Heterogeneity of the Carnegie Effect

Erlend E. Bø
Elin Halvorsen
Thor O. Thoresen

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Abstract

The Carnegie effect (Holtz-Eakin, Joualfaian and Rosen, 1993) refers to the idea that inherited wealth harms recipients' work efforts, and possesses a key role in the discussion of taxation of intergenerational transfers. However, Carnegie effect estimates are few, reflecting that such effects are hard to trace in data. Most previous studies have relied on data from limited size sample surveys. Here we use information from a rich administrative data set (for the whole Norwegian population), which makes it possible to undertake a detailed examination of the Carnegie effect, including how it varies across groups of recipients. We find that Carnegie effects differ according to the size of the transfer, the age of the recipients, the recipients' eligibility to other transfer programmes, and the existence of new heirs (children) in the family chain.

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Erlend E. Bø
Research Department
Statistics Norway
Oslo / Norway
erlend.bo@ssb.no

Elin Halvorsen
Research Department
Statistics Norway
Oslo / Norway
elin.halvorsen@ssb.no

Thor O. Thoresen
Research Department / Statistics Norway &
Oslo Fiscal Studies / University of Oslo
Oslo / Norway
thor.olav.thoresen@ssb.no

1 Introduction

The potential of harmful effects of intergenerational transfers on donees was eloquently expressed by the 19th century industrialist Andrew Carnegie: "the parent who leaves his son enormous wealth generally deadens the talents and energies of the son, and tempts him to live a less useful and less worthy life than he otherwise would ..." (Carnegie, 1962).[1] Hence, even though bequests in many societies in the 21st century are more often recieved by offspring in their fifties rather than by young adults, and few bequests have the size of the wealth of Andrew Carnegie, detrimental effects of inheritance on donees' labor supply are often referred to as the "Carnegie conjecture" or the "Carnegie effect", see Holtz-Eakin et al. (1993).

Recently there has been a resurgence in the interest of taxation of wealth transfers, with several studies suggesting that taxation of intergenerational transfer is preferable, see for example Golosov et al. (2003), Piketty and Saez (2013) Piketty (2013) and Kopczuk (2013).[2] The Carnegie effect possesses an important role in the discussion of tax design, see for example Kopczuk (2013), who refers to it as an fiscal externality cost due to loss of tax revenue. Further, the Carnegie effect represents an idiosyncratic income effect, which cannot simply be represented by other income effect estimates, as those obtained from the labor supply literature. In this perspective it is surprising that relatively few Carnegie estimates are found in the literature; exceptions are Holtz-Eakin et al. (1993), Joulfaian and Wilhelm (1994), Brown et al. (2010) and Elinder et al. (2012).

The lack of empirical evidence is explained by severe obstacles in the identification of effects. A major problem is that if the inheritance is expected, the transfer will be fully absorbed in the life cycle plan of the recipient according to the standard life cycle model. A perfectly foreseen inheritance would lower the heir's marginal utility of wealth from the first year of his economic life, yielding a downward shift in his entire life cycle profile of labor. Permanent life cycle adjustments are obviously not easily identified in data. Still, we expect to observe short term Carnegie effects, as at least some recipients will time their labor supply responses to the period just after the actual transfer: some inheritances are unexpected, beneficiaries may be liquidity constrained (before the actual transfer), and risk averse recipients will avoid using money they do not have.

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[1] Carnegie gave or bequeathed most of his vast fortune to charity.

[2] However, tax rates have been cut in several OECD countries, such as the US, the UK, Italy, and France (Piketty, 2010), and some countries, such as Canada, Australia, New Zealand, Sweden, Austria and Norway, have abolished their bequest tax completely. Still, the dominant picture, see Denk (2012) and Strawczynski (2014), is that inheritance tax schedules are widespread in OECD countries.

The present study contributes to the knowledge about short term Carnegie effects by exploiting an exceptional data set. Even though the Carnegie effect may be measured with error, biased downward due to measurement problems because of anticipated bequests, we identify responses materializing in the time period shortly after the transfer. Further, we add to the understanding of Carnegie effects by discussing empirical evidence across population groups. In a discussion of the economic implications of the Carnegie effect it is essential to obtain information on who the respondents are (are they e.g. in their prime working age or closer to retirement?), how much they respond, and the time frame of the responses (i.e., the persistence of effects). As we have access to a large panel data set for the years 1997 to 2010, based on Norwegian administrative registers covering the whole population, we can enter into a relatively broad and detailed discussion of Carnegie effects. The previous literature on Carnegie effects, such as Holtz-Eakin et al. (1993), Joulfaian and Wilhelm (1994) and Brown et al. (2010), have had limited scope for more detailed analysis, as they predominantly have been based on evidence from sample surveys, with restricted sample sizes.

The Carnegie effect is measured by addressing information on three labor supply response indicators: inheritors' labor income, working hours and early retirement take-up. Identification is based on comparing inheritors to non-recipients with similar characteristics, using propensity score matching (Rosenbaum and Rubin, 1983). To avoid possible short term anticipatory effects, the matching is done three years before receipt of inheritances. Moreover, to see how effects evolve over time, we measure responses 1-6 years after receiving bequests. As a control we use the same specification to describe inheritors' behavior 1-6 years prior to transfers, when no behavioral differences between recipients and non-recipients are expected.

The response heterogeneity is measured along several dimensions, based on both characteristics of the heirs and attributes of the setting in which they make their decisions. Firstly, we examine the age dependency of the Carnegie effect, highlighting that many recipients are in their fifties or sixties. The interaction with public transfer schedules, such as the early retirement scheme, is important in this perspective. Secondly, given that there are (fixed) costs of finding a new optimum, as is well-established in the labor market literature (see, for instance,Cogan, 1981, Altonji and Paxson, 1992 and Chetty, 2012), we expect to observe a nonlinear relationship between responses and the size of the transfer, with responses increasing at an increasing rate with the amount transferred. Thirdly, we also draw attention to the fact that inheritances may come with "strings attached". Parents have expectations and aspirations for their children, which means that they have opinions on how the

intergenerational transfers are used (Becker, 1991; Haveman and Wolfe, 1995; Chami, 1998), and consumption of leisure may be seen as an inferior activity, as Andrew Carnegie seemed to maintain. Intergenerational transfers may follow a replication norm, where parents step into a chain of intergenerational transfers, which is referred to as the "golden rule of bequests" (Bevan and Stiglitz, 1979) or "indirect reciprocity" (Arrondel and Masson, 2006). If such constraints are working, we expect recipients without children to show stronger responses than recipients who are constrained by having offspring.

The paper is organized as follows. In Section 2 we present findings from the literature on Carnegie effects and refer to some relevant perspectives and studies given our focus on response heterogeneity. The empirical approach is presented in Section 3, and results are discussed in Sections 4 and 5. First, in Section 4, we present overall estimates of the Carnegie effect for all recipients and for recipients of large transfers. In Section 5 heterogeneity is further discussed by addressing age dependency, including responses of people being eligible to early retirement pension, and by providing separate estimates for people being potentially restricted by having own heirs. Results of robustness tests are reported in Section 6, whereas Section 7 concludes the paper.

2 Carnegie magnitudes

2.1 Idiosyncratic income effect

In a model with perfect foresight, as the structural life cycle labor supply model of Heckman and MaCurdy (1980, 1982), inheritance is anticipated and fully absorbed, yielding a downward shift in the entire life cycle profile of labor, and no immediate response would follow the receipt of inheritance. However, there are several reasons for expecting any potential labor supply effects to materialize shortly after the actual transfer of resources.

Firstly, there may be uncertainty about both timing and amount of inheritance, which can generate a wealth shock. Recipients may receive larger or smaller inheritances than expected, dependent on how much of the wealth that is consumed by the parents, to what extent people or organizations outside the family, such as religious movements, are supported through transfers inter vivos or through testament, and to what degree parents are able and willing to divide unequally between children. Secondly, although inheritances may be anticipated, credit constraints may prevent the heirs from incorporating the inheritance into their budget. Finally, risk averse recipients will avoid using money they do not fully control. There is a sizeable

literature of life cycle models, where contemporaneous income are allowed to be affected be affected by a transfer, see e.g. Deaton (1991) and Carroll (1997). Thus, given that inheritances are not perfectly foreseen, and assuming a positive income effect on the consumption of leisure, we expect to observe reduced work shortly after the transfer.[3]

Even though the change in labor supply as a result of bequest resembles the income effect of the standard labor supply literature, see reviews of the latter in Blundell and MaCurdy (1999) and Keane (2011), there are several reasons for not using estimates of the average labor supply income effect to represent the Carnegie response. Some of these idiosyncracies of intergenerational transfers are further explored in the following with reference to the heterogeneity of the Carnegie effect.[4]

The first type of heterogeneity is, however, inspired by findings of the labor supply literature, namely that there are fixed cost of adjustments, such as search costs and other adjustments costs, which means that agents can be expected to respond only to changes that are sufficiently large. A change in unearned income will only have effect if it exceeds the fixed costs of finding a new optimum, see Cogan (1981), Altonji and Paxson (1992) and Chetty (2012). Thus, we expect to see responses increasing at an increasing rate with the size of the transfer. Other studies of the Carnegie effect, such as Brown et al. (2010), also report such effects.

Next, we discuss age dependency in the Carnegie response. Of course, the negative fiscal externality of bequests is particularily problematic if people at an early stage of life (the people Carnegie most likely had in mind) are affected, and there is permanence in the responses. On the extensive margin, an inheritance increases the reservation wage, which means that some recipients withdraw from the labor market. It can be expected that those who already have high income in the non-work alternative, for instance because of eligibility to public transfer schedules such as the early retirement scheme, are more responsive.

An important reason for not treating donations from parents as conventional lump sum incomes for the beneficiaries is that they may often come with strings

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[3]Of course, one obvious reduction in labor supply, which will not be discussed in the following, comes from children's mourning.

[4]In addition, there is substantial uncertainty about the magnitude of labor supply responses in general, see for instance the different assessments in Chetty (2012) and Keane and Rogerson (2012). Correspondingly, there is no general agreement concerning the size of the income effect (Kimball and Shapiro, 2008; Hines, 2013). One line of research uses information on winners of lotteries to obtain income response estimates. For example, Imbens et al. (2001) estimate the propensity to earn among lottery winners, and find propensities that range from -0.1 to -0.25, but on average approximately -0.11, and significantly more for those close to retirement age, whereas Kimball and Shapiro (2008) use hypothetical lottery winners (e.g. they ask a sample of people what they would do in the event of winning the sweepstakes) and arrive at estimates close to -0.3.

attached. In the exchange model of intergenerational transfers (Bernheim et al., 1985; Cox, 1987) this is highlighted, as parents use transfers strategically to engender desired behavior, for instance to obtain attention from their own children. Thus, the exchange model perspective focuses on intergenerational transfers as a device for controlling children's actions. Similarly, in an altruism model, it has been focused on the importance of "having the last word" or controlling the last actions in a temporal sequence (Hirshleifer, 1977) in order to derive the positive outcomes of the "rotten kid" behavior; see Becker (1974), Bergstrom (1989) and Bruce and Waldman (1990) on the rotten-kid theorem and the Samaritan's dilemma.[5]

Tied transfers may also come from mutual obligations, resulting from the interactions of attitudes and expectations within the family (Haveman and Wolfe, 1995; Chami, 1998). There are several variants of this type of family ties in the literature, characterized by different concepts. For example, Arrondel and Laferrere (2001) use the term "indirect reciprocity", meaning a system of transfer between generations where emotions, expectations and obligations play important roles. "Impure altruism" is another characterization (Laferrère and Wolff, 2006).[6] Such behavior may also develop into principles of donee behavior characterized as a "golden rule of bequests" (Bevan and Stiglitz, 1979): people bequeath an equal amount to what they inherited themselves, plus or minus some adjustments for luck over the life cycle. Irrespective of the precise mechanism and what terms that are used, we expect that heirs outside a direct line of kinship are less affected, implying that such effects will manifest in larger labor supply effects among recipients without children.

2.2 Previous studies

As already noted, the literature on Carnegie effects is relatively small and the few studies are based on data sources of limited size. Most contributions focus on unanticipated bequests, similar to the approach of the present study. A notable exception to this is Joulfaian and Wilhelm (1994), where models with both unanticipated bequests and perfect foresight are estimated. In the latter case, the inheritance variable is discounted back to age 25. Two datasets are exploited in the estimation of the models: the Michigan Panel Study of Income Dynamics (PSID), which include both inheritors and non-inheritors, and the Treasury's Estate-Income Tax Match Sample (EITM), which is a sample of wealthy descendents and their heirs. Joulfaian and Wilhelm (1994) find that the labor supply responses are small, both under

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[5]The quote from Andrew Carnegie in the Introduction may indicate that he warned against children free riding on their parents' altruism (Samaritan's dilemma).

[6]See also Gatti (2005) and Lindbeck and Nyberg (2006) on the relationship between altruistic parents and work incentives for children.

the perfect foresight and the unanticipated inheritance hypotheses. One possible explanation put forward is that the PSID data do not adequately represent recipients of large transfers.

The EITM data are also used by Holtz-Eakin et al. (1993). Labor market behavior of recipients before and after they recieved inheritances are examined, such as transitions in and out of the labor force and effects on income growth. Thus, identification of effects comes from response differences generated by variations in the size of transfers. They find clear indications that large inheritances reduce labor force participation, whereas effects on labor earnings are smaller. Brown et al. (2010) focus on the binary work/retire decision. Using 1994-2002 U.S. survey data from the Health and Retirement Study, they find a significantly higher probability of retirement amongst those who receive inheritances, increasing with the size of the inheritance. They also have the possibility to split bequests into expected and unexpected, and find higher responses to unexpected inheritances. The study by Elinder et al. (2012) uses a small panel of wealthy decedents and their children. They find immediate labor supply effects that increase in the age of the recipient and the size of the transfer. Moreover, compared to Joulfaian and Wilhelm (1994), effects are reported to be larger and longer lasting.

3 Empirical framework

3.1 Data descriptions

In contrast to most of the previous literature, the present study uses data from administrative registers, which means that we can exploit information for the whole Norwegian population. Behavioral effects in terms of responses in labor income, early retirement and working hours (on the intensive margin) are discussed, utilizing that information from various administrative registers can be linked by employing unique personal identification numbers. A key data source is the Inheritance statistics (Statistics Norway, 2014), based on a register of all Norwegian inheritances by recipient. Inheritances are reported to tax authorities whether or not they are liable for inheritance taxation; the only source of missing observations is that very small estates are not always electronically registered by the tax authorities.[7] Further, the Income statistics for persons and families (Statistics Norway, 2012) gives register-based information about variables such as income (wage income and all other types of income), wealth, family composition and educational level. In addition, the Wage

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[7]Our data includes few inheritances of less than 5,000 NOK ($660 in 1998), as the tax authorities reduced the administrative burden by not registering estates that were far from generating inheritance tax.

statistics (Statistics Norway, 2006) provides data for weekly hours of work for a sub-sample of the population.[8]

Important elements of our empirical design are that we follow inheritors over time, both before and after receipt, and that we let non-heirs represent counterfactual outcomes (not receiving transfers). Thus, we assign a time window for the transfers to take place, and make sure that we have at least three years of observations both before and after the transfer. The time window 2000-2004 is used for transfers, and what we in the following will refer to as the "year of receipt" therefore varies between the years from 2000 to 2004 for the observations in the data set.[9]

Further, in the descriptions of effects, we refer to "before transfer" and "after transfer" periods, to examine the behavior of recipients and non-recipients in the labor market (income, working hours, retirement) for up to six years before and six years after the transfer. As for the data from the Income statistics for persons and families, we primarily use information for the years from 1997 to 2010,[10] which means that a person inheriting in 2000 will be covered by data for three "before transfer" years (data for 1997, 1998 and 1999) and the six years of the "after transfer" period (2001-2006). As the recipients are spread around in the time window 2000-2004, we get data points scattered over the thirteen year period: the transfer year plus six years before and six years after the transfer.

As we will return to soon, the identification technique is based on letting non-recipients represent the counterfactual outcome, and a propensity score matching technique is used to match donees and non-donees. To avoid anticipatory effects, the year three years prior to the transfer year is used for the matching.

We limit the sample to persons who are between 18 and 66 years old (to avoid including children of school age and old age pensioners)[11] and exclude individuals not continuously present in the data for all years, except those who enter or exit the sample due to age. Self-employed[12] are left out, as we do not have register-based information on working hours for that group and because the bequest model for the self-employed may differ.[13] Individuals with zero income in the period leading

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[8]Note that this information is based on formal or contract weekly hours of work, not actual hours.

[9]We use inheritance statistics covering the period 1998-2006. Persons from households that we know have inherited in the years outside of 2000-2004 (i.e., in the years 1998, 1999, 2005 and 2006) are excluded.

[10]In the construction of variables measuring previous income we use accumulated information over several years, also involving data from years prior to 1997.

[11]Note that effect on early retirement is one of the outcomes we are interested in, but not standard retirement; the formal retirement age in Norway is 67.

[12]Self-employment is defined as having higher total business income than wage income in the years before transfer.

[13]Transfer of firms to the next generation will often be examples of bequests coming with strings
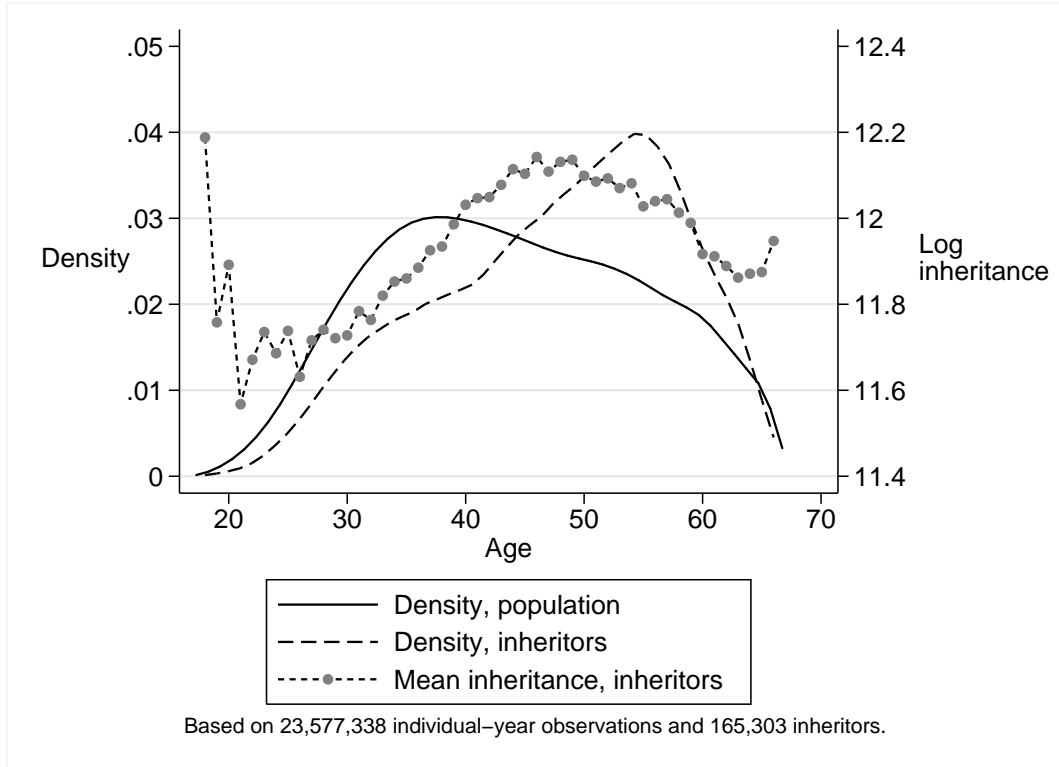
Figure 1. Population densities and inheritance

up to the period of inheritance are also excluded. These restrictions leave us with 1,684,967 persons followed over at least five years. For 317,945 of these individuals we also have information about hours of work over the period 1998-2006, obtained from the Wage statistics.

For married couples where one of the partners receives an inheritance, findings from the labor supply literature suggest the that the spouse's labor supply is affected by changes in the budget constraint too, see for example Blundell and MaCurdy (1999). An advantage of our paper, compared to the previous literature, is that we account for effects on both the heir and the spouse of the heir. We assume that couples have a common economy, implying that both spouses are defined as recipients. Persons who are living in a multiple-person household, but are classified as singles, are excluded from the data set.[14] Note also that all income and wealth variables are log transformed.

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attached. Effects of inheritance on entrepreneurship and the probability of becoming self-employed are discussed in Section 6.3.

[14]These are mostly grown children registered as living in their parents' household, and represent a small number of observations.

Table 1. Descriptive statistics, full sample

	Non-inheritors	Inheritors	Inheritors, large transfers[1]
Mean values[2]			
Age	40.0	45.0	45.4
Labor income	218,116	240,082	257,279
Capital income	15,609	22,242	29,519
Business income	3,290	3,958	4,018
Financial wealth	140,125	221,989	283,152
Housing wealth	77,026	97,104	105,099
Debt	303,952	290,119	308,742
Male	.481	.476	.482
No of adults	1.62	1.77	1.76
No of children	.823	.758	.768
High school	.471	.480	.465
University	.278	.323	.377
High school father	.337	.307	.330
High school mother	.322	.300	.329
University father	.100	.104	.131
University mother	.061	.061	.073
Preceding labor inc[3]	1,039,292	1,218,084	1,310,755
Preceding capital inc[3]	52,168	85,494	118,799
Preceding business inc[3]	27,839	35,962	36,936
Inheritance[4]			
Mean	.	318,240	668,555
Standard deviation	.	491,269	678,292
Median	.	198,871	495,868
No of persons	1,524,254	160,713	58,307

[1] Inheritances over 300,000 NOK ($1=7.55 NOK)

[2] Measured in the last pre-transfer year (1999). All income and wealth variables measured in 1998 NOK ($1=7.55 NOK).

[3] Summed over the period from 1993 to 1998.

[4] Transfers recieved in the period 2000-2004.

Table 2. Descriptive statistics, subsample defined by hours of work information

	Non-inheritors	Inheritors	Inheritors, large transfers[1]
Mean values[2]			
Age	42.2	45.8	46.2
Weekly hours of work	33.3	33.4	33.9
Labor income	261,299	268,158	280,539
Capital income	6,533	7,841	9,131
Business income	1,925	2,722	2,950
Financial wealth	97,279	131,720	145,139
Housing wealth	88,800	99,085	106,365
Debt	295,644	259,380	266,907
Male	.403	.397	.414
No of adults	1.71	1.82	1.81
No of children	.931	.854	.854
High school	.412	.401	.372
University	.459	.496	.546
High school father	.355	.332	.352
High school mother	.348	.327	.356
University father	.113	.117	.146
University mother	.067	.070	.086
Preceding labor inc[3]	1,258,314	1,346,963	1,416,700
Preceding capital inc[3]	24,104	31,932	34,446
Preceding business inc[3]	14,207	19,511	19,704
Inheritance[4]			
Mean	.	320,524	650,044
Standard deviation	.	465,937	623,241
Median	.	207,897	495,352
No of persons	276,152	37,274	14,082

[1] Inheritances over 300,000 NOK ($1=7.55 NOK)

[2] Measured in the last pre-transfer year (1999). All income and wealth variables measured in 1998 NOK ($1=7.55 NOK).

[3] Summed over the period from 1993 to 1998.

[4] Transfers recieved in the period 2000-2004.

Table 1 and Table 2 show descriptive statistics for the full sample and the sample which is restricted by access to information about hours of work, respectively. Pointing forward to separate analyses for recipients of larger transfers, we also show separate figures for persons who have inherited more than 300,000 NOK, which is roughly the mean inheritance.[15]

The tables clearly suggest that the recipients are not similar to the rest of the population, reflecting that this is not a randomly selected group. Recipients are different because they most likely have received other (unobservable) transfers from their parents, in the form of human wealth. Human wealth is influenced by favorable educational and environmental opportunities, which may also be interrelated to intergenerational transfers. Table 1 provides indications of such mechanisms: for example, inheritors (in 1999, one to five years before the transfer) have on average a higher level of education, higher earnings and higher wealth prior to inheritance. The fraction of inheritors that has high school as the highest level of education is about the same as for non-inheritors; 48 percent in the former group and 47 percent in the latter. However, there is a larger fraction of recipients (32 percent) that have attained college or university degrees than non-recipients (28 percent), and this fraction is increasing with the size of the inheritance. For those who have received inheritances above 300,000 NOK, 38 percent of the recipients have a college or university degree. Pre-inheritance wage income and net wealth is also increasing in the level of inheritance.[16] Note also that for the subsample for which we have observations on working hours (Table 2), the differences between non-inheritors and inheritors are smaller (in particular for earnings), probably due to the requirement, in the establishement of this data set, that all persons work continously throughout the whole period.

Figure 1 further elaborates on age differences, comparing age densities of inheritors with age densities of the general population (as represented by the data set established for the present analysis), and also showing mean inheritance by age. The figure confirms that the population of inheritors is not representative of the general population. Because of the natural timing of inheritances, inheritors are on average older that the rest of the population, which will result in higher observed pre-inheritance earnings and wealth in this group. On average the recipients are 46 years old in 1999, which means that they are on average 47-51 years old at the time

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[15]All sums are deflated using the consumer price index, and given as Norwegian kroner (NOK) in 1998; \$1=7.55 NOK according to the exchange rate in 1998, which means that 300,000 NOK equals \$40,000.

[16]This differs from the Swedish sample studied by Elinder et al. (2012), where high transfers are correlated with low wages.

of inheriting. As well as a higher average age, the distribution peaks at around age 55 for inheritors, whereas the general population between 18 and 66 years old peaks at age 35. In the next subsection we discuss how to obtain unbiased estimates of the Carnegie effect, given that recipients is a selected group and that we use the non-recipients to describe counterfactual outcomes.

3.2 *Data balancing with propensity score matching*

A possible identification strategy is to study only the recipients over time (before and after the transfer), as done in Holtz-Eakin et al. (1993); thus, refraining from using information on non-recipients. However, results are then in danger of being confounded by unobserved time effects, and it would be hard to disentangle the Carnegie effect from other life cycle adjustments. When employing observations of non-recipients, there exist various methods to handle the covariate differences just described. Instead of using parametric regressions to control for effects of covariates, we use matching to improve the balance between the datasets of recipients and non-recipients. Matching techniques hold the promise of including the covariates in a more flexible way than standard parametric regression methods, as regressions may be vulnerable to the curse-of-dimensionality problem, i.e., it may be difficult to detect model inadequacies when different groups have covariates stretched thinly over a wide space, with their probability mass concentrated at different parts of the distribution, see for example Imbens (2004), Blundell and Dias (2009), Imbens and Wooldridge (2009) and Huber et al. (2013). Applying matching methods makes it straightforward to discuss heterogeneous effects, by establishing balanced datasets for the various effects put forward here. In addition, we shall also combine matching with regression analysis in some parts of the analysis.

In the identification of Carnegie effects we exploit that there are many households who have characteristics and a probability of inheriting close to the households receiving transfers. A comparison along these lines could be achieved by matching persons with similar observed characteristics, except receiving intergenerational transfers. Such a multivariate matching procedure is cumbersome and requires a number of more or less justified choices concerning who are considered to be "equal". Instead of comparing individuals who have similar values on variables such as age, education, previous earnings and wealth, we may use the variables to construct the propensity score (Rosenbaum and Rubin, 1983). This is the estimated probability that a person receives an inheritance given the values of all the confounding variables. Persons with similar propensity scores are then used to obtain effects of inheritance on the dependent variables. As the propensity score function is not directly related

to the outcome variables, estimates of effects obtained via propensity score matching are expected to deliver results which are more robust to misspecification, compared to results of standard methods, such as linear regression (Huber et al., 2013).

Using the treatment terminology, and denoting that we use nearest-neighbour matching, the Carnegie effect (CE), α^{CE}, can be seen as an estimate of the average treatment effect on the treated,[17]

$$E\left[Y_i^1 - Y_i^0 | D = 1\right] = \alpha^{CE} = \frac{1}{N^R} \sum_{i \in R} \left\{ Y_i - \sum_{j \in NR(i)} Y_j \right\}.$$

Thus, outcome for individual i after inheriting, Y_i^1, compared to the outcome without inheritance, Y_i^0, is empirically adressed by letting person j representing the no-inheritance situation for individual i. In other words, the identification relies on the matched individuals providing the counterfactual outcome of not recieving bequests: the sample counterpart for the missing observation of the behavior of individual i belonging to the group of recipients (R) is obtained from the group of non-recipients (NR). In the present study, this means finding one match for the receipient (by the propensity score); thus, no weights are involved and the number of recipents dictates the number of matches, N^R. This means that control variables are used to design data sets which consist of "treated" (those who receive bequests) and a relevant, "non-treated" comparison group, where the treatment is the only observable difference. In the case where the two groups are perfectly balanced, this estimator will be equal to $\bar{Y}_i - \bar{Y}_j$, and α^{CE} can be consistently estimated by OLS.

The two main identification assumptions in matching are unconfoundedness and overlap (or common support) (Imbens, 2004). The assumption of unconfoundedness means that, conditional on the propensity score, the potential outcomes are independent of treatment. That is, there are no unobservable variables influencing both the assignment to treatment and the outcome. The overlap assumption ensures that over the whole range of $\mathbf{X}$, there is the possibility for matches, i.e., similar persons with different treatment status.

The propensity score in our case is the estimated probability that a person or his/her spouse receives an inheritance, given the values of the confounding variables. We argue that the timing of inheritance receipt is to a large degree coincidental, and that the large set of control variables available makes it less likely that there are biases in the comparison between recipients and non-recipients; thus, the unconfoundedness assumption holds. The matching is done three years before the receipt of inheritance,

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[17]As the recipients belong to a selected group of the population, the effects derived can not be interpreted as overall average effects.

in order to avoid possible anticipatory effects (people adjusting to the transfer in advance). Since our treatment group consists of persons who inherit in a year that varies from 2000 to 2004, and we want to compare outcomes for the years after receipt, we also need to assign a specific "year of inheritance receipt" to persons in our control group. After matching, the control observation is assigned the same year of inheritance as its match. For this reason, the nearest-neighbor matching is done without replacement.[18]

Given the outcomes we investigate, pre-inheritance earnings is an important matching variable. Further, as inheritors are older and have higher education than non-inheritors (see Table 1), and being in a couple increases the probability of inheriting (two are more likely to inherit than one), these variables are obvious candidates in the estimation of the propensity score. We have explored several different specifications to find the best fit. To guide the specification we have looked at how closely the covariates of the matched treated and control group fit, using t-tests. In addition, inspired by Dehejia and Wahba (2002), we have split the sample into 10 equally large groups sorted on propensity score, and looked at the balance of covariates within the groups. The preferred specification uses a logit procedure[19] with the following explanatory variables: log of wage, capital and business income; log of financial wealth, housing wealth and debt; log aggregated wage, capital and business income for a period before the matching (from 1993 to the the year before matching); log square terms for the previous variables; age dummies; region (*fylke*) dummies; sex; a dummy for marriage/cohabitation; an interacted term of sex and marriage; and dummies for high school and university education, for the person as well as for the person's father and mother.[20] The results for the participation model is presented in Appendix A, see Table A.1, along with mean equality tests in Table A.2. The mean equality test shows that our matching procedure is successful in balancing the dataset over the dimensions included in the model.

In Figure 2, the propensity score densities of inheritors and non-inheritors are displayed. As shown in the left diagram of the figure, the distribution is massed at higher levels of propensity score for inheritors than for non-inheritors, which means

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[18] As a recipient year is assigned to the control observations, this procedure would potentially be problematic if one control was matched to several treated observations. However, as we have many control persons available for comparison, not using replacement should not affect results.

[19] The matching is implemented in Stata 12 with the package psmatch2 (Leuven and Sianesi, 2014).

[20] Information about parents' level of education is included in the educational register. Other parental information, such as year of birth, must be obtained by linking identification numbers. This is only possible for a sub-sample of the population (see Section 6.2 where we use such linkages). Although the age at death of the longest living parent may be perceived as an interesting explanatory variable, with few exceptions it follows from the age of the child at the time of transfer.
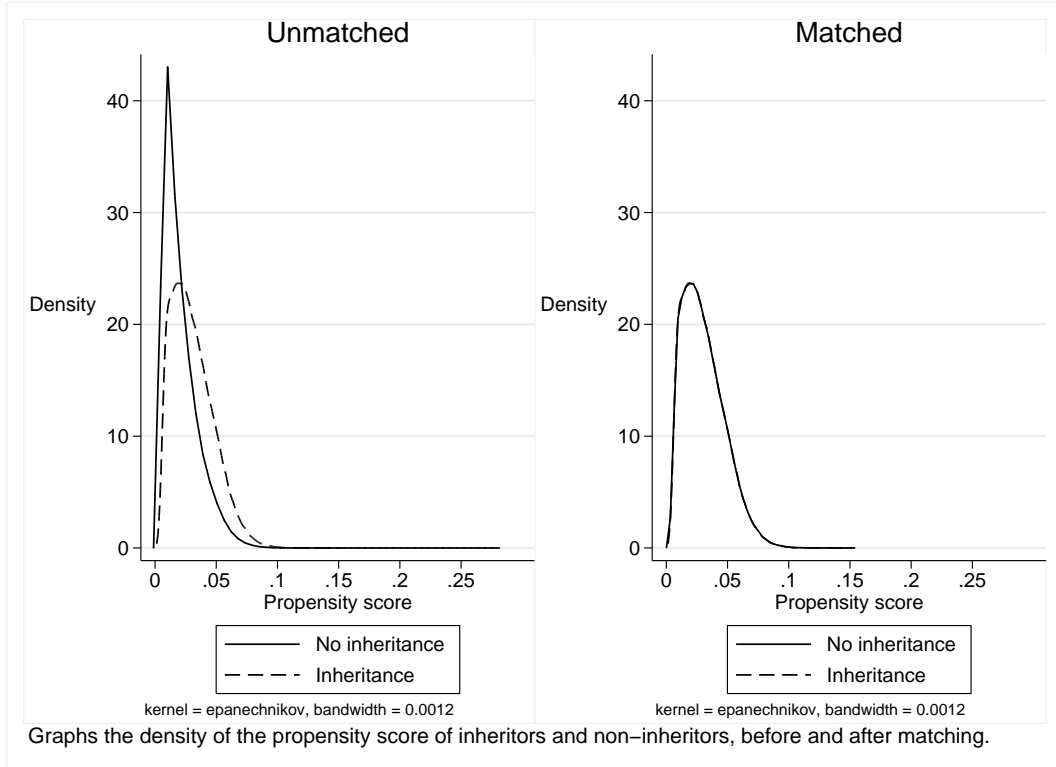
Graphs the density of the propensity score of inheritors and non−inheritors, before and after matching.

Figure 2. Propensity score densities before and after matching

that the propensity score does have some predictive power. The plot reveals a clear overlapping of the distributions, which is an indication of common support for all treated observations (Caliendo and Kopeinig, 2008). In addition, the right diagram shows that the matching procedure implies that there are matches over the whole distribution of inheritors.

An important ambition of the present study is to discuss the heterogeneity of the Carnegie effect, examining how it varies with respect to the size of the transfer, the age of recipients, the existence of new heirs in the chain, and the recipients' eligibility to early retirement. Thus, we also give a brief overview of the empirical strategies to that end. The effect of early retirement is discussed by using early retirement pension take-up as the dependent variable (whereas income or working hours are used as dependent variables for the other dimensions.) The identification of effects of age and new heirs combines propensity score matching and OLS regressions.[21] Given

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[21]Many authors have discussed the benefits of combining matching or propensity score weighting and linear regression. Most of the discussion is aimed at ways in which regression adjustment can improve efficiency of the matching method. The intuition behind using both methods is that regression adjustment can be used to alleviate the effects of remaining covariate imbalances. Supplementary regression analysis can increase efficiency (Heckman et al., 1997; Rubin and Thomas, 2000; Abadie and Imbens, 2006). The additional regression method is mainly aimed at situations where the treament and comparison groups are unequally sized (matching with replacement), and one may use a weighted regression where the comparison units are weighted by the number of

that we believe we have obtained a balanced matched dataset, it is straightforward to include interaction effects in a regression framework. Therefore, in contrast to the more common practice of examining subgroups one at a time, we estimate an equation where we (in practice) let the Carnegie effect, α^{CE}, be explained by various characteristics and interactions between them, including dummies for age group and whether the recipient has own heirs or not included,[22]

$$\alpha^{CE} = \delta + \delta_1 \bar{X}_{1D=1} + \delta_2 \bar{X}_{2D=1} + \delta_{12} \left(\overline{X_1 X_2} \right)_{D=1},$$

where again the ATT is illustrated with only two characteristics.

4 Size and non-linearity of the Carnegie effect

First, we establish to what extent an overall Carnegie effect can be distinguished, and in case it is, how it varies over time and with respect to the size of the transfer. Recall that we discuss the heterogeneity of the Carnegie effect with respect to the size of the transfer by employing a separately matched data set, whereas we in the next section will study heterogeneity by adding in explanatory variables directly in regressions based on the matched samples.

The first column of Table 3 presents estimates of the effect on labor income of receiving an inheritance by reporting average differences in log labor income between recipients and non-recipients over the thirteen year time period: six years before and six years after the transfer year.[23] Given the identification strategy, it is reassuring to see that there are no signs of effects on income prior to the transfer. Moreover, we see a drop in earnings among inheritors after the transfer, in accordance with the Carnegie conjecture and previous findings in the literature (Holtz-Eakin et al., 1993; Joulfaian and Wilhelm, 1994). There seems to be a gradual and temporary wage income response to the receipt of an inheritance: the coefficients turn negative at the year of receipt and increases gradually thereafter until the second to third year. The point estimates suggest that the inheritors reduce their income by approximately 2 percent 3 years after the transfer. However, none of the estimates are statistically significant.

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times that they are matched to the treated unit. Since we have the advantage of a very large data set with ample possibilities of finding suitable matches, we can use matching without replacement and obtain a fully balanced sample, and therefore we will not benefit from regression adjustment. Regressions are, however, used in the discussion of heterogenity of the Carnegie effect, see on.

[22]This setup is similar to Djebbari and Smith (2008), although they also controlled for idiosyncratic heterogeneity. Another difference is that we estimate a full interaction of all covariates.

[23]Remember that the matching is based on individual characteristics three years before inheritance.

Table 3. Effect of inheritance on earned income. Average difference between recipients and non-recipients

	All inheritances		Above mean inheritances[1]		Below mean inheritances[2]	
	Est.	SE	Est.	SE	Est.	SE
6 years before	.0032	.0166	.0253	.0246	-.0273	.0221
5 years before	.0016	.0130	.0008	.0198	.0027	.0172
4 years before	-.0032	.0111	-.0046	.0174	.0017	.0145
3 years before[3]	.0013	.0100	-.0117	.0160	-.0014	.0127
2 years before	.0021	.0103	-.0067	.0163	.0091	.0131
1 year before	.0146	.0109	.0019	.0174	.0204	.0138
Year of receipt	-.0041	.0117	-.0209	.0188	.0216	.0149
1 year after	-.0219	.0126	-.0504*	.0206	.0087	.0160
2 years after	-.0226	.0134	-.0739**	.0219	.0123	.0169
3 years after	-.0196	.0142	-.0638**	.0233	.0070	.0180
4 years after	-.0120	.0153	-.0511*	.0250	.0204	.0193
5 years after	-.0005	.0163	-.0376	.0267	.0292	.0205
6 years after	-.0061	.0173	-.0506	.0283	.0281	.0218
No of matches[4]	143,000		51,669		91,331	

[1] Inheritances larger than 300,000 NOK ($1=7.55 NOK).

[2] Inheritances smaller than 300,000 NOK.

[3] Year of matching.

[4] Maximum number of matches, i.e. from the year of matching until one year after receipt.

* $p < 0.05$ ** $p < 0.01$

Table 1 shows that mean inheritance is approximately 40 percent higher than mean wage income for the recipients, while the median inheritance is lower than the mean wage. In other words, there is a substantial share of inheritances that are smaller than the average labor income. If there are fixed adjustment costs in the optimization process, as suggested by several studies of the labor supply literature, it is likely that smaller inheritances have small or no effect on labor supply. Table 3 presents separate estimates for inheritances above 300,000 NOK (roughly the mean inheritance).[24] For larger inheritances we find a much more distinct pattern than for the full sample, in accordance with the hypothesis of adjustment costs. Again we find a gradually stronger negative effect on wage income in the first years after the transfer, reaching a maximum effect of about 7 percent two to three years after inheriting. In the following years, the effect seems to diminish, until it is no longer statistically significant (though still negative) five to six years after the

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[24]The matching is done separately for each subgroup, which means that recipients of large inheritances are matched with persons based on a different participation model.

transfer. In contrast, the effect on those receiving an inheritance below 300,000 NOK is non-discernable. Figure 3 provides a graphical representation of the first four columns of Table 3.

In Table 3, standard errors are those calculated by default by psmatch2 (Leuven and Sianesi, 2014). The calculation does not account for the fact that the propensity score is estimated. As a robustness check, we have also calculated standard errors by bootstrap (not reported in the paper). There are only small differences between the two sets of standard errors, and no clear direction of the differences.
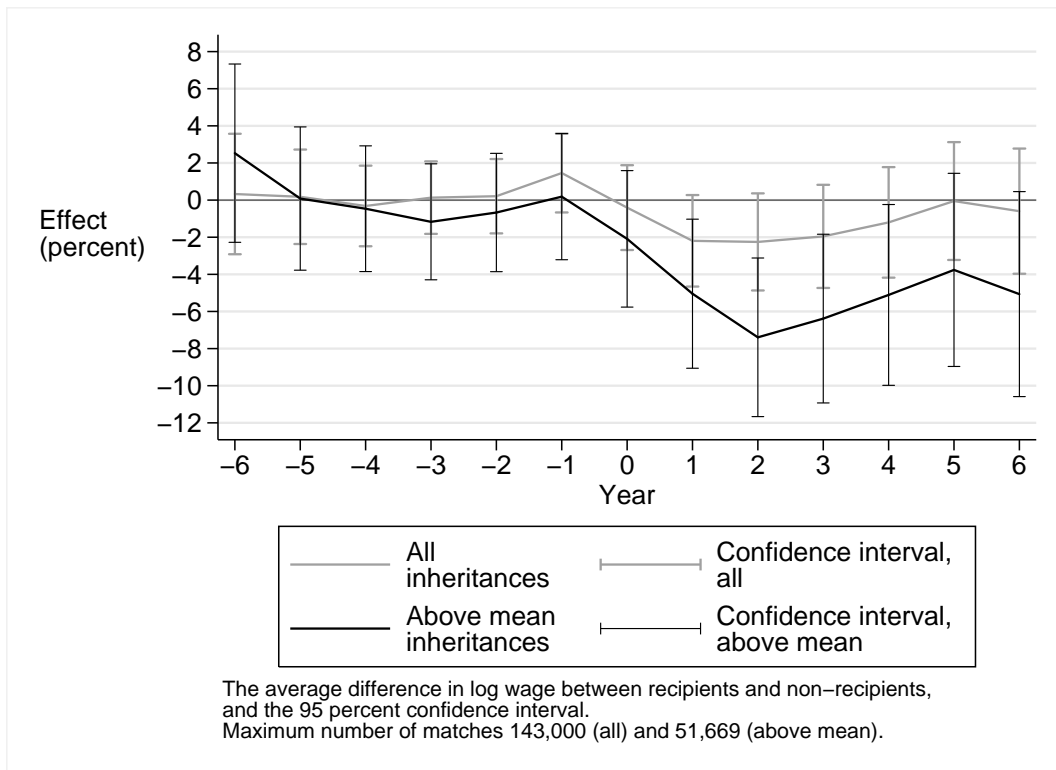
Figure 3. Effect of inheritance on earned income

As denoted by the literature focusing on the measurement of income responses to changes in taxes (see Saez et al., 2012), income responses reflect a diversity of behavioral responses. To obtain separate estimates for the effect on working hours at the intensive margin, we use the sub-sample with information about hours of work over the period 1998-2006. Being in the sample is conditional on working over the whole observation period, and we only have information about contractual working hours for a sub-sample of persons. People who retire or completely stop working will not show up in this sample, which implies that only effects on the intensive margin are obtained.

When using the same identification strategy as for income, we obtain results for working hours that are hard to interpret due to very large standard errors, see Table

The difference between recipients and non–recipients in share working less than in
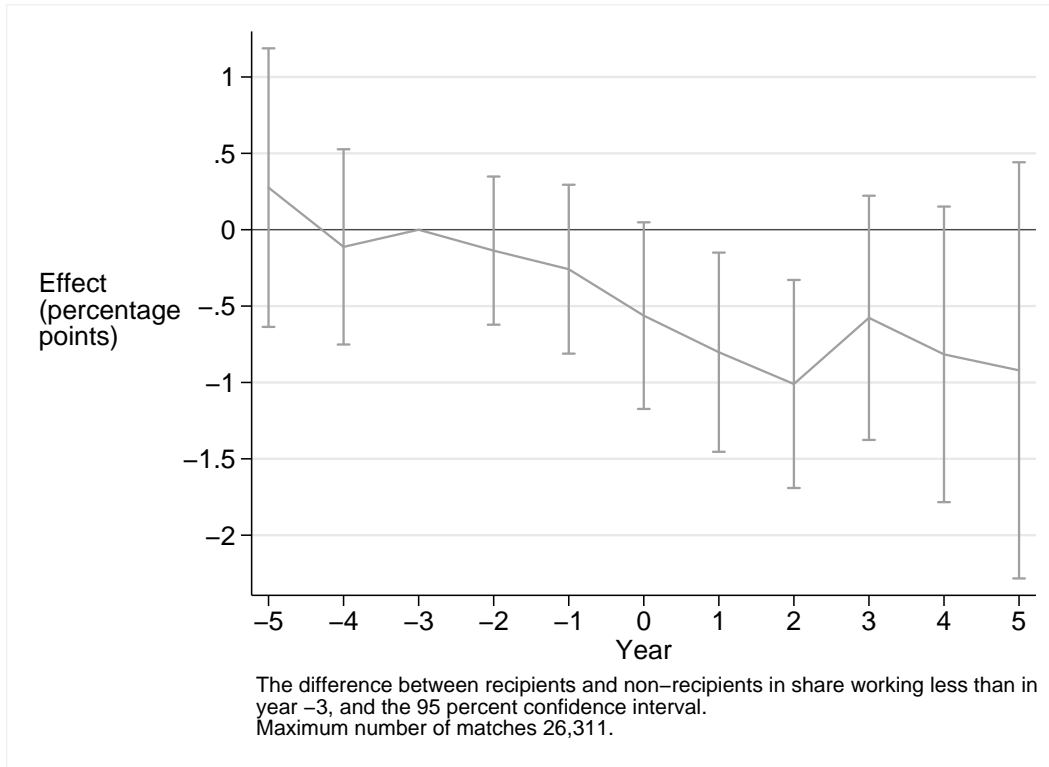year –3, and the 95 percent confidence interval.
Maximum number of matches 26,311.

Figure 4. Effect of inheritance on the probability of reducing working hours.
Sub-sample with information about working hours

A.3 in the Appendix. We therefore use a somewhat modified empirical strategy,
defining outcome by a dummy indicator which takes the value 0 if working hours is
reduced from its level in the year of matching and 1 if the level of hours of work is
the same or higher. The matching procedure is the same as previously used. The
results are presented in Figure 4, showing that the share of people cutting their
working time is up to one percentage point larger for recipients. However, the effects
are statistically significant only in the two years directly following the transfer.

Our Carnegie effect results, although using another method for identification,
are qualitatively similar to Joulfaian and Wilhelm (1994) in finding small change in
working hours, and somewhat larger changes in earnings. We also confirm the result
from Holtz-Eakin et al. (1993) that larger inheritances leads to larger labor supply
responses. Quantitatively, our estimates of the effect on labor earnings are larger
than in both of these papers. The time pattern of the labor supply responses is
similar to the findings of Elinder et al. (2012): the effect is strongest after a couple
of years, then decreasing over time.

To understand the economic implications of the Carnegie effect, some simplified
calculations can be carried out, to provide insights into magnitudes of the fiscal

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externality costs of intergenerational transfers.[25] For illustration, we restrict to recipients of large transfers, given that significant estimates are obtained for this group only, see Table 3. According to the Inheritance statistics (Statistics Norway, 2014) approximately 15,000 Norwegians received taxable bequests in 2003, which means that they received amounts which correspond to our definition of "large transfers". When we let these persons reduce their taxable income by 6 percent, which according to Table 3 is the average annual reduction, we find that the nationwide reduction in the revenue from the personal income tax is 23 million NOK, which corresponds to only 0.01 percent of the total tax revenue from the individual income tax (in 2003). However, estimates should account for persistence of effects. Significant responses are observed for four years after the transfer, and the point estimates for subsequent years (although not significant) suggest that they may last even longer. We cannot therefore rule out that there are substantial fiscal externality costs working through the Carnegie effect.

5   Further response heterogeneity

So far we have split the initial sample into recipients with an inheritance smaller than mean inheritance (smaller than 300,000 NOK) and recipients with above mean inheritance (and their comparable units). When we in the following discuss how Carnegie effects vary with respect to the age of recipients and the existence of new heirs, we use the "large transfer" sub-sample and employ the propensity score matching technique in combination with regression analysis (see Section 3). Estimation results are obtained by employing a standard OLS regression, including the inheritance indicator and its interactions with dummies for age group and whether the recipient has heirs or not. We also present estimation results for some of the other covariates: gender, marital status and educational level.

Note that the specification includes direct effects of all additional covariates and all possible interactions between the covariates. With a fully flexible model where all characteristics are allowed to interact with each other it is difficult to evaluate the point estimates. Therefore, we compute the predicted marginal effect of inheritance on wage income for each subgroup. Table 4 shows these marginal effects by age, existence of heirs, marital status, and level of education, together with the benchmark - the overall marginal effect of inheritance (reported in the first line of Table 4). The marginal effect is the difference in the adjusted predictions of log earnings for those who inherit compared to those who do not inherit within each

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[25]Using the terminology of Kopczuk (2013)

group, e.g. for female recipients compared to female non-recipients. In the table, results for selected years are presented in order to reduce the dimensionality of the table.

Table 4. Marginal effects of inheritance on earned income. Sub-sample conditioned on larger bequests

| | Year of inheritance | Years after inheriting | | | |
		1 year	2 years	4 years	6 years
Inheriting	-.045*	-.077**	-.100**	-.080**	-.078**
Age 21-42[1]	-.115**	-.163**	-.171**	-.114*	-.188**
Age 43-49[1]	-.033	-.043	-.015	.031	.080
Age 50-55[1]	-.023	-.025	-.052	-.021	.043
Age 56-60[1]	-.025	-.079*	-.139**	-.172**	-.222**
No heirs	-.206**	-.257**	-.338**	-.216**	-.199*
Heirs	-.024	-.053*	-.072**	-.066**	-.069*
Male	.001	-.023	-.048	-.064	-.041
Female	-.081**	-.119**	-.143**	-.096**	-.118**
Couple	-.030	-.053*	-.068**	-.067*	-.075*
Single	-.087*	-.150**	-.208**	-.135**	-.107
Elementary school	.109	.035	-.006	-.039	.011
High school	-.075**	-.112**	-.143**	-.126**	-.143**
Higher education	-.065*	-.072*	-.082*	-.044	-.045

Note: Propensity scored matched sample and OLS. Marginal effects are obtained using the STATA margins procedure.
[1] Age in the year of inheritance.
* $p < 0.05$ ** $p < 0.01$

Carnegie effects for four age groups are reported in Table 4. The average age of heirs (at receipt) is about 49 years, which is probably a higher age than that of the sons who Andrew Carnegie had in mind when he was concerned about a "general deadening of talents and energies". Moreover, Table 4 confirms that responses vary across age groups, with the youngest and oldest age groups showing large responses, while no significant results are found for recipients in their forties and early fifties. These results suggest that transfer magnitudes are not large enough to move middle-aged people away from their stable position in the labor market. For the eldest inheritors we see a pattern of steadily declining earnings over the entire period we are studying. The largest response with respect to age is seen for the oldest age group: recipients reduce their income by up to 22 percent, compared to the non-recipients of that age group.

The negative marginal effect on earning for young households who inherit com-

pared to young households who do not inherit is also large. However, one must remember that in this part of the life-cycle the comparison group is likely to experience a strong growth in earnings, which means that any labor reductions by inheritors on the extensive margin is likely to yield a pronounced effect over time. In the youngest age group the majority of observations are located in the upper end of the age range, in other words, there are few observations of inheritors in their twenties. Otherwise the group is similar to the overall population of inheritors with two exceptions. One is that there are somewhat more females in this group (58 percent), but the second and main difference is that they have more children under 18 years old. Taking time off to care for smaller children might be another explanation for the large negative marginal effect in this group. This explanation also accord with the finding that transfers negatively affects female earnings more than male earnings.

Although sometimes large in size and thus significantly different from zero, the marginal effects by subgroups may also have wide confidence intervals, which imply that one group's effect is not necessarily significantly different from the effect of a comparison group. For instance, differences in responses between males and females are not significant in the longer run. This is shown in Table 5, where we present F-values for tests of differences between groups. The asterisks indicate rejection of the null hypothesis that the marginal effects in the pairwise comparisons are equal, at different significance levels. Table 4 confirms that the youngest and the oldest age groups have long run marginal responses to inheriting which significantly differ from the middle-aged groups, see the results for six years after inheriting.

Table 5. F-test values for differences in marginal effects between groups of recipients

	Year of inheritance	Years after inheriting			
		One	Two	Four	Six
Age 21-42 vs age 43-49[1]	1.91	3.42	5.33*	3.68	10.5**
Age 43-49 vs age 50-55[1]	0.03	0.09	0.35	0.54	0.22
Age 50-55 vs age 56-60[1]	0.01	1.12	2.50	5.93*	14.5**
Heirs vs no heirs	9.05**	9.59**	14.6**	3.63	2.17
Males vs females	5.03*	5.82*	5.07*	0.45	2.08
Singles vs couples	1.68	4.14*	7.65**	1.41	0.23
Elementary vs high school	11.7**	6.26*	4.89*	1.49	3.71
High school vs higher edu.	0.06	0.81	1.82	2.49	2.87

[1] Age in the year of inheritance.
* $p < 0.05$ ** $p < 0.01$

Since we observe a pattern of steadily declining earnings for the age group approaching retirement it is reasonable to conjecture that this is influenced by

responses on the extensive margin, i.e. that some individuals in this group use the transfer to withdraw completely from the labor market. It is likely that the choice of when to retire is affected by the sudden receipt of an inheritance.

Even though we readily acknowledge that retirement decisions are far from Andrew Carnegie's original notion, we further investigate extensive margin responses for this age group by providing estimates for the probability of retirement before normal retirement age.[26] The results are reported in Figure 5, where the outcome is the difference in the share of inheritors and non-inheritors who have taken early retirement. The results show an increase in the uptake of early retirement in the years after inheritance receipt; the share of inheritors that retire early is around two percentage points higher than the share among non-inheritors, and the difference in shares is statistically significant for most years following the receipt. The results are in accordance with the findings of Brown et al. (2010), who show a significant increase in the probability of retirement for inheritors, increasing with the size of the inheritance.
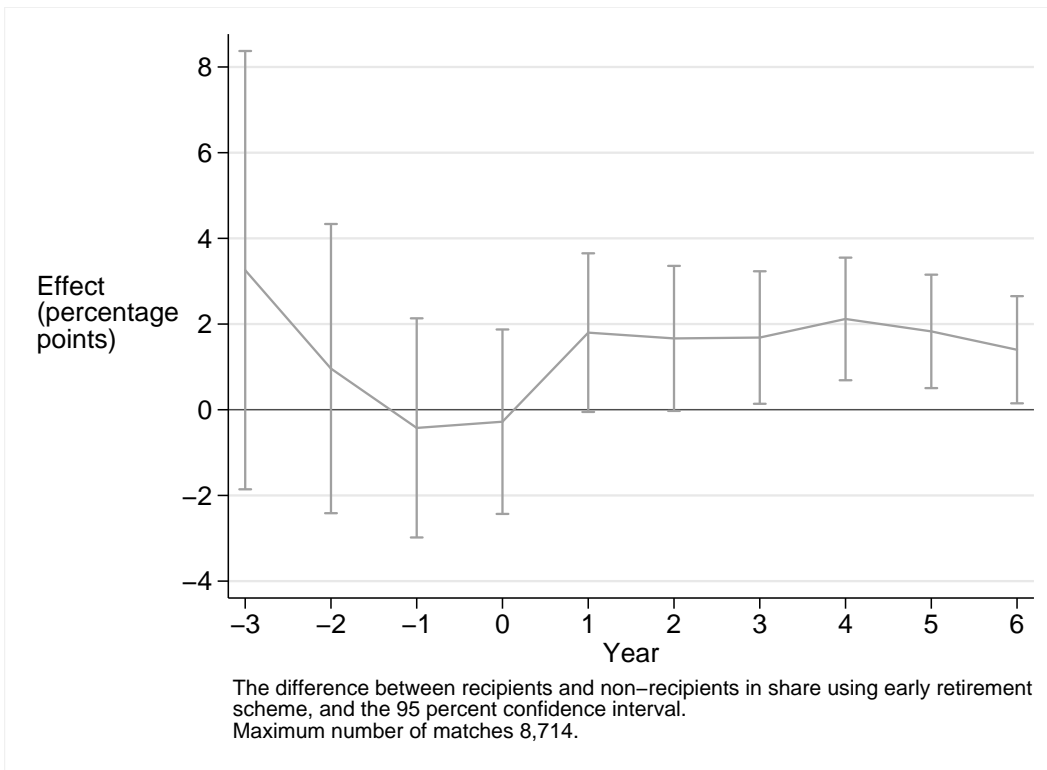

Figure 5. Effect of inheritance on early retirement. Sub-sample conditioned on larger bequests

Returning to the other results of Table 4, we see results which comply with

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[26]Uptake of an early retirement pension before the formal retirement age (67 years old), given to employees that participate in a pension scheme through a collective agreement, called AFP.

a "strings attached" conjecture (see discussion of several reasonings behind this pattern in Section 2). The marginal effects for the group with no direct heirs show the largest response of all subgroup-responses reported in Table 4, suggesting that recipients are restricted in their use of bequests by new heirs in the "family chain". Note that significant differences between recipients with and without offspring are obtained for the first two years after the transfer (see Table 5). Thereafter effects are positive, but non-significant. Connecting this to the discussion of the Carnegie effect magnitudes at the end of Section 4, the effect of future heirs denotes that there are factors involved which limit the Carnegie effect. On the other hand, if the relatively large response among young recipients (see Table 4) is permanent, tax revenue losses are substantial.

As seen in Table 4, we have also looked more closely at effects of the gender of the recipient, whether the recipient is single or in a couple (married/cohabiting) and educational level. Educational level is included since it may be a proxy for high income, or may influence financial literacy and ability to plan. We note that higher female labor supply responses are in line with the literature on labor supply elasticities, which typically find that women's labor supply is more elastic than men's labor supply (Blundell and MaCurdy, 1999; Keane, 2011). Regarding education, it seems that the main difference is between recipients with elementary school level and recipients with high school level, with the latter group being more responsive. Overall, the least responsive group is highly educated couples in their fifties, with direct heirs. This also happens to be the group receiving the main part of inheritances.

6 Robustness checks

6.1 Unobserved heterogeneity

A disadvantage of the propensity score matching estimator is that it only accounts for observed (and observable) covariates. If there are unobserved factors that simultaneously affect the probability of inheriting and the earnings outcome (selection on unobservables), the usual matching estimator can be seriously biased. In the presence of longitudinal data, Heckman et al. (1997) has proposed a combination of matching methods and difference-in-differences techniques that may accommodate selection on unobservables and weaken the strong underlying assumptions of both methods (Blundell and Dias, 2009). According to the matching difference-in-differences (MDID) technique, time independent unobservable individual effects cancel out by taking differences over time. Given that we compare recipients and non-recipients

over an observation period (t_0, t_1), the matching estimator now becomes

$$\alpha^{CE} = \sum_{i \in R} \left\{ (Y_{it_1} - Y_{it_0}) - \sum_{j \in NR(i)} (Y_{jt_1} - Y_{jt_0}) \right\}.$$

Table 6 shows results when applying the MDID method for estimating the effect of receiving a large transfer. Since we have many observation periods, one must make a choice with respect to the observation period (t_0, t_1). The table shows results for two alternatives: one where t_0 is the year before inheriting, and another where the initial level is based on the average earnings in the three years before inheriting.

Table 6. Effects of inheritance on earned income in levels and long differences (MDID estimator). Sub-sample conditioned on larger bequests

	Level	Diff. from year before inheriting	Diff. from mean of the 3 years before inheriting
Year of inheriting	-.020 (.018)	-	-
1 year after	-.050* (.021)	-.052** (.015)	-.044** (.016)
2 years after	-.073** (.022)	-.066** (.018)	-.062** (.018)
3 years after	-.066** (.024)	-.057** (.020)	-.053** (.020)
4 years after	-.054* (.025)	-.043 (.022)	-.040 (.022)
5 years after	-.035 (.027)	-.030 (.024)	-.027 (.024)
6 years after	-.044 (.029)	-.039 (.026)	-.034 (.026)

Note: Standard errors in parentheses.
* $p < 0.05$ ** $p < 0.01$

The results of Table 6 are encouraging, as estimates based on the MDID technique are close to the estimates based on levels. These results therefore do not suggest that unobserved heterogeneity represents a major source of bias. Also under this specification, the effect is clearly negative in the years after inheriting. The overall negative effect on earnings of inheritors after the (large) transfer is approximately five percentage points. However, needless to say, the MDID method also relies on assumptions which may not hold.

6.2 Testing family ties with more parental information

In Section 6 we found that inheritors with no own heirs reduced their work effort more than inheritors with heirs, which was explained by obligations towards later generations discouraging recipients with heirs from using the inheritance on own consumption of leisure. In the data used so far we have included all inheritances, irrespective of the donors kinship. In order to obtain an exhaustive test of this

hypothesis, one would ideally restrict to bequests given by a parent (and not from others), although bequests do predominantly go from parents to children or grandchildren. The main reason for not conditioning on kinship in general is that the register data is not complete with respect to family linkages, and conditioning on information about parental transfers would cause a large drop in the number of observations.

Table 7. Marginal effects of inheritance on earned income. Recipients with and without own heirs, restricted and full data set

	Restricted sample[1]			Full sample[2]		
	No heirs	Heirs	Diff.	No heirs	Heirs	Diff.
	Marg. effect		F-test	Marg. effect		F-test
1 year before	-.027	.048	0.58	-.133*	-.001	5.49*
Year of receipt	-.105	.011	1.72	-.206**	-.024	9.05**
1 year after	-.232**	.002	6.13*	-.257**	-.053*	9.59**
2 years after	-.237*	.015	6.19*	-.338**	-.072**	14.6**
3 years after	-.189	.019	3.37	-.267**	-.072**	6.99**
4 years after	-.149	.051	3.02	-.216**	-.066**	3.63
5 years after	-.106	-.021	0.48	-.154	-.067*	1.07
6 years after	-.148	-.025	0.89	-.199*	-.069*	2.17
No of matches[3]		17,401			51,669	

[1]Inheritances larger than 300,000 NOK ($1=7.55 NOK) from own parents.
[2]Inheritances larger than 300,000 NOK ($1=7.55 NOK).
[3]Maximum number of matches, i.e. from the year of matching until one year after receipt.
* $p < 0.05$ ** $p < 0.01$

However, it is of interest to check to what extent the dissimilar results for inheritors with and without own heirs are replicated in a data set generated by stricter conditions. For the inheritors we require that the inheritance is left by the last surviving parent, and for the non-recipients, used in the comparison, we require that at least one parent is alive during the entire comparison period (which is up to six years after the assigned year of inheritance receipt). Table 7 presents results for the smaller sample and compare them to the initial estimates for the heirs/no heirs dimension, obtained from Table 4. We see that the F-tests for significant differences are weakened with the smaller sample, but that the overall results stand. We still find that recipients with no heirs have a larger propensity to spend the inheritance on leisure. Significantly different response estimates are obtained in the two first years after inheriting.

6.3 Entrepreneurship

We have excluded self-employed and restricted the analysis to wage earners, defined as those having had higher wage income than business income in the years before transfer. However, we cannot rule out that some inheritors may have used the acquired funds to start up a new business. Thus, part of the decline in earnings could be attributed not to increased leisure, but to a transition into self-employment and a start-up period, in which the person allocates very little wage income to himself/herself. Some may also have inherited the ownership of a small family business and for that reason changed from being an ordinary wage earner to becoming self-employed. There are some studies that report positive effects of windfall gains (both lotteries and inheritance) on the probability of entering self-employment, see Evans and Leighton (1989), Lindh and Ohlsson (1996) and Blanchflower and Oswald (1998). A standard interpretation of a positive windfall effect on entrepreneurship is that the windfall relaxes liquidity constraints.

The difference between recipients and non–recipients in share being self–employed, and the 95 percent confidence interval.
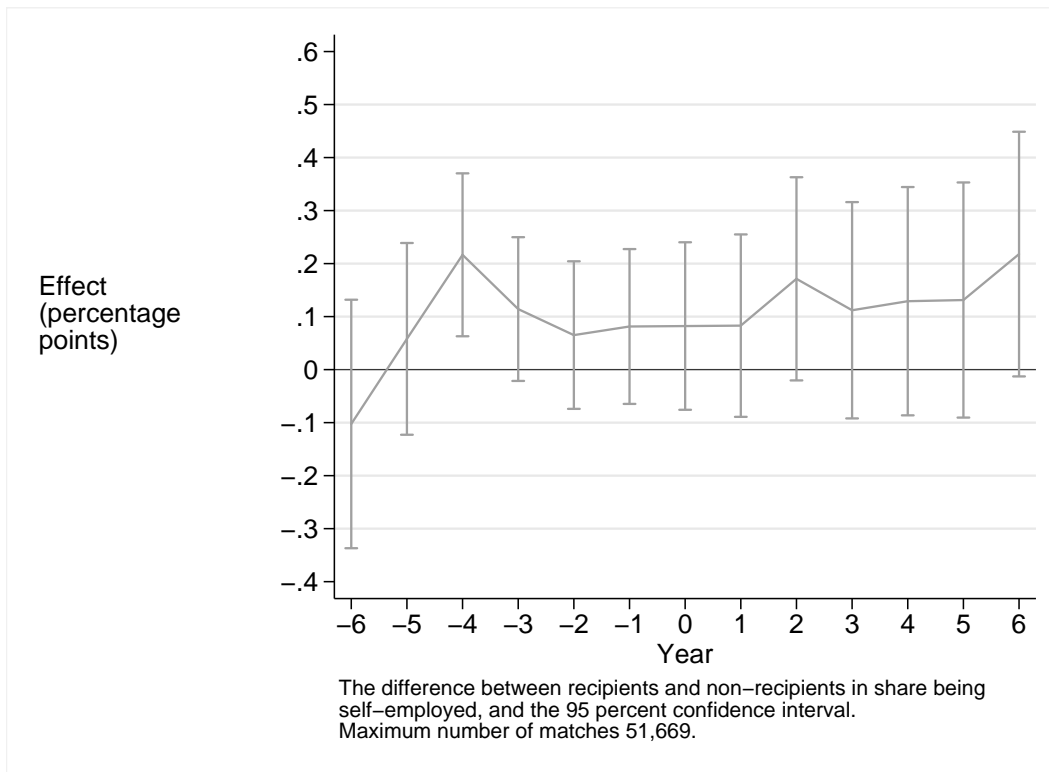Maximum number of matches 51,669.

Figure 6. Effect of inheritance on self-employment. Sub-sample conditioned on larger bequests

We check this alternative explanation by studying how the receipt of an inheritance affects the probability of becoming self-employed. Results are derived for the data set restricted to large bequests, since we expect such behavioral responses to

be dependent on large transfers, and the dependent variable is the difference in the share of self-employment between recipients and non-recipients. As seen in Figure 6, there is no clear evidence of recipients moving into self-employment, as there is no upward trend in self-employment following the receipt of inheritance.

7 Summary

Recent discussions of the reasons for taxation of estates or inheritance, as in Kopczuk (2013), assign a key role for the Carnegie effect in the overall judgment. In this perspective it is problematic that the literature providing estimates of Carnegie effects is rather limited. The results of the present study warn against using other income effect estimates to characterize Carnegie effects, as the response heterogeneity revealed clearly signifies that Carnegie effects are idiosyncratic, and therefore should be obtained from observations of behavioral responses to intergenerational transfers - simply adopting income effects from other labor supply studies can be highly misleading.

We find clear evidence of recipients using bequests to increase their consumption of leisure shortly after the transfer. For persons close to retirement we find permanent reductions in labor supply, but also for younger inheritors effects are quite large. In addition, short term estimates, as those obtained in this study, most likely underestimate responses, as there are reasons to believe that parts of the bequests are perfectly foreseen and accounted for in the life cycle plan of the recipients.

Even though we believe that our study provides the most comprehensive description of Carnegie effects seen so far, there are still some uncertainty regarding the economic implications. We have seen signs of Carnegie effects resulting in permanent responses in labor supply, and then the costs are substantial. Also, given that we have found stronger effects for recipients of large transfer, it is important to be aware that the transfer amounts most likely will increase in the future, which may mean that Carnegie effects will have stronger influence in the future.

The diversity of behavioral responses also point to factors that constrain the Carnegie effect. We see evidence that adjustment costs in finding new optima result in smaller negative labor supply effects and, notably, find results which support the theory that recipients may not feel eligible to use intergenerational transfers only on their own consumption of leisure when there is a new generation awaiting support. Interestingly, these latter two findings give support for two rather common features of the inheritance tax, given that one would like to limit the Carnegie effect: progressive rate schedules and higher tax rates for heirs not in the direct line from the deceased.

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A Supplementary descriptions of estimation results

A.1 Estimation results for the propensity score model

	Coefficient	SE	t-stat
Log wage income	.62361832	2.0986603	.29715067
Log capital income	-.29128213	.21296642	-1.3677374
Log financial wealth	.00196621	.41085275	.00478568
Log debt	.3233201	.64224324	.50342312
Log housing wealth	-8.4310527	.72464954	-11.634662
Log business income	.14830162	3.4524141	.04295592
Male	-.01910904	.05324444	-.35889274
Housh. size	.53336845	.02107421	25.309058
Male*Housh. size	-.05460765	.03009494	-1.8145126
Wage equals zero	.11133634	.11823463	.941656
High school	.11318758	.01648598	6.8656866
University	.19599449	.01918542	10.215801
High school father	.13662074	.0156844	8.7106146
High school mother	.1129047	.01587817	7.1106855
University father	.23189255	.02507227	9.2489644
University mother	.22533329	.03022703	7.4546947
Age 18[1]	-.87974073	.32868695	-2.6765308
Age 19	-1.3062156	.26065865	-5.0112113
Age 20	-1.1404213	.16709006	-6.8251897
Age 21	-1.178634	.13471368	-8.7491788
Age 22	-1.127297	.10858234	-10.381955
Age 23	-1.1557025	.09381522	-12.318924
Age 24	-1.0992844	.08033906	-13.683062
Age 25	-1.0553106	.07026382	-15.019261
Age 26	-1.0356195	.06397672	-16.187445
Age 27	-1.0290123	.0601584	-17.105048
Age 28	-.96816731	.05641777	-17.160679
Age 29	-.96585232	.0548832	-17.598323
Age 30	-.94536366	.05371912	-17.598272
Age 31	-.88170786	.05225194	-16.874165
Age 32	-.89266276	.05239001	-17.038796
Age 33	-.80876987	.05116891	-15.805886
Age 34	-.74966194	.05065301	-14.799949
Age 35	-.71193691	.05054532	-14.085121
Age 36	-.64913572	.05010278	-12.956083

A.1 Logit results – *Continued from previous page*

	Coefficient	SE	t-stat
Age 37	-.5950899	.04984145	-11.939658
Age 38	-.55122948	.04950463	-11.134907
Age 39	-.43114076	.04790064	-9.0007312
Age 40	-.36263031	.04704361	-7.7083866
Age 41	-.28998817	.04602845	-6.3001947
Age 42	-.20540018	.04484019	-4.5807157
Age 43	-.16619236	.04431328	-3.7503959
Age 44	-.10083681	.04355358	-2.3152357
Age 45	-.01295133	.04246701	-.30497396
Age 46	.04794895	.04192119	1.143788
Age 47	.11649358	.04129042	2.8213221
Age 48	.1678171	.0407078	4.12248
Age 49	.22191555	.04014893	5.527309
Age 50	.2607717	.03967556	6.5726032
Age 51	.2719302	.0394738	6.8888788
Age 52	.31459705	.03900491	8.0655757
Age 53	.29628285	.03943646	7.5129174
Age 54	.30324728	.03998376	7.5842608
Age 55	.30992806	.04080823	7.5947444
Age 56	.24471886	.04309405	5.6787154
Age 57	.22637675	.04451159	5.0857934
Age 58	.15127026	.04650967	3.2524472
Log previous wage inc.	2.3558405	3.7180784	.63361778
Log previous business inc.	-2.3199333	4.5414531	-.51083502
Log previous capital inc.	-.39078764	.39739158	-.98338177
One child	-.04786599	.01817087	-2.6342157
Two children	-.08957406	.02022306	-4.4293023
Three children	-.1293405	.02792339	-4.6319768
Four or more children	-.20246249	.05520062	-3.6677574
Square log wage inc.	-.30485163	1.0490815	-.29058908
Square log capital inc.	.14617405	.10590098	1.3802898
Square log financial w.	.00524918	.20501356	.02560409
Square log debt	-.16538261	.32108827	-.515069
Square log housing w	4.2173968	.3627762	11.62534
Square log business inc	-.07200087	1.7262135	-.04171029
Square log previous wage inc.	-1.1688629	1.8589386	-.62877971
Square log previous business inc.	1.1594082	2.2707638	.51058069
Square log previous capital inc.	.20952808	.1982205	1.0570454

A.1 Logit results – *Continued from previous page*

	Coefficient	SE	t-stat
Region 1	-.25198958	.06226014	-4.0473661
Region 2	.17765505	.05703015	3.1151076
Region 3	.18050741	.05726696	3.1520341
Region 4	.29384768	.06168223	4.7638948
Region 5	.09752066	.06272029	1.5548503
Region 6	.33599069	.05947198	5.6495633
Region 7	.63661201	.05913027	10.766263
Region 8	.28125792	.06226347	4.5172219
Region 9	.18457957	.06724905	2.7447165
Region 10	.43740846	.06191843	7.0642689
Region 11	.33362136	.05768527	5.7834756
Region 12	-.10086192	.05833076	-1.7291379
Region 13	.15100341	.06825433	2.2123636
Region 14	-.14879022	.06168756	-2.4119971
Region 15	-.15841103	.06117867	-2.5893179
Region 16	.07553585	.06652446	1.1354598
Region 17	-.01411953	.06174821	-.22866302
Region 18	.44699359	.06229806	7.175081
Constant	-5.4712723	.13318904	-41.078997
Matches		143,000	

Parameters represent the weighted results of logit estimation, weighted by the numbers of matches each year. Weights: .228, .220, .209, .182, .161.
[1]The variable Age 18 fully predicts failure in one year. Matches/weights: 119,931/.271, .262, .249, .217, 0

A.2 t-tests of differences between characteristics of recipients and non-recipients

	Inheritors (mean)	Non-inheritors (mean)	t-stat
Log wage income	11.61	11.61	.0768
Log capital income	6.638	6.638	-.0011
Log financial wealth	9.828	9.829	-.0089
Log debt	8.354	8.339	-.3035
Log housing wealth	5.518	5.499	-.3867
Log business income	.6716	.6735	.0661
Male	.4596	.4603	.1679
Housh. size	1.773	1.773	.1266
Male*Housh. size	.8164	.8177	.1667
Wage equals zero	.0450	.0447	-.2125
High school	.4801	.4823	.5252
University	.3161	.3151	-.2448
High school father	.3079	.3067	-.3154
High school mother	.2987	.2993	.1184
University father	.1027	.1023	-.1818
University mother	.0598	.0593	-.2946
Age	44.85	44.86	.0545
Log previous wage inc.	13.44	13.44	.0939
Log previous business inc.	1.478	1.481	.0594
Log previous capital inc.	8.384	8.384	.0069
Number of children	.7727	.7637	-1.0470
Matches		143,000	

The weighted values of observable characteristics for inheritors and non-inheritors, as well as the t-statistic of a mean equality test, weighted by the numbers of matches each year. Weights: .228, .220, .209, .182, .161.

A.3 Effect of inheritance on intensive margin hours of work

	All inheritances		Above mean inheritances[1]	
	Est.	SE	Est.	SE
6 years before	-.2819	.1518	-.2787	.2167
5 years before	-.0554	.1010	-.2369	.1490
4 years before	-.0136	.0804	-.0789	.1185
3 years before[2]	.0012	.0666	-.0727	.1016
2 years before	-.0500	.0666	-.0761	.1021
1 year before	-.1097	.0669	-.0331	.1026
Year of receipt	-.1098	.0664	-.0950	.1036
1 year after	-.1596	.0668	-.1689	.1042
2 years after	-.0914	.0655	-.0192	.1030
3 years after	-.1130	.0736	.0293	.1169
4 years after	-.1572	.0895	-.0337	.1449
5 years after	-.1595	.1261	-.1135	.2054
No of matches[3]	26,312		10,303	

[1] Inheritances larger than 300,000 NOK ($1=7.55 NOK).

[2] Year of matching.

[3] Maximum number of matches, i.e. from the year of matching until one year after receipt.

* $p < 0.05$ ** $p < 0.01$