), ceteris paribus, the typical Anglo-Saxon economy takes about 7 years, while the typical continental European economy takes 36 years. This adjustment is equivalent to 90% of the 1991 deviation from equilibrium of the Anglo-Saxon group and only to 18% of the 1991 deviation from equilibrium of the continental European group. (Had the deviation for both groups been equal, the difference in the years of adjustment would be even higher.)

Notably, both groups are very far from a fully flexible labour market. Even the typical Anglo-Saxon country requires 7 years to achieve 90% of a very small adjustment, which is not quick by any standards. The estimated speed of wage-adjustment, however, is highly dependent on the choice of specification (the 0.86 coefficient of Table 3 for the Anglo-Saxon group, for example, would have meant a much faster adjustment).

6 Conclusion

This paper has examined the determinants of the deteriorating situation of youths in advanced labour markets by modelling youth labour outcomes relative to those of adults in a structural system of simultaneous equations. The model has then been estimated on an unbalanced panel of 10 OECD countries from the mid-1970s to the early 2000s in two steps. In the first step, the ten OECD countries were taken as a whole and the results pictured the labour market situation in the typical economy in the sample; while the second step explored differences between country-groups particularly in wage-adjustment.

For the typical OECD labour market, the suggested scenario is as follows: Labour markets have been operating in disequilibrium under excess supply, with moderately elastic relative demand and relative supply possibly more so, owing to the significant price-elasticity of educational participation. However, relative wage-adjustment in the typical market has been too slow for the demand or supply elasticity to make much difference. And the market has had a lot to adjust to. During the recent decades, the exogenous economic forces active on the demand-side – aggregate macroeconomic changes, international trade and technology – have resulted in a downward shift of relative demand, working against youth, while supply-side forces, such as demographic cycles and changes in educational participation, have resulted in an inward shift in labour supply, working in favour of youth. The market has re-acted to these shifts by moving relative pay towards equilibrium but adjustment has been restricted by wage-setting institutions, especially labour unions, which appear to slow down the process.

Although instructive, the results from the pooled sample describe mostly what one would expect to hold in a highly coordinated labour market, especially regard-

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ing the slow pace of wage-adjustment. The expectations for the more liberalised markets though different. Indeed, the idea that this scenario is representative of the situation in the typical advanced economy is shaken when cross-country heterogeneity is allowed. Quite simply, this is because there is no representative economy in the sample. On the contrary, the countries follow the much-discussed dichotomy between the Anglo-Saxon and the continental European labour market paradigms.

More specifically, when the rate of wage-adjustment is allowed to differ between country-groups, the results strongly suggest that the Anglo-Saxon countries enjoy higher wage-flexibility than the continental European economies, where wage-adjustment is minimal. This is consistent with the corresponding dichotomy in the evolution of relative labour outcomes: Anglo-Saxon countries where relative wages are flexible to adjust have mostly experienced declines in pay outcomes, while continental European countries where the wage-mechanism is significantly more rigid have mostly experienced declines in relative employment.

These findings have brought to the surface the familiar trade-off between equity and efficiency: sustaining high relative wages is not reconcilable with adjustment to lower equilibrium points. Given that labour unions appear to act against downward relative wage flexibility, the evidence is in support of labour market deregulation on the price-side of the market when in pursuit of efficiency.

Some may argue that it is unacceptable to allow the cost of labour market flexibility to fall disproportionately on youth. But what is the alternative? As things currently stand, keeping relative salaries by age high means letting the induced labour surplus to be absorbed by unemployment and educational participation, to be financially supported by families or by state benefits and to enjoy a work-free youth. However, at a time of fierce international competition, the efficiency losses

can be too large to give up: higher relative wage flexibility encourages Pareto-improving trades that involve lower youth pay but higher youth employment, and carry the promise of higher overall growth in the long-run.

Yet, deregulation is not the only way to go. The evidence has suggested that "bargained flexibility" is also a possibility, as high levels of bargaining coordination tend to outweigh the "rigidity" effects induced by bargaining coverage, although in most specifications only to a limited extent.

Notes

[1]Given that both an educational attainment gap and an experience gap exist between age-cohorts, the hypothesis here is that young and older workers are imperfect substitutes in demand. Assuming a CES production function provides a convenient testing mechanism for this hypothesis.

[2]A stylistic way of deriving this equation is to assume that youth educational participation enters the household utility funtion (*a la* Tyler, 2003), that the utility has the CES form, and that youth demand for leisure and for education have the same variable cost (i.e. the opportunity cost of wages).

[3]Note that both (1) and (2) depend on the same relative wages. However, employee labour supply responds to effective purchasing capacity, while employer demand responds to real labour costs, neither of which equals net wages. Consequently, the way (1) and (2) are modelled implies that:

$$\text{Relative disposable income: } \frac{GW_i(1-\tau_i)}{GW_j(1-\tau_j)} \approx \frac{W_I}{W_J} \approx \frac{GW_i(1-t_i)}{GW_j(1-t_j)} \text{: Relative labour cost}$$

Where τ and t denote the average rate of taxation per age-group in supply and demand-side respectively and GW denotes gross wages. For this to hold it is assumed that $\frac{(1-\tau_I)}{(1-\tau_J)} \approx \frac{(1-t_I)}{(1-t_J)}$.

[4]Although relative pay is a poor proxy of the relative present value of future wage-streams – the relevant factor here, as instructed by human capital theory – it is the only option, given the lack of alternative data.

[5]This is translated as supply-side super-cyclicality under the assumption that educational participation is not an option for prime-age adults (consistent with the relatively low number of mature students per country) and therefore, unlike youths, they cannot use it to further adjust their labour supply to adverse labour market conditions. Or more appropriately, under the assumption that, when education is an option for mature adults, it is more likely to be voluntary.

[6]A note should be made on the choice of lags. A lagged value of youth unemployment, as opposed to a current value, is closer to reality: responses of educational participation to labour market conditions are expected to naturally involve some lag. However, on the same grounds relative pay should also appear in the equation with a lag. The reasons for this inconsistency are practical. In particular, as absolute levels of current unemployment would have to be treated as endogenous, a lagged level of youth unemployment used as a predetermined variable contributes to the simplicity of estimation, especially since its purpose is to act as an exogenous cyclical indicator. On the other hand, if relative pay was also inserted in the equation with a lag, that would imply

that educational participation is predetermined itself, and would, therefore, disallow any possibility of endogenous codetermination between labour and education outcomes, which is one of the major objectives of the model. The optimal option is, thus, specification (3).

[7](4) is an approximation derived following the procedure of Layard (1982, endnote 41).

[8]Exceptions are the US unemployment rate, which shows minimal long-run trend, and the pre-1980 period, during which no trend is present for many of the countries. Indeed, when US and pre-1980 observations are excluded from the estimation, the performance of the system improves, yet only marginally. These results are not shown here but are available from the author by request.

[9]The age-categories are different for some countries due to restricted data availability. Specifically, youth category is 25-29 for Netherlands and adult category is 35-44 for France and Sweden and 40-44 for Netherlands.

[10]First differences rather than levels in R&D spending are chosen as the technology indicator in order to capture the rate of technological change and not the level. This is expected to be more relevant with the analysis assuming that the easiness of continuous adaptation to new technologies comes with experience. Estimations with the R&D spending in levels were also attempted, only to prove that the variable in levels is weaker as an instrument for the system than the variable in first differences.

[11]The time dummies estimates appear with negative signs and in the period between the late 1980s and the late 1990s they are statistically significant. Interestingly, the effect suggested by the time dummies in (3) is higher than the one suggested by the time-trend in (1) and (2). This is not implausible, as time-effects capture both common unobserved trends among countries and common cyclical factors. The sizeable and significant time-effects during the last decade are suggestive of severe non-trending adverse demand shifts, which can now be associated with technological change more plausibly than pure trend shifts.

[12]This brings about an interesting possibility: if youth-related derogations are more prominent when general employment protection is stronger for mature adults, then the positive and significant coefficient on relative employment may not capture the effect of strict general employment protection but that of the accompanying youth-specific derogations, suggesting that less strict employment protection for youths actually increases their relative employment. However, this is difficult to test.

[13]Note that, even though paid apprentices are normally measured as employees, given that the apprenticeship variable includes mainly 15-19 year-olds (less so in Anglo-Saxon countries and more so in Germany and the Netherlands, which in this case dominate the variable in hand), and that the dependent variable measures the relative employment of 20-24 year-olds, no measurement effect is captured by the estimated coefficient. Thus, the result could be interpreted as a "persistence" effect; that is, the higher the number of teenage apprentices at a present time, the higher their regular employment prospects as young adults in the future.

[14]When time-dummies are included in specification (3) they are not significantly different from zero for all years apart from 1988.

[15]This has been calculated taking the relative wage coefficient in relative supply as equal to zero.

[16]The average proportion of male 25-39 year-olds enrolled in tertiary education for the countries examined was 29.8% in 1993 (1994 for France, Germany and Netherlands; 1995 for the UK and the US) and only 0.8% higher (i.e. 30.6%) in 2000 (1999 for Japan). Source: OECD online education database.

[17]When time-dummies are included in the equation, the estimated coefficients appear negative and significant only during the 1980s.

[18]These figures have been calculated by subtracting all wage effects from the estimated relative supply value, including the wage-effect in educational participation.

[19]The relative minimum wage index is zero for all but three countries and it is automatically dropped.

[20]The relative unemployment rate by age is treated as endogenous for each country-group. The instruments used are all the exogenous and predetermined variables in the corresponding relative demand, relative supply and educational participation equations. Estimations with the relative unemployment coefficient varying between individual countries were not feasible due to failure of identification.

[21]"Delogging" 5.237 and 5.072 gives 188.1% and 159.5% respectively.

[22]The fact that the lines in figure 3 do not cross means that there is no single year that can serve as a starting point for the simulations of both country-groups so that the adjustment processes are comparable. Moreover, given that due to the data limitations the only time-period for which data are available for all countries is 1988-1996, there do not even exist two different years at which the deviation from equilibrium is about the same for the two groups. As a result, 1991 is randomly chosen as the starting point for simulating the movement to equilibrium of both groups.

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Appendix

Table 1: 2SLS estimation on pooled panel for 20-25 vs. 25-54 year-old males

	(1)	(2)	(3)
Relative demand (Relative employment)			
Relative pay	-0.153 (0.647)	-0.153 (0.279)	-0.566 (0.345)
Output gap	0.018 (0.003)*	0.018 (0.003)*	0.021 (0.004)*
Openness	-0.461 (0.075)*	-0.461 (0.074)*	-0.621 (0.090)*
Change in R&D spending p.c.	0.719 (0.258)*	0.719 (0.257)*	0.440 (0.313)
Strictness of empl. protection	0.626 (0.163)*		
Strictness of temp. contracts	-0.164 (0.085)		
Apprenticeship	-0.041 (0.003)*	0.149 (0.035)*	0.210 (0.045)*
Time trend	-0.019 (0.002)*	-0.019 (0.002)*	
Sargan test: $nR_{\tilde{u}}^2 /(n-p)R_{\tilde{u}}^2$	160.5 / 138.3	160.5 / 141.5	160.6 / 117.8
Relative supply (Relative employment plus relative unemployment rate)			
Relative pay	0.011 (0.647)	0.011 (0.644)	-0.732 (0.635)
Educational participation	-1.496 (0.365)*	-1.496 (0.363)*	-1.149 (0.269)*
Relative population	0.526 (0.273)	0.526 (0.272)	0.810 (0.212)*
Replacement rates	0.097 (0.026)*		
Benefit duration	1.815 (0.512)*		
Spending on ALMP	0.038 (0.014)*	0.206 (0.052)*	0.233 (0.051)*
Time trend	0.018 (0.008)*	0.018 (0.008)*	
Sargan test: $nR_{\tilde{u}}^2 /(n-p)R_{\tilde{u}}^2$	2.5ℓ / 2.1ℓ	2.5ℓ / 2.2ℓ	13.2ℓ / 9.7ℓ
Hausman test: m	1093.4*	1105.6*	588.3*
Educational participation (Tertiary education enrolment over youth population)			
Relative pay	-0.678 (0.397)	-0.678 (0.395)	-1.579 (0.460)*
Replacement rates	0.044 (0.011)*		
Benefit duration	0.939 (0.301)*		
Spending on ALMP	0.019 (0.008)*	0.098 (0.029)*	0.170 (0.034)*
Lagged youth unempl. rate	0.135 (0.036)*	0.135 (0.036)*	0.218 (0.043)*
Time trend	0.017 (0.003)*	0.017 (0.003)*	
Sargan test: $nR_{\tilde{u}}^2 /(n-p)R_{\tilde{u}}^2$	20.2 / 17.4ℓ	20.2 / 17.8	13.4ℓ / 9.9ℓ
Relative wage-adjustment (First differences in relative wage)			
Relative unemployment rate	-0.100 (0.035)*	-0.100 (0.035)*	-0.065 (0.029)*
Union contract coverage	0.215 (0.077)*	0.215 (0.077)*	0.144 (0.068)*
Union membership	0.001 (0.000)	0.001 (0.000)	0.000 (0.000)
Bargaining coordination	-0.018 (0.008)*	-0.018 (0.008)*	-0.011 (0.008)
Relative minimum wages	dropped	dropped	dropped
Time trend	-0.000 (0.000)	-0.000 (0.000)	
Sargan test: $nR_{\tilde{u}}^2 /(n-p)R_{\tilde{u}}^2$	13.0ℓ / 11.2ℓ	13.0ℓ / 11.5ℓ	15.6 / 11.4ℓ
Country/Time effects	Yes/No	Yes/No	Yes/Yes

Notes: Sample includes all available observations (195 in total) for Australia, Canada, Finland, France, Germany, Japan, Netherlands, Sweden, UK, US. All variables are in natural logs except for the time-invariants and those with negative values. Numbers in parentheses are standard errors. * & ℓ denote significance level 5% & 95% respectively.

Table 2. Cross-country-group heterogeneity in relative wage-adjustment speed

Relative wage-adjustment equation (First differences in relative wage)	
Relative unemployment rate	
Anglo-Saxon	-0.284 (0.132)*
Continental Europe	-0.039 (0.054)
Japan	0.136 (0.103)
Union contract coverage	0.813 (0.406)*
Union membership	0.017 (0.011)
Bargaining coordination	-0.585 (0.370)
Relative minimum wages	dropped
Sargan test: $nR_{\tilde{u}}^2/(n-p)R_{\tilde{u}}^2$	$4.7^{l}/3.5^{l}$
No. of observations	195

Notes: Instruments are all exogenous variables from the equivalent relative demand, relative supply & educational participation equations. All other information as in Table 1.

Table 3. Relative wage-adjustment speed
of continental European group vs. Anglo-Saxon group

Relative wage-adjustment equation (First differences in relative wage)	
Relative unemployment rate	
Anglo-Saxon	-0.185 (0.067)*
continental Europe	-0.009 (0.027)
Country dummies	
Australia	0.988 (0.363)*
Canada	0.964 (0.353)*
Finland	0.048 (0.145)
France	0.052 (0.156)
Germany	0.043 (0.132)
Netherlands	0.040 (0.138)
Sweden	0.048 (0.156)
UK	0.963 (0.353)*
Sargan test: $nR_{\tilde{u}}^2/(n-p)R_{\tilde{u}}^2$	$25.6^{l}/19.7^{l}$
Estimated equilibrium (log) rel. unempl. rate	
Anglo-Saxon	5.237
continental Europe	5.072
Observations	131

Notes: The specification is the same as in Table 2, with time dummies, institutions and observations on Japan removed. The remaining information as in Table 2.

Figure 1. Unemployment rates by age-group

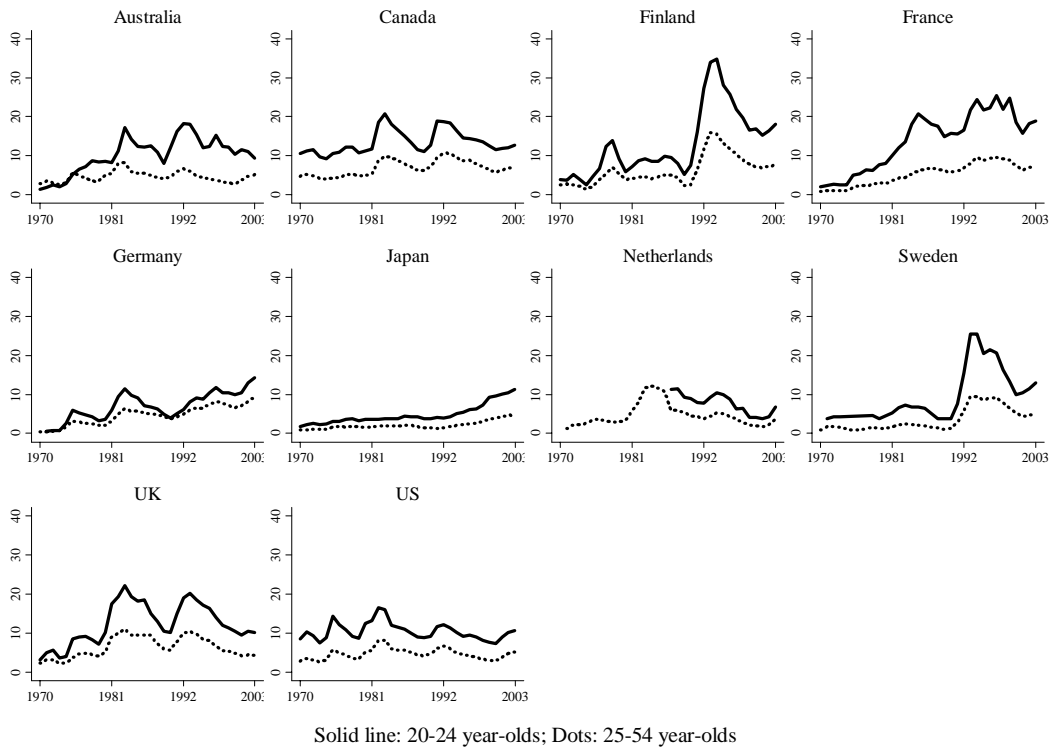Solid line: 20-24 year-olds; Dots: 25-54 year-olds

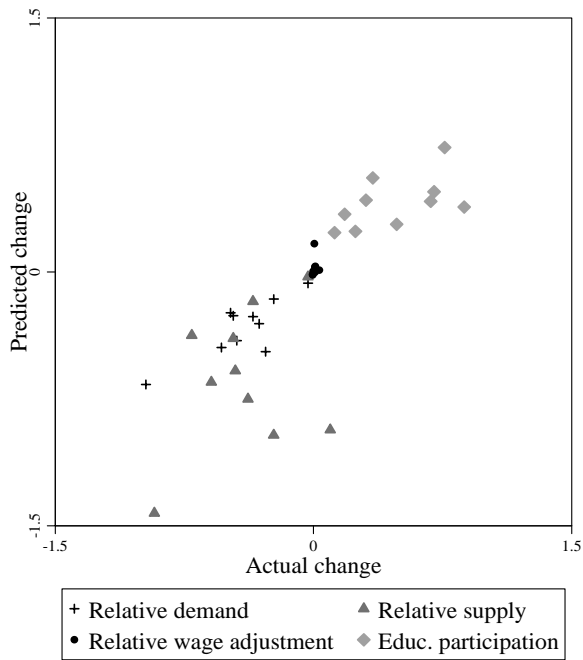Figure 2. Actual and predicted change in dependent variables

Figure 3. Deviation of average relative unemployment
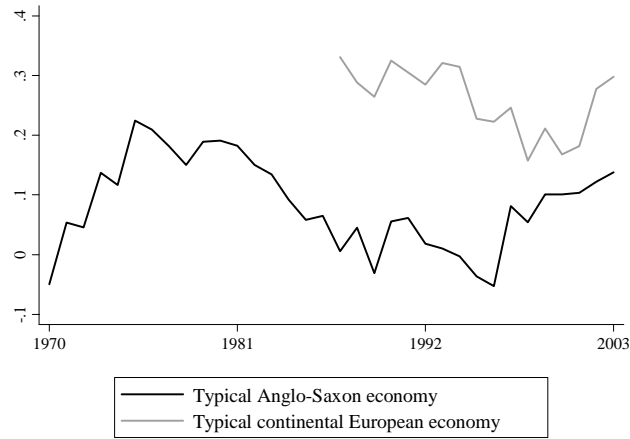rates from equilibrium (Numbers in logs)

Figure 4. Simulation of the movement of the relative
unemployment rate to equilibrium (Numbers in logs)

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