Discussion Papers
Statistics Norway
Research department

No. 853
December2016

Statistics Norway
Statistisk sentralbyrå

Erlend E. Bø, Elin Halvorsen and Thor O. Thoresen

Heterogeneity of the Carnegie Effect

Discussion Papers No. 853, December 2016
Statistics Norway, Research Department

Erlend E. Bø, Elin Halvorsen and
Thor O. Thoresen

Heterogeneity of the Carnegie Effect

Abstract:
The Carnegie effect (Holtz-Eakin, Joualfaian and Rosen, 1993) refers to the idea that inherited wealth harms recipient's 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 covering the entire Norwegian population, which makes it possible to undertake a detailed examination of the Carnegie effect, including how it varies across groups of recipients. The estimation results show significant reductions in labor supply for recipients of large inheritances, in the range from 7 to 10 percent in the first six years after the transfer. Moreover, we find that the Carnegie effects differ according to the size of the transfer, the age of the recipients, the recipient's eligibility to other transfer programs, and the existence of new heirs in the family chain.

Keywords: inheritance, labor supply, heterogeneous responses

JEL classification: D10, D80, D91, J22

Acknowledgements: We thank Timm Bönke, Oscar Erixson, Laurence Jacquet, Claus Kreiner and seminar participants of the UCFS Workshop in Public Economics (Uppsala, May, 2012), the 68th IIPF conference (Dresden, August, 2012), Oslo Fiscal Studies' Workshop on Taxation of Inheritance and Wealth (Oslo, March, 2013) and THEMA seminar series (University of Cergy-Pontoise, March, 2015) for comments to earlier versions of the paper. This work has been supported by the Norwegian Research Council (grant no 217423).

Address: Erlend E. Bø, Statistics Norway, Research Department. E-mail: erlend.bo@ssb.no

Elin Halvorsen, Statistics Norway, Research Department. E-mail: elin.halvorsen@ssb.no

Thor O. Thoresen, Statistics Norway, Research Department,Fiscal Studies (Department of Economics, University of Oslo) and CESifo (Munich), e-mail address: thor.olav.thoresen@ssb.no

Discussion Papers	comprise research papers intended for international journals or books. A preprint of a Discussion Paper may be longer and more elaborate than a standard journal article, as it may include intermediate calculations and background material etc.

Abstracts with downloadable Discussion Papers
in PDF are available on the Internet:
http://www.ssb.no/en/forskning/discussion-papers
http://ideas.repec.org/s/ssb/dispap.html

ISSN 1892-753X (electronic)

Sammendrag

Den store industrimagnaten Andrew Carnegie (1835-1919) mente at barn ikke hadde godt av å arve formue fordi det ville undergrave deres vilje til å arbeide. I denne studien undersøker vi om den såkalte Carnegie-effekten, altså at arv fører til redusert arbeidsinnsats, er av stor betydning i Norge. Videre undersøker vi om det er en midlertidig eller en varig effekt, og hvordan responsen varierer mellom husholdningstyper. Vi finner en signifikant reduksjon i arbeidsinntekten til personer som arver mer enn en gjennomsnittlig stor arv, på om lag 7 til 10 prosent. Effekten er størst i de første to til tre årene etter arven, men også så lenge som seks år etter er det en signifikant negativ effekt. Unge arvemottakere og mottakere nær pensjonsalder reduserer arbeidstilbudet mest, og enslige mer enn gifte med små barn. Vi har en hypotese om at arvinger som selv har livsarvinger har en lavere tilbøyelighet til å bruke arven på seg selv enn arvinger uten egne livsarvinger, altså at man føler et ansvar for å videreføre ressursene til neste generasjon. Derfor ser vi spesielt på om arvemottakere uten egne livsarvinger er mer tilbøyelige til å bruke arven på seg selv, i form av mer fritid og mindre arbeid. Vi finner at dette stemmer. Å skattlegge arven reduserer Carnegie-effekten, og øker dermed arbeidstilbudet. Resultatene har også implikasjoner for hvordan arveavgiftssystemet bør utformes. Både progressive satser og lavere sats for livsarvinger støttes av våre resultater.

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 received 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 transfers 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 a fiscal externality cost due to loss of tax revenue. Knowledge about the heterogeneity of the response is important in this perspective. For example, the variation in supply responses with respect to the size of the transfer may be accounted for in the design of a possible inheritance tax schedule, i.e., in terms of progressivity in tax rates. Further, how the Carnegie effect works with respect to age and early retirement schemes is relevant for policy. The large oil windfall in Norway, which may both increase demand for labor and reduce labor supply (Van der Ploeg, 2011), combined with demographical challenges, makes it vital to uphold the labor market participation. If bequests are extensively used to shorten working careers, one may decide to tax the transfer, and the heterogeneity of the Carnegie affect may provide guidance on how this can be done.In any discussion of the economic implications of the Carnegie effect it is thus useful 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).

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

[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.

Carnegie estimates are found in the literature; exceptions are Holtz-Eakin et al. (1993), Joulfaian and Wilhelm (1994), Joulfaian (2006), 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.

This study contributes to the knowledge about short term Carnegie effects by exploiting exceptional Norwegian register-based administrative data. 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. As we have access to a large panel data set for the years 1997 to 2010, 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: inheritor's wage 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 inheritor's behavior $1-6$ years prior to transfers, when no behavioral differences between recipients and non-recipients are expected.

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 are uncertainty about both the timing and the 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 sizable literature of life cycle models, where contemporaneous income are allowed to 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 effort after the transfer. One obvious reduction in labor supply may come from children's mourning following the death of a parent. Though we would expect grief to add to the responses in the very short run, it is unlikely to be an important aspect in a longer time perspective. In addition, we may expect to see a reduction in work prior to inheriting because of the care of an ailing parent prior to death.

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 idiosyncrasies of intergenerational transfers are further explored in the following with reference to the heterogeneity of the Carnegie effect.[3]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

[3]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 and arrive at estimates close to -0.3.

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 particularly 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.[4]

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 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, according to the exchange model perspective, intergenerational transfers are devices 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 Laferrère (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.

[4]In Norway, all residents are members of the National Insurance Scheme, so there are no incentives to hold on to a job because of employer-provided health insurance.

[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.

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 data sets 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 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 received 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 wage income, early retirement and working hours (on the intensive margin) are discussed, utilizing

that information from various administrative registers can be linked by 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 the 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] Savings accounts and housing wealth constitute the two largest components of the average inheritance.[8] 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 statistics (Statistics Norway, 2006) provides data for weekly hours of work for a sub-sample of the population.[9]

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 counter-factual 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 in the range from 2000 to 2004 for the observations in the data set.[10]

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,[11] which means that a person inheriting in 2000 is observed for three "before transfer" years (data for 1997, 1998 and 1999) and in 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

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

[8]Life insurance is included in the inheritance with its cash value. Transfers to trusts is considered as a non-family transfer, since it is forbidden by law to set up a trust that benefits one's own family.

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

[10]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.

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

scattered over the thirteen year period: the transfer year plus six years before and six years after the transfer. There are no reasons to expect macroeconomic condition to have had any substantial effects on results, as the period under consideration is characterized by a large degree of stability. Even though the financial crisis of 2008−2009 affected the Norwegian economy too, effects were much smaller than seen in other countries (Berg and Eitrheim, 2013).

In Norway, during the period we are studying here, it is unlikely that any reduction in wage income should stem from a reduction in wage rates. Thus, we interpret reductions in wage income as generated by adjustments in hours of work, at the extensive and/or the intensive margin. As we will return to soon, the identification technique is based on letting non-recipients represent the counter-factual outcome. 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 children of school age and old age pensioners)[12] and exclude individuals not observed in all years, except those who enter or exit the sample due to age. As wage income is used as the main indicator of behavioral response (some evidence on working hours and early retirement is presented too), the study is restricted to responses of wage earners. Limiting the study to wage earners means that we exclude persons who are self-employed prior to inheriting.[13] However, we acknowledge that receiving an inheritance could prompt a switch from wage earning to self-employment, also noting that transfer of firms to the next generation are examples of bequests coming with strings attached. Later, in Section 6.3, we explore the possibility that some wage earners may have used the inheritance as a basis for setting up own business, i.e., becoming self-employed after inheriting, and to what extent this explains outcomes. Individuals with zero income in the whole period leading up to the period of inheritance are also excluded.[14] 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.

[12]Note that the effect on early retirement is one of the outcomes we are interested in. The formal retirement age in Norway is 67.

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

[14]Five percent of the observations are excluded due to self-employment, mostly men. An additional five percent are excluded due to zero wage income. These are mainly people on social security benefits, along with a few students. Although we exclude observations with zero income prior to inheriting, we allow for zero wage income after inheriting.

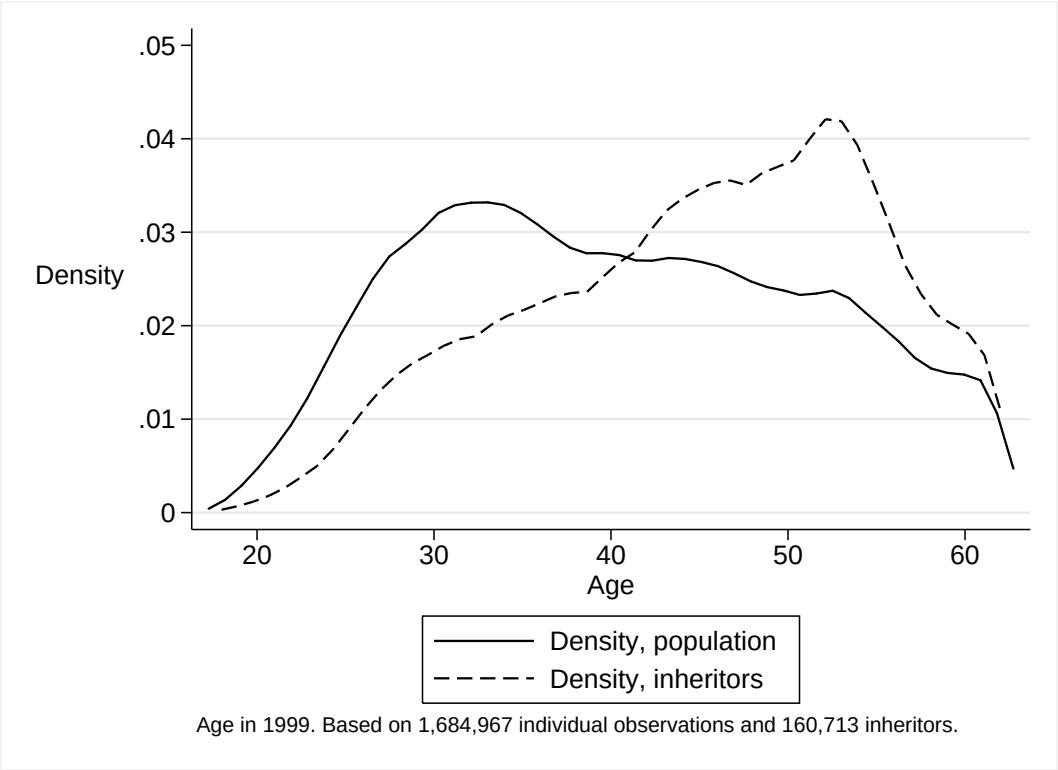


Figure 1. Population densities and inheritance

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 heirs and spouses are defined as recipients.[15] As we have the information about who is the direct recipient, we will later (in Section 5) look at whether the effect of inheritance receipt differs between the direct recipient and the spouse. Persons who live in a multiple-person household, but are classified as singles, are excluded from the data set.[16] Note also that all income and wealth variables are log transformed.[17]

[15]We assign the full inheritance sum to both the recipient and the spouse. As matching is not dependent on the sum of inheritance, dividing the transfer between the spouses would not matter. The composition of the "large inheritance" sample would however be somewhat affected.

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

[17]All log transformations are done using the value of the variable plus one, to avoid log(0).

Table 1. Descriptive statistics, initial and matched samples

	Initial sample			Matched sample			
	Non-inheritors	Inheritors	Inheritors, large sums[1]	Inheritors	Control group	Inheritors, large sums[1]	Control group
Mean values[2]							
Age	40.0	45.0	45.4	45.1	45.1	45.6	45.5
Wage income	218	240	257	237	237	253	253
Capital income	16	22	30	20	24	25	30
Business income	3.3	4.0	4.0	4.3	4.3	4.4	4.2
Financial wealth	140	222	283	187	198	239	255
Housing wealth	89	107	117	106	105	115	113
Debt	304	290	309	272	273	288	290
Male	.481	.476	.482	.459	.458	.464	.463
No of adults	1.62	1.77	1.76	1.78	1.77	1.77	1.77
No of children	.823	.758	.768	.770	.760	.777	.775
High school	.471	.480	.465	.482	.481	.470	.472
University	.278	.323	.377	.317	.319	.370	.369
High school father	.337	.307	.330	.304	.304	.329	.332
High school mother	.322	.300	.329	.295	.295	.324	.324
University father	.100	.104	.131	.100	.100	.127	.126
University mother	.061	.061	.073	.058	.057	.070	.068
Preceding labor inc[3]	1,039	1,218	1,311	1,204	1,199	1,291	1,282
Preceding capital inc[3]	52	85	119	72	81	99	108
Preceding business inc[3]	28	36	37	38	37	40	38
Inheritance[4]							
Mean	.	318	669	315	.	662	.
Standard deviation	.	491	678	467	.	633	.
Median	.	199	496	198	.	494	.
No of persons[5]	1,524,254	160,713	58,307	141,726	141,766	51,207	51,250

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

[2] Measured in 1999, before all transfers. All income and wealth variables measured in 1000s 1998 NOK.

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

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

[5] Not all persons in the matched sample are in the 1999 data set, which explains differences in the number of observations.

Table 2. Descriptive statistics, sub-sample defined by hours of work information

	Hours of work sample		Matched sample	
	Non-inheritors	Inheritors	Inheritors	Control group
Mean values[1]				
Age	42.2	45.8	45.7	45.8
Weekly hours of work	33.3	33.4	33.2	33.2
Wage income	261	268	265	266
Capital income	6.5	7.8	6.7	7.2
Business income	1.9	2.7	3.0	3.0
Financial wealth	97	132	112	114
Housing wealth	101	109	106	108
Debt	296	259	250	251
Male	.403	.397	.379	.387
No of adults	1.71	1.82	1.82	1.81
No of children	.931	.854	.859	.844
High school	.412	.401	.405	.409
University	.459	.496	.490	.487
High school father	.355	.332	.335	.332
High school mother	.348	.327	.330	.331
University father	.113	.117	.115	.116
University mother	.067	.070	.068	.066
Preceding labor inc[2]	1,258	1,347	1,328	1,332
Preceding capital inc[2]	24	32	29	32
Preceding business inc[2]	14	20	21	20
Inheritance[3]				
Mean	.	321	327	.
Standard deviation	.	466	389	.
Median	.	208	217	.
No of persons	276,152	37,274	26,112	26,106

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

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

[3] Transfers received in the period 2000—2004.

[4] Not all persons in the matched sample are in the 1999 data set, which explains differences in the number of observations.

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.[18] 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. Further, the differences are not coming from deviations in age only: for example, 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.[19]

From the National Educational Register we have information about parents' level of education, but the data does not contain information about parental age. However, there is a close connection between recipients' age and parents' age at the time of their death. Bequests from parents in Norway are normally left by the last surviving spouse, so if one parent dies early, this will not affect the timing of inheritance. Of course, some inheritances may originate from other relatives. In our data, about 75 percent of the inheritances are from parents to children. For the remaining transfers, it is not possible to distinguish between different donors, such as grandparents, siblings, etc.

Note also that for the sub-sample for which we have observations on working hours (Table 2), the differences between non-inheritors and inheritors are smaller (in particular for wage income), probably due to the requirement, in the establishment of this data set, that all persons work continuously throughout the whole period. This data set includes all public sector employees, but covers only parts of the private sector. Characteristics of public sector employees give a higher share of females and a higher education level in the "working hours sample", compared to the general sample.

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) for the year 1999. The figure confirms that the population of inheritors is not representative of the general population. Because of the natural timing of bequests, inheritors are on average older that the rest of the population, which will result in higher observed pre-inheritance wage income

[18] 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.

[19] Also, the fact that wage income increases with the inheritance size differs from the Swedish sample studied by Elinder et al. (2012), where high transfers are correlated with low wage income.

and wealth in this group. On average the recipients are 45 years old in 1999, which means that they are 46−50 years old at the time of inheriting. In addition, the age distribution of inheritors peaks at around age 55, whereas for the general population, between 18 and 66 years old, the peak is at age 35. In the next subsection we discuss how to obtain unbiased estimates of the Carnegie effect, given that recipients belong to a selected group, and given that we use the non-recipients to describe counter-factual 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), refraining from using information on non-recipients. However, results are then in danger of being confounded by unobserved time effects, and it is challenging to disentangle the Carnegie effect from other life cycle adjustments. When employing observations of non-recipients, there exist various methods to handle the co-variate differences just described. We use matching to improve the balance between the data sets of recipients and non-recipients. Matching techniques hold the promise of including the co-variates in a more flexible way than standard parametric regression methods, as regressions may be vulnerable to the curse-of-dimensionality problem, see for example Imbens (2004), Blundell and Dias (2009), Imbens and Wooldridge (2009) and Huber et al. (2013). In addition, we also combine matching with regression analysis in some parts of the analysis.

In the identification of the Carnegie effects we exploit that there are many households who have characteristics and a predicted probability of inheriting close to the households actually receiving transfers. Therefore we use variables such as age, education, previous wage income and wealth to construct the propensity score (Rosenbaum and Rubin, 1983), i.e., the estimated probability that a person receives an inheritance given the values of all 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 mis-specification, compared to results of standard methods, such as linear regression (Huber et al., 2013).

Using the treatment terminology, and noting that we use nearest-neighbor matching, the Carnegie effect (CE), α^{CE}, can be seen as an estimate of the average treatment effect on the treated,[20]

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

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

Thus, outcome for individual i after inheriting, Y_i^1, compared to the outcome without inheritance, Y_i^0, is empirically addressed by letting person j representing the no-inheritance situation for individual i. In other words, the identification relies on the matched individuals providing the counter-factual outcome of not receiving bequests. In the main specification we use nearest-neighbor matching, which means finding one match for each recipient; no weights are involved and the number of recipients dictates the number of matches, N^R. As discussed by Dehejia and Wahba (2002) and Caliendo and Kopeinig (2008), the number of observations matched to each treated observation is a trade-off between bias and precision. Using more matches, the average difference in propensity score between treated and non-treated observations increase, as each subsequent match is further away from the treated observation. At the same time, as more matches allow for more information to be used, precision increases. With a very large number of treated and control observations, we think precision is a less pressing concern than bias. Nonetheless, we have also used a specification where each treated observation is matched with three controls, and the results of this alternative matching methodology will be referred to in Section 4.[21]

The two main identification assumptions in matching are un-confoundedness and overlap (or common support) (Imbens, 2004). The assumption of un-confoundedness means that, conditional on the propensity score, the potential outcomes are independent of treatment. 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 un-confoundedness assumption holds. The matching is done three years before the receipt of inheritance, in order to avoid possible anticipatory effects (people adjusting to the transfer in advance). Matching is done with replacement, and within years (or equivalently, there is exact matching on years) to avoid time effects affecting outcomes.[22] The non-recipients are defined by not having inherited in the period used for observing inheritances (1998−2006). This means that they may have already inherited, or may inherit in the period after 2006. The possibility of later transfers may introduce a downward bias to our estimates of Carnegie effects.[23]

[21] As an additional robustness check, we also use an inverse probability weighting estimator (Hirano et al., 2003).

[22] There is a large number of control persons available for comparison within each year. We also impose a caliper of 0.00001, to assure that no matches are too different.

[23] Note that in Section 6 we estimate the effects on a sample conditioned on the control group

Given the outcomes we investigate, pre-inheritance wage income 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 co-variates 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 the propensity score, and looked at the balance of co-variates within the groups.

The preferred specification uses a logit procedure,[24] with the following explanatory variables: log of wage, capital and business income; log of financial wealth, housing wealth, vacation housing wealth and debt; log aggregated wage, capital and business income for a period before the matching year (from 1993 to the year before matching); log square terms for the previous variables; age dummies; gender; a dummy for marriage/cohabitation; an interacted term of gender and marriage; and dummies for high school and university education (for the person as well as for the person's father and mother). 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 data set over the dimensions included in the model. Descriptive statistics of the matched samples of inheritors and non-inheritors are presented in Table 1 and Table 2.

As the present study discusses 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, 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.[25] Given that we believe we have

having parents alive over the whole period, and recipients inheriting their last living parent.

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

[25]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 co-variate imbalances, using supplementary regression analysis to 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), in which case one may use a weighted regression, where the comparison units are weighted by the

obtained a balanced matched data set, 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.[26]

4 Size and non-linearity of the Carnegie effect

First, we establish to what extent an overall Carnegie effect can be found, and in case it is, how it varies over time and with respect to the size of the transfer. 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 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 wage income of receiving an inheritance by reporting average differences in log wage income between recipients and non-recipients over the thirteen year time period: six years before and six years after the transfer year.[27] Recall that outcome estimates are based on separate estimation for each period on all matched pairs.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 wage income 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). When looking at results for "all inheritances", there seem 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 year.[28] The point estimates suggest that the inheritors reduce their income by approximately 2 percent two years after the transfer. However, none of the estimates are statistically significant.

Table 1 shows that mean inheritance is approximately 30 percent higher than

number of times that they are matched to the treated unit. Since we have access to very large data sets, with ample possibilities of finding suitable matches, regression adjustment in matching is not employed here.

[26]This setup is similar to Djebbari and Smith (2008), although they also control for idiosyncratic heterogeneity. Another difference is that our estimations involve a full interaction of all co-variates.

[27]Remember that the matching is based on individual characteristics three years before the transfer.

[28]We do not know at what time of the year the inheritance is received. For those inheriting in e.g., December, it seems reasonable that the adjustment process lasts well into year one.

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

	All inheritances		Above mean inheritances[1]	
	Est.	SE	Est.	SE
6 years before	-.0069	.0164	.0083	.0247
5 years before	-.0073	.0129	-.0009	.0200
4 years before	-.0055	.0111	.0026	.0176
3 years before[2]	.0025	.0100	.0015	.0162
2 years before	.0155	.0103	.0071	.0166
1 year before	.0169	.0109	.0053	.0176
Year of receipt	-.0050	.0117	-.0266	.0190
1 year after	-.0111	.0127	-.0845**	.0205
2 years after	-.0163	.0134	-.1007**	.0219
3 years after	-.0034	.0143	-.0911**	.0232
4 years after	-.0006	.0153	-.0748**	.0249
5 years after	.0014	.0163	-.0806**	.0266
6 years after	.0149	.0173	-.0705*	.0283
No of matches[3]	142,882		51,597	

[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.
* $p < 0.05$ ** $p < 0.01$

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 wage 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 will have small or no effect on labor supply. Table 3 presents separate estimates for inheritances above 300,000 NOK (roughly the mean inheritance).[29] 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 10 percent two year after inheriting. In the following years, the effect seems to diminish somewhat, though it is still 7—8 percent five and six years after the transfer.[30]

[29] As the matching is done separately for each subgroup, recipients of large inheritances are matched with persons based on a participation model with different parameter values than the one used for all recipients.

[30] In Table 3, standard errors are those calculated by default by psmatch2 (Leuven and Sianesi,

Since the estimated effects are small for recipients of small transfers, one could alternatively let these recipients enter into the control group, and compare them to those who get large inheritances. This procedure would be similar to the framework of e.g., Holtz-Eakin et al. (1993) and Elinder et al. (2012), where identification is based on the size of the transfer. When doing this, we find (as expected) lower estimates, in particular in the first years after inheriting, with an estimated response of minus 3 percent in the first year, approximately minus 5 percent in the subsequent second, third and fourth years, before rising to minus 7−8 percent in the fifth and sixth years.

Figure 2 provides a graphical representation of the results in Table 3.[31] Results using a specification with three-nearest neighbor matching are presented in Appendix B, Figure B.1, showing that results are very similar to the results of Table 3 (as already denoted, the standard errors are somewhat smaller). In Appendix B (Figure B.2) we also show estimations results when employing an inverse probability weighting (IPW) estimator (Hirano et al., 2003), for all inheritances and for large inheritances, respectively. This method implies that all observations are used in a regression, which is weighted by the inverse of the estimated propensity score. The propensity score is estimated using the same variables as in our matching models. The IPW estimation results are close to estimates derived by the main matching specification, although the effects for large inheritances are somewhat smaller: the maximum effect is around 7 percent. It is also worth noting that the standard errors in the later years are larger.[32]

Table 4 shows a further split of responses by the size of the inheritance, and confirms that the effect on labor supply in increasing in the size of the transfer. Instead of matching separately by each subgroup, we here estimate an OLS on the matched sample for all recipients, with a dummy specification for each of the quantiles 0-p50, p50-p75, p75-p90, p90-p95, and above p95, and for each year separately. Despite smaller coefficients and less statistical significance, the overall pattern of a post-inheritance decline in wage income is found for inheritance above

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 in the differences.

[31]We have also obtained estimation results for the same specification when using matching without replacement. Effects for the "large inheritance" dataset are somewhat smaller, but we basically see the same pattern as in Table 3.

[32]When using the matching estimator, only matches where both control and observation are present in data are used, which excludes some observations in later years. The use of the IPW estimator implies that all available observations are included, and data sets may thus be unbalanced toward the end of the estimation period.

Table 4. Effect of inheritance on wage income, by size of inheritance[1]

	Size of inheritance				
	0-p50	p50-p75	p75-p90	p90-p95	p95+
6 years before	-.016	-.013	.007	.049	.082
5 years before	-.011	-.013	.032	.027	.052
4 years before	-.015	.008	.030	.038	-.004
3 years before[2]	-.005	.010	.021	.027	.012
2 years before	.004	.040	.037	.001	.031
1 year before	.014	.034	.032	.010	.014
Year of receipt	.003	.003	.008	-.005	-.064
1 year after	.018	-.011	-.026	-.034	-.118**
2 years after	.032	-.027	-.031	-.050*	-.173**
3 years after	.040	-.020	-.014	-.056*	-.200**
4 years after	.039	-.020	-.003	-.053*	-.187**
5 years after	.048*	-.020	.005	-.068*	-.192**
6 years after	.059**	-.030	.020	-.060*	-.162**
Inheritance/wage income					
Mean	1.5	5.1	7.0	11.1	26.3
Median	0.3	1.2	2.0	3.1	5.2

[1] Yearly OLS on the matched sample for all inheritances with a dummy for each of the quantiles 0-p50, p50-p75, p75-p90, p90-p95, and p95+.
[2] Year of matching.
* $p < 0.05$ ** $p < 0.01$

the median. To illustrate the relative importance of inheritance with respect to income, in the lower part of the table, we report the mean and median inheritance in relation to income across groups.[33]

To illustrate the economic implications of the Carnegie effects that we find, we use the (significant) estimates for the large transfers, see Table 3. We use the estimated average reduction in income, 8.5 percent, to calculate the corresponding decrease in yearly working hours, and then use figures for how many who receive large inheritances to obtain an estimated loss in working hours. Based on a measure for the average labor supply of Norwegians in 2004, the income reduction corresponds to a reduction of 130 hours of work per recipients of large transfers, which in turn means that approximately 800 man-years are withdrawn from the labor market in one year. When also accounting for the effect lasting for six years and aligning to national figures (for one year), our results correspond to the labor supply being 0.24 percent higher if there was no Carnegie effect, i.e., as obtained if the government

[33]Although intuitively appealing, studying income responses to inheritance weighted by income gives interpretational difficulties, as income is the dependent variable and the variable inheritance over income is (strongly) negatively correlated with income levels.

confiscated all transfers.

Given this estimate of aggregate Carnegie effects on working hours, one may speculate on to what extent the recent abolishment of the Norwegian inheritance tax (in 2014) has influenced labor supply. In the period under consideration, the Norwegian inheritance schedule implied that transfers were taxed progressively, by 20 percent at the maximum, above 550,000 NOK.[34] Simple calculations based on the average large transfer, reported in Table 1, suggest that recipients on average received 800,000 NOK before tax, and paid approximately 135,000 NOK in taxes. We may approach the effect of the tax relief following a hypothetical elimination of the inheritance tax in 2004 by uprating the estimates of Table 3 linearly by the increase in income. For example, in terms of effects on tax revenue, the loss working through less income taxation corresponds to an additional 4 percent reduction in the revenue, when the direct loss from the abolition of the scheme is 1.7 billion NOK.[35]

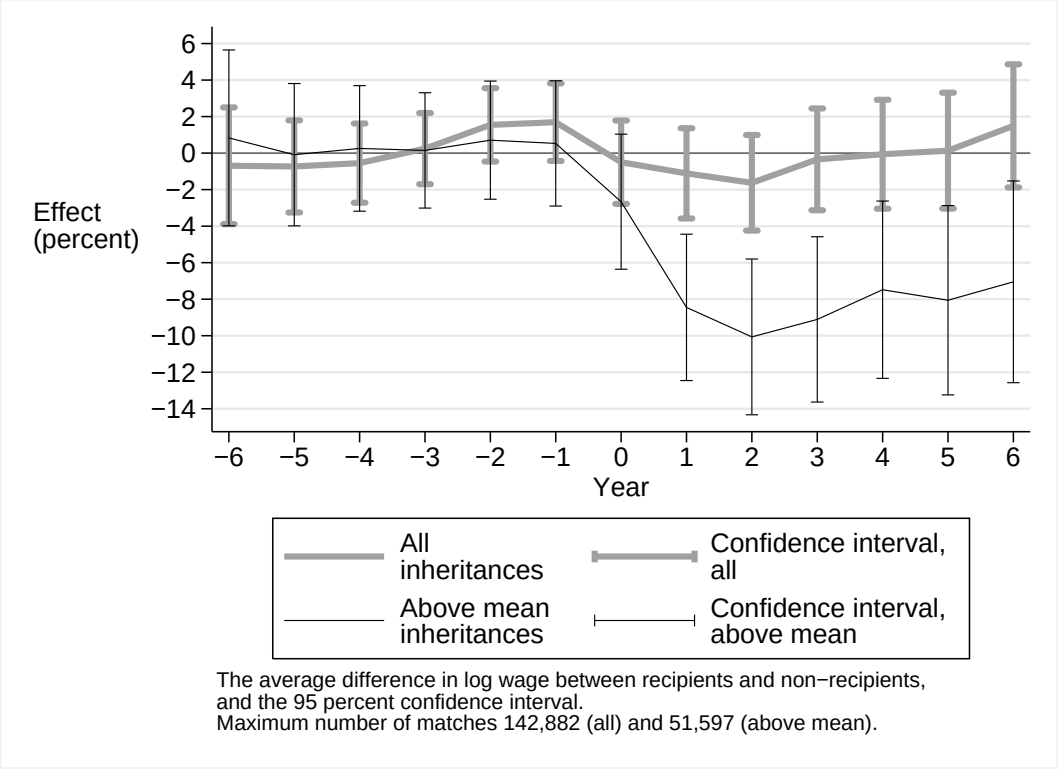


Figure 2. Effect of inheritance on wage income

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

[34]For children and grandchildren. The top rate was 30 percent for recipients not in a direct line of the deceased.

[35]However, note that this calculation only accounts for effects working through recipients of large transfers.

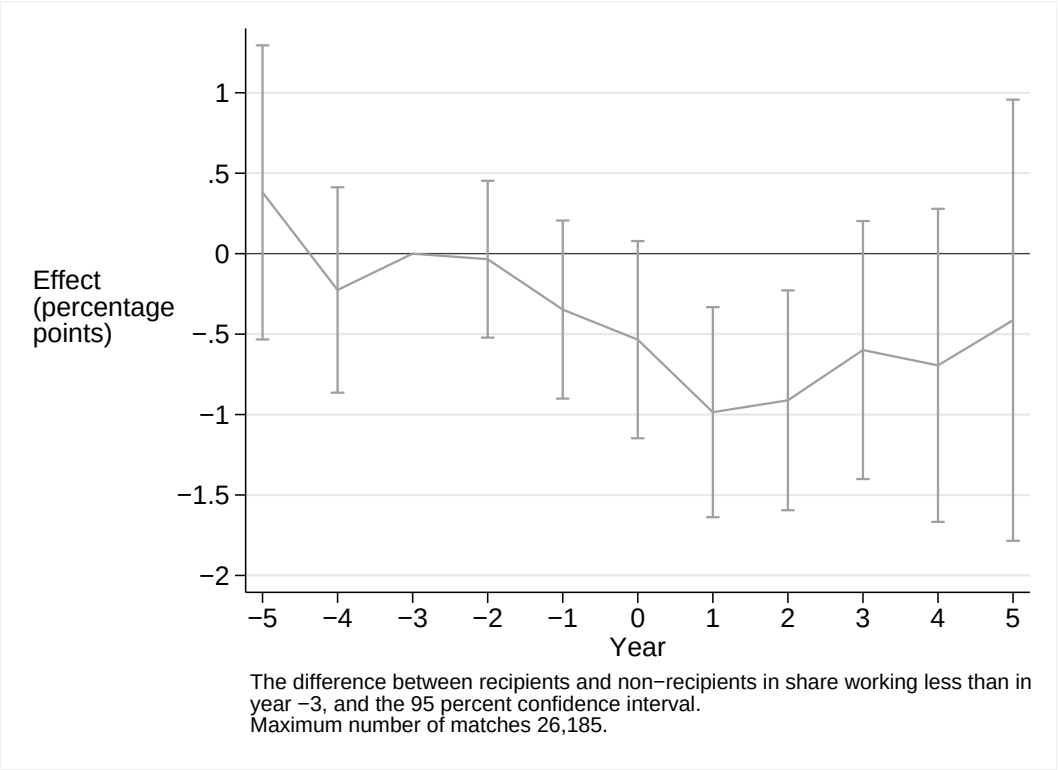


Figure 3. Effect of inheritance on the probability of reducing working hours. Sub-sample with information about working hours

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. Recall from Section 3 that that individuals in this sample need to be employed over the whole observation period, and that we only have information about contractual working. 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 B.1 in the Appendix). We therefore use a somewhat modified empirical strategy, defining the outcome by a dummy indicator, which takes the value 0 if working hours are reduced from their level in the year of matching and 1 if hours of work are similar or higher. The matching procedure is the same as previously used. The results are presented in Figure 3, 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 nearest to the transfer.

Our Carnegie effect results, although using another method for identification, are qualitatively similar to results in Joulfaian and Wilhelm (1994), in finding small

change in working hours, and somewhat larger changes in wage income. We also confirm the result from Holtz-Eakin et al. (1993) that large inheritances lead to stronger 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.

5 Further response heterogeneity

So far, we have split the initial sample into recipients with an inheritance smaller than the mean inheritance (smaller than 300,000 NOK) and recipients with above mean inheritance. 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, as discussed in 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 co-variates: gender, marital status, dependent children[36], 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.

Note that the specification includes direct effects of all additional co-variates and all possible interactions between the co-variates. 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 average marginal effect of inheritance on wage income for each subgroup. The marginal effect is the difference in the predicted margins of log wage income for those who inherit compared to those who do not inherit within each group; for example, for female recipients compared to female non-recipients. Table 5 shows these marginal effects by age, existence of heirs, gender, marital status, dependents and level of education, together with the benchmark - the overall marginal effect of inheritance (reported in the first column of Table 5).

Carnegie effects for four age groups are reported in Table 5. 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 5 confirms that responses vary

[36]Dependent children are defined as children younger than 19 years old and living at home. Direct heirs, or offspring, is a wider definition, as it also includes grown children not living at home.

Table 5. Marginal effects[1] of inheritance on wage income. Sub-sample conditioned on larger bequests[2]

		Age in the year of inheritance				Direct heirs	
	Overall	Age 21-42	Age 43-49	Age 50-55	Age 56-60	No	Yes
6 years before	-.003	-.018	.015	-.037	.013	-.102	.006
5 years before	-.016	-.035	-.016	-.056	.014	-.117	-.006
4 years before	-.014	-.099	-.009	-.052	.044	-.104	-.004
3 years before	-.012	-.090**	-.031	-.025	.043	-.096	-.003
2 years before	-.006	-.062	-.026	-.022	.041	-.109*	.004
1 year before	-.007	-.052	-.026	-.006	.024	-.173**	.011
Year of receipt	-.038*	-.153**	-.050	-.028	.017	-.230**	-.017
1 year after	-.095**	-.212**	-.089*	-.078	-.051	-.294**	-.072**
2 years after	-.108**	-.192**	-.035	-.118**	-.101**	-.290**	-.088**
3 years after	-.099**	-.151**	-.062	-.104**	-.090**	-.299**	-.077**
4 years after	-.087**	-.122*	-.034	-.088	-.098**	-.225**	-.071**
5 years after	-.096**	-.144**	.024	-.095	-.143**	-.159*	-.089**
6 years after	-.082**	-.162**	.060	-.075	-.130**	-.170*	-.072**

	Gender		Marital status		Dep. child(ren)		Educational level	
	Male	Female	Couple	Single	No	Yes	High school	College /Univ.
6 years before	.019	-.022	.004	-.033	-.016	.019	-.012	.010
5 years before	.001	-.032	-.028	.024	-.024	-.004	-.017	-.016
4 years before	.011	-.036	-.014	-.014	.002	-.041	.003	-.043
3 years before	-.001	-.022	.002	-.063	-.005	-.024	.014	-.057*
2 years before	.009	-.020	.001	-.036	.002	-.020	.010	-.035
1 year before	-.008	-.006	.002	-.042	.000	-.019	.022	-.056*
Year of receipt	-.023	-.051*	-.022	-.094**	-.010	-.083**	-.014	-.078**
1 year after	-.080**	-.107**	-.065**	-.196**	-.080**	-.119**	-.082**	-.116**
2 years after	-.091**	-.123**	-.078**	-.213**	-.110**	-.106**	-.092**	-.135**
3 years after	-.093**	-.104**	-.070**	-.202**	-.105**	-.090**	-.088**	-.118**
4 years after	-.097**	-.078**	-.058*	-.188**	-.098**	-.070	-.073**	-.110**
5 years after	-.084*	-.106**	-.062*	-.216**	-.125**	-.053	-.112**	-.071
6 years after	-.072	-.090**	-.048	-.198**	-.125**	-.020	-.103**	-.048

[1] Marginal effect of a discrete change from 0 to 1.

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

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

across age groups, with the youngest and oldest age groups showing large responses, while results for recipients in their forties and early fifties are found to be smaller and less significant. These results suggest that transfer magnitudes are not large enough to move middle-aged people away from their stable positions in the labor market. For the oldest inheritors we see a pattern of declining wage income over the entire period after inheriting, while the youngest age group responds immediately at the time of inheritance receipt and exhibit the largest response in the first two years.

With respect to the results for the young recipients, we expect that being a young inheritor is a good indicator of an unexpected inheritance. Either parents have died young or the bequest has been left by relatives other than parents, such as grandparents. One would think that the age at death is a good indication of the unexpectedness of an inheritance. Since bequest from parents in Norway are (predominantly) left by the last surviving spouse, the rare incidence of both parents dying early may explain unexpected inheritance. In such an unlikely event, one would expect the mourning period to be important. Alternatively, bequests from someone other than parents is also likely to be unexpected. Thus, we believe that the responses among young recipients may reflect the effect of an unforeseen inheritance, more than for other age groups. Furthermore, young individuals or households are more likely to be liquidity constrained, which can explain responses in the short run even when inheritances are anticipated.[37]

Since we observe a pattern of steadily declining wage income 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. In this perspective, the choice of when to retire is affected by the sudden receipt of an inheritance. We further investigate extensive margin responses for this age group by providing estimates for the probability of retirement before normal retirement age. In the Norwegian public pension scheme the retirement age is 67, but early retirement is available from age 62. Uptake of an early retirement pension before the formal retirement age (67 years old) is eligible to employees that participate in a pension scheme through a collective agreement, called AFP. The self-employed are not eligible to the scheme. The AFP-scheme covers the public sector and about half of the employees in the private sector. In the time window for which we measure transfers of inheritance,

[37]We have experimented with an additional indicator for liquidity constraint, the degree of loan-to-income (LTI). We find larger responses for recipients with high LTI (3 or more), but also that the marginal effects are not statistically significantly different from marginal effects for heirs with lower LTIs. We conclude that the potential effect of being liquidity constrained is most likely captured by age.

2000−2004, approximately 20 percent of all persons in the age group 62−66 were on the early retirement scheme.

The relationship between early retirement and inheritance is described in Figure 4, where the outcome is the difference in the share of inheritors and non-inheritors who have taken early retirement. The share of inheritors that retire early is consistently around two percentage points higher than the share among non-inheritors, though the difference in shares is not statistically significant.[38] However, the results point in the same direction as the findings of Brown et al. (2010), who show that the probability of retirement increases for inheritors in the U.S.

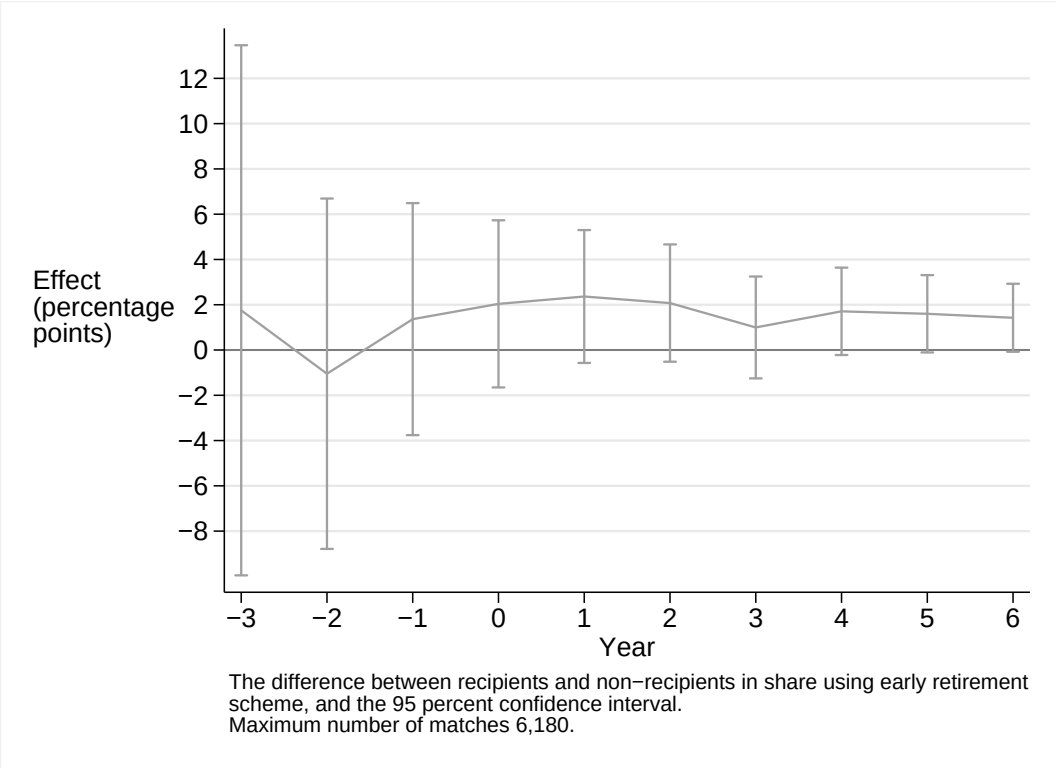


Figure 4. Effect of inheritance on early retirement. Sub-sample conditioned on larger bequests

While Table 5 highlights the varying response by characteristics of the inheritor, Table 6 presents evidence on whether these marginal effects are significantly different across groups. Even though point estimates suggest that female responses are stronger, there is no significant difference between the responses of male and female recipients. However, we see that single recipients, statistically significantly, reduce their labor supply more than recipients that are in a couple.[39]

[38]Because we condition on two post-matching years, and a maximum age of 67, there are relatively few observations being eligible for early retirement, and the standard errors are large.

[39]As stated in Section 3.1, we assume that couples have a common economy, implying that

Table 6. Difference in marginal effects between groups of recipients

	Age group						Dep.	College/
	No heirs	21-42[1]	50-55[1]	56-60[1]	Female	Single	child	univ.
6 years before	-.108	-.033	-.052	-.002	-.041	-.037	.035	.022
5 years before	-.111	-.019	-.040	.030	-.033	.052	.020	.001
4 years before	-.100	-.090	-.043	.053	-.047	-.000	-.043	-.046
3 years before	-.093	-.059	.006	.074	-.021	-.065	-.019	-.071*
2 years before	-.113*	-.036	.004	.067	-.029	-.037	-.022	-.045
1 year before	-.184**	-.026	.020	.050	.002	-.044	-.019	-.078*
Year of receipt	-.213**	-.103	.022	.067	-.028	-.072	-.073	-.064
1 year after	-.222**	-.123*	.011	.038	-.027	-.131**	-.039	-.034
2 years after	-.202**	-.157*	-.083*	-.066	-.032	-.135**	.004	-.043
3 years after	-.222**	-.089	-.042	-.028	-.011	-.132**	.015	-.030
4 years after	-.154	-.088	-.054	-.064	.019	-.130*	.028	-.037
5 years after	-.070	-.168*	-.119*	-.167*	-.022	-.154**	.072	.041
6 years after	-.098	-.222**	-.135*	-.190*	-.018	-.150*	.105	.055

[1] Age in the year of inheritance. Age 43-49 is the reference group.
* $p < 0.05$ ** $p < 0.01$

The results of Table 6 suggest that the strongest detrimental effect on labor supply is among those who do not have any direct heirs, i.e., own children of any age, suggesting that recipients are restricted in their use of bequests by new heirs in the "family chain". However, it could be argued that the lack of response among parents comes from caring for dependent children (children below 18 years of age), or that dependent children is a proxy for strong attachment to the labor force. The separate estimation results for the effect of dependent children, see Table 5, do not provide any clear answers, but given that effects are not statistically significant , they do not give support to the hypothesis that the effect works through having dependent children. Thus, although acknowledging the indicative character of this evidence, we see results which comply with 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 are the largest responses of all subgroup-responses reported in Table 5. Thus, this result suggests that there are factors involved which limit the Carnegie effect.

both heir and spouse are defined as recipients. Since we have information about who the direct recipient is, we have also looked at whether the effect of inheritance receipt differs between the direct recipient and the spouse; in other words, if bequests from own parents affect own labor supply differently compared to bequests from the spouse's parents. The magnitudes indicate a stronger response to inheritance from own parents than when the transfer originates from the spouse's parents, but differences are not statistically significant.

6 Robustness checks

6.1 Unobserved heterogeneity

A disadvantage of the propensity score matching estimator is that it only accounts for observed (and observable) co-variates. If there are unobserved factors that simultaneously affect the probability of inheriting and the wage income 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 7 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 average wage income in the three years up to the point of inheriting.

Table 7. Effects of inheritance on wage income in levels and long differences (MDID estimator). Sub-sample conditioned on larger bequests[1]

	Level		Diff. from year before inheriting		Diff. from mean of the 3 years before inheriting	
	Est.	SE	Est.	SE	Est.	SE
Year of inheriting	-.027	.019	-		-	
1 year after	-.085*	.021	-.090**	.015	-.089**	.016
2 years after	-.101**	.022	-.105**	.018	-.105**	.019
3 years after	-.091**	.023	-.097**	.020	-.097**	.021
4 years after	-.075*	.025	-.075**	.023	-.075**	.023
5 years after	-.081	.027	-.080**	.025	-.081**	.025
6 years after	-.071	.028	-.058*	.027	-.061*	.026

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

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

The results of Table 7 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. The overall negative effect on wage income of inheritors after the (large) transfer is approximately nine 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 5 we found that inheritors without own heirs reduced their work effort more than inheritors with heirs, which was explained by obligations towards later generations, discouraging recipients with direct 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 a better test of this hypothesis, one would ideally restrict to data where bequests are transferred from parent to child (and not between others). 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 8. Marginal effects of inheritance on wage income. Recipients with and without direct heirs, restricted and previous data set

	Restricted sample[1]			Previous sample[2]		
	Direct heirs		Diff.	Direct heirs		Diff.
	No	Yes		No	Yes	
1 year before	-.051	.020	-.071	-.173**	.011	-.184**
Year of receipt	-.086	.028	-.115	-.230**	-.017	-.213**
1 year after	-.205**	.018	-.224*	-.294**	-.072**	-.222**
2 years after	-.208*	.033	-.241*	-.290**	-.088**	-.202**
3 years after	-.160	.039	-.198	-.299**	-.077**	-.222**
4 years after	-.122	.071	-.194	-.225**	-.071**	-.154
5 years after	-.072	.001	-.072	-.159*	-.089**	-.070
6 years after	-.111	-.004	-.106	-.170*	-.072**	-.098
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.
* $p < 0.05$ ** $p < 0.01$

As it is of interest to check to what extent the dissimilar results for inheritors

with and without direct heirs are replicated in a data set generated by stricter conditions, we employ a data set in which we have the possibility to link parental information from the National Population Register. 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 8 presents results for the smaller sample, and compare them to the initial estimates for the direct heirs/no direct heirs dimension, obtained from Table 5. We see that the tests for significant differences are weakened with the smaller sample, but that the overall results stand. We still find that recipients with no direct heirs have a larger propensity to spend the inheritance on leisure. However, significantly different response estimates are obtained only in the two first years after inheriting.

6.3 Entrepreneurship

Recall that we exclude the self-employed and restrict 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 new businesses. Thus, part of the decline in wage income could does not reflect increased leisure, but follow from transitions into self-employment and a start-up period, in which the persons allocate very little wage income to themselves. Some may also have inherited the ownership of a small family business and for that reason changed from being a 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 Lindh and Ohlsson (1996) using Swedish data, and Blanchflower and Oswald (1998) on British data. A standard interpretation of a positive windfall effect on entrepreneurship is that the windfall relaxes liquidity constraints. Holtz-Eakin et al. (1994a) and Holtz-Eakin et al. (1994b) use longitudinal data from the US to study both the transition into self-employment and the probability of survival as an entrepreneur. They find that receipt of an inheritance has a substantial positive effect on the decision to become self-employed, both on the amount of capital invested in the firm and the probability of survival of the firm.

In the data we see that when self-employment is defined as having business income greater than wage income, there is a small and insignificant increase in the fraction of self-employed among donees, see Table 9. Furthermore, when using an

Table 9. Effect of inheritance on the fraction self-employed, wage income, and business income + wage income. Subsample conditioned on larger bequests[1]

	Fraction self-employed		Wage income		Business income + wage income	
	Est.	SE	Est.	SE	Est.	SE
6 years before	-.0010	.0012	.008	.025	.012	.024
5 years before	.0006	.0009	-.001	.020	.000	.019
4 years before	.0021	.0008	.003	.018	.016	.017
3 years before[2]	.0011	.0007	.002	.016	.006	.016
2 years before	.0006	.0007	.007	.017	.009	.016
1 year before	.0008	.0008	.005	.018	.020	.018
Year of receipt	.0008	.0009	-.027	.019	-.013	.019
1 year after	.0008	.0010	-.085**	.021	-.074**	.021
2 years after	.0017	.0010	-.101**	.022	-.090**	.024
3 years after	.0011	.0011	-.091**	.023	-.056*	.025
4 years after	.0013	.0011	-.075**	.025	-.043	.026
5 years after	.0013	.0011	-.081**	.027	-.036	.028
6 years after	.0022	.0011	-.071*	.028	-.020	.029

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

[2] Year of matching.

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

even more narrow concept of self-employment, i.e., defined by sole proprietorship, we find no effect (not reported). However, in Norway there is only a small percentage of the population who are self-employed, which means that a larger fraction may have a combination of wage income and income from self-employment. Hence, we check to what extent our main result holds if we include business income in the income definition; results are reported in the last column of Table 9. As the effect of inheritance is smaller for this income concept, these estimation results suggest that part of the decline in the labor supply of wage earners is substituted by an increase in business activities, at least in the long run, although it is a very small fraction of wage earners which actually shifts into self-employment because 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. In this perspective, although we believe that results of the present study are applicable to other economies, one should be aware of the contributions from the institutional setting too. For example, we have seen effects working through take-up of early retirement, which is likely influenced by the design of the Norwegian scheme.

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 strong reductions in labor supply, but we find large and significant effects also for younger inheritors. In addition, short term estimates, as those obtained in this study, most likely underestimate responses, as there are reasons to believe that some bequests are foreseen and accounted for in the life cycle plan of the recipients.

Even though we believe that our study provides a comprehensive description of Carnegie effects, the economic implications are still uncertain and mixed. The results with respect to young recipients denote long lasting harmful Carnegie effects, but we also see signs that parts of the effects come from using the new funds for business activities. Carnegie effects are also curbed by adjustment costs in finding new optima and, notably, we find results which support the theory that recipients may not feel entitled 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 recipients that are not direct heirs. Also, given that we have found stronger effects for recipients of large transfer, it is important to emphasize that Norwegian wealth likely will increase in the future (Thoresen et al., 2001), which in turn implies that intergenerational transfers also will rise (despite the Carnegie effect), having consequences for labor supply in the years to come.

References

Abadie, A. and G. W. Imbens (2006). Large sample properties of matching estimators for average treatment effects. *Econometrica 74*, 235–267.

Altonji, J. G. and C. H. Paxson (1992). Labor supply, hours constraints, and job mobility. *Journal of Human Resources 27*, 256–278.

Arrondel, L. and A. Laferrère (2001). Taxation and wealth transmission in France. *Journal of Public Economics 79*, 3–33.

Arrondel, L. and A. Masson (2006). Altruism, exchange or indirect reciprocity: what do the data on family transfers show? In S. C. Kolm and J. Mercier-Ythier (Eds.), *Handbook of the Economics of Giving, Altruism and Reciprocity*, Volume Vol 2, pp. 971–1053. Elsevier.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy 82*, 1063–1093.

Becker, G. S. (1991). *A Treatise on the Family*. Harvard University Press.

Berg, S. A. and Ø. Eitrheim (2013). Lessons from the world financial crisis for the central bank of norway: The approach to monetary policy and financial stability. In S. F. J. Braude, Z. Eckstein and K. Flug (Eds.), *The Great Recession: Lessons for Central Bankers*, pp. 269–306. MIT Press.

Bergstrom, T. C. (1989). A fresh look at the rotten kid theorem–and other household mysteries. *Journal of Political Economy 97*, 1138–1159.

Bernheim, B. D., A. Shleifer, and L. H. Summers (1985). The strategic bequest motive. *Journal of Political Economy 93*, 1045–1076.

Bevan, D. L. and J. E. Stiglitz (1979). Intergenerational transfers and inequality. *Greek Economic Review 1*, 8–26.

Blanchflower, D. G. and A. J. Oswald (1998). What makes an entrepreneur? *Journal of Labor Economics 16*, 26–60.

Blundell, R. and M. C. Dias (2009). Alternative approaches to evaluation in empirical microeconomics. *Journal of Human Resources 44*, 565–640.

Blundell, R. and T. MaCurdy (1999). Labor supply: A review of alternative approaches. In O. Ashenfelder and D. Card (Eds.), *Handbook of Labor Economics*, Volume Vol 3A, pp. 1559–1695. Elsevier.

Brown, J. R., C. C. Coile, and S. J. Weisbenner (2010). The effect of inheritance receipt on retirement. *Review of Economics and Statistics 92*, 425–434.

Bruce, N. and M. Waldman (1990). The rotten-kid theorem meets the samaritan's dilemma. *Quarterly Journal of Economics 105*, 155–165.

Caliendo, M. and S. Kopeinig (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys 22*, 31–72.

Carnegie, A. (1881/1962). *The gospel of wealth and other timely essays.* Harvard University Press.

Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *Quarterly Journal of Economics 112*, 1–55.

Chami, R. (1998). Private income transfers and market incentives. *Economica 65*, 557–580.

Chetty, R. (2012). Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor supply. *Econometrica 80*, 969–1018.

Cogan, J. F. (1981). Fixed costs and labor supply. *Econometrica 49*, 945–63.

Cox, D. (1987). Motives for private income transfers. *Journal of Political Economy 95*, 508–546.

Deaton, A. (1991). Saving and liquidity constraints. *Econometrica 59*, 1221–1248.

Dehejia, R. H. and S. Wahba (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics 84*, 151–161.

Denk, O. (2012). Tax reform in Norway: A focus on capital taxation. OECD Working papers 950, OECD Publishing.

Djebbari, H. and J. Smith (2008). Heterogeneous impacts in PROGRESA. *Journal of Econometrics 145*, 64–80.

Elinder, M., O. Erixson, and H. Ohlsson (2012). The impact of inheritances on heirs' labor and capital income. *BE Journal of Economic Analysis & Policy 12, Contributions*, Art. 61.

Gatti, R. (2005). Family altruism and incentives. *Scandinavian Journal of Economics 107*, 67–81.

Golosov, M., N. Kocherlakota, and A. Tsyvinski (2003). Optimal indirect and capital taxation. *Review of Economic Studies 70*, 569–587.

Haveman, R. and B. Wolfe (1995). The determinants of children's attainments: A review of methods and findings. *Journal of Economic Literature 33*, 1829–1878.

Heckman, J. J., H. Ichimura, and P. E. Todd (1997). Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme. *Review of Economic Studies 64*, 605–654.

Heckman, J. J. and T. E. MaCurdy (1980). A life cycle model of female labour supply. *Review of Economic Studies 47*, 47–74.

Heckman, J. J. and T. E. MaCurdy (1982). Corrigendum on a life cycle model of female labour supply. *Review of Economic Studies 49*, 659–660.

Hines, J. R. (2013). Income and substitution effects of estate taxation. *American Economic Review: Papers and Proceedings 103*, 484–488.

Hirano, K., G. W. Imbens, and G. Ridder (2003). Efficient estimation of average treatment effects using the estimated propensity score. *Econometrica 71*(4), 1161–1189.

Hirshleifer, J. (1977). Shakespeare vs. Becker on altruism: The importance of having the last word. *Journal of Economic Literature 15*, 500–502.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen (1993). The Carnegie conjecture: Some empirical evidence. *Quarterly Journal of Economics 108*, 413–435.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen (1994a). Entrepreneurial Decisions and Liquidity Constraints. *The Rand Journal of Economics*, 334–347.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen (1994b). Sticking It Out: Entrepreneural Survival and Liquidity Constraints. *Journal of Political Economy 102*(1), 53–75.

Huber, M., M. Lechner, and C. Wunsch (2013). The performance of estimators based on the propensity score. *Journal of Econometrics 175*, 1–21.

Imbens, G. W. (2004). Nonparametric estimation of average treatment effects under exogeneity: A review. *Review of Economics and Statistics 86*, 4–29.

Imbens, G. W., D. B. Rubin, and B. I. Sacerdote (2001). Estimating the effect of unearned income on labor earnings, savings, and consumption: Evidence from a survey of lottery players. *American Economic Review 91*, 778–794.

Imbens, G. W. and J. M. Wooldridge (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature 47*, 5–86.

Joulfaian, D. (2006). Inheritance and saving. Technical Report 12569, National Bureau of Economic Research.

Joulfaian, D. and M. O. Wilhelm (1994). Inheritance and labor supply. *Journal of Human Resources 29*, 1205–1234.

Keane, M. and R. Rogerson (2012). Micro and macro labor supply elasticities: A reassessment of conventional wisdom. *Journal of Economic Literature 50*, 464–476.

Keane, M. P. (2011). Labor supply and taxes: A survey. *Journal of Economic Literature 49*, 961–1075.

Kimball, M. S. and M. D. Shapiro (2008). Labor supply: Are the income and substitution effects both large or both small? NBER Working paper 14208, National Bureau of Economic Research.

Kopczuk, W. (2013). Incentive effects of inheritances and optimal estate taxation. *American Economic Review. Papers and Proceedings 103*, 472–477.

Laferrère, A. and F.-C. Wolff (2006). Microeconomic models of family transfers. In S. Kolm and J. Mercier-Ythier (Eds.), *Handbook on the Economics of Giving, Reciprocity and Altruism*, Volume Vol 2, pp. 889–969. Elsevier.

Leuven, E. and B. Sianesi (2014). Psmatch2: Stata module to perform full mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing. Software, http://ideas.repec.org/c/boc/bocode/s432001.html.

Lindbeck, A. and S. Nyberg (2006). Raising children to work hard: altruism, work norms, and social insurance. *The Quarterly Journal of Economics 121*, 1473–1503.

Lindh, T. and H. Ohlsson (1996). Self-employment and windfall gains: evidence from the swedish lottery. *The Economic Journal 106*, 1515–1526.

Piketty, T. (2010). Taxation of wealth and wealth transfers: Commentary. *Dimensions of Tax Design: The Mirrlees Review*, 825–831.

Piketty, T. (2013). *Capital in the Twenty-First Century*. Harvard University Press.

Piketty, T. and E. Saez (2013). Rethinking capital and wealth taxation. http://piketty.pse.ens.fr/files/PikettySaez2014RKT.pdf.

Rosenbaum, P. R. and D. B. Rubin (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika 70*, 41–55.

Rubin, D. B. and N. Thomas (2000). Combining propensity score matching with additional adjustments for prognostic covariates. *Journal of the American Statistical Association 95*, 573–585.

Saez, E., J. Slemrod, and S. H. Giertz (2012). The elasticity of taxable income with respect to marginal tax rates: A critical review. *Journal of Economic Literature 50*, 3–50.

Statistics Norway (2006). Wage statistics. http://www.ssb.no/en/arbeid-og-lonn/statistikker/lonnansatt.

Statistics Norway (2012). Income statistics for persons and families. http://www.ssb.no/en/inntekt-og-forbruk/statistikker/ifhus.

Statistics Norway (2014). Inheritance statistics. http://www.ssb.no/en/inntket-og-forbruk/statistikker/arv/.

Strawczynski, M. (2014). The optimal inheritance tax in the presence of investment in education. *International Tax and Public Finance 21*, 768–795.

Thoresen, T. O., D. Fredriksen, and S. I. Pedersen (2001). Skatt på overføringer mellom generasjoner. en diskusjon av arveavgiften. Reports 2001/32, Statistics Norway (in Norwegian).

Van der Ploeg, F. (2011). Natural resources: Curse or blessing? *Journal of Economic Literature 49*, 366–420.

A Supplementary descriptions of the matching

A.1 Estimation results for the propensity score model

	Coefficient	SE	t-stat
Log wage income	.05510113	.08224276	.66998159
Log capital income	-.00888375	.01137971	-.78066601
Log financial wealth	-.01807157	.00939608	-1.9233098
Log debt	.00609102	.00608637	1.0007651
Log housing wealth	-.01322149	.01510352	-.87539139
Log vacation housing w.	.01177483	.01820479	.64679818
Log business income	.01273834	.01834363	.6944285
Male	-.02482608	.05344429	-.46452257
Houshold size	.52503054	.02124822	24.709391
Male*housh.size	-.05367302	.03031698	-1.7703947
Wage equals zero	.2897031	.43680827	.66322715
High school	.11266626	.01649235	6.8314259
University	.19593142	.01936291	10.118904
High school father	.13537568	.01563613	8.6578758
High school mother	.11954891	.01583155	7.5513091
University father	.233977	.02498943	9.3630394
University mother	.23582104	.03018711	7.8119782
Age 18[1]	-.58672849	.36421949	-1.6109201
Age 19	-.74720673	.32972281	-2.2661663
Age 20	-.56704801	.24655125	-2.2999195
Age 21	-.60402208	.22755959	-2.6543469
Age 22	-.55262126	.20962337	-2.6362579
Age 23	-.58362866	.19966926	-2.922977
Age 24	-.52859477	.19096385	-2.7680357
Age 25	-.48624477	.18414665	-2.6405301
Age 26	-.46680456	.18051387	-2.5859762
Age 27	-.46314653	.17834238	-2.5969516
Age 28	-.40522517	.17617342	-2.3001493
Age 29	-.40575746	.17531887	-2.314397
Age 30	-.38791638	.1744971	-2.2230535
Age 31	-.32636161	.17359942	-1.8799695
Age 32	-.3376059	.1737845	-1.9426698
Age 33	-.25417358	.17302249	-1.4690205
Age 34	-.19455022	.17279029	-1.1259326
Age 35	-.15781381	.17281528	-.91319357

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

	Coefficient	SE	t-stat
Age 36	-.09635211	.17257043	-.55833502
Age 37	-.04419431	.1725913	-.25606338
Age 38	-.0029563	.17236361	-.01715156
Age 39	.11625802	.17163579	.67735304
Age 40	.1829724	.17122743	1.0685928
Age 41	.25386369	.17062792	1.4878204
Age 42	.33749926	.17000835	1.9851923
Age 43	.37530184	.16964889	2.2122269
Age 44	.43857542	.16935119	2.5897393
Age 45	.52420268	.16873038	3.1067474
Age 46	.5831221	.16848927	3.4608856
Age 47	.64952993	.16832805	3.8587148
Age 48	.69836224	.16804095	4.155905
Age 49	.75011943	.16782927	4.4695386
Age 50	.78779607	.16761572	4.700013
Age 51	.79646728	.1677149	4.7489357
Age 52	.83749731	.16727983	5.0065647
Age 53	.8185682	.16738004	4.8904767
Age 54	.82404287	.16751877	4.9191076
Age 55	.83154396	.16779747	4.9556406
Age 56	.76546297	.16877616	4.5353737
Age 57	.74730155	.16930971	4.4138139
Age 58	.67075073	.17056262	3.9325776
Age 59	.60298294	.17147898	3.5163664
Age 60	.53074954	.17241846	3.0782639
Age 61^2	.34579508	.1365072	2.5331637
Log prev wage inc.	-.01242517	.01383708	-.89796133
Log prev business inc.	-.00505946	.01016572	-.49769757
Log prev capital inc.	.04470505	.0118392	3.7760188
One dep. child	-.04273629	.01814461	-2.3553163
Two dep .children	-.08249114	.02019344	-4.0850464
Three dep .children	-.12753485	.02786529	-4.5768361
Four or more dep. children	-.20109758	.05514414	-3.6467625
Square log wage inc.	-.00249864	.00388104	-.64380713
Square log capital inc.	.00029501	.00086745	.34008598
Square log financial w.	.00237085	.0006377	3.7178378
Square log debt	-.00114011	.00047917	-2.3793285
Square log housing w.	.00146388	.00124535	1.1754801

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

	Coefficient	SE	t-stat
Square log vac. housing w.	-.00040612	.00164973	-.24617678
Square log business inc.	-.00086454	.00168472	-.51316391
Square log previous wage inc.	.00210425	.00091086	2.3101684
Square log previous business inc.	.00046364	.00087432	.53028578
Square log previous capital inc.	-.00128534	.00077762	-1.6529123
Constant	-5.9178531	.48209921	-12.275177
Matches		142,882	

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 three years. Matches/weights: 55,906/0, 0, .534, .466, 0

[2]The variable Age 61 fully predicts failure in one year. Matches/weights: 110,370/0, .285, .271, .236, .209

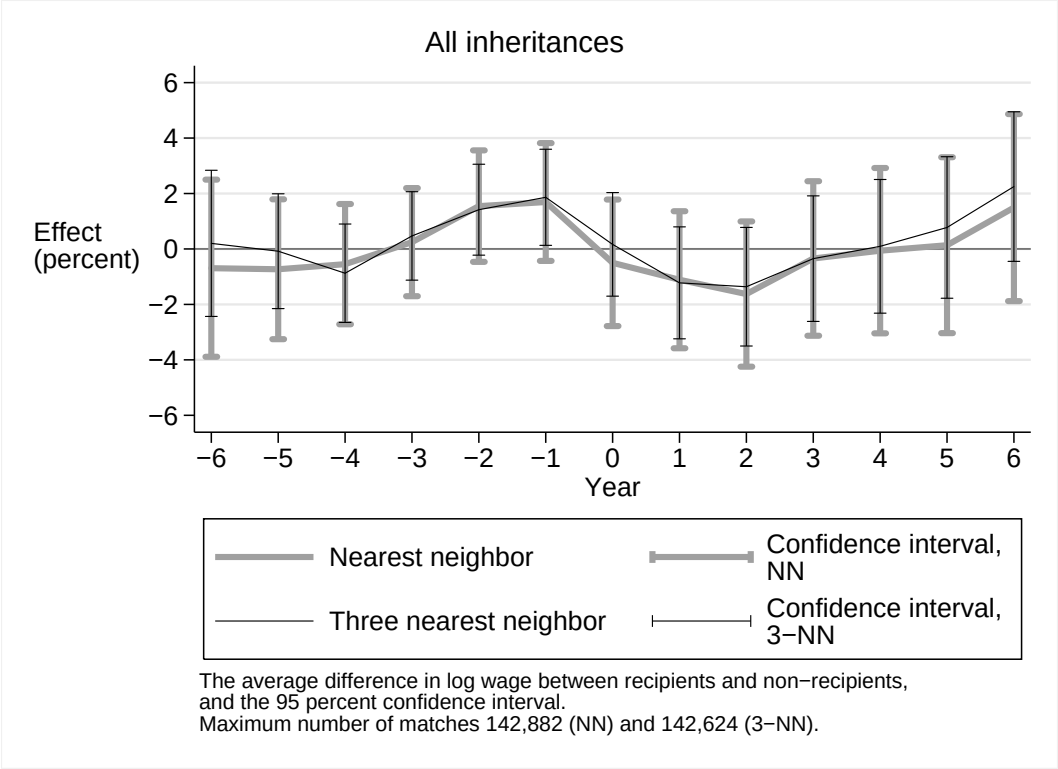
A.2 t-tests of differences between characteristics of recipients and non-recipients

	Inheritors (mean)	Non-inheritors (mean)	t-stat
Log wage income	11.61	11.61	-.1177
Log capital income	6.634	6.638	.1277
Log financial wealth	9.825	9.825	-.0186
Log debt	8.358	8.320	-.7815
Log housing wealth	6.386	6.354	-.6340
Log vacation housing w.	1.566	1.555	-.3322
Log business income	.6702	.6773	.3100
Male	.4595	.4587	-.1792
Housh. size	1.773	1.771	-.5801
Male*Housh. size	.8162	.8127	-.4384
Wage equals zero	.0451	.0452	.0986
High school	.4804	.4800	-.1133
University	.3156	.3165	.2445
High school father	.3080	.3077	-.0877
High school mother	.2986	.2991	.1028
University father	.1021	.1016	-.2329
University mother	.0594	.0581	-.5972
Age	44.85	44.83	-.2052
Log previous wage inc.	13.44	13.44	.0977
Log previous business inc.	1.476	1.469	-.2228
Log previous capital inc.	8.381	8.395	.7134
Number of dep. children	.7731	.7657	-.9048
Matches		142,882	

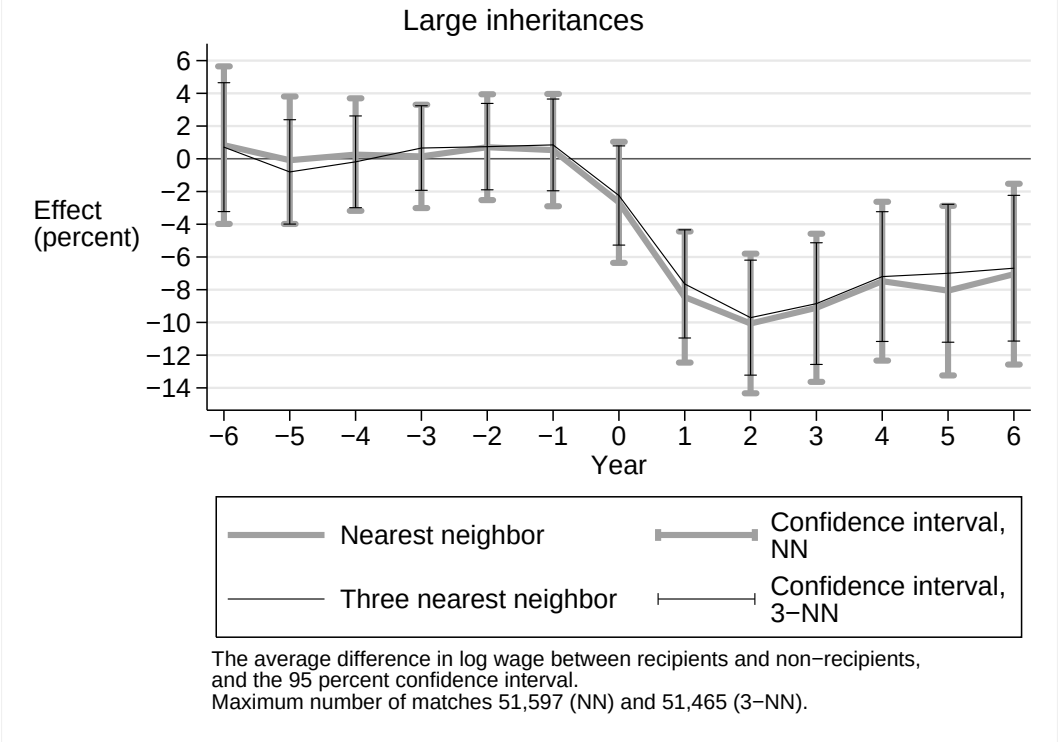
The weighted values of observable characteristics for inheritors and non-inheritors, as well as the t-statistic of a mean equality test, weighted by the numbers of matches each year. Weights: .228, .220, .209, .182, .161.

B Supplementary results

B.1 Nearest and three-nearest neighbor matching

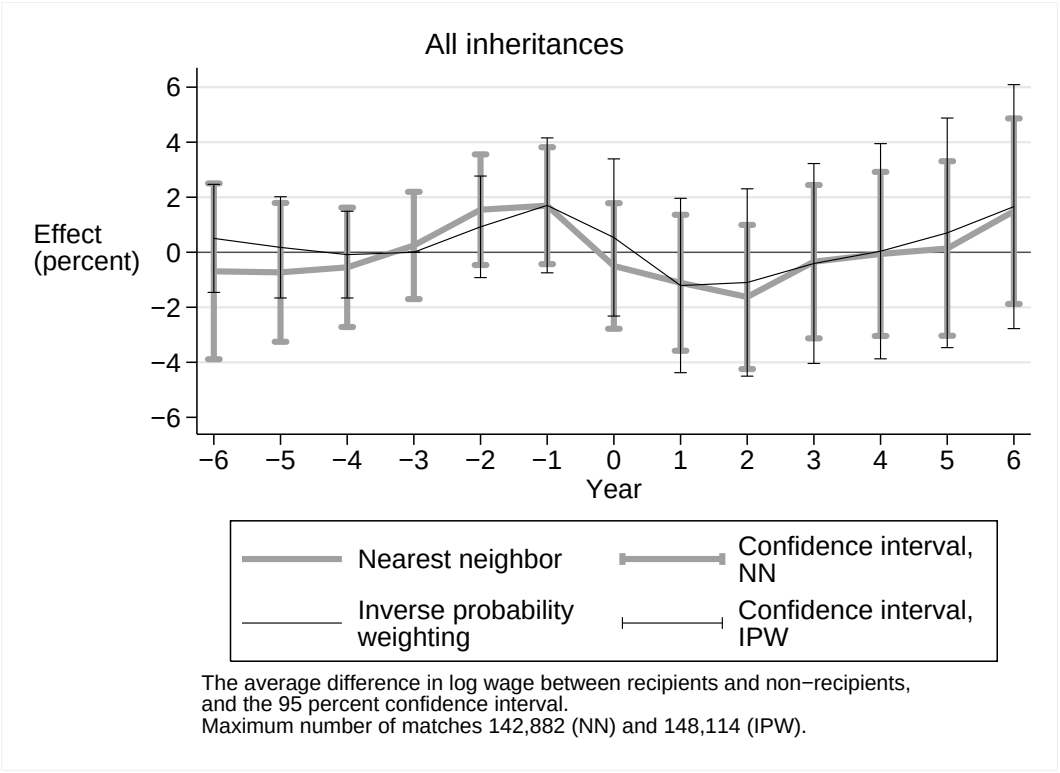


The average difference in log wage between recipients and non−recipients, and the 95 percent confidence interval.
Maximum number of matches 142,882 (NN) and 142,624 (3−NN).

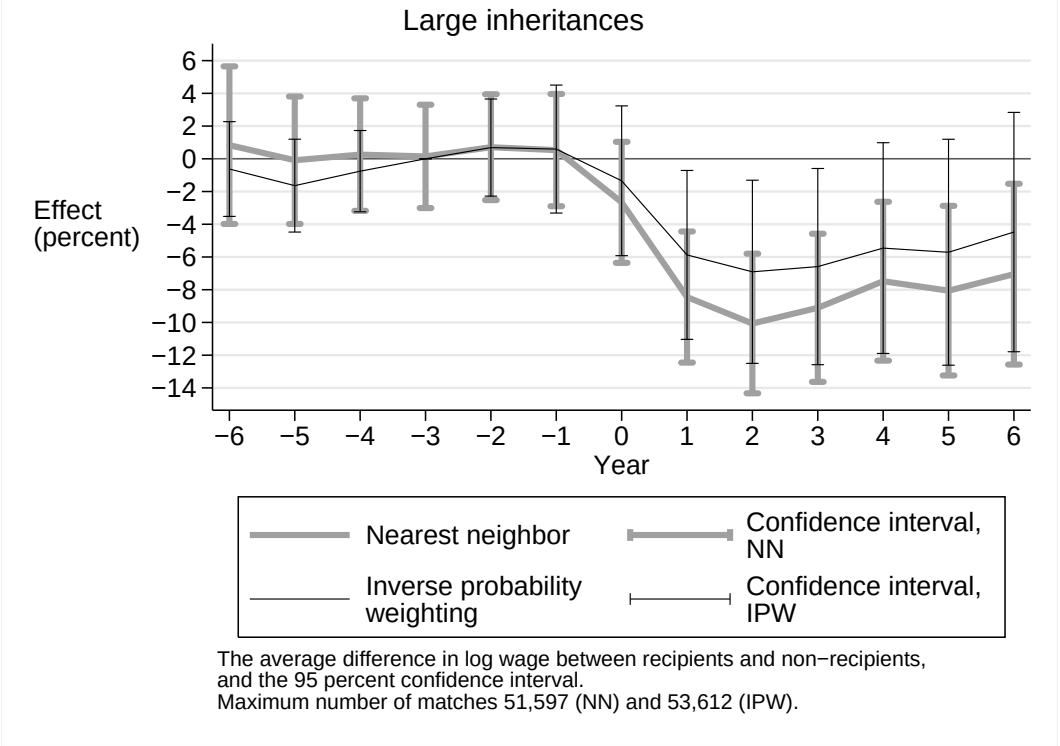


The average difference in log wage between recipients and non−recipients, and the 95 percent confidence interval.
Maximum number of matches 51,597 (NN) and 51,465 (3−NN).

B.2 Nearest neighbor matching and inverse probability weighting



The average difference in log wage between recipients and non−recipients, and the 95 percent confidence interval.
Maximum number of matches 142,882 (NN) and 148,114 (IPW).



The average difference in log wage between recipients and non−recipients, and the 95 percent confidence interval.
Maximum number of matches 51,597 (NN) and 53,612 (IPW).

B.1 Effect of inheritance on intensive margin hours of work

	All inheritances		Above mean inheritances[1]	
	Est.	SE	Est.	SE
5 years before	.1079	.1015	.0606	.1466
4 years before	.0359	.0807	.0045	.1179
3 years before[2]	-.0223	.0672	-.1103	.1022
2 years before	-.0223	.0669	-.0532	.1017
1 year before	-.0639	.0669	.0530	.1020
Year of receipt	-.1127	.0668	-.1394	.1031
1 year after	-.1939**	.0670	-.2035*	.1033
2 years after	-.1451*	.0659	-.0969	.1019
3 years after	-.1134	.0744	-.1041	.1168
4 years after	-.1169	.0903	-.0292	.1460
5 years after	-.2105	.1260	.1423	.2107
No of matches[3]	26,185		10,250	

[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.

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

Statistics Norway

Postal address:
PO Box 8131 Dept
NO-0033 Oslo

Office address:
Akersveien 26, Oslo
Oterveien 23, Kongsvinger

E-mail: ssb@ssb.no
Internet: www.ssb.no
Telephone: + 47 62 88 50 00

ISSN: 1892-753X

Statistisk sentralbyrå
Statistics Norway

Design: Siri Boquist