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THE RELATIONSHIP OF AGE WITH PRODUCTIVITY AND WAGES

A literature review for the study 'Ageing and Employment'

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THE RELATIONSHIP OF AGE WITH PRODUCTIVITY AND WAGES: A LITERATURE REVIEW

1 INTRODUCTION

One of the factors which is seen as a large obstacle for improving the labour market position and participation of older workers is the discrepancy between (declining) productivity and (increasing) wages at older ages. In this perspective older workers are too expensive in relation to their productivity which explains why employers have a preference to get rid of older workers, when the workforce has to be reduced.

However, to what extent is this discrepancy in line with empirical research in this area? In this paper we discuss economic theory around this issue and inventory the empirical evidence. In section 2 we start with the description of economic theories. The next section 3 deals with empirical evidence regarding the age–wage relationship. Before we go into a similar description of the age-productivity relationship (section 5), we discuss the ways productivity could be measured (section 4), because this is less straightforward than in the case of wages. When discussing the age-productivity relationship, some of the related empirical studies also directly compare the results of the age-productivity relationship with the age-wage relationship to see if both relationships follow different patterns. We end with the main conclusions (section 6).

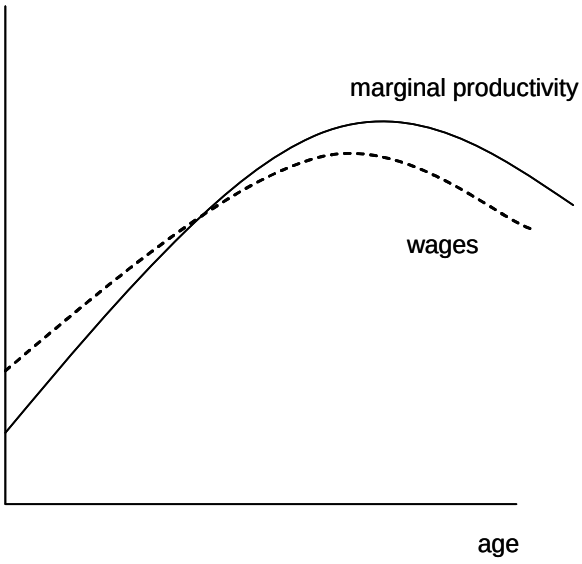
2 THEORIES

From neoclassical theory we would expect that wages reflect marginal productivity. So in that case no discrepancy between productivity and wages takes place at older ages, because both follow the same pattern. However, modern theories of the labour-market tend to break away from this close connection between productivity and wages. First we discuss human capital theory, from which can be argumented that productivity is higher than wages at older ages. Second we discuss other theories which lead to the opposite conclusion.

In a human capital context the age-productivity profile can be determined by making a comparison with physical capital. At younger ages, most investments in training take place. Employees are trained at young age, because they lack certain skills coming out of school and because at young age, the pay-off period of training investments is longest. This is definitely not only formal training, but also informal training. This human capital accumulation increases productivity at younger ages. However, similar to physical capital, depreciation takes place. People forget what they have learnt and skills learnt become outdated (economic depreciation). At a certain age, the depreciation can become larger than the new human capital acquired. From that moment on productivity no longer increases and even decreases if depreciation is stronger than the new human capital acquired. The resulting age productivity profile is a strong increase at younger ages, but a diminishing increase at more mature ages and a possibility of decline at older age.

The pattern for wages is not similar to productivity. According to the original model of Becker (1964) companies pay for firm-specific training, implying that wages will exceed productivity at young age and that the reverse is true at older ages. In the case of specific training the employee is unable to "sell" his skills learnt in another company, so the company takes responsibility of both the benefits and the costs. Wages and marginal productivity will not be equal at a given point in time, but will be on average over the working period. Later contributions made some adjustments. First it was shown that in the case of firm-specific training, companies and workers would share both costs and revenues of training (Ritzen, 1989). Second, employers also bear part of the costs of general training (see for example Bishop, 1988 and Feuer and others, 1987). However, this does not alter the basic predictions of the theory concerning the shape of age-productivity and age-wage curves. These curves are shown in figure 1. Because of the discrepancy of wages and productivity in human capital theory as discussed above, the diminishing profile at older ages is even stronger when looking at wages. Therefore this theory gives no backup for the expulsion of older workers from the labour market.

Figure 1 Age-productivity and age-wage curve according to the human capital theory



Human capital theory does not distinguish between potential and actual productivity, but simply assumes that workers attain the highest possible achievement. Recent economic theories of the labour market stress the behavorial aspect of productivity and do no longer assume that actual productivity automatically equals potential productivity. There is a wide variety of these so-called efficiency wage models or contract theory[2]. Some aspects covered by these models are:

- The uncertainty about the productivity of newly recruited workers (Harris and Holmstrom, 1982). The firm has to make costs in order to acquire information

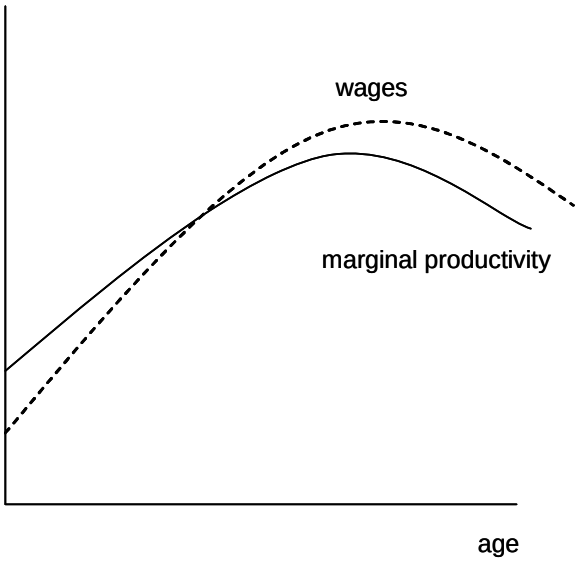
[2] For an overview of these theories in the context of age profiles of wages and productivity, see Kotlikoff and Gokhale, 1992, Loewenstein and Sicherman, 1991 and Skirrbekk, 2003.

about this productivity. Therefore, it will offer relatively low pay to young workers;

- Upward sloping wage profiles strengthen the employees' work effort by raising their shirking costs (Lazear, 1979). This type of incentive systems are most commonly found for work tasks, which are difficult to observe or measure (Hutchens, 1989). Over time the actual productivity will become more clear and the "bonus" of higher wages will partly depend on this, which is an incentive to avoid shirking. Also the risk of being fired because of the appearing bad performance means that the "bonus" is lost.
- Because turnover is costly and workers are risk-avers, contract theory predicts that labour relations tend to be lasting. However, this makes it necessary to keep workers motivated. When older workers receive higher wages as a reward for past productivity, junior workers' loyalty rise.
- Deferred wages may serve as a self-selection device to discourage workers with high quit propensities from joining the firm (Salop and Salop, 1976).

So these types of models predict that wages are below productivity in the early stages of one's career and will exceed productivity at the end of it (see figure 2 for a graphic representation). This is precisely the reverse of the pattern predicted by human-capital theory.

Figure 2 Age-productivity and age-wage curve according to the wage-efficiency/contract theories



We should be aware of the fact that contract theory deals with implicit contracts. In practice companies facing older workers with a relatively low productivity-wage ratio may be inclined to find ways to get rid of these workers in spite of the implicit arrangements made.

Another theory explaining increasing wage profiles is that workers have a strong preference for these type of profiles (Loewenstein and Sicherman, 1991). These profiles

"safeguard" future income and reflect the fact that increasing profiles are important for the self-esteem of workers because they give the suggestion that they grow in their performance. This would mean that workers are not fully rational in the sense that rational behaviour would mean that they have a preference for high income at the short term and lower income at longer term, because future incomes have to be discounted. Loewenstein and Sicherman tested this hypothesis by presenting a number of profiles to employees. The choices showed a strong preference for increasing wages, in spite of the fact that that option was not optimal from present value maximization viewpoint. Even after exposure to arguments favouring the decreasing payment option, a majority of the respondents ranked increasing payments higher than decreasing payments. Like other theories that imply deferred wages this theory requires some form of explicit or implicit contract guaranteeing long term employment. Only with such a guarantee both parties will be able to benefit from the mutual gains offered by asymmetric preferences of workers and firms.

Arai (1997) offers an explanation for the steeply rising wage profiles in Japan which has strong similarities with the idea of preferences discussed above. He shows that the age expenses profiles follows nearly the same pattern as the age wage profile, reflecting the preferences for life-cycle consumption. At around say 50 years of age the expenses are highest because children follow expensive education. In practice companies act as institutions which take care of transfers between age groups which fit with this expenditure patterns, because other institutions like financial institutions and governments do not function perfectly for workers.

Psychological and sociological factors can also play a role in another sense. Older people may have a different attitude towards working than younger people have. There is also evidence of prejudice against older workers which can work out as a self-fulfilling prophecy. So while potential productivity may still be high at older age, the rate of utilisation may decline.

3 AGE AND EARNINGS

In the former section we have discussed theories about the relationship age, wages and productivity. But what are the results of empirical work in this area? We start with some patterns between age and earnings. The OECD has published an overview of these patterns for a number of countries in their Employment Outlook of 1998 (table 1). The table clearly shows that those at 45-54 years of age clearly earn more than those 25-29. However, this pattern differs per country. The differences between age groups is low in the Czech Republic and in the UK. Spain is a country with high differences. The overall ratio of earning between age groups could even be an underestimation of age differences if the older workers are less educated. Therefore, the table also shows the ratios for age groups, controlled for a number of educational levels. For some countries, it is clear that controlling for education leads to even higher ratios, for example Portugal. Generally speaking there is also a trend that the differences between age groups are higher the higher the educational level. For those with university education the ratio between earnings of those 45-54 compared to 25-29 is in a number of countries even higher than 2.

In table 1, another ratio between age groups is the one between 55-64 compared to the age group of 45-54. This ratio is in most cases somewhat below 1 reflecting that the oldest age group earns somewhat less. This could partly reflect that older workers are less

educated. For this ratio the table does not give controlled figures for educational levels. These results reflect that earnings increase with age, but that after a certain age this increase becomes smaller and can even switch in a limited decrease at the older ages. Comparing countries, France seems to be a country without this backward bending, which indicates strong seniority rules.

Table 1 Earnings ratio (gross annual earnings before taxes) by age group and level of educational attainment, 1995

Country	45-54 years/25-29 years					55-64 /45-54
	< upper secondary	Upper secondary	Non-universitairy tertiairy	University	Overall	Overall
Czech Republic	0.99	0.99	-	1.42	1.00	0.90
Denmark	1.21	1.23	1.29	1.60	1.29	0.92
Finland	1.43	1.36	1.69	2.11	1.49	0.90
France	1.18	1.47	1.45	1.95	1.38	1.07
Germany	0.97	1.28	1.10	1.76	1.33	0.97
Ireland	1.24	1.59	1.59	2.25	1.41	-
Italy	1.27	1.64	-	2.60	1.46	0.97
Netherlands	1.19	1.41	-	1.73	1.43	-
Portugal	1.56	1.89	-	1.80	1.46	0.89
Spain	1.75	2.09	-	2.61	1.86	0.94
Sweden	1.38	1.26	1.67	1.70	1.40	0.90
United Kingdom	0.93	1.09	1.41	1.50	1.09	0.81
Australia	1.30	1.26	1.35	2.06	1.42	0.85
Japan	1.23	1.44	1.64	1.99	1.42	0.86
United States	1.29	1.28	1.39	1.67	1.48	0.89

Source: OECD (1998)

These figures reflect the situation for 1995. It is possible that the ageing process since then has and will have an influence on this profile. In the USA some research has been carried out regarding the influence of cohorts on the wage level (e.g. Welch, 1979, Berger, 1985 and Murphy and Welch, 1992). The size of (young) cohorts has a negative influence on their earnings. However, this research concentrates on younger cohorts and there is no consensus in these studies to what extent this cohort effect lasts when cohorts become older. Gottschalk (2001) confirms that there are no similar studies which concentrate on the cohort size effects for older workers. So it is difficult to say to what extent the ageing process will have a downward influence on the wages of older workers.

Some of the case studies give some back-up for such a trend, because they show that automatic seniority rules in payment have become less important in companies who are explicitly dealing with ageing in their policy (Box 1).

Box 1 Examples in case studies of increasing link of wages to performance instead of fixed seniority rules

In the *Czech production company IRISA* earnings do not directly correspond to age. The wage level is linked to professional level of work and responsibility. Manual occupations are rewarded according to accomplishments of tasks, which has an important incentive effect. In addition, extra rewards (so-called premiums) are used as well. Norms to be met are lower here in comparison with other production companies, so that everybody could meet them. Accordingly, the base wages are lower as well. The flexible performance component on top of that is relatively large.

Wages in the *German EADS companies* are regulated by collective agreements negotiated with IG-Metall, one of the biggest German trade unions. Payments to workers below the professional and management level are based on these agreements. Collective agreements include seniority wage rules which guarantee rising wages related to age. In addition, workers receive yearly bonus payments up to one monthly wage. Above this level, wages are determined individually and seniority rules were abandoned recently. Bonus payments are higher for this group. They are 15-20 % of annual wages for middle management and 30-40 % for senior management. From January 2006 onwards, professionals will also receive variable bonuses ranging between 10-15 %.

Two of the Dutch case studies give examples where wage levels are linked to multitasking of the employees. The first company is the *printing company Beck* which has to act in a market in which flexibility and quick delivery has become more important. Therefore it is important that workers are able to perform various tasks, depending on where their input is most necessary. The extent of employability in various tasks for the individual employees has been assessed and recorded in individual skill matrices. The wage level is depending on the score of these broadness of skills. The second example is the *environmental service of the city of Groningen.* Traditionally wages in such a public service are strongly dominated by fixed seniority rules. However, because the service had to work more market and performance oriented to avoid privatisation, seniority rules have been reduced. Multi-skilling is now also an important element of the pay system. Except facilitating flexibility in services, multitasking also helps to avoid problems in employability at older age.

4 AGE AND PRODUCTIVITY: MEASUREMENT PROBLEMS

Determining age-wage profiles is a relatively easy task compared to age-productivity profiles. Wages are quite straightforward to measure. Of course this also contains some problems, for example the monthly wages of individuals who are compared could differ because they do not work the same number of hours. Wages should therefore be standardised regarding the wage per time unit. But these types of difficulties can be overcome quite easy. However, the measurement of individual productivity is less straightforward.

One set of research which is interesting in this respect is more medical, biological and psychological oriented research in which maximum performance on a certain effort is measured. In that case representatives of age groups are confronted with a number of specially prepared tests to examine their capabilities. One of the conclusions of these types of tests is that physiological functions like vision, balance, muscular strength, speed of reaction and the oxygen transport system decrease at older age (see for example Meier and Kerr (1976), Goedhard (1992) and Winnubst and others (1995)). The optimum age is roughly between 20 and 30. However, the decline in capacities after these ages is often limited until the age of 55/60 and the individual variation within age categories is large. Verhaegen en Salthouse (1997) conclude on the basis of a meta analysis that a similar pattern exists for cognitive abilities like reasoning, speed and episodic memory. However, Skirrbekk (2003) cites some studies which show that the differences between age groups are larger in cross-section studies than in longitudinal studies, indicating that cohort effects can also play a role. Younger generations are probably more trained in "maintaining" these types of abilities, illustrating that these patterns do no have to be fully "fixed laws".

These types of experiments are interesting and reveal a lot about potentials and capabilities of age groups, but do not lead automatically to final conclusions about how people actually perform in their work. First, actual performance in a job usually requires much less efforts than using maximum capacities all the time. Second, most of these tests are targeted towards measuring potentials and do not value experience. However, in many functions productivity does not only depend on potential capabilities but also on experience developed in similar work. For example, a network of personal relationships with potential customers can be a crucial element for salespersons, which can only be built up by experience. Experience can also mean that strategies are developed to compensate deteriorating physical potentials. Winnubst (1995) cites Salthouse (1987) who found that younger typists have a higher speed of touch. However, older typists were as productive as their younger colleagues, because they compensated their lower speed of touch by strategies to be able to read further before typing. Third, most jobs require the combination of various types of capabilities and the end result will depend on all of these aspects, but also on the way these various capabilities are combined.

So it is important to look at actual productivity differences for age groups in jobs. But how to measure productivity in a job? Some of the older studies on age differences focus on (physical) output, for example the number of shoes produced per hour, or the number of letters sorted per hour. However, this is only possible when physical production can easily be monitored per individual. With the shift from manufacturing to services and the increased importance of team work, such individual measurement of (physical) output has become more and more difficult. Moreover, such a comparison is easier in the case of homogeneous products, which has also become less usual with trends of product differentiation.

Another indicator for productivity which is used is the income of independant workers without personnel (see for example Lazear and Moore, 1984). We have seen that in case of employees wages do not automatically reflect marginal productivity, because wage profiles over the life cycle are used by the employer to create incentives. Moreover, in the case of employees, productivity cannot always be monitored, because it is not always clear what the contribution of an individual is to the overall result which is achieved in cooperation with others. However, such "implicit contracts" underlying wage profiles and the disguise of productivity because of cooperation are not relevant for independent workers without personnel. So their income reflects productivity much closer.

A procedure often used to make individual performance within larger organisations and teams more visible is a judgement by a superior. Such a judgement is made periodically and provides a basis for a decision on wage (growth). The judgement is often standardised by giving a score on a certain scale. However, in practice supervisors are sometimes reluctant to give low scores, because they are afraid to communicate "bad news", or are afraid that a negative score will undermine motivation. The result is that the variation in scores will be rather limited. Another disadvantage with the use of supervisors ratings is that managers may wish to reward older employees for their loyalty and past achievements. This can inflate the evaluations of senior employees and bias the results (Skirrbekk, 2003).

Supervisors or higher level managers can also be directly asked to what extent they think that the performance of various age groups among the employees in their company varies. Such a question gives a quick insight in possible differences in performance. A drawback of such an approach is that these perceptions of managers on age differences could be partly based on prejudice.

Another alternative is to use perceptions on performance by the employees themselves. Employees can give a certain ranking to themselves or indicate if their performance has increased, stabilised or deteriorated in a certain recent period. Another possibility is to ask them if they perceive bottlenecks in their performance. All these indicators can be differentiated for various work aspects. This differentiation is all the more useful, when the age – productivity profile varies for several work-aspects. Also with these types of indicators there can be a certain upward bias because of optimistic self-perceptions, limiting variation in scores.

One of the main problems in determining individual productivity is that productivity is determined at company level and that the individual contribution of every employee in this end result is very difficult to distinguish. Most of the indicators used above try to improve the visibility of individual productivity in such a situation. Another way could be to start with the labour productivity at company level and try to link this with the age composition of the work force. Of course in that case the analysis has to control for many other factors which influence company productivity, for example capital intensity. In fact a sort of production functions are estimated in which labour is also disaggregated in age groups. Such an approach has also the advantage that also the effect of individuals on the productivity of others is incorporated. For example if older workers are important to transfer experience or tacit knowledge to younger generations, this will have a result on aggregate production and will therefore also reflect back on their share in the workforce. The advantage of this approach is that these types of studies are less subjective than those based on supervisors' rating. However, the main challenge to this approach is to isolate the effect of the employees' age from all the other factors that affect the firm's value added. This requires large scale employer surveys which contain financial information (value added, capital indicators) as well as information on the composition of the workforce. Matched employer-employee data sets are often a very suitable alternative to provide the necessary data.

Advantages and disadvantages of the various indicators are summarised in table 2.

Table 2 Overview of productivity indicators and related advantages and disadvantages

Indicator		Advantages	Disadvantages/limitations
1	Individual output (piece-rate) indicators	Objective indicator	Can only be applied in certain jobs with a clear product and little team work
2	Income of independent workers without employees	Objective indicator Relatively easy to determine	Applies to limited group
3	Individual judgement by superior	Common practice for many workers Differentiation for various work aspects is possible	Subjective Upward biased (little variation) Can partly be based on performance in the past (reward of loyalty) Can reflect prejudice/stereotypes
4	Judgement of managers regarding productivity of age groups	Relatively easy to carry out	Subjective (for example possibly biased by prejudice)
5	Self-perception	Relatively easy to carry out Differentiation for various work aspects is possible	Subjective Upward biased (little variation)
6	Company productivity related to workforce	Objective indicator	Demanding data requirements Complex analysis with many control variables to isolate the effect of age groups

Finding a suitable, workable and reliable indicator is not the only problem to determine the relationship of age to productivity. A second problem is the mixing up of age and cohort effects. If older age groups perform less good than younger age groups, this does not necessarily mean that individual performance has deteriorated in time. The presently older can have started at much lower levels when they were young in comparison with those who are now young. Similar to this: when the present young people will grow older in the future, they could perform differently (better) than then the presently old. This is more to be expected if these young people are from the start of their career regularly trained and have a higher mobility. The latter point reflects that it is very difficult to distinguish age effects from factors like experience, training and exercise in earlier years. Future older cohorts could perform better than the present older cohorts if earlier and present investments in training, mobility and flexibility would be higher.

Another problem is that selectivity bias can play a role in the comparison of younger and older workers. In general participation rates of older generations are relatively low. This means that a relative large part of these age groups are not present at the labour market. The older who participate could be a selective group of the relative good performing ones among those age groups. If older people in these age groups have problems in their performance they could have used a number of exit routes out of the labour market, for example through disability arrangements. Although these exit routes are more and more blocked and participation rates of say those between 55 and 64 are increasing, these types of selectivity mechanisms can still play a role.

In the types of analyses using the aggregate productivity of a company and linking this to the age composition of the workforce, another type of selectivity can also play a role. Firms' success may increase the number of new employees and lead to a younger age structure, rather than a young age structure causing firms' success (Skirrbekk, 2003).

Table 3 Overview of empirical studies on age and productivity

Study	Group analysed	Type of productivity indicator[v)]	Results (in some studies also a direct comparison with age-wages profile)
Waldman and Aviolo (1986)	Meta-analysis of 40 studies	1 + 3 + peer ratings	No clear association between age and performance. Results vary and also depend on performance indicator: on average a positive correlation in case of indicator type 1 and peer ratings and negative in case of indicator type 3 (supervisors ratings)
McEvoy and Cascio (1989)	Meta-analysis of 96 studies	Mainly 1 + 3	No clear association between age and performance (results vary in individual studies). This conclusion holds when a separate division of studies is made according to performance and type of work (professional vs. non-professional)
Bureau of Labour Statistics (1957)	Employees in large plants in men's footwear and household furniture industries	1	Decline in output per hour at older ages (starting seriously after about 45 years of age)
Kutscher and Walker (1960)	Office workers, US	1	Very little differences in output per hour between age groups
Walker (1964)	Mail sorters, US	1	Very little differences in output per hour between age groups
Stephan and Levin (1988)	Researchers within Physics, Geology, Physiology and Biochemistry	1 (publications)	Negative association with age
Oster and Hamermesh (1998)	Researchers in Economics	1 (publications)	Negative association with age
Miller (1999)	Artists (painters, musicians and writers)	1 (paintings/albums/ books)	The peak ages are at the 30s and 40s
Galenson and Weinberg (2000)	Artists	1 (output "weighed" by price)	Peak age is 50.6 for those born before 1920 and 29 years for those born after 1920.
Lazear and Moore (1984)	Self-employed and employees	2	Wage profile of employees is much steeper than for self-employed, leading to the conclusion that increasing wages with age for a large part reflect incentive effects
Oliviera, Cohn and Kiker (1989)	Self-employed in US (compared with employees)	2	Productivity increases strongly at younger age, but declines at older age (parabolic). Earnings tend to stabilize at older age for employees in similar functions
Medoff and Abraham (1980 and 1981)	White collar employees in a number of large American corporations	3	Seniority is either unrelated or negatively associated with performance evaluations. So wage growth with experience cannot be explained by growing productivity.

Study	Group analysed	Type of productivity indicator[v)]	Results (in some studies also a direct comparison with age-wages profile)
Flabbi and Ichino (2001)	Employees in a large Italian firm	3 + "1" ("1" = absenteeism and misconduct episodes)	Seniority is unrelated to performance evaluations. More senior workers score less good on absenteeism and misconduct.
Van der Heijden (2003)	Employees in middle or higher level functions in Dutch SMEs	3 + 5 (surveys of self perception and judgments of superiors for the same employees)	No relationship with age for self-perceptions, while at the same time superiors are somewhat more negative about the oldest age group
Remery and others (2001)	Dutch private and public companies/ organizations	4	Companies expect increases in wage costs because of ageing of their workforce, but no increases in productivity
Gelderblom, de Koning en Kroes (2004)	Dutch private and public companies/ organizations	4	A large group of managers and HR managers does not see differences in the average productivity of those 55 and older compared to younger workers.
Gelderblom and de Koning (1996)	Civil servants in the Netherlands	5 (differentiation for various work aspects)	Older workers have more problems with work-pressure, but perform well on social skills
Simoens and Denys (1997)	Employees in Belgium	5 (differentiation for various work aspects)	Older workers have more problems with work-pressure, but perform well on social skills
Haegeland and Klette (1999)	Manufacturing companies in Norway	6	Decline for those with more than 15 years experience (late 30s and over)
Hellerstein et al. (1999)	Manufacturing companies in US	6	Increase/decrease over life cycle according to model specification
Ilmakunnas et al. (1999)	Manufacturing companies in Finland	6	40 years old peak. Declining thereafter
Crépon et al. (2002)	Manufacturing and non-manufacturing companies in France	6	25-34 year peak. Lowest for those over the age of 50.
Gelderblom and de Koning (2002)	Manufacturing and non-manufacturing in companies in the Netherlands	6	Productivity is rising until somewhere between 40-50 and declining afterwards. Productivity is relatively high compared to wages at middle ages. The young and older have less favorable productivity-wage ratios
Gelderblom, de Koning en Kroes (2004)	Manufacturing and non-manufacturing companies in the Netherlands	6	Productivity is rising until the age of around 50, after which a strong decline occurs

v) The numbers correspond with the indicators in table 2.

Sources: Partly based on Gelderblom and Vos, 1999 and Skirrbekk, 2003.

Regarding the relationship age-productivity, two types of patterns often come back in table 3. The first is a rather flat pattern with increasing age. The second is a more parabolic pattern: increasing at younger ages, but decreasing at older ages. Even though these patterns vary, in both cases a discrepancy with wages exists, like predicted by the more efficiency wage type of theories (section 2). Even if productivity is unrelated with wage, this is not the case for wages. Because of seniority rules, wages increase with age.

Some of the studies in table 3 directly confront the pattern for productivity with the pattern for wages (for example Lazear and Moore, 1984; Medoff and Abraham, 1980 and 1981; Oliviera, Cohn and Kiker 1989; Remery and others, 2001; Gelderblom and de Koning, 2002). All these studies with a direct confrontation conclude that the patterns for wages and productivity with age differ, leading to a certain discrepancy at older ages.

However, these patterns of age with productivity should not be seen as inevitable fixed laws. First, it is important to note again that the ones from the 50-65 age group who have left employment are in most cases probably also the ones with the lowest productivity. This is most likely the case for the ones that became unemployed or disabled, but it will also hold for some who flew into early retirement. This would mean that an increase in employment rates among the 50-65 years old could at the same time reduce productivity for this group.

On the other hand, there is evidence that the negative relationship between age and productivity depends at least too some extent on context factors and can thus be avoided by changing the conditions under which older workers have to work. Both Gelderblom and de Koning (1996) and Simoens and Denys (1997) suggest that older workers have more difficulties than younger workers with some aspects of jobs such as a high work pressure, but for other aspects the differences are small or even to the advantage of older workers (social skills, management skills). Warr (1994), cited by Skirbekk (2003), suggests a categorization of professions according the whether age boosts or reduces performance. "Age enhanced activities" are for example knowledge-based judgements with no time pressure.

Also in the company case studies, it is often expressed that the relationship between age and performance depends on the type of work. One example that is expressed in a number of these firms is that older workers are strong in contacts with clients. Clients value the presence and advice of older workers. The latter is for example expressed in the case of the *Polish grocery Tesco Polska*. Customers have great confidence in the advice of older workers. The latter is also put forward in the case of the *Italian Bank San Paolo IMI*. In the case study of the *Hospital of Prienai* (Lithuania), it is clearly expressed that clients prefer older doctors, because they have greater confidence in them. Related results come from the case of *Hotel Lisboa Plaza*. Older workers are considered a key asset to make hotels charming and family like. Other strong points which regularly come back for older workers are: dependability/reliability, precision and good judgement because of experience[3]. Speaking about areas in which older workers perform relatively weak, two aspects regularly turn up in the cases: physically demanding work and adaptability to new technologies (e.g. ICT).

Given the fact that age groups on average have relative weak and strong points, it seems logical that career patterns should reflect this. If career lines would take this more in account, the position of older workers could improve. Box 2 gives some examples of case studies in this area.

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[3] Because the cases represent examples of good practice in ageing, these positive links of older workers to certain work aspects could be less abundant in other companies. However, the idea that the link between performance and age is different over various work aspects is a more general finding in the literature.

Box 2 Examples of career lines and mobility which makes use of weak and strong points of various age groups

Task adjustment is the more common way for age management in the Portuguese hotel *Lisboa Plaza* Task adjustment is the more common way for age management. This is done according to worker preferences and capabilities and hotel needs. For instance waiting tables is a physically demanding job, especially at rush hours when clients need to be attended efficiently and quickly. But restaurants and bars have calmer shifts. Usually these are provided by older workers that can then be efficient enough. In this change of shifts experience is also seen by the management as an advantage because an older worker has knowledge enough to fill for more specialized tasks, like playing the roles of *maitre d'hotel* or *cupbearer*, without the presence of these high qualified workers. Quality can be provided for lesser clients without no extra costs. If the shift was provided by an younger worker it would have difficulty to play those roles, even if it was very qualified.

In the Italian *Bank SanPaolo IMI* workers approaching the age of 50 are usually moved from "front-office"activities, which are more tiring to back-office duties. These back-office duties include more elaborate advice to customers for new product lines (new type of loans, strategic financing). These products are not sold via tellers, but in the back office where clients feel safer dealing with older and more experienced consultants. The customers want to deal with someone who they can trust, a "middle aged client is not comfortable receiving advice from a banker who is much younger than they are". In this way older banking employees can continue their experience to serve the clients.

Another example is the Polish *construction company Wjdyla*. This construction company gives much attention in allocating workers to task which fit them good. In practice this can for example mean that older workers flow into jobs demanding high precision and less physical effort.

The fact that older workers are considered reliable and responsible is very important in the Portuguese *security company Securitas*. However, in some jobs physical requirements can be strong, for instance in mobile surveillance, where long hours of walk can be required. But if problems show up, there are more static security positions available to move to, for example entrance security.

There is also evidence that the level of investment in human capital (also during earlier stages of life) is a crucial factor for productivity (see for example overviews in the OECD Employment Outlooks of 1999 and 2004 and Ok and Tergeist, 2003). Factors like mobility and training are therefore important policy instruments influencing productivity. There is ample evidence that older workers are underrepresented in training and mobility rates. Moreover, training and regular change of jobs was less common in times when the present older workers were young. This could mean that the lower productivity rates of older workers partly reflect cohort effects instead of fixed age effects. It is possible that those with a different background in terms of past "HR-maintenance" behave differently when they grow older. There is also evidence that the attitude of the direct superior is important. Gelderblom and de Koning (2002-II) show that direct superiors show less attention to the older workers and that this has direct consequences for their performance.

Finally, it is important to notice that the relationship of age and productivity can also depend on the relative shares of these groups in the workforce. It is possible that a certain "mix" of age groups is the most optimal situation, which means that a certain proportion of older workers can be important for overall productivity, for example to pass over their experience, but that too much of them is less favourable. However, in the literature this is hardly tested, because many studies focus on individual productivity. In principle the studies which relate overall productivity of companies to the shares of the age groups, can text this, but to do this, specific types of equations have to be used which are less common.

The importance of a mix is also stressed in various case-studies. Teams and departments are often composed in such a way that various age groups are represented. A motive often mentioned is that in this way (experience-based) knowledge of older workers is transferred to younger workers. A good example is the Deutsche Bank (Germany), see box 3.

Box 3 Teamwork of people of various age groups as an age management strategy at the Deutsche Bank

The following describes how *Deutsche Bank* considers teamwork as one of the most supporting pillars of Deutsche Banks' age management strategies. Strengthening the team work between older and younger colleagues strives to achieve the following goals:

- Use of entrepreneurial and personal capability
- Positive influence related to business results through the optimal use of experienced based knowledge
- Communication of know-how and experience valuation of older employees
- Support of openness and trust in relation to knowledge and experience transfer
- Improving of mutual understanding and teamwork
- Creation of learning and working situations, where diversity is accepted and appreciated

There are three approaches to encourage team work between different age groups and thus improving both knowledge transfer and individual competences:

- **Intergenerational teams:** Whereas formerly project teams were often built exclusively on younger employees, where problem solving would often be through trial and error, today heterogeneous project teams are constructed. The team is supported by two experienced members of the bank's corporate HR centre with the aim of improving the service of the department. Workshops at the executive level are implemented to impart how critical to success the open and supportive management of these intergenerational teams is.
- **Know-how-tandems**: are based on the cooperation of an older, more experienced employee and a junior clerk, in particular in the area of client consulting. It targets optimising customer hand-over through knowledge transfer and is mainly used in the area of "private wealth management". Younger and older colleagues got to know and understand their clients and in addition need specific skills and abilities of the 'other generation'. Younger colleagues are able to learn skills relating to customer contact and acquisition, whereas the transfer of e.g. IT-related skills takes place in the other direction. This model is also highly appreciated by clients. Experience from personnel managers monitoring these tandems shows that it is an important instrument for transferring firm goals to younger workers and, to achieve a successful

final hand-over of customer relations.

- **The 'x% job' model:** this model focuses on knowledge transfer and individual learning processes. An experienced employee spends a certain part of his working time (x % of the working time, in general two to four hours per week) outside his area of activity in order to collect relevant experiences and to accumulate new knowledge. Deutsche Bank teams are then able to use the acquired insight and knowledge to help optimise its own internal processes. Participants think that this model is ideal for transferring organisational knowledge and strategies between business units and should be implemented on a broader basis. Moreover, it is an instrument to develop individual competences.

It has to be mentioned that these measures are focused particularly on older employees with important customer relations to private or corporate clients. Deutsche Bank detected experience based knowledge of their older employees particularly in the mentioned areas as a crucial competitive advantage and developed the above mentioned approaches to manage it professionally.

Conclusions

Regarding the relationship of age with productivity, two types of patterns often come back in the empirical literature. The first is a rather flat pattern with increasing age. The second is a more parabolic pattern: increase at younger ages, but decrease at older ages. The pattern of age with wages is rather different, namely rising wages with increasing age. At older ages, wages stabilise more. This leads to a discrepancy between productivity and wages at older wages, which is an incentive for employers to use various types of social security and early retirement arrangements to expel older workers. Implicit contracts and wage efficiency theories give a certain rationale for the increasing wage pattern, for example because this gives certain incentives to workers to avoid shirking. However, these patterns of age with productivity are not fixed forever, but also depend on past and present HR-investments in (older) workers, like training and mobility and attention given to them by their direct superiors. Moreover, the patterns of age with performance also depend on the type of work aspects. For example, in work areas strongly demanding professional judgment and/or social skills, older workers can perform better than younger workers. Career patterns which incorporate these relative strong points of older workers, could improve their position. Finally, a number of case studies also show that companies dealing with ageing reduce the importance of seniority rules in pay systems and put more emphasis on performance related elements, so that wage increases with age become less "automatic".

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