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Project description
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Wage Inequality and the Rise of Services

The problem: How do we explain the evolution of the skill premium?

Over the past decade, an enormous body of literature has examined the evolution of the skill premium, i.e. the ratio of educated workers wage to that of relatively uneducated workers. Specifically, the skill premium in the US (college graduates relative to high school graduates) rose from 1.35 in 1975 to 1.5 in 1985 to 1.75 in 1995 - despite increases in the relative supply of college graduates. An obvious explanation is that demand for skilled labor has risen sufficiently fast so as to offset the increase in supply, thus instigating a rising skill premium. Such demand shifts are often attributed to skill biased technological change (SBTC).

While the evolution of the skill premium has been far from uniform across countries the overall rise appear to be a relatively pervasive phenomenon (e.g. Berman, Bound and Machin, 1998). The SBTC explanation has also found its way to the Danish policy debate (e.g. Hougaard Jensen et al, 2003). Indeed, from a policy perspective the implication of this theory is that investments in education might be seen as warranted for two reasons: (1) educated workers apply more productive technologies, (2) An increasing supply of skilled workers may also dampen a tendency for increasing (wage) inequality (though, obviously, not necessarily).

However, there are a number of stumbling blocks for theories which rely on fast (skill biased) technological change as the source of an increasing skill premium.

First, it is not straightforward to explain why the rate of change in the skill premium has varied across countries in the OECD; countries that are often taken to be relatively homogenous in terms of technology. Therefore, observed differences are often attributed to variations in labor market institutions. Regrettably, however, this explanation seems hard to test, since the influence from institutions is hard to disentangle from technologically generated shifts in labor demand.

Second, starting sometime in the 1970s the major developed economies in the world experienced what is commonly referred to as "the productivity slowdown". Hence, during the period where significant increases in the skill premium are well documented, total factor productivity growth was very modest. This is especially true for the US. Since the theory relies on *relative* productivity growth this is not necessarily an invalidating problem. Still, as one may sense from the numbers quoted above, the rate of productivity growth in occupations using skilled labor would need to be rather large over the period 1975-85, given the significant increase in the supply. To illustrate, Johnson (1997) calculates for the US that *relative* demand (attributable to technological change) expanded at a rate of 4.7 % (3.7%) per

year from 1979-89 (1970-79). So in the absence of technological *regress* in unskilled occupations, the rate of productivity growth relevant for the skilled labor force would need to be 4.7 % from 79-89 *at least.* Hence, these numbers may fuel a certain amount of scepticism in light of the fact that TFP only grew at 1.4% per year in US manufacturing from 1974-84 (e.g. Grilliches, 1988).

Third, since 1995 there appears to have been a revival in productivity growth in the US.[1] Moreover, during the late 90s and the early 2000s, a major infusion of computers into the US economy took place. This is significant since "IT" often is taken to be a concrete example of a skill-biased technology (e.g. Autor, Katz and Krueger, 1998). Under the SBTC hypothesis one would expect that such events would be accompanied by *acceleration* in the growth rate of the skill premium. Yet the rate of change in the skill premium has clearly *de-*accelerated compared with the period prior to 1995 (cf. Figure 1, curve labelled "College/HS Gap").

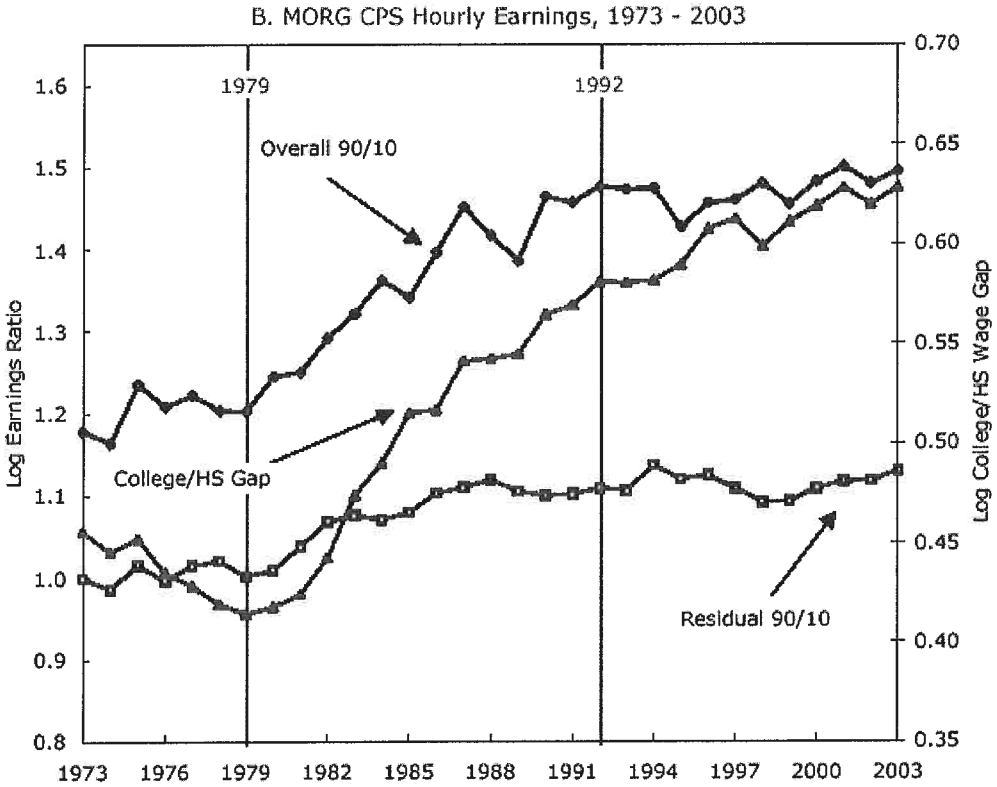

Figure 2. Three Measures of Wage Inequality: College/High School Premium, Male 90/10 Overall Inequality and Male 90/10 Residual Inequality

Figure 1. *Source*: Autor, Katz and Kearney (2004).

[1] A recent paper by Ha and Howitt (2005) documents that US TFP growth from 1950-2000 is trend stationary. Hence, the recent revival of TFP growth may be viewed as a "return to trend".

The purpose and hypothesis of the project

The objective of the present project is to provide an alternative macroeconomic explanation for these observed patterns. A stripped down version of the theory would rest on three simple assumptions, two of which are verifiable (and crucial), whereas the last is a simplification only (more on that below).

First, services are in general more skill intensive than manufacturing. This is not a well-known fact and (a small) part of the project consists of documenting it carefully, initially for the US. Second, productivity growth – until the midt-90s – was relatively slow in services, compared with manufacturing (an idea that goes back to Baumol (1967), and which is now reasonably well documented). Since then, however, a productivity surge in services has been shown to be a major explanation for the revival of productivity growth in the US (Triplet and Bosworth, 2002). Third, preferences over services and manufactured goods are Leontieff. By implication, relative demand for goods is fixed.[2]

On this basis the theory is the following. The 70s saw a (temporary) reduction in (relative) productivity growth in service occupations. This leads (eventually) to a sharp increase in the relative price of services, yielding an increase in the price of the factor used intensively in production of services: Skilled labor. In addition, the productivity slowdown in services (and to a lesser extent in manufacturing) entails a productivity slowdown in the aggregate as well. Once productivity growth "bounces back", aggregate productivity growth picks up, and the tendency for an increasing wage premium is reduced (the skill premium can continue to grow as suggested in Figure 1, if productivity growth in services remains below that of non-service occupations, but the growth trend in the skill premium will change).[3]

As should be clear; this explanation has somewhat different implications for the perceived productiveness of more education. Incidentally, at the aggregate level, it has been notoriously difficult to document a significant effect from years of schooling on per worker GDP growth (e.g. Pritchett, 2001; Temple, 2001, Krueger and Lindahl, 2001). Indeed, a case can be made that most of the observed correlation between enrolment rates (which Mankiw, Romer and Weil, 1992, used in their well-known work) can be accounted for by the impact of growth on the schooling decision rather than the other way around (Bills and Klenow, 2000).

Aside from providing a rationalization of the observed trajectory of the skill premium and aggregate productivity growth over the last three decades, the theory is consistent with the observed rise in services as a share of GDP (i.e. *nominal* service value added to *nominal*

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[2] By extension; *real* shares of output remains constant over time. This feature is in fact found in US data (Baumol et al, 1985). What has been going up is the share of *nominal* service value added to *nominal* GDP; suggesting a powerful relative price effect.

[3] What causes this temporary decline in productivity growth in services? Here one could invoke the theory of "general purpose technologies". Since services tend to be big on information and communication technology as well (Triplet and Bosworth, 2002), one may think of the temporary drop in productivity growth in the 70s as the result of temporary "experimentation" with a "general purpose technology" (computers). Once the experimentation phase is over, productivity growth is revitalized.

GDP), which has taken place throughout the OECD during the period in question. Another marked stylized fact, the implications of which seems to be somewhat neglected in the theory of economic growth.

In the simple version of the theory outlined above, the rise of services is motivated technologically (i.e. by a relatively low TFP growth rate combined with the Leontieff assumption). However, one could easily add demand considerations as well, since services tend to be more income elastic than manufactured goods. In equilibrium, therefore, it would be possible to generate implications like those deduced above, without the Leontieff assumption. As income rises, relative demand for services rises while the relative supply curve shifts up (as before: due to low relative TFP growth) thus leading to an equilibrium with approximately constant relative quantities, but featuring a higher relative price of services. If demand for services is sufficiently sensitive to increasing income it may even generate a larger price increase in equilibrium, compared with the Leontieff scenario, and thus predict a larger increase in the skill premium, *ceteris paribus*.

Method

An advantage of this theory is that it is - in principle – quantifiable. Numbers on sector specific TFP growth rates and prices exists, which could allow for calibrations. Moreover, since the composition of the service sector varies across countries, and since productivity growth differs across service sectors, nothing guarantees that we should see the same evolution of the skill premium in all OECD countries. In some places, for example, the structure of the service sector may imply a smaller increase in the skill premium than what holds for the US.

Hence a second part of the project consists of trying to calibrate a sensible (growth) model of the aggregate economy to try and match the key regularities observed in the data with respect to sectoral composition, aggregate productivity growth, and naturally, the skill premium. This should be, contingent on data availability, feasible for most countries in the OECD, including Denmark. An evaluation of the proposed mechanism may also involve formal econometric testing.

Policy relevance and relevance for Denmark

The project will throw additional light on the role of education in the process of economic growth and in the explanation of the evolution of wage inequality. The cross-country investigation which will be carried out as part of the project should also contribute to a better understanding of the reasons why the wage structure in Denmark has remained relatively stable in recent decades, in contrast to the experience of many other countries.

Literature

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Forventet sluttidspunkt for projektet, publikationsmålsætning

Første udkast forventes færdiggjort senest ved årets udgang.

Publikationsmålsætning: Ledende internationalt ``generelt" tidsskrift (ca. på niveau med *Economic Journal).* Alternativt et ledende specialist tidsskrift (fx *Journal of Economic Growth* eller *Journal of Economic Dynamics and Control*).

Budget

3 måneders lektorløn:	127.745 kr.
Rejser:	20.000 kr.
Forskningsassistance, materialer (28% af lønudgift)	35.769 kr.