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JULIAN VEDELER JOHNSEN AND
KATRINE HOLM REISO

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WORKFARE REFORMS FOR
SINGLE MOTHERS: BENEFIT
SUBSTITUTION AND LABOUR
SUPPLY RESPONSES



Department of Economics
UNIVERSITY OF BERGEN

Economic Impacts of Workfare Reforms for Single Mothers: Benefit Substitution and Labour supply responses

Julian Vedeler Johnsen^{*} and Katrine Holm Reiso^{**}

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Abstract

We analyse the economic impacts of Norwegian nationwide reforms on the state benefit programme targeting single mothers and derive the net fiscal impacts of the reforms on both the affected single mothers and public expenses. Our analysis accounts for behavioural reform responses by single mothers in terms of benefit substitution and labour supply. We find that for each 100-NOK reduction in benefit payments from the programme, single mothers replace approximately 60 NOK through benefit substitution. In the short term, we find a sizeable positive reform effect on single mothers' labour supply and earnings. However, the positive labour supply response diminishes drastically in the long term. The reforms increase single mothers' disposable income in the short term, but in the long term, we find no or even negative effects on disposable income. In terms of the net fiscal impact on public expenses, the reforms are successful. We estimate a total net gain of 3.56 billion NOK (37 million EUR) in public expenditures covering the 1998–2008 period.

JEL Codes: *H53, I38, D19*

Keywords: workfare reforms, single mothers, benefit substitution, public policy

^{*} University of Bergen, e-mail: julian.johnsen@uib.no

^{**} *Konkurransetilsynet*, e-mail: katrineholmreiso@gmail.com

1. Introduction

Despite high female employment rates and multiple state-founded family-policy measures, single mothers in Norway have traditionally had weaker labour market attachment compared with non-mothers and married mothers.¹ The traits associated with single motherhood in Norway are the universal ones. They are situated at the lower end of the income distribution scale and more likely depend on welfare and live in poverty compared with their married counterparts. For the single mothers who receive welfare benefits, there are risks of underinvesting in education, accumulating little labour market experience and becoming increasingly disregarded by potential employers. Thus, by being dependent on welfare, single mothers may forego potential higher future labour income and associated higher levels of well-being.

Therefore, welfare dependence among single mothers has been a concern of policymakers for decades. In an attempt to urge single mothers to work and reduce their dependence on welfare, in 1998, Norway implemented a nationwide reform of the state benefit programme targeting this group. The most important features of this reform were a substantial reduction in the maximum period for the receipt of the targeted benefits, the introduction of work requirements for eligibility and lowering of the maximum eligible age of the youngest child.

There are two main and (from a public expenditure perspective) opposite potential behavioural responses to the reform. On one hand, if single mothers respond to the reform by increasing their labour market participation, this will increase labour earnings and public revenue from income taxes. On the other hand, single mothers could respond to the benefit payment decreases caused by the reform by substituting these with various publicly funded benefit programmes, so-called “benefit substitution”.

¹ See Table A1 in the Appendix.

From the individual perspective, single mothers who are affected by the reform may experience a drop in disposable income if they are unable to offset the loss of targeted benefits with labour earnings or other benefit payments. From a public economic perspective, benefit substitution may threaten the welfare state's sustainability, given that overall welfare costs may not decrease even though the costs of a particular programme are reduced. Therefore, identifying the degree of substitution with the different types of state benefit programmes is highly relevant for policymakers. We analyse the economic impacts of the Norwegian reform on the state benefit programme for single mothers and derive the net fiscal impacts of the reform on both the affected single mothers and public expenses.² Our analysis accounts for behavioural responses in terms of benefit substitution and labour supply.

To identify the causal effects of the reform, we use a difference-in-differences approach whereby we compare single mothers with married mothers, who are ineligible for the targeted benefits in the periods before and after the reform. We separately identify the effects of the reform during the phase-in period (1998–2000), the period immediately after the full implementation of the reform (2001–2004, i.e., short-term effects) and the period spanning several years after their full implementation (2005–2008, i.e., long-term effects).³ We employ several empirical strategies and show that our main findings are robust to a series of specification checks.⁴

Our findings show that the reform is successful in reducing benefit payments from the programme targeting single mothers. However, for each 100-NOK reduction in benefit

² The Nordic welfare model provides an interesting background for analysing the effects of work-encouraging reforms on single mothers. On one hand, multiple family-policy measures should ease the transition from welfare to work. On the other hand, the generosity of alternative benefit programmes may entice benefit substitution.

³ Please note that the long-term effects we identify are the long-term effects of the reform over time, which is different from the long-run effects of the reforms on the affected individuals.

⁴ A caveat of our quasi-experimental setting is that we find evidence of compositional changes in the treatment and comparison groups. We employ empirical strategies designed to deal with compositional changes, but the reader should note that the causal interpretation of our results is based on that the common trend assumption holds conditional on adjusting for compositional changes. We provide suggestive graphical evidence in favour of this.

payments from the programme, the single mothers affected by the reform replace approximately 60 NOK through benefit substitution. The affected mothers increase their uptake of paid sick leave (SI) by about 85%, rehabilitation (Rehab) benefits by about 115%, disability insurance (DI) benefits by about 65% and finally, unemployment insurance (UI) benefits by about 35%. The benefit substitution that we observe also persists over the long term. Additionally, we find sizeable positive short-term effects on employment and labour earnings. In the short term, each 100-NOK loss in targeted benefits is replaced by a 94-NOK gain in labour earnings. However, the estimated positive effect on labour earnings strongly diminishes over the long term.

In total, through benefit substitution and labour supply responses, the reform increases the disposable income of the affected single mothers. However, because the positive effect on labour earnings is temporary, the effect on disposable income disappears over the long term, with some evidence even pointing to a negative long-term effect. In terms of the net fiscal impact on public expenses, the reform is successful. In the 11-year period covering the implementation of the reform (1998–2008), we calculate that the reform results in a net gain of 3.56 billion NOK in public expenditures.⁵

As welfare dependence among single mothers is a universal problem, the reforms of the welfare programme for single mothers in Norway are far from unique. Reforms aimed at stimulating single mothers and low-wage earners to work, thereby reducing their dependence on welfare, have been implemented in several countries (the US, the UK, Australia and the Netherlands).⁶ The literature has so far focused on labour supply responses, showing that such reforms have succeeded in increasing average earnings and labour market participation among

⁵ At 1998 prices

⁶ See, for instance, Blank (2002) and Moffitt (2007) for details of the US reform; Finn and Gloster (2010) for an overview of the reforms in welfare programmes in Britain, Australia and the Netherlands; Ochel (2005) for details on the German Hartz reforms; and Knoef and van Ours (2014) for a report on a field experiment in the Netherlands, aimed at encouraging single mothers to work.

single mothers and decreasing the programme caseload and expenditures.⁷ The Norwegian reform has previously been studied by Mogstad and Pronzato (2012). They find that the reform increases the average labour market participation and the earnings of single mothers but also lead to reduced disposable income and increased poverty among a sizeable subgroup of single mothers.⁸

However, there is scant evidence of benefit substitution and total state expenses of reforms in welfare programmes for single mothers. Such evidence is important for policymakers because it allows them to make more accurate predictions of the budgetary impact of such reforms. To our best knowledge, our study is the first to analyse the total state expenses of a reform that stimulate single mothers to work. Our data also allows us to analyse benefit substitution by single mothers, using an exhaustive list of all possible alternative benefit programmes. Thus, to our best knowledge, this study is also the first to identify the precise types of state benefit programmes that are used as substitutes by single mothers who have not managed the transition from welfare to work.⁹

Our paper relates to the literature on benefit substitution of reforms with DI and UI programmes in several European countries. Overall, these studies find evidence of substantial benefit substitution.¹⁰ However, few of these studies estimate overall state expenses. The exception is the study by Inderbitzin, Staubli and Zweimüller (2016). They analyse how extended UI benefits in Austria affect early retirement through programme complementarity

⁷ See, for instance, Blank (2002) and Moffitt (2007) for an overview of the literature on a work-encouraging reform in the US, and Eissa and Liebman (1996), Meyer and Rosenbaum (2001), Blundell, Brewer and Shephard (2005) and Francesconi and van der Klaauw (2007) for in-work tax benefit reforms.

⁸ Note that unlike Mogstad and Pronzato (2012), we do not track the same mothers over time. Doing so results in a restricted sample of mothers with children in a certain age range and who have been single for a prolonged period. Thus, the results of such an analysis are less general. When we restrict our sample in a similar fashion, we find larger benefit substitution and smaller labour supply responses compared with the unrestricted sample (see Section 5.2.3).

⁹ Two US studies by Schmidt and Sevak (2004) and Garrett and Glied (2000) find that single mothers substitute the welfare programme targeting them with the Supplementary Security Income (SSI) programme, which provides benefits to individuals with disabilities.

¹⁰ See, for instance, Inderbitzin, Staubli and Zweimüller (2016), Borghans, Gielen and Luttmer (2014), Bloemen, Hochguertel and Lammers (2013), Karlström, Palme and Svensson (2008) and Henningsen (2008).

(more labour market exits and DI uptake in the future) and programme substitution (less DI uptake in the present). They estimate the effect of the reform on net state expenditures and find that the reform increases costs by about 13,000 EUR per eligible worker aged 50 to 54 and about 9,000 EUR per eligible worker aged 55 to 57.

The remainder of this paper is organised as follows. Section 2 provides details of the Norwegian reform in the welfare programme for single mothers, briefly describes the alternative benefit programmes for single mothers and discusses why the reform could result in benefit substitution. Section 3 describes the data and presents descriptive evidence relating to the outcomes of interest. Section 4 outlines the empirical strategy and discusses possible threats to identification of reform effects. Section 5 presents the main results and robustness tests. Section 6 draws the conclusions.

2. Background

2.1 The welfare programme for single mothers and the reforms

The welfare programme for single mothers in Norway, called the transitional benefit programme, secures income for mothers who are temporarily unable to support themselves by working because they are the sole caregivers of their children.¹¹ In 1998 and 1999, the Norwegian government introduced two reforms. Table 1 details their most important features.

Before the reforms, there were no work requirements, and a mother could technically receive benefits continuously until her youngest child finished the third grade of primary school, that is, when the child turned 9–10 years old. Additionally, a mother who was cohabiting could receive benefits as long as she was unmarried and had no children with her current partner.

¹¹ Single fathers in Norway may also receive transitional benefits. The reasons for excluding them from this study are that few single parents in Norway are men (only about 14% of single parents in the 1990s, according to the income statistics for households), and they have significantly higher labour market attachment and earnings than single mothers (Andersen, Birkeland, Epland and Kirkeberg, 2002).

The main reform in 1998 imposed several new restrictions, namely, a three-year time limit on the receipt of benefits, a reduction in the maximum eligible age of the youngest child, and work requirements. The work requirements were for single mothers with children aged three years or older and included working for at least half of the hours of a standard work week in Norway (37.5 hours), studying for at least half of the hours of a full-time course or registering as unemployed. However, the same reform also increased the benefit levels to improve the incomes of single mothers who remained eligible. The reform was implemented over a three-year period from 1 January 1998 to 1 January 2001. During this period, new applicants received benefits according to the new rules, while mothers who had applied for benefits before 1 January 1998 could continue receiving benefits according to the pre-reform rules. From 1 January 2001 onwards, all single mothers were subject to the new rules. An additional restriction introduced in the 1999 reform rendered mothers who had been cohabiting with a partner other than the father of her children for at least 12 of the last 18 months ineligible for the programme.¹²

2.2 Other contemporaneous reforms

Two other family-related reforms took place in Norway at about the same time as the reforms of the welfare programme for single mothers. In 1998 and 1999, the government introduced cash subsidies for families with one- to two-year-old children that did not make full use of Norway's publicly subsidised daycare centres.¹³ In a robustness test, we estimate the reform effects for a sample consisting solely of mothers who were never eligible for cash subsidies for their one- to two-year-old children (see Section 5.3). It is reassuring that the results of this exercise are similar to the main results.

¹² Implemented for all single mothers on 1 July 1999.

¹³ The cash subsidies are not limited to single mothers. However, to obtain consistent estimates of the benefit substitution effects of the reforms in the transitional benefit programme on single mothers with children younger than three years old, the cash subsidies must have the same impact on single and married mothers. This assumption is doubtful. The cash subsidies reduce the mothers' labour market participation (Drange and Rege, 2013; Naz, 2004; Schöne, 2004). However, the responses are heterogeneous with regard to the mothers' educational and earnings levels and thus likely to differ between single and married mothers.

In 1997, the mandatory age for starting school in Norway fell from seven to six years. This reform has affected all mothers (single and married) with children aged six in 1997 and the following years. Drange, Havnes and Sandsør's (2012) study shows no effect of this mandatory reform on the labour market attachments of mothers. Moreover, the inclusion of year-fixed effects in our estimated model (see Section 4.1 for the identification strategy) would wipe out any potential effects of this reform. Thus, there is no concern that either of these family-related reforms would contaminate our results.

2.3 Alternative benefit programmes

The comprehensive Norwegian income security system provides a variety of benefits to residents who are unable to support themselves by working. Hence, single mothers may have the option to receive benefits from other state benefit programmes (in addition to receiving the benefits from the transitional benefit programme) or to substitute one programme for another and to quit receiving benefits from the transitional benefit programme. Relevant alternative benefit programmes include SI, medical- and work-related Rehab, DI, UI and social assistance (SA).¹⁴

The SI benefits are intended to compensate for 100% of the loss of income for workers with a short-term illness lasting less than one year. Previously, to be entitled, the employees must have worked for at least two weeks prior to the injury or illness, and their work capacity must have been reduced by at least 20%. Certification by a physician would be needed. Reforms in the SI programme in 2004 increased the number of weeks worked to be entitled to benefits from two to four weeks and required recipients who had been ill for more than eight weeks to engage in some work-related activity in order to qualify (unless they were unable to

¹⁴ Alternative reform responses of single mothers could be to rely on other household members, family or friends to maintain some income. These alternatives are less relevant in this context, as less than 2% of the single mothers in the sample are neither working nor receiving benefits of any kind.

do so for medical reasons). The employer pays SI benefits for the first 16 sick days.¹⁵ If the workers have not recovered within one year and are unable to work more than 50% because of their illness, they are then eligible for Rehab benefits. Non-working residents who can document that they have been ill for at least one year are also entitled. These benefits are provided while the individuals undergo treatment to improve their ability to work and may be received for several years.¹⁶ The eligible age range for Rehab benefits is 18–67 years (i.e., until the usual retirement age). In the sample period of this study, two reforms concerning the Rehab programme took place. First, in an attempt to tighten the inflow of DI benefits, the state tightened the eligibility criteria in 2000, making pre-participation in the Rehab programme mandatory for most applicants. The state also increased the focus on having the Rehab recipients return to work. In 2004, stricter time limits on the receipt of Rehab benefits were implemented; ideally, a recipient should not receive benefits for more than one year. Additionally, screening Rehab recipients for residual work capacity intensified in 2004.

The DI benefit programme provides income to all individuals (including those with no employment record) who are unable to work more than 50% because of enduring health-related reasons.¹⁷ The illness must have been certified by a physician. The process of applying for and receiving DI benefits is time consuming; the mean duration of the receipt of other benefits prior to being granted DI is approximately 2.5 years, and it is longer for younger age groups.¹⁸ Unlike welfare recipients of other benefit programmes, individuals receiving DI benefits usually never fully return to work and are likely to depend on welfare for the rest of

¹⁵ Until 1998, the number of days was 14.

¹⁶ The compensation rate is about two-thirds of the recipient's previous earnings from work, and the minimum payment was about 6,000 NOK per month in 1998. Earnings exceeding 272,000 NOK per year in 1998 were uncompensated by SI benefits and were excluded from the calculation of medical- and work-related Rehab benefits.

¹⁷ The compensation rate is determined based on the workers' earning histories, and the minimum payment was about 6,800 NOK per month in 1998. Earnings exceeding 544,000 NOK per year in 1998 were excluded from the calculation of DI benefits.

¹⁸ Ministry of Labour, Report to the Storting No. 9 (2006–2007): *Work, Welfare and Inclusion*, p. 45).

their lives.¹⁹ In 2004, time-limited DI benefits were introduced to secure income for individuals for a maximum of four years in cases where (further) medical- or work-related Rehab was not considered beneficial but where the individuals' ability to perform work-related activities would likely improve within some years. The eligible age range for DI benefits is 18–67 years.

To be entitled to UI benefits, the individuals must have previously earned income, lost their jobs for reasons beyond their control, are actively seeking employment and are capable of working. The benefit received is 62.4% of their previous earnings up to some maximum amount.²⁰ Depending on the previous income from work, UI benefits may be received for one or two years.²¹

The SA payments are not health related and do not require documentation of an illness or previous work history for eligibility. The purpose of SA payments is to ensure that everyone has a reasonable standard of living. They are means tested against income and assets, and the level of payments is set according to each applicant's needs. These payments are considered the last resort. To be eligible, the applicants must have exhausted all other opportunities to support themselves economically, including their eligibility for other benefit programmes. However, there are no restrictions on receiving SA payments on top of earnings or other benefits, as long as the given level of income is considered insufficient.

2.4 Why reforms of the transitional benefit programme may cause benefit substitution

Prior to the reforms, fewer single mothers were working; consequently, fewer single mothers were eligible for UI and SI benefits.²² The costs of participating in the transitional benefit programme were also lower than the costs of actively engaging in Rehab programmes or

¹⁹ Of those who left the DI programme in 2003, 74% entered the old-age pension programme, 19% died and only 7% no longer met the eligibility criteria and might have returned to work (Kostøl and Mogstad, 2014).

²⁰ Earnings exceeding 272,220 NOK per year in 1998 were excluded from the calculation of UI benefits.

²¹ A reform in the UI programme in 1998 reduced the maximum years of the receipt of benefits from three to two.

²² Mogstad and Pronzato (2012) show that the Norwegian reform increases the average labour market participation and the earnings of single mothers.

going through the process of applying for DI benefits. Hence, the relatively high participation and/or application costs of the latter two programmes might have outweighed any potential gain from increased benefit levels or relaxed time limits on the receipt of payments by switching programmes.

After the reforms, an increasing number of working single mothers may have gained access to UI and SI benefits, and single mothers facing the new transitional benefit rules may have found the medical- and work-related Rehab programmes and the DI programme relatively advantageous. Reports show that single mothers generally have poorer health than the rest of the population below the retirement age (Andersen, Birkeland, Epland and Kirkeberg, 2002) and that single mothers have poorer mental health and worse self-reported health than married or cohabiting mothers (Ugreninov, 2005). These findings imply that many single mothers may be eligible for health-related benefits. The remaining single mothers who (as a consequence of the reforms) are no longer eligible for transitional benefits and are neither able to fully support themselves by working nor able to document having an illness may have had to rely on SA payments.

3. Data and descriptive evidence

3.1 Data

We employ several administrative registries provided by Statistics Norway. The registries are linked through unique identifiers for each individual and cover all Norwegian residents from 1993 to 2008. For each year, the registries contain individual socioeconomic data (including labour earnings, benefits and transfers, and educational level) and demographic information (including date of birth, gender, marital status and municipality of residence).

The analysed sample consists of single and married mothers aged 19 to 55 years,²³ with at least one child aged 4–10 years. Mothers are classified as single in the data if they are neither married nor cohabiting with their respective partners with whom they have children. The data does not allow for the separation of mothers living *without* partners from mothers living *with* partners as long as they remain unmarried and do not have children in common. Thus, a cohabiting unmarried mother is assigned a single status if her partner is not the father of any of her children.²⁴ Our definition of married mothers include those who cohabit with their respective partners with whom they have children.²⁵ We restrict the sample to mothers who are assigned the same status (single or married) in both the beginning and the end of the calendar year. This ensures no overlaps between the groups within a given year.²⁶

Benefit payments are calculated yearly in NOK 1998 prices. The data provides information on payments from all social security benefits, including transitional benefits, DI benefits,²⁷ UI benefits, SI benefits, SA payments and various benefits related to health issues and rehabilitation. The SI registry includes only spells that last longer than the number of employer-paid sick days (14 days). Social assistance is paid to the household, so we define married mothers as SA recipients if either they or their husbands receive such benefits. Apart from the transitional benefits, none of the programmes we study has differential eligibility or benefit calculation rules related to the marital status of the recipient.

Earnings are measured as labour earnings reported in the tax registry and are not top-coded. The administrative data only contains a crude measure of work hours, making it

²³ We have selected this age range because it satisfies the age eligibility criterion for all the alternative benefits while excluding the option of old-age pension.

²⁴ These cohabiting single mothers had access to transitional benefits before, but not after, the 1999 reform that made mothers who had been cohabiting with a partner other than the father of her children for at least 12 of the last 18 months ineligible.

²⁵ Some 0.2% of the observations on married mothers indicate the receipt of transitional benefits. As this is inconsistent with the fact that married mothers are strictly ineligible for transitional benefits, we exclude the observations on these mothers.

²⁶ If we were to take a snapshot of the data and compare single with married mothers based on their family status (e.g., on 1 January each year), there could be mothers in the married group who later in the same year became single and vice versa.

²⁷ Including benefits from the time-limited DI programme introduced in 2004.

difficult to measure employment. We follow Havnes and Mogstad's (2011) and Løken, Lundberg and Riise's (2017) method of using administratively set earnings thresholds as proxies for hours of work. These thresholds are set by the Norwegian Social Insurance Scheme to define the labour market status and determine the eligibility for various benefits. The thresholds are based on a basic amount (1G), adjusted on a yearly basis.²⁸ Based on Havnes and Mogstad's (2011) definition, employment refers to earnings above two basic amounts (2G), and full-time employment denotes earnings above four basic amounts (4G).

To analyse disposable income for the individual and the net public expenditures, we need to calculate taxes. To do so, we compute gross income as equal to labour earnings plus total benefit payments.²⁹ We then impute taxes based on this constructed gross income measure, accounting for the changing characteristics of the Norwegian income tax in terms of tax rates and minimum deductible amounts during our period of study.³⁰

3.2 Descriptive evidence

Table A1 in Appendix A displays the characteristics of single and married mothers in Norway in the years prior to the reforms. On average, single mothers were younger, less educated, worked less and had substantially lower labour earnings compared with married mothers. Single mothers also received significantly more income from various benefit programmes than married mothers did. This pattern of weaker labour force attachment and higher welfare dependence of single mothers is common across the Organisation for Economic Co-operation and Development (OECD)-member countries.³¹

²⁸ At present (2017), the basic amount equals 93,634 NOK.

²⁹ With a few minor exceptions that do not apply to our setting, All benefits from the National Insurance Scheme are taxable

³⁰ We calculate yearly taxes using Professor Erik Sørensen's user-written Stata command "norsk_skatt", which calculates yearly individual taxes for the 1956–2005 period. We extend the programme to calculate the taxes for the 2006–2008 period. The ado command was previously available from Erik Sørensen's homepage.

³¹ See, for instance, comparisons across OECD countries in http://ec.europa.eu/justice/genderequality/files/documents/140502_gender_equality_workforce_ssr3_en.pdf.

In Figure 1, we plot yearly payments of different benefit programmes separately for single and married mothers. As expected, single mothers' receipt of transitional benefits decreased during the implementation period of the reforms from 1997 to 2001 and then drastically dropped in 2001 when the phase-in period ended. The increase in average payments in the first year of the reform (1998) is consistent with the fact that the 1998 reform increased the benefit levels of those single mothers who remained eligible (as explained in Table 1).

Examining other benefit programmes shows that there is an increase in SI payments for both single and married mothers. The increase is larger for single mothers than for married mothers during the post-reform period. For the various Rehab benefits, it is apparent that single mothers have already received more Rehab payments than married mothers prior to the reforms, and this difference increases in the phase-in and the post-reform periods. The pattern is similar for payments from the DI programmes. Furthermore, the reforms in the SI programme and the Rehab programme (discussed in Section 2) are apparent in the post-reform period. However, these reforms affect both single and married mothers. The trends in UI benefit payments follow the national business cycles. Single mothers have a similar or somewhat lower level of UI payments during the pre-reform period but receive relatively more UI benefits during the phase-in and the post-reform periods. Finally, single mothers receive much more in SA payments compared with married mothers. There is a downward trend in SA payments for single mothers in the pre-reform period, but at the end of the phase-in period, SA payments increase for single mothers and stabilise at a higher level in the post-reform period. Overall, the figures do not show clear signs of diverging pre-reform trends for single and married mothers, with the exception of the pre-reform trends in SA payments.

Figure 2 plots the trends for the other outcome variables, including total benefit payments, labour earnings, gross income, disposable income, and part- and full-time

employment rates. Single mothers have received much more in total benefit payments compared with married mothers. After the reforms, this gap somewhat diminishes. Furthermore, single mothers have lower labour earnings compared with married mothers throughout our period of observation. In total, single mothers actually have higher gross income compared with married mothers in the pre-reform and the phase-in periods. However, single mothers have lower gross income compared with married mothers in the post-reform period. This pattern is replicated in the section of the figure that plots trends in disposable income during the period under study. Finally, the bottom sections of the figure show trends in employment rates.³² Single mothers have lower employment rates compared with married mothers throughout our period of observation. Overall, there are no clearly visible divergences in the pre-reform trends of single and married mothers for any of the outcomes plotted in Figure 2.

4. Empirical strategy

4.1 Research design

We employ a difference-in-differences strategy by comparing single mothers who have at least one child aged 4–10 years (our treatment group) with married mothers who have at least one child age 4–10 years (our comparison group). The reforms give us variation within single mothers in terms of exposure to stricter eligibility criteria for transitional benefits.³³ Recall that the comparison group of married mothers were never eligible for transitional benefits. The use of a comparison group of married mothers removes any time-specific confounding factors common to both single and married mothers.

³² As explained in Section 3.1, we calculate part-time employment as labour earnings above two basic amounts and full-time employment as labour earnings above four basic amounts.

³³ The introduction date of the reforms on 1 January 1998 could potentially be used to estimate the effects of the reforms in a regression discontinuity design. However, the 1998-reform was announced well in advance of the implementation date. Thus, single mothers who applied for transitional benefits just before the 1st of January 1998 do not constitute a valid control group for single mothers who applied for transitional benefit just after the 1st of January 1998 (and as such were subject to the new rules). This hypothetical research design therefore suffers from potential self-selection into treatment.

Our difference-in-differences model includes four periods. The first is the pre-reform period from 1993 to 1997. The second is the phase-in period from 1998 to 2000. Finally, we split the post-reform period into two – from 2001 to 2004 and from 2005 to 2008. This enables us to identify and separate the short-term effects of the reforms (2001–2004) from their long-term effects (2001–2008).

To arrive at the identification of causal estimates, the assumption in the difference-in-differences design is that the groups follow the same time trend. In other words, in the absence of the reforms, the average outcome for single mothers would have changed in the same way across the years as that for married mothers. While most of our outcomes appear to display the same pre-reform time trends for both single and married mothers, this is not the case for SA payments (see Figure 1). Thus, the common-trend assumption might be violated for this outcome. Therefore, we flexibly control for potential differences in the time trends between our treatment and comparison groups by including group-by-period-specific time trends in our difference-in-differences model.

We implement our difference-in-differences estimator by estimating the following regression:

$$y_{itgp} = \beta_1 + \beta_2 Single_{ig} + \sum_{p=2}^4 \alpha_p Period_p + \sum_{p=2}^4 \gamma_{gp} (Period_p \times Single_{ig}) + \sum_{p=1}^4 \phi_p t + \sum_{p=1}^4 \delta_{gp} (t \times Single_{ig}) + \lambda_t + X'_i \theta + \varepsilon_{itgp}, \quad (1)$$

where subscript i denotes the individual, subscript t denotes the year, subscript g denotes the group (single or married mothers) and subscript p denotes the period (pre-reform, phase-in, short-term post-reform and long-term post-reform). y_{itgp} is the outcome variable. $Period$ is an indicator taking the value of 1 for the 1993–1997 period (pre-reform), 2 for the 1998–2000 period (phase-in), 3 for the 2001–2004 period (short-term post-reform) and 4 for the 2005–

2008 period (long-term post-reform). t is a trend variable numbering from 1 (1993) to 16 (2008). $Single$ is a binary variable taking the value of one if the mother is single or zero if she is married. λ_t is a vector of yearly fixed effects. X_i is a vector of observed characteristics, comprising the mother's age in 1997, a binary variable for having a college degree in 1997, a binary variable for a non-Norwegian country of birth, the number of children in 1997 and the local female labour market unemployment rate in 1997.³⁴ Note that we measure all controls in 1997, the last year prior to the reforms. Thus, the set of controls is pre-determined and unaffected by the reforms. The set of exogenous control variables is included to control for compositional changes across time in the pool of single mothers. Finally, ε_{itq} is the error term.

To alleviate the problems associated with any potential non-parallel time trends in the pre-reform period, the model includes interactions of the trend variable t with the full set of indicators for group and period. Thus, we include a full set of linear controls for group-by-period-specific time trends, allowing our treatment and comparison groups to have different time trends in the pre-reform, phase-in and post-reform periods. The coefficients of the group-by-period-specific time trends capture the differences in pre-reform, phase-in and post-reform trends between single and married mothers that would render the estimated effects inconsistent if the common-trend assumption is violated. The identifying assumption underlying our modified difference-in-differences model specified in Equation (1) is that the differences between single and married mothers in the average growth rate of the outcomes are constant and linear within each period (pre-, phase-in, short-term post-reform and long-term post-reform).

³⁴ The local labour market unemployment rates for females are calculated yearly for 46 regional labour markets in Norway. The labour markets are constructed based on commuting patterns (Bhuller, 2009). We calculate unemployment rates separately for females because the labour market in Norway is highly gender segregated. To calculate the unemployment rates, we use data from the Norwegian Social Science Data Services (NSD). The NSD is not responsible for the analysis of the data or the interpretations drawn in this paper.

Our coefficients of interest are γ_{gp} . These coefficients measure the effect of the phase-in of the reforms, as well as the short-term and the long-term post-reform effects, that is, the change in the mean outcome in the phase-in or the post-reform period relative to the pre-reform period, for single mothers relative to married mothers. The identifying assumption is that the reforms are conditionally exogenous. If the necessary assumption holds true, the parameters γ_{gp} will estimate the causal effects of the reforms during the phase-in, short-term post-reform and long-term post-reform periods.

We exclude individual fixed effects from the main model specifications because this allows us to estimate the effect of the reforms on the full population of single mothers. If we include individual fixed effects, our coefficient of interest, γ_{gp} , is identified only for those mothers who are single in both the pre- and the post-reform periods, that is, mothers who are long-term single for at least four years. Mogstad and Pronzato (2012) find that the effects of the reforms are significantly different for long-term single mothers compared with newly single mothers. Thus, to analyse the overall effect of the reforms on the complete population of single mothers, we need to identify the reform effects by utilising the information on all single mothers, not just mothers who have been single for at least four years. Furthermore, we need to estimate the effects on the full population of single mothers to capture accurately the total effects of the reforms on net public expenses.

Excluding individual fixed effects from the model implies treating individuals as annually separate observations and disregarding the serial correlation of outcomes across the years. The assumption underlying the model without individual fixed effects is that no individual specific effects are correlated with the outcome variables. This assumption is clearly unlikely to hold true in our setting. Therefore, Section 5.2 focuses on showing that our main results are robust to various ways of dealing with the serial correlation. We estimate year-by-year effects of the reforms, aggregate the data to just two groups before and after the

reforms and include individual fixed effects in the model. Moreover, we cluster all standard errors in the main analysis on treatment \times year.³⁵

4.2 Confounding effects and compositional changes in treatment and comparison groups

If the reforms had causal effects on outcomes other than labour market outcomes and receipt of benefit payments, it would be more complicated to isolate the causal effects on the outcomes that we study. We are mainly concerned with two potential effects of the reforms. First, because the reforms make it more costly to be a single mother, they could increase marriage rates among single mothers and/or decrease divorce rates among married mothers. Second, because single mothers of children below four years old do not face tightened work requirements after the reforms, the reforms could cause an increase in birth rates among single mothers.

To investigate the first issue of whether the reforms affect the likelihood of being a single mother, Figure A1 in the Appendix A plots the share of single mothers (left side) and marriage rates for women aged 19 to 55 (right side) over the sample period. The share of single mothers is stable and about 0.23 at the time of the reforms, implying no change in the probability of becoming a single mother within the reform period. The slight increase in the proportion of single mothers between 1992 and 1996 is likely due to higher divorce rates in years of recession (Norway experienced a recession in the early 1990s). The marriage rate of women over the 1993–2003 period, is relatively stable (between 0.03 and 0.04). However, a slight increase in the marriage rate occurs before the reforms, followed by a slight decrease after the reforms.

The 1998 reform introduced both a three-year time limit on the receipt of benefits and a three-year implementation period from 1998 to 2001, meaning that single mothers receiving transitional benefits continuously since 1997 would have needed to have another child in 2000

³⁵ This implies 32 clusters, which admittedly may be at the lower limit for clustered errors.

to remain eligible for benefits. Thus, the reforms could potentially influence mothers' choice of having another child. To investigate this possibility, we have estimated the effect of the reform on the likelihood of having a child in the phase-in period, short-term post-reform period, and long-term post-reform period. We found no effects of the reforms on the likelihood of having a child in either of the periods.³⁶ Thus, we are not concerned that our results are contaminated by reform effects on marriage or birth rates.

Another criterion for the difference-in-differences specification in Equation (1) to produce causal estimates is that there should be no compositional changes over time in the treatment and the comparison groups that have patterns similar to the reforms. To check for this requirement, we conduct a balancing test in which the pre-reform covariates (the mother's age in 1997, having a college degree in 1997, a non-Norwegian country of birth, the number of children in 1997 and the local female labour market unemployment rate in 1997) serve as dependent variables in Equation (1). Table 2 shows the results.

The results of the balancing test provide reasons for concern. There are positive effects of the phase-in and the post-reform periods on all covariates for single mothers relative to married mothers.³⁷ The test therefore indicates that compositional changes in the treatment and the comparison groups may dilute the effects of the reforms. However, it is noteworthy that the relative size of the majority of the estimated coefficients is small, especially for local unemployment rates in 1997, the age of mothers in 1997, and the share of immigrants in each groups. However, focusing on the short-term post-reform period, the reforms are associated with a 25.6% increase in the number of children in 1997 and a 54.7% decrease in the share of mothers with a college degree by 1997. However, it is reassuring that a further graphical inspection of the raw time trends in the covariates for single and married mothers shows no

³⁶ If we do not include controls in the regression, we find a 0.002 increase in the likelihood of having a child in the phase-in period of the reforms (8% in relative terms), statistically significant at the 10 % level.

³⁷ To test for the overall significance of the covariates during the entire period 1993 to 2008, we regress single mother status on the covariates and obtain an F statistic of 31.1 (clustering on group×year).

change in the trends coinciding with the exact timing of the reforms (see Figure A2 in Appendix A), with the notable exception of the number of children in 1997.³⁸

To deal with the compositional changes in our treatment and comparison groups, we follow a reweighting strategy similar to that used by Mogstad and Pronzato (2012).³⁹ When estimating the difference-in-differences model specified in Equation (1), we weight each individual by the inverse of her propensity score, as suggested by Imbens (2000). The propensity score for being a single mother is estimated based on our covariates measured in 1997.⁴⁰ We then weight each treated individual with the weight $\frac{1}{p_i}$ and each comparison individual with the weight $\frac{1}{1-p_i}$, where p is the propensity score (the estimated probability of being a single mother). Thus, we weight each observation by the inverse of the probability of the actual status (single or married) of the mothers. Intuitively, within each year, single mothers who resemble married mothers in that year are weighted more and vice versa for married mothers who resemble single mothers in that year. The key identifying assumption for the weighted version of the difference-in-differences model specified in Equation (1) to provide causal estimates is that the common-trend assumption holds conditional on adjusting for the compositional changes in the pre-treatment covariates by applying the inverse probability of treatment weights. Figure A3 in the Appendix A shows the distribution of propensity scores for single and married mothers.

5. Results

5.1 Main results

³⁸ The pattern in the figure for the number of children in 1997 can be attributed to the fact that many mothers who enter our sample after 1997 do not have any children in 1997. These mothers are typically younger than the average mothers.

³⁹ We thank the anonymous referee who suggested this.

⁴⁰ To be more specific, we estimate the model $Single_i = \beta_1 + X_i'\theta + \varepsilon_{iq}$ separately for each year using a logit specification. The procedure is carried out with the user-written Stata command `psmatch2`.

This section shows the main results of the estimation of the difference-in-differences model specified in Equation (1) by OLS regression.⁴¹ We find considerable benefit substitution in both the short term and the long term, with reference to increased benefit payments from SI, Rehab, DI and UI. The reforms also increase the single mothers' labour market participation, in terms of both part-time and full-time employment. However, the positive effect on employment diminishes in the long term. We find a strong short-term increase in labour earnings, but it drops considerably in the long term. There is a dynamic effect of the reforms on disposable income. For the average single mother, the reforms increase disposable income in the short term but decrease it in the long term. There is a net public fiscal gain from the reforms, which is stronger in the short term than in the long term.

5.1.1 Benefit substitution

Row (A) in Table 3 shows that the reforms decrease the single mothers' receipt of transitional benefits by around 15,500 NOK in both the short-term and the long-term post-reform period, corresponding to an approximately 50% decrease in payments.⁴² If there were no behavioural responses to the reforms, this would equal the effect of the reforms on the average (pre-tax) financial loss to single mothers and the average net public expenses per single mother. However, the reforms have prompted significant behavioural responses of single mothers in terms of benefit substitution and labour market participation.

Rows (B) to (F) in Table 3 show that the reforms result in considerable benefit substitution. Focusing on benefit substitution by switching to health-related benefit programmes, Rows (B), (C) and (D) indicate that the short-term effects of the reforms include

⁴¹ For presentational convenience, our discussion of the main results focuses on the short-term and the long-term post-reform effects and mostly disregard the phase-in period.

⁴² Note that since married mothers lack access to transitional benefits, they do not constitute a valid comparison group when estimating the effect of the reforms on transitional benefits. Thus, when estimating the reform effect on this outcome, we restrict the sample to single mothers only and estimate $y_{itp} = \beta_1 + \sum_{p=2}^4 \alpha_p \text{Period}_p + \sum_{p=1}^4 \phi_p t + \lambda_t + X_i' \theta + \varepsilon_{itp}$, where the notation follows Equation (1). The coefficients of interest are α_p – the changes in the mean outcomes in the phase-in and the post-reform periods relative to the pre-reform period for single mothers.

a 2,920-NOK increase in SI, a 3,079-NOK increase in Rehab benefits and a 1,477-NOK increase in DI benefits on average. These estimates are large in relative terms. Compared with the mean rates of benefit payments to single mothers in the pre-reform years, the short-term estimated effects correspond to 86%, 117% and 65% increases in the above-mentioned benefit payments, respectively.

However, part of the increase in SI is mechanical; it is conditional on employment, and as shown in Table 4, the reforms increase the employment rates of single mothers in both the short term and the long term. To assess the mechanical effect, we decompose the estimated effect on SI benefits into a direct mechanical effect and an indirect behavioural effect, using the following simple relationship:⁴³

$$\Delta Total\ SI\ benefits = \underbrace{[\Delta empl. \times \overline{SI\ benefits}]}_{mechanical\ effect} + indirect\ effect, \quad (2)$$

where $\overline{SI\ benefits}$ is the average difference in the yearly SI benefits between employees who work part-time or more and employees who work less than part-time. We estimate the short-term effect of the reforms on part-time employment at an 8.0-percentage point increase [Row (M) in Table 4]. For the period from 1993 to 2008, we calculate that mothers with at least part-time⁴⁴ employment received on average 8,041 NOK in SI benefits each year. Mothers who worked less than part-time received on average 979 NOK in SI benefits each year. The mechanical effect of the reforms on SI benefits is therefore equal to a 565-NOK⁴⁵ increase in SI benefits. Thus, as much as 81% (2,355 NOK out of 3,280 NOK) of the observed short-term increase in SI benefits comes from an indirect behavioural response.

The increases in benefit payments from health-related welfare programmes persist over the long term. The persistent long-term effects on benefit substitution with health-related

⁴³ We thank the anonymous referee who suggested this decomposition exercise.

⁴⁴ Defined as earning at least two basic amounts, following Havnes and Mogstad's (2011) definition.

⁴⁵ $(8041 - 979) \times 0.08 = 565$

benefits suggest that many single mothers are eligible for benefits designed to secure income for individuals who have a temporary or long-term illness, in line with the reports showing that single mothers have poorer health than the general population (see Section 2.4). Conversely, the benefit substitution with health-related welfare programmes could indicate a worsening of the single mothers' health after the reforms, possibly caused by stress or difficulties in combining work with caring for their children. Unfortunately, the lack of access to health data restricts us from studying this potential mechanism. Furthermore, we cannot rule out the possibility that some single mothers have gained access to health-related benefits even if their physical and mental conditions do not preclude them from working. In any case, the increase in DI benefits is of particular concern since the recipients will likely depend on welfare for the rest of their lives.

Turning to the non-health-related benefit programmes, Row (E) in Table 3 shows that in the short term, the reforms increase the UI benefits received by single mothers by 1,176 NOK (in relative terms, 34%). This effect persists over the long term. For SA payments [Row (F)], we find no effects of the reforms on either the short term or the long term.

Despite the considerable amount of benefit substitution, the reforms still cause a sizeable decrease in the total welfare benefits received by single mothers. By subtracting the increases in payments (from the various benefit programmes) from the decrease in transitional benefits, we arrive at an estimate of total benefits, shown in Row (G) of Table 3. The reforms decrease the total benefits by 6,209 NOK in the short term and 6,487 NOK in the long term. These findings imply that due to benefit substitution, the overall loss in total benefits is only around 40% of the loss in transitional benefits. Thus, disregarding this behavioural response in terms of benefit substitution would lead to a serious miscalculation of the reform effects on reductions in welfare dependence and state benefit payments.

5.1.2 Labour market responses

We report the effects of the reforms on employment rates (see Table 4). The estimated short-term effects are large. The reforms increase the single mothers' part-time employment rates by 8.0 percentage points (17%) and full-time employment rates by 6.1 percentage points (23%). These short-term effects diminish in the long term. We estimate the long-term effects of the reforms at a 5.2-percentage point increase in part-time employment and a 2.6-percentage point increase in full-time employment.

The large short-term increase in employment rates is reflected in a similar sizeable short-term increase in labour earnings, reported in Row (H) of Table 3. We estimate that the reforms increase labour earnings by 14,554 NOK in the short term, corresponding to a 15% increase compared with the pre-reform mean labour earnings of single mothers. The result implies that in the short-term, the population of single mothers more than fully compensates for the loss of total benefit payments caused by the reforms by increasing their labour earnings. However, this finding is reversed in the long term. We estimate that the long-term effect of the reforms on labour earnings diminishes to a 4,316-NOK increase. This figure is lower than the estimated decrease in total benefit payments in the long term.

5.1.3 Private and public financial costs and benefits of reforms

In the short term, the behavioural responses in terms of benefit substitution and labour supply response more than outweigh the loss in transitional benefit payments caused by the reforms. By subtracting the loss in total benefit payments from the gain in labour earnings, we calculate the average change in gross income caused by the reforms in the short term. As shown in Row (I) of Table 3, the estimated short-term effect of the reforms on gross income is an 8,346-NOK increase. Our analysis implies that in the short term, for every 100 NOK of lost transitional benefits, 60 NOK is replaced by payments from other benefit programmes, and 94 NOK is replaced by an increase in labour earnings.

However, the picture changes in the long term. Because the loss in total benefit payments persists over the long term, while the positive effect on labour earnings diminishes by 70%, we estimate that the long-term effect of the reforms on gross income is a 2,170-NOK decrease. In the long term, for every 100 NOK of lost transitional benefits, 59 NOK is still replaced by payments from other benefit programmes, but only 27 NOK is replaced by an increase in labour earnings.

To determine the net fiscal costs and benefits of the reforms for the affected single mothers and public expenditures, we calculate the effect of the reforms on income taxes. We estimate that the reforms raise income taxes by 4,263 NOK in the short term, an 11% increase compared with the pre-reform baseline. We find no statistically significant long-term effect on taxes. The estimated effects on taxes allow us to calculate the net fiscal gains of the reforms for both the affected single mothers and in terms of public expenditures.

First, to analyse the net fiscal costs and benefits of the reforms for the affected single mothers, we estimate the reforms' effect on the single mothers' disposable income, equal to the effect on gross income minus the effect on taxes. As shown in Row (K) of Table 3, in the short-term, the reforms increase the single mothers' disposable income by 4,829 NOK, corresponding to a 4.6% raise relative to the pre-reform level. Our estimated average short-term effect of the reforms on disposable income for the population of single mothers can be compared with Mogstad and Pronzato's (2012) findings that in the short term, the reforms increase disposable income by 2,447 EUR at 1998 prices (23,311 NOK using today's exchange rate) for "newly lone mothers" but decrease the disposable income of "lasting lone mothers" by 844 EUR at 1998 prices (8,040 NOK using today's exchange rate).

However, there is no positive long-term effect of the reforms on single mothers' disposable income. Instead, we estimate that the reforms decrease the single mothers' disposable income by 2,086 NOK in the long term. The contrasting findings in the short term

and the long term highlight the significance of taking a dynamic perspective to estimate the financial costs and benefits of the reforms. In terms of single mothers' fiscal costs and benefits, the reforms succeed in increasing their disposable income in the short term. However, in the long term, we find no evidence of an increase in single mothers' disposable income. They experience a decrease in labour earnings that they are unable to offset by increases in benefit payments.

Second, we estimate the effects of the reforms on the average net public expenditures per single mother. The net public fiscal expenditure per person is equal to the total benefit payments minus the gross income tax. Prior to the reforms, the public expenditure per single mother was 6,978 NOK. As reported in Row (L) of Table 3, the reforms decrease net public expenses per single mother by 9,725 NOK in the short term. The short-term total public fiscal gain from the reforms over the 2001–2004 period is equal to the sum of the average short-term reduction in the net public expenditure times the population of single women in each year of the 2001–2004 period, amounting to approximately 2.0 billion NOK at 1998 prices.⁴⁶ The long-term effect of the reforms on net public expenses is somewhat smaller, but we still estimate an average decrease of 6,402 NOK per year in net public expenses over the 2005–2008 period. The long-term total public fiscal gain from the reforms over the 2005–2008 period amounts to approximately 1.3 billion NOK at 1998 prices.⁴⁷

In terms of public fiscal costs and benefits, the reforms are therefore successful, resulting in a large decrease in costs to taxpayers and reversing the net public fiscal cost per single mother to a net public fiscal gain per single mother. Including the total gains in public expenditures during the phase-in period,⁴⁸ the reforms saved the taxpayers more than 3.5 billion NOK (at 1998 prices) in public expenses from the year it was introduced (1998) to

⁴⁶ [(9,725 NOK × 52,202) + (9,725 NOK × 51,958) + (9,725 NOK × 52,401) + (9,725 NOK × 51,570)] = 2,022,128,875 NOK

⁴⁷ [(6,402 NOK × 51,760) + (6,402 NOK × 51,441) + (6,402 NOK × 50,007) + (6,402 NOK × 48,851)] = 2,022,128,875 NOK

⁴⁸ [(2,487 NOK × 51,666) + (2,487 NOK × 50,036) + (2,487 NOK × 48,125)] = 248,304,657 NOK

2008.⁴⁹ Of this gain to public expenses, roughly two-thirds comes from reduced benefit payments and one third comes from increased income taxes.

5.2 Dealing with potential serial correlation

As mentioned, a potential concern about our main analysis is that because employment, earnings and the receipt of benefits are unlikely to be annually independent states, we might improperly account for the serial correlation among mothers, potentially inflating the precision of our results. In this section, we report the results from a series of empirical strategies that deal with the potential problem of serial correlation. Together, they show that our main results are robust to various ways of handling serial correlation.

5.2.1 Year-by-year effects

Our first strategy for addressing serial correlation involves a time-to-event analysis. Specifically, we define 1997 as the base year and then separately estimate the model, as follows:

$$y_{it} = \beta_1 + \beta_2 \text{Single}_i + \gamma_1 \text{Year}_{t \neq 1997} + \gamma_2 (\text{Year}_{t \neq 1997} \times \text{Single}_i) + X_i' \theta + \varepsilon_{it}, \quad (3)$$

for each year between 1993 and 2008 (except, of course, the base year).⁵⁰ By comparing the base year of 1997 to just one pre-reform, phase-in or post-reform year in each regression, we account for any potential serial correlation in the outcomes of the mothers. Another advantage of this approach is that we can more formally assess the common-trend assumption of the difference-in-differences model while explicitly controlling for covariates and year-fixed effects. We also weight observations by the inverse of the propensity score to control for compositional changes. If the common-trend assumption holds true, we should expect γ_2 to be

⁴⁹ Please note that, due to non-available data, the estimate does not account for administrative costs which could potentially vary between the different benefit programmes.

⁵⁰ We cluster standard errors at the individual level, as the group \times year level only yields four clusters in this setup.

close to zero and statistically insignificant for the pre-reform years (1993–1996). Any potential effects of the reforms on earnings, employment or receipt of benefits should be reflected in statistically significant estimates of γ_2 for the post-reform years (2001–2008).

Figure 3 plots the estimated year-by-year effects separately for all payments from the various benefit programmes.⁵¹ For most of the outcomes, γ_2 is close to zero for all the pre-reform years (1993–1996). There seems to be no clear trend in the pre-reform year-by-year effects, apart from SA benefits, for which there is a negative trend for single mothers compared with married mothers in the pre-reform years. The estimated effect on SI benefits is positive and increases in both the phase-in and the post-reform periods. The drop in 2005 is due to a restrictive reform in the SI programme in 2004 (see Section 2 for details). The estimated effect on Rehab benefits is positive and increasing in the phase-in period before it stabilises in the post-reform period. Several reforms in the Rehab programme (see Section 2) may explain the observed change between 2001 and 2002, as well as the decline in payments from 2004. The estimated effect on DI benefits is positive and increases in both the phase-in and the post-reform periods. For UI benefits, there are positive and increasing effects during the phase-in period and stable positive effects during the post-reform period. The year-by-year effects on UI benefits are smaller in size compared with the health-related benefit programmes. For SA benefits, the estimated pattern is less clear. There have been strong effects already in the pre-reform period, which imply that we should interpret the year-by-year effects on SA benefits with caution. However, if we compare the yearly effects immediately prior to the reforms (1995 and 1996) with the years immediately after the reforms (2001 and 2002), there seems to be a positive and significant effect of the reforms on SA benefits.

⁵¹ Except transitional benefits, for which there is no comparison group from which to calculate differences.

Figure 4 shows the treatment effects year-by-year on total benefits, labour earnings, gross and disposable incomes and employment rates. Reassuringly, the year-by-year estimate of γ_2 is close to zero and stable for all outcomes during the pre-reform periods (1993–1996). Looking first at the total benefits payment, there is a slight downward trend in the year-by-year effects in the pre-reform period, and the estimated effect is statistically significant in the pre-reform years of 1993 and 1994. However, the estimated effect is small in size compared with the estimated post-reform effects. There are positive but decreasing effects during the phase-in period, followed by a clear shift to negative year-by-year effects during the post-reform period. The negative effect on total benefits is slowly increasing in absolute size in the post-reform period. For labour earnings, γ_2 is nearly statistically significant at a 5% level for any of the pre-reform years. A positive and increasing reform effect already emerges in the phase-in period. The positive effect on labour earnings peaks in the post-reform year of 2002 before the yearly effect diminishes in the period from 2003 to 2008. In 2008, the effect of the reforms in terms of labour earnings is close to zero.

For gross and net incomes, all the pre-reform effects are close to zero, but we observe a slight downward trend in the pre-reform years, and the estimated coefficients are statistically significant for 1993 and 1996. During the phase-in period, there are clear positive and increasing effects. The positive effects on gross and disposable incomes are stable and peak from 1999 to 2004. The positive effects then diminish, and we estimate negative long-term effects of the reforms on gross and disposable incomes in 2007 and 2008.

Looking at the pre-reform effect on part-time employment, only the coefficient in 1996 compared with the base year (1997) is statistically insignificant, from zero at the 5% level. However, γ_2 is small in size for all the other pre-reform years (1993–1995) and only just statistically significant at the 5% level. From Figure 4, it seems that apart from the final pre-reform year of 1997, there is a parallel trend in part-time employment for the treatment

and the comparison groups. There are positive and increasing year-by-year effects during the phase-in period. The effect on part-time employment peaks from 2001 to 2003, before it diminishes and then stabilises at around 0.05 from 2006 to 2008. For full-time employment, γ_2 is close to zero and statistically insignificant for all the pre-reform years, except 1993. The pattern in the phase-in and the post-reform periods is similar to that observed for part-time employment in that the effect is positive and increasing in the phase-in period and then peaks in the first years of the post-reform period before declining again.

To sum up, the year-by-year effects analysis is supportive of the main results presented in Table 3.

5.2.2 Aggregating observations within each period

In the second strategy for dealing with serial correlation, we aggregate the data to just two groups in each period by constructing the means of the outcome variables for each individual in each separate period (pre-reform, phase-in, short-term post-reform and long-term post-reform). This is the most conservative strategy for tackling the potential problems of serial correlation in the outcomes of interest. We then estimate the following model:

$$Y_{it} = \beta_1 + \gamma_1 Period_{\neq pre} + \gamma_2 (Single_i \times Period_{\neq pre}) + \gamma_3 Single_i + X_i' \theta + \varepsilon_{it}, \quad (4)$$

separately for each of the periods (phase-in, short-term post-reform and long-term post-reform), using the pre-reform period as the base period. The notation follows Equation (1), and γ_2 is the coefficient of interest. We report the results of this specification in Table 5. The important take-away from the table is that aggregating the data to just two groups in each period does not alter the statistical significance of our main findings. Moreover, the estimated coefficients are of roughly the same size as those reported in Table 3, as expected. The only difference is that when we use this conservative strategy for dealing with the potential

problem of serial correlation, the estimated decrease in the long-term disposable income is no longer statistically significant. We therefore acknowledge that we cannot claim to find that the reforms decrease disposable income in the long term although our main results suggest it. Nevertheless, the evidence from this exercise and the main results imply that single mothers' disposable income does not increase in the long term.

5.2.3 Individual fixed effects

This section presents our final strategy of dealing with the potential problem of serial correlation: We include individual fixed effects in the aggregated difference-in-differences model discussed in the previous Section 5.2.2. The inclusion of individual fixed effects in the model controls for all potential time-invariant individual confounders. The drawback of this specification is, as mentioned in Section 4.1, that we only identify the reform effects on the mothers who have remained single as observed in both the pre-reform and the post-reform periods (termed “lasting single mothers” by Mogstad and Pronzato (2012)), implying that the findings are less generalisable and do not capture the full effects of the reforms on the total population of single mothers. The results from the aggregated specification including individual fixed effects are presented in Table 6. When we discuss the results in Table 6 for the sub-population of lasting single mothers, we will compare to them to the results for the general population of single mothers as estimated in the aggregated specification without individual fixed effects, reported in Table 5 discussed in the previous section.

Comparing the results from the specification including individual effects with the results from the aggregated specification without individual fixed effects outlined in Section 5.2.2, most of the main results are similar. However, there are some notable exceptions. In the short term, we find no effect on total benefits. The reason is that benefit substitution is more intensive among lasting single mothers than in the general population of single mothers, especially in terms of the health-related benefits. Compared to estimates for the general

population of single mothers, the short-term increase in benefit payments among lasting single mothers is 48% larger for SI benefits, 35% larger for Rehab benefits, 147% larger for DI benefits, and 19% larger for UI benefits. We also find a 1,195 NOK short-term increase in SA benefits, for which we found no effect for the general population.

Furthermore, the long-term effect of the reforms is a 5,696 NOK increase in total benefits for the population of lasting single mothers. This increase in total benefits in the long term is driven by increased benefit substitution into Rehab and DI benefits. Recall that for the general population of single mothers, we find negative short-and long-term effects on total benefits of about a 6,000 NOK decrease (see Table 3 and 5).

For labour earnings of lasting single mothers, the pattern of the effects of the reforms is similar to that estimated for the general population of single mothers; an increase already in the phase-in period, which further increases in the short-term post-reform period and then sizably diminishes in the long-term post-reform period. However, the estimated effect is smaller in size for lasting single mothers compared to the general population of single mothers. We find that the reforms increased labour earnings for lasting single mothers by 9,272 NOK in the short term, corresponding to 60% of the baseline estimate for the general population. This positive effect of the reforms on labour earnings for lasting single mothers does not persist in the long term. The contrasting findings for lasting single mothers and the general population of single mothers are not surprising. Mogstad and Pronzato (2012) show that, in response to the reforms in transitional benefits, lasting single mothers increased their labour supply by less than newly single mothers.

However, contrary to Mogstad and Pronzato, who find a decrease in disposable income of mothers who stayed single for at least four years, we find that the reforms increase disposable income of the affected single mothers.⁵² For lasting single mothers, we estimate

⁵² Please note that our sample of lasting single mothers does not fully overlap with Mogstad and Pronzato's sample of lasting single mothers who have stayed single for at least four years.

the short-term effect of the reform to a 5,874 NOK increase in disposable income, similar in size to the estimate for the general population of single mothers. While we find no long-term effect on disposable income for the general population of single mothers, we estimate the long-term effect of the reforms to a 3,549 NOK increase in disposable income for lasting single mothers. The effect is entirely driven by benefit substitution.

Finally, in regard to the effect of the reform on net gain to public expense, the result is drastically different for the sub-population of lasting single mothers compared to the general population of single mothers. In the short term, the effect is an average reduction in net public expenses of 3,398 NOK. However, this reduction is offset in the long term by an average increase in net public expenses of 3,989 NOK.

5.3 Sensitivity analysis: specification and robustness checks

In this section, we show that our main results are robust to a wide range of alternative specifications. Table A4 presents the results of the estimation of these alternative specifications. For presentational convenience, we focus on the four outcomes that are central to our overall findings: total benefits, labour earnings, disposable income and net public expenses. The other outcomes presented in the paper are also robust to the alternative specifications (available on request).

First, we show that the main results are not driven by how we control for the changing composition of the treatment and the comparison groups. In specification (2) we estimate the difference-in-differences model specified in Equation (1) without weighting on the inverse of the propensity score of each observation. In specification (3) we estimate the model with reweighting but exclude the control variables. In both these alternative specifications, the estimates are very similar to the main results. The sole exception is that we estimate a negative long-term effect on labour earnings in the specification that does not implement the weighting approach.

To investigate whether the increasing proportion of non-Norwegian-born mothers may drive the results of the analysis over time, we exclude immigrants from the sample. For this alternative specification (4), the estimates are also very close to the main results. Furthermore, we check whether the results are sensitive to how we specify the group-by-period-specific time trends. In specification (5) we include group-by-period-specific quadratic time trends in the model and again arrive at estimates similar to those for the main specification.

To address any potential concerns that our results are driven by a contemporaneous reform that introduced cash-for-care subsidies, we estimate specification (6) in which we exclude mothers with children in the 1–3 age group, as this is the age eligibility criterion for cash-for-care benefits.⁵³ When estimating specification (6), all results are similar to our main results, except that there is no significant, positive short-term effect on disposable income. The reason is that the short-term effect on earnings is smaller in size for this specification compared with the baseline specification, perhaps reflecting that the mothers in this sample are older on average and therefore less likely able to respond to reduced transitional benefits by increasing their labour supply. However, overall, the results from specification (6) imply that the cash-for-care subsidies do not dilute the main results.

6. Conclusion

In this paper, we analyzed the economic impacts of workfare reforms in the state benefit programme targeting single mothers in Norway. The reforms were implemented in 1998 and 1999 and resulted in stricter eligibility criteria for the transitional benefits targeted at single mothers. The reforms decreased the transitional benefits to single mothers by about 50%. We find considerable benefits substitution in response to the reforms: For each 100-NOK reduction in targeted transitional benefits, single mothers replace approximately 60 NOK

⁵³ Conditioning on the age of the youngest child implicitly entails conditioning on the choice of having another child, which could possibly be endogenous to the reforms. This is why we do not condition on this outcome in our main specification. Nonetheless, we show in Section 4.2 that the reforms have no effect on the likelihood of having a child.

through increased uptake of other benefit programmes, mainly health-related benefits.

Moreover, we find that the reforms resulted in a sizeable positive short-term labour supply response among the affected single mothers. This positive labour supply response diminishes in the long term five to eight years after the reform. Investigating the overall economic impact of the reforms for the affected single mothers, we find that the benefit substitution and positive labour supply response resulted in a short-term gain to single mothers' disposable income. However, as the labour supply response diminishes in the long term, we find that the reforms had no, or even negative, long-term effects on disposable income of the affected single mothers.

The reforms significantly reduced overall costs to taxpayers. We estimate the total net gain to public expenses to 3.56 billion NOK over the period 1998 to 2008. Of the total gain to public expenses, roughly two-thirds comes from reduced benefits payments and one third comes from increased income taxes.

However, we do wish to note that there are compositional changes in the treatment and comparison groups over the period we observe. The causal interpretation of our findings are based on the assumption that the common trends assumption holds conditional on the reweighting strategy we employ to adjust for these compositional changes. Reassuringly, our graphical analysis of the year-by-year effects suggests that, conditional on the adjusting for compositional changes, the pre-trends are parallel for our treatment and comparison groups. Finally, note that the estimated total effect to public expenses is true even if it came about as a result of compositional changes.

Our study has implications for evaluations of workfare reforms to welfare programmes. Along with other important studies like Inderbitzin, Staubli, and Zweimüller (2016), it underscores the significance of analysing behavioural responses in terms of benefit

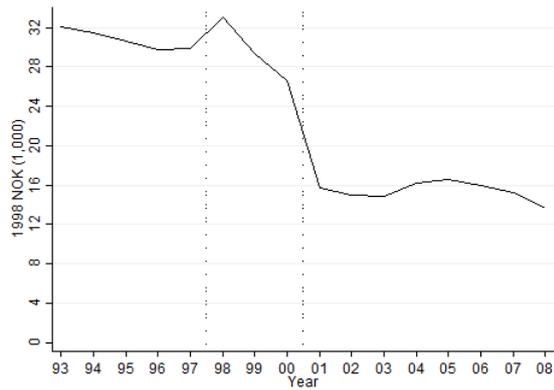
substitution *in addition* to labour market responses to capture the full costs and benefits of reforms to welfare programmes, both for the affected individuals and to public finances.

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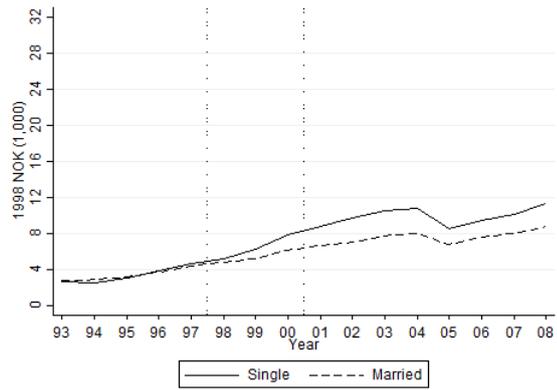
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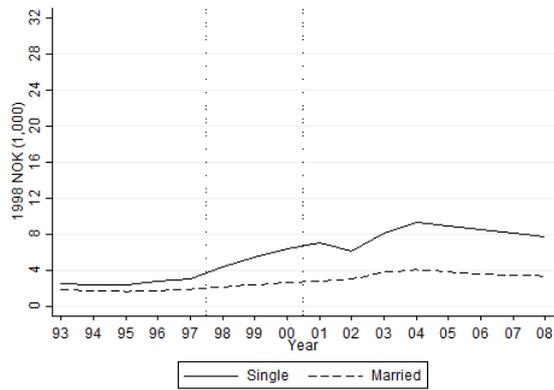
Transitional benefits



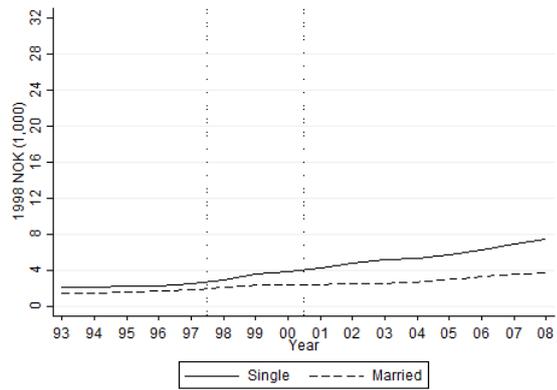
Paid sick leave benefits



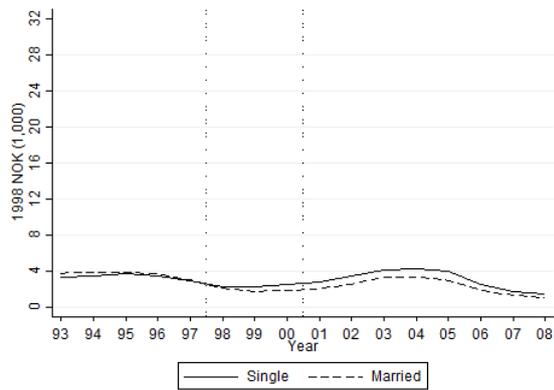
Rehabilitation benefits



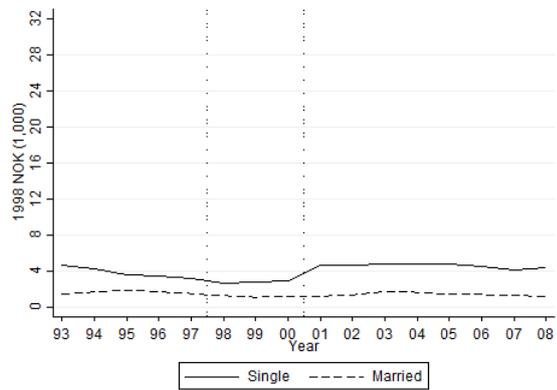
Disability insurance benefits



Unemployment insurance benefits



Social assistance benefits



— Single mothers - - - Married mothers

Figure 1: Trends in benefit payments for single and married mothers (1993–2008)

Notes: The sample comprises single and married mothers with at least one child aged 4–10 years. The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. Benefits measured in 1,000 NOK at 1998 prices.

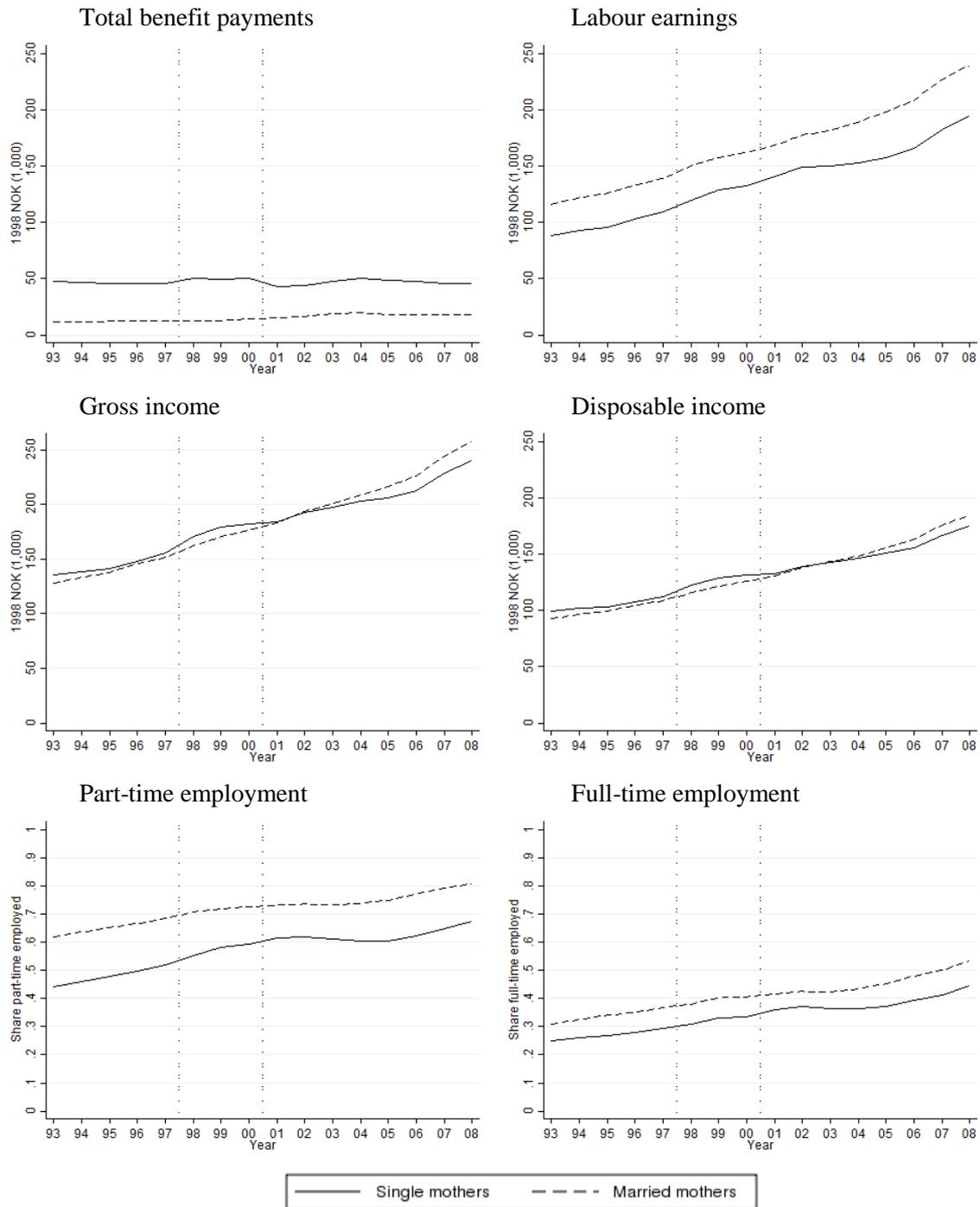


Figure 2: Trends in income and employment for single and married mothers (1993–2008)

Notes: The sample comprises single and married mothers with at least one child aged 4–10 years. The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. Income and benefits measured in 1,000 NOK at 1998 prices.

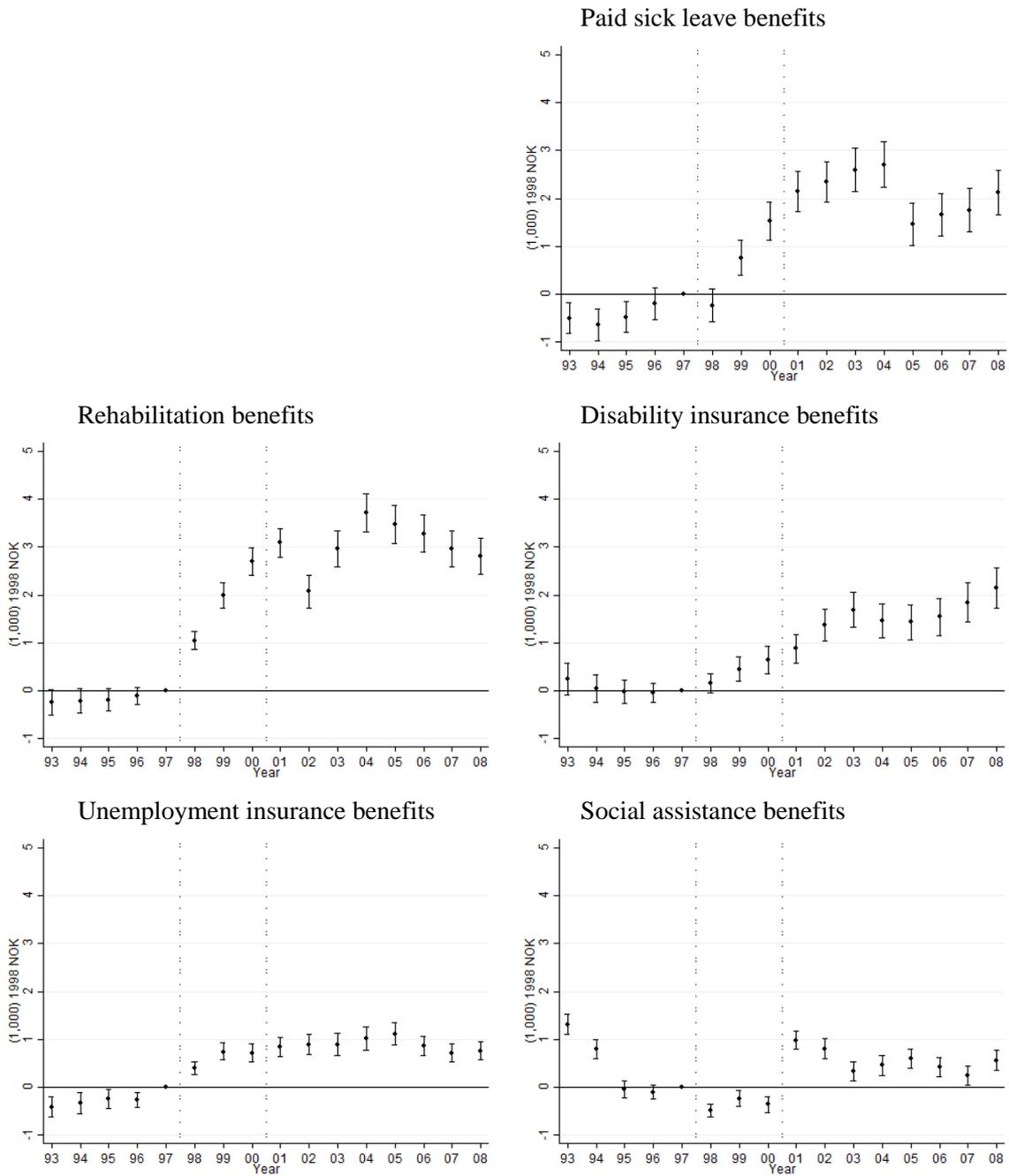


Figure 3: Year-by-year effects on payments from the various benefit programmes

Notes: Coefficients with 95% confidence intervals (standard errors clustered at the individual level). Each observation weighted by the inverse of her propensity score. The base year is 1997. The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. Benefits measured in 1,000 NOK at 1998 prices.

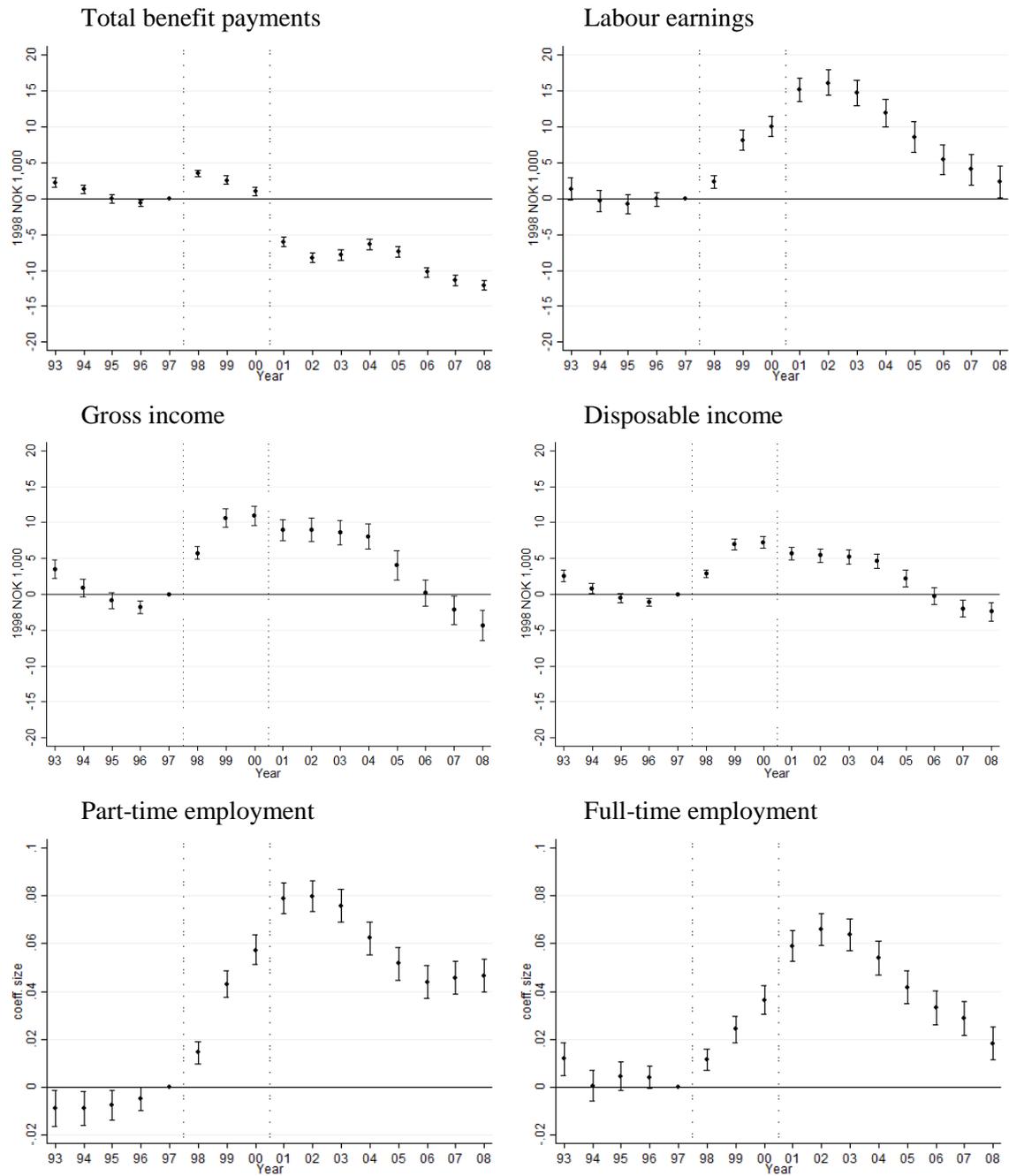


Figure 4: Year-by-year effects on income and employment

Notes: Coefficients with 95% confidence intervals (standard errors clustered at the individual level). Each observation weighted by the inverse of her propensity score. The base year is 1997. The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. Benefits and income measured in 1,000 NOK at 1998 prices.

Table 1. Features of the 1998 and the 1999 reforms in the transitional benefit programme

Characteristics	Pre-reform	Post-reform
1998 reform		
Time limit ^{a)}	None	3 years
Age limit	Youngest child has not yet finished third grade of primary school (9–10 years old)	Youngest child is less than 8 years old
Work requirement ^{b)}	None	Youngest child is aged 3 years or older
Maximum benefit level ^{c)}	6,171 NOK (1998 prices) per month in 1998	6,995 NOK (1998 prices) per month in 1998
Asset, means-tested	No	No
1999 reform		
Cohabitation status	Ineligible if the couple have children in common or are married	Ineligible if the relationship has lasted for at least 12 of the past 18 months

Notes: a) The time limit relates to the mother's youngest child and resets to three years for every newborn child. Benefits may be awarded in non-consecutive periods. b) Work requirements include working for at least half of the hours of a standard work week in Norway (37.5 hours), studying for at least half of the hours of a full-time course or registering as unemployed at the government agency of the Labour and Welfare Service. c) The maximum benefit level was obtained if the mother had earnings from work or received SI benefits below a threshold of 1,891 NOK (1998 prices) per month in 1998 and did not receive Rehab or DI benefits.

Table 2. Balancing test

Covariate	Phase-in effects 1998-2000	Short-term effects 2001-2004	Long-term effects 2005-2008	Mean dependent variable
Age in 1997	0.345** (.022)	0.585** (.017)	1.086** (0.025)	32.98
College degree by 1997	-0.054** (0.003)	-0.082** (0.002)	-0.074** (0.006)	0.15
# of children in 1997	.164** (0.031)	0.466** (0.030)	0.639** (0.013)	1.82
Immigrant	-0.002** (0.000)	-0.006** (0.001)	-0.005** (0.000)	.07
Local female unempl. rate in 1997	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	.05
Year FE	✓	✓	✓	
Group×period time-trends	✓	✓	✓	
N		4,231,745		

Notes: ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at group × year). All covariates measured in 1997, prior to the reforms.

Table 3. Main results

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Mean dependent variable
(A) Transitional benefits ^{a)}	-3,056** (844)	-15,413** (617)	-15,799** (320)	30,681
(B) SI benefits	1,598** (155)	2,920** (42)	2,216** (50)	3,392
(C) Rehab benefits	2,588** (150)	3,079** (232)	3,185** (138)	2,637
(D) DI benefits	551** (68)	1,477** (68)	1,812** (104)	2,264
(E) UI benefits	1,019** (29)	1,176** (26)	1,036** (46)	3,413
(F) SA benefits	-814** (113)	145 (114)	31 (154)	3,814
(G) Total benefits (A + B + C + D + E + F)	1,086 (405)	-6,209** (721)	-6,487** (254)	46,200
(H) Labour earnings	8,875** (662)	14,554** (594)	4,316** (415)	98,128
(I) Gross income (G + H)	9,961** (469)	8,346** (429)	-2,170** (574)	144,329
(J) Taxes	3,573** (130)	3,516** (149)	-85 (194)	39,222
(K) Disposable income (I - J)	6,388** (345)	4,829** (285)	-2,086** (381)	105,107
(L) Net public expenses (G - B)	-2,487** (413)	-9,725** (642)	-6,402** (174)	6,978
Controls	✓	✓	✓	
Year FE	✓	✓	✓	
Group × period time trends	✓	✓	✓	
N		4,231,745		

Notes: All outcomes measured in NOK at 1998 prices. ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at group × year). Each observation is weighted by the inverse of her propensity score. ^{a)} N = 795,451

Table 4. Employment effects

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Mean dependent variable
(M) Part-time employment	0.057** (0.00)	0.080** (0.00)	0.052** (0.00)	0.481
(N) Full-time employment	0.028** (0.00)	0.061** (0.00)	0.026** (0.00)	0.271
Controls	✓	✓	✓	
Year FE	✓	✓	✓	
Group × period time trends	✓	✓	✓	
N		4,231,745		

Notes: ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at group × year). Each observation is weighted by the inverse of her propensity score.

Table 5. Aggregating each period into one group and re-estimating the results

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Mean dependent variable
(A) Transitional benefits ^{a)}	-1,691** (122)	-15,102** (134)	-15,481** (137)	30,681
(B) SI benefits	1,233** (111)	2,824** (131)	2,147** (129)	3,392
(C) Rehab benefits	2,078** (111)	3,163** (132)	3,574** (148)	2,637
(D) DI benefits	492** (127)	1,352** (143)	1,752** (162)	2,264
(E) UI benefits	815** (73)	1,105** (88)	1,228** (77)	3,413
(F) SA benefits	-1,071** (111)	-163 (88)	-85 (85)	3,814
(G) Total benefits (A + B + C + D + E + F)	1,209** (235)	-6,284** (276)	-5,484** (296)	46,200
(H) Labour earnings	11,158** (697)	15,534** (728)	4,665** (845)	98,128
(I) Gross income (G + H)	12,367** (528)	9,250** (651)	-809 (765)	144,329
(J) Taxes	4,347** (210)	3,754** (269)	310 (309)	39,222
(K) Disposable income (I - J)	8,019** (324)	5,497** (391)	-1,119 (464)	105,107
(L) Net public expenses (G - B)	-3,139** (335)	-10,037** (399)	-5,784** (447)	6,978
Controls	✓	✓	✓	
Year FE	⊗	⊗	⊗	
Group × period time trends	⊗	⊗	⊗	
N	706,511	723,477	714,963	

Notes: All outcomes measured in NOK at 1998 prices. ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at the individual level). Each observation is weighted by the inverse of her propensity score. ^{a)} N = 139,116

Table 6. Aggregating each period into one group and re-estimating the results with individual FE

Outcome	Phase-in effects 1998–2000	Short-term effects 2001–2004	Long-term effects 2005–2008	Mean dependent variable
(A) Transitional benefits ^{a)}	-7,164** (137)	-27,917** (237)	-30,877** (333)	30,681
(B) SI benefits	1,875** (128)	4,172** (181)	4,739** (250)	3,392
(C) Rehab benefits	2,148** (118)	4,871** (188)	7,088** (328)	2,637
(D) DI benefits	1,276** (100)	3,335** (175)	5,929** (324)	2,264
(E) UI benefits	790** (83)	1,318** (120)	1,361** (153)	3,413
(F) SA benefits	-790** (78)	1,195** (121)	1,419** (178)	3,814
(G) Total benefits (A + B + C + D + E + F)	2,842** (222)	-94 (344)	5,694** (542)	46,200
(H) Labour earnings	8,348** (458)	9,272** (692)	-440 (1,172)	98,128
(I) Gross income (G + H)	11,191** (528)	9,178** (642)	5,254** (1,100)	144,329
(J) Taxes	3,724** (162)	3,304** (254)	1,705** (429)	39,222
(K) Disposable income (I - J)	7,467** (261)	5,874** (398)	3,549** (464)	105,107
(L) Net public expenses (G - B)	-881** (265)	-3,398** (404)	3,989** (660)	6,978
Controls	✓	✓	✓	
Year FE	⊙	⊙	⊙	
Group × period time trends	⊙	⊙	⊙	
N	706,511	723,477	714,963	

Notes: All outcomes measured in NOK at 1998 prices. ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at the individual level). Each observation is weighted by the inverse of her propensity score. ^{a)} N = 139,116

Appendix A

Table A1. Pre-reform characteristics of single and married mothers

Characteristics	Single mothers	Married mothers
Age	32.98	35.44
College degree by 1997 (%)	14.83	22.90
Non-Norwegian (%)	6.88	8.29
Number of children	1.82	2.47
Age of youngest child	6.13	4.84
Local female unemployment rate (%)	4.71	4.72
Outcomes		
Labour earnings	98,128	127,269
Part-time employment (%)	48.06	65.17
Full-time employment (%)	27.11	33.85
Transitional benefits	30,681	0
SI benefits	3,392	3,404
Rehab benefits	2,637	1,792
DI benefits	2,264	1,620
UI benefits	3,413	3,633
SA benefits	3,814	1,658

Notes: Characteristics and outcomes are measured as means or percentages in the pre-reform years (1993–1997). In each year, the sample comprises single and married mothers with at least one child aged 4–10 years. Earnings and payments of benefit programmes are measured in NOK at 1998 prices.

Table A2. Specification and robustness checks

Outcome	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	No weighting	No controls	No immigrants	Quadratic trends	Ineligible for cash-for-care
<i>Phase-in period</i>						
Total benefits	1.1 (0.4)	1.4* (0.4)	1.0 (0.4)	0.6 (0.3)	1.6** (0.3)	0.8 (0.3)
Labour earnings	8.9** (0.7)	6.2** (0.6)	9.2** (0.8)	9.7** (0.7)	9.2** (0.7)	2.8** (0.2)
Disposable income	6.4** (0.3)	5.2** (0.3)	6.5** (0.4)	6.5** (0.4)	7.0** (0.4)	2.1** (0.3)
Net public expenses	-2.5** (0.4)	-1.1 (0.4)	-2.7** (0.5)	-3.1** (0.4)	-2.3** (0.4)	-0.7** (0.2)
<i>Short-term reform period</i>						
Total benefits	-6.2** (0.7)	-6.4** (0.6)	-6.5** (0.7)	-6.3** (0.7)	-5.8** (0.8)	-6.3** (0.7)
Labour earnings	14.6** (0.6)	9.2** (1.0)	16.5** (0.5)	15.1** (0.7)	14.9** (0.6)	8.7** (0.4)
Disposable income	4.8** (0.3)	1.6** (0.4)	5.8** (0.3)	5.1** (0.3)	5.3** (0.2)	1.0 (0.5)
Net public expenses	-9.7** (0.6)	-7.5** (0.9)	-10.6** (0.6)	-10.0** (0.7)	-9.5** (0.7)	-7.7** (0.5)
<i>Short-term reform period</i>						
Total benefits	-6.5** (0.3)	-6.6** (0.4)	-6.9** (0.2)	-7.3** (0.2)	-6.0** (0.2)	-7.8** (0.4)
Labour earnings	4.3** (0.4)	-3.0** (0.8)	6.3** (0.5)	4.1** (0.6)	4.6** (0.4)	4.7** (0.5)
Disposable income	-2.1** (0.4)	-6.5** (0.6)	-1.1** (0.4)	-3.0** (0.5)	-1.6** (0.3)	-2.7** (0.4)
Net public expenses	-6.4** (0.2)	-3.5** (0.4)	-7.4** (0.2)	-7.0** (0.2)	-6.2** (0.2)	-7.4** (0.3)
N	4,231,745	4,231,745	4,231,745	3,775,804	4,231,745	2,961,095

Notes: All outcomes measured in 1,000 NOK at 1998 prices. ** and * indicate significance at 1% and 5% levels, respectively (standard errors clustered at group × year).

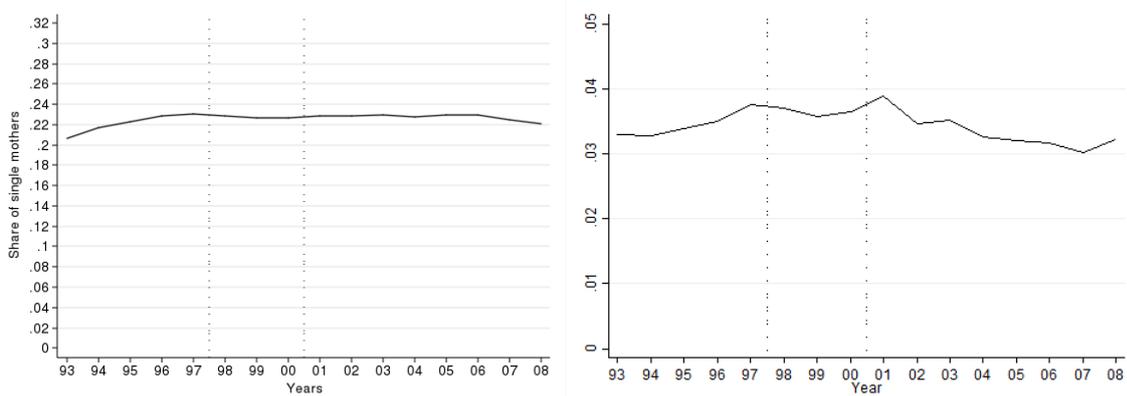


Figure A1: Share of single mothers and marriage rates over the 1993–2003 period

Notes: The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. The marriage rate is for women aged 19 to 55 (our selected sample) and is weighted by the age composition of the sample in 1993 to adjust for changing demographics over time.

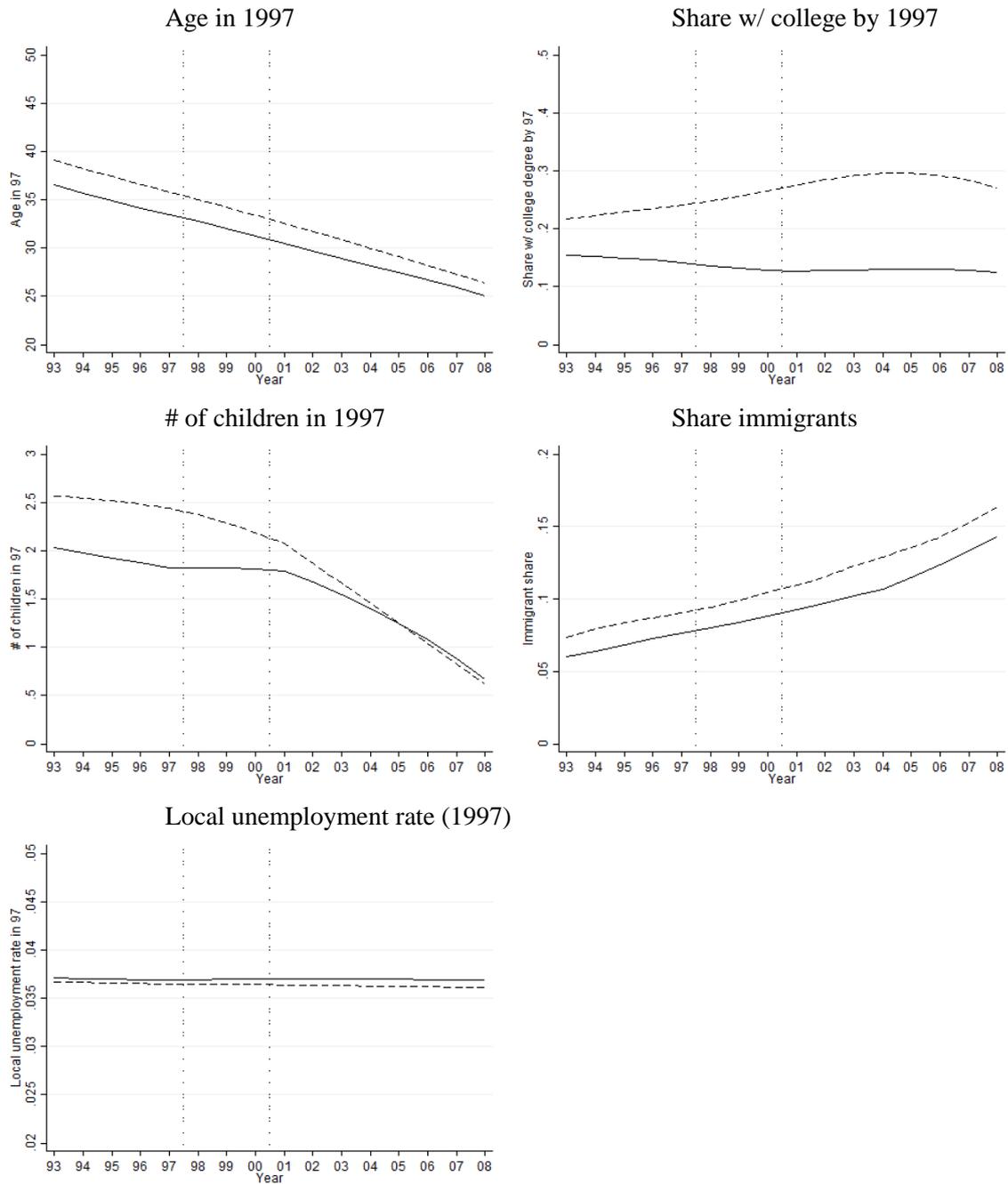


Figure A2: Trends in covariates for single and married mothers

Notes: The sample comprises single and married mothers with at least one child aged 4–10 years. The vertical lines indicate the years before (1997) and after (2001) the phase-in period of the reforms. Covariates measured in 1997 prior to the reforms.

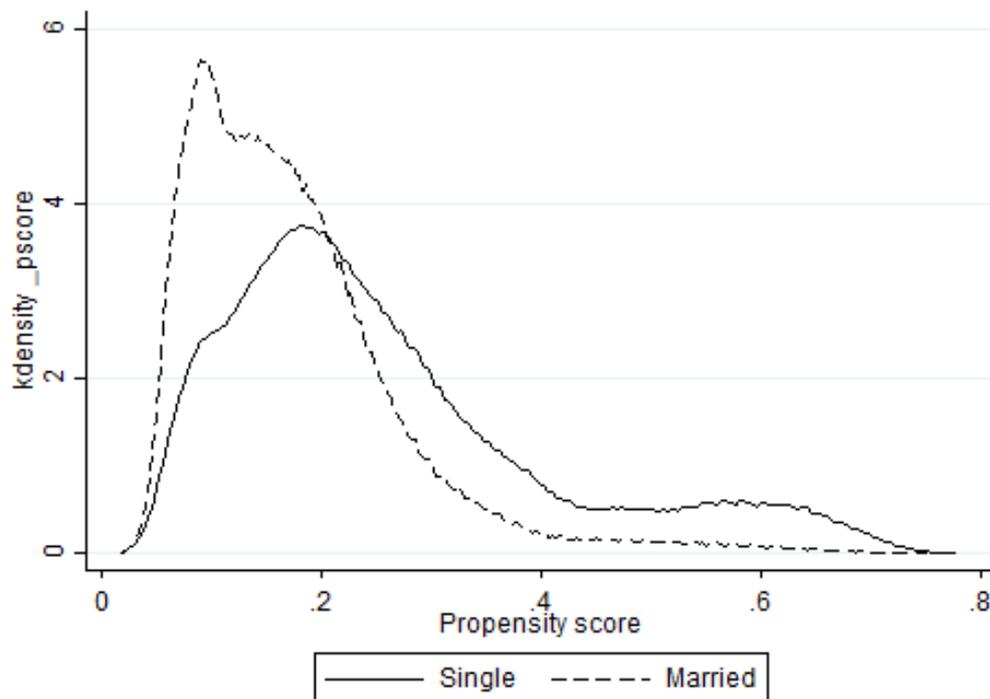


Figure A3: Distribution of propensity scores for single and married mothers

Notes: The sample comprises single and married mothers with at least one child aged 4–10 years.

Department of Economics
University of Bergen
PO BOX 7800
5020 Bergen
Visitor address: Fosswinckels gate 14
Phone: +47 5558 9200
www.uib.no/econ/